Technical Specification for

Three Phase, Four Wires, 10-60 Amps, Class 1

Direct Connected Static Trivector Energy Meter

1. SCOPE

1.1. This specification covers design, manufacture, testing of Three Phase, Four wire 3 x 240 volts, 10-60 Amps, Class 1 direct connected static Trivector energy meter.

1.2. The scope of supply comprises of following:

1.2.1. LT Three Phase Four wire 10-60 Amps Class 1 Direct connected Static Trivector Energy Meter with optically isolated RS 232 front Communication Port

1.2.2. Memory resident software for Common Meter Reading Instruments (preferably with DOS and/or Windows Latest Operating System) and Laptops to download the data from energy meter through optically isolated RS 232 communication port

1.2.3. Base Computer Software for analysis of meter data

1.2.4. Operational manuals of energy meter and software including drawings

1.2.5. Routine test certificates.

1.3. It is not the intent to specify completely herein all the details of the design and construction of material. However the product shall conform in all respects to high standards of engineering, design and workmanship and shall be performing in continuous commercial operation in manner acceptable to the Customer. The material shall be complete with all components necessary for their intended purpose. The design, manufacture and performance of equipment shall comply with all currently applicable standards, regulations and safety codes in the locality where the equipment will be installed.

2. APPLICABLE CODES AND STANDARDS

2.1. The meter shall conform (for performance and testing thereof) in all respects to the relevant Indian/International Standard Specifications with latest amendments there to unless otherwise specifically mentioned in this specification.

2.2. The meter shall conform to the following standards

2.2.1.	IS 13779 (1999)	:	AC static watt hour meters Class 1 & Class 2 specification

2.2.2.	IEC 62053	:	Alternating Current Static energy meters for measurement of active energy, class 1 (62052: 11)
2.2.3.	CBIP Technical Report No. 325	:	Standardization of AC Static Electrical Energy Meters.
2.2.4.	CEA Regulation	:	Central Electricity Authority (Installation and Operations of Meters) Regulation – 2006 (together with amendments 2010 and 2014)

2.3. Unless otherwise specified elsewhere in this specification the meter shall conform to the latest version available of the standards/codes as specified above.

2.4. This meter shall have Type Test certificates of laboratories approved by NABL such as ERDA, NPL, and CPRI etc.

2.5. The meter shall conform shock test as per IS 9000 Part 8 and IS 13010 Clause # 12.3.2 to their latest amendments.

3. SERVICE CONDITIONS

3.1. The meter shall be required to operate satisfactorily and continuously under the following tropical conditions.

3.1.1.	Maximum Ambient Air Temperature	:	50° C
3.1.2.	Minimum Ambient Air Temperature	:	2° C
3.1.3.	Average Daily Ambient Air Temperature	:	40° C
3.1.4.	Maximum Relative Humidity	:	95%
3.1.5.	Average Annual Rainfall (mm)	:	1500 mm
3.1.6.	Seismic Zone	:	III

3.2. The overall climatic condition is moderately hot and humid tropical climate, conducive to rust and fungus growth.

4. ACCURACY

The meter shall be of class 1 or better accuracy as per IS: 13779.

5. GENERAL TECHNICAL PARAMETERS

5.1. The meter shall comply all the provisions of IS/ CBIP recommendations and CEA Regulations-2006 (together with amendments 2010 and 2014) at all power factor angles from 0 to 360 degrees.

5.2. System of Supply : 3 Phase 4 Wire Solidly earthed system

5.3. Rated Voltage : 3 x 240 Volts (Phase to Neutral)

5.4. Basic current : 10 Amps

5.5. Maximum Current : 60 Amps (600 % Ib)

5.6. Meter shall be suitable for measurement of active energy (kWh), reactive energy (kVArh) and apparent energy (kVAh) and power demands (kW, kVAr, kVA) with balanced and unbalanced loads over a power factor range from zero (lagging) through unity to zero (leading).

5.7. The meter shall be suitable to carry continuously and work accurately (within class 1 performance) at a load of 72 amperes (120% of Imax).

5.8. Power Supply Variation

The meter should be suitable for working with following supply system variations without damage and without degradation of its metrological characteristics.

5.8.1.	Voltage	:	-40% to +20% Vref
5.8.2.	Frequency	:	47.5 Hz to 52.5 Hz
5.8.3.	Power Factor	:	Zero (Lag) – Unity – Zero (Lead)

5.9. Power Consumption:

5.9.1. Voltage Circuit

5.9.1.1. The active power consumption in each voltage circuit including the power supply of meter at reference voltage; reference temperature and reference frequency shall not exceed 1 watt per phase.

5.9.1.2. The apparent power consumption shall not exceed 8 VA per phase at leading power factor and 2.5VA per phase at lagging power factor.

5.9.2. Current Circuit

The apparent power taken by each Current circuit at basic Current, reference frequency and reference temperature shall not exceed 1VA per phase.

5.10. Starting Current

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

5.11. This meter shall be direct reading type without application of any multiplication constant.

5.12. Meter shall not register any energy when the voltage is applied with no current flowing in the measurement circuit.

5.13. The meter shall be capable of withstanding 600 Volts continuously across the voltage circuit without degrading its metrological properties.

5.14. The meter shall be capable of withstanding surges and voltage spikes by providing necessary isolation and/or suppression system built-in the meter. The manufacturer shall furnish the details of immunity values of the surges and spikes.

5.15. The meter should be capable of withstanding 10 kV 1.2/50 micro-second impulse voltage immunity test in case of open circuit voltage and 8/20 micro second in case of short circuit current as per IEC: 1000-4-5 Standard.

5.16. The meter shall have to be immune to external abnormal AC/ DC EMF/ Permanent magnet of 0.5 Tesla as per CBIP Report No 325 (with its latest amendments). A test report from accredited laboratory shall be provided.

6. GENERAL MECHANICAL REQUIREMENTS

6.1. The energy meter shall be suitable for outdoor (housed in a box) installation.

6.2. The meter shall conform to degree of protection IP51 (as specified in IS 12063) for protection against ingress of dust, moisture and vermin.

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

6.4. The meter shall be compact and reliable in design, rugged for rough handling during transport.

6.5. The meter shall have a case made of unbreakable high grade, fire resistant, reinforced polycarbonate or equivalent high grade engineering plastic which can be sealed in such a way that the internal parts of the meter are accessible only after breaking the Meter Cover seals.

6.6. The meter cover shall be fully transparent made of transparent polycarbonate material for easy reading of all the displayed values / parameters, nameplate details and observation of operation indicator.

6.7. The meter base and meter cover shall be ultrasonically welded fully in a seamless manner. In addition, providing self lockable feature for top cover like press-fit mechanism or unidirectional screws is desirable.

6.8. Arrangement shall be provided to record the opening of meter cover with date and time of opening with snap shot for KWh reading. Once the meter cover is opened, the LCD shall display only "C-OPEN" or "TAMPER", on display and stop the display sequence in Auto display mode. However, the meter shall continue to register the energy consumption and it shall be possible to view the data in push button mode as well as data download to CMRI/Laptop through optical communication port.

6.9. The meter shall be wall mounted projected type, fitted with the help of screws, and shall have a handle at its top to facilitate carrying around.

6.10. The meter case shall have at least three mounting holes. Two holes for mounting screws on the terminal block sealed beneath the terminal over and one for hanging screw on the top.

6.11. All parts, which are subject to corrosion under normal working conditions, shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling or damage due to exposure to air, under normal working conditions. Meter shall withstand solar radiation.

6.12. All insulating material used in the construction of the meter shall be non hygroscopic, non-aging and of tested quality.

6.13. The terminal block, terminal cover, meter cover and meter case shall ensure reasonable safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them.

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

6.14.1. Personnel safety against electric shock

6.14.2. Personnel safety against effects of excessive temperature.

6.14.3. Protection against spread of fire

6.14.4. Protection against penetration of solid objects, dust and water.

6.15. Meter base, cover & terminal cover shall conform to the following tests

6.15.1. UV ageing for 200 Hrs as per ASTM: G53 (Clause No. 9.3)/ASTM: G154-12

6.15.2. Boiling water test (10 min)

6.15.3. Glow wire test IS:11000 (Part 2 / Sec-1) 1984 or IEC 60695-2-12

6.15.4. Heat deflection Temperature (HDT) HDT / Ae, 1.8MPa edgew (100mm) As per ISO 75/Ae

6.15.5. Ball pressure test as per IEC--60695-10-2

6.15.6. Flammability Test as per UL 94 or as per IS 11731 (Part-2) 1986

6.16 Type test certificates shall be provided in support of the above.

6.17 Detailed dimensional drawing of the meter is to be furnished along with the meter.

7. METERING COMPONENTS

7.1. The meter shall use 04 No's of high accuracy CTs; 03 No's for phases and one for neutral circuit.

7.2. Meter shall be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and re-flow solder process.

7.3. It is preferable to have the electronic components integrated into single chip. The integrated chip may consist of metrology engines, LCD drivers, I/Os, RTC, communication port, program memory and data memory etc.

7.4. The calibration of meter must be carried out digitally and in-house only. It shall not be possible to calibrate the meter without opening the meter cover once the meter passes the above tests.

8. COMPONENT SPECIFICATION

8.1. The meter base, meter cover and terminal cover shall be made of virgin engineering plastic or polycarbonate with fire retardant and ultraviolet resistance additives.

8.2. The source of the engineering plastic/ polycarbonate resin shall be from any one of the following manufacturers.

8.2.1. Sebic Plastics

8.2.2. Du Pont

8.2.3. Buyer

8.2.4. Dow Plastics

8.3. The manufacturer shall use ASICs, PCBs and other meter components manufactured by highly repute firms across the world. Following are the list of approved makes of components.

8.3.1.	Memory Chips	:	Atmel (USA) National Semiconductor (USA) Texas Instruments (USA) Phillips (USA) Hitachi (Japan) Oki (Japan) Teredian
8.3.2.	Liquid Crystal Display	:	Displaytek (Hongkong) Truly (China) RCL Display (USA) Veritronics (USA) Advantek (Korea) Tianma

8.3.3.	ASICs	:	Analog Devices (USA) Cyrus Logic (USA) Atmel (USA) Phillips (USA) Sames (South Africa) NEC (Japan) Motorolla (USA) Teredian Texas Instruments
8.3.4.	Printed Circuit Board	:	Shogini (Pune) Circuit Systems
8.3.5.	LED	:	Osram Unity Opto
8.3.6.	EPROM	:	Atmel Microchip ST Renesas
8.3.7.	Optical port	:	National Semiconductor (USA) Phillips (USA) Hitachi (Japan) Maxim (Taiwan)

8.3.8.	Communication Modules	:	National Semiconductor (USA) Phillips (USA) Hitachi (Japan) Oki (Japan) Ricoh (Japan) Maxim (Taiwan)
8.3.9.	RTC / Micro Controller	:	Phillips (USA) Dallas (USA) Atmel (USA) Motorola (USA) NEC (Japan) Oki (Japan)
8.3.10.	Battery	:	Varta (Hongkong) Tedirun (Isarel) Sanyo (Japan) Saft (France) Tekcel (korea)
8.3.11.	Power Supply	:	Power Integrations (USA) SP Micro (USA)

8.3.12.	Electronic Components	:	National Semiconductor (USA) Atmel (USA) Texas Instruments (USA) Phillips (USA) Hitachi (Japan) Oki (Japan) AVX (Japan) Ricoh (Japan) Samsung (Korea)
8.3.13.	Current Transformer	:	Ashmor Narayan Powertech Rosy

8.4. A detailed list of bought out items that are used in the manufacture of the meter should be furnished indicating the name of firm from whom these are procured.

8.5. Detailed specification and datasheets for the above items shall be provided along with the meter.

9. DISPLAY

9.1. The meter shall have a minimum 6+1 (total 7) digits pin type built-in Liquid Crystal Display (LCD) with few more digits for legends. It is preferable to have decimal digit slightly smaller than the integer digits.

9.2. The energy (except in high resolution mode) shall be displayed with one decimal digit.

9.3. The minimum size of each digit shall be 10 mm (Height) x 5 mm (Width).

9.4. The LCD shall be STN/ transflective type industrial grade with extended temperature range. The LCD may be subjected to 65˚C temperature for at least 72 Hours. The display shall be visible and readable after the test.

9.5. The LCD shall have STN type with horizontal viewing angle of ±50º and vertical viewing angle of +60º/-35º.

9.6. The display module shall be well protected from the external ultraviolet radiations.

9.7. The LCD shall be with backplane with LED illumination. The LCD shall be bright and with uniform backlit.

9.8. It shall be possible to display contents of relevant parameters/tamper events with another digit displaying legend for identification.

9.9. The meter should have facility for a manual mode where the parameters can be read by push button operation. The manual display shall switch over to auto-display mode automatically after 30 idle minutes.

9.10. The electronic display of parameter need not be visible, when meter is not energized.

10. BATTERY

10.1. The battery provided shall be of Lithium Thyonil Sulphide ($LiSOCl_2$) with 15 years of useful life and a minimum of 3 years shelf life.

10.2. It is preferable that the battery is of cylindrical type with more than 800 mAh capacity and rated output voltage of 3.6 volts.

10.3. The battery shall support powering up the meter in the event of mains power failure. This battery shall support meter reading through meter display as well as complete meter data download through CMRI.

10.4. Meter reading through battery shall be restricted to 5 times only for a maximum duration of 30 minutes in a month

10.5. The datasheet or/and the test certificates shall be provided for the same along with the meter.

11. OUTPUT DEVICES

11.1. The meter shall have a suitable test output device for testing of meter. The blinking LED or other similar device shall be provided. Test output should also work as operating indicator for meter.

11.2. The device shall be suitable for use with sensing probe used with test benches or reference standards.

11.3. The test output device shall have constant pulse rate i.e. number of impulses per kWh and impulses per kVARh and their values should be indelibly printed on the name plate.

11.4. It is preferable that two separate output devices, one for active energy and second for reactive energy are provided.

12. METER CONSTANT

12.1. The relation between test output and the indication in the display shall comply with the marking on the nameplate.

12.2. The meter constant shall be preferably 1000 imp / kWh or kVArh or kVAh.

12.3. The manufacturer shall state necessary number of pulse / counts to ensure a measuring accuracy of at least 1/10 of the accuracy class at different test points.

13. REAL TIME CLOCK

13.1. The meter shall have a real time clock based on a quartz crystal with a battery totally independent of power supply.

13.2. The time measurement shall be independent of line frequency.

13.3. A lithium maintenance free battery of long life (minimum fifteen years) shall be provided for operation of time clock.

13.4. It shall be possible to select the various time zones for various seasons of the year through suitable software built into the electronic register.

13.5. It shall be possible to synchronize Real Time Clock (RTC) of the meter through MRI through explicit software command. The software module with password protection specifically to reset/correct RTC shall be provided.

13.6. The drift in RTC shall not be more than ±3 minutes in a year.

14. MEMORY

14.1. The meter shall have non-volatile memory, so that the registered parameters will not be affected by loss of power.

14.2. The non-volatile memory shall have a minimum retention time of 15 years.

14.3. The memory shall have sufficient capacity to store energy data, load survey data and tamper data as per the relevant clauses of this specification.

15. COMMUNICATION FACILITIES

15.1. The meter shall be equipped with a galvanically isolated optical communication port with removable cover and with locking arrangement so that it can be easily connected to an MRI / laptop for data transfer or transfer of data through remote metering device such as modem / multiplexer etc.

15.2. Any other communication port shall not be provided on the meter.

15.3. The optical communication port shall also have a sealing provision.

15.4. The details of speed at which data is to be downloaded from meter to MRI/ laptop shall be provided. Also the maximum time the meter will take to

download following sets of data form meter to MRI/ Laptop shall be provided

15.4.1. Energy values

15.4.2. Energy Values and Tamper data

15.4.3. Energy values and load survey data

15.4.4. Load Survey data

15.4.5. Tamper data

15.4.6. Entire data set including energy values, load survey, tamper and transaction data

15.5. The meter manufacturer would be responsible for ensuring that the data extracted from the meter using manufacturer specific algorithms in the software up to downloading to the BCS remains secure during the process.

16. TERMINAL BLOCK

16.1. The terminal block shall be of high grade non-hygroscopic, low tracking property fire resistant, reinforced polycarbonate (non Bakelite) or equivalent high grade engineering plastic which shall form an extension of the meter case and have terminal holes and shall be of sufficient size to accommodate minimum 25 Sqmm solid/stranded aluminium/ copper conductors.

16.2. The manner of fixing the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Detailed drawing of the terminal arrangements shall be provided.

16.3. Two screws shall be provided in each terminal for effectively clamping the conductor or thimbles. Each clamping screw shall engage at least 3 threads in the terminal after insertion of the cables.

16.4. The terminals and connections shall be suitable to carry up to 72 Amps continuously and shall be capable of passing the test given in ISO 75 for temperature of 135^{o}C and a pressure of 1.8 MPa. The test certificate in support of the same shall be provided along with Meter.

16.5. The terminals shall have suitable construction with barriers to prevent phase to phase short circuit inside the meter.

16.6. The potential link shall not be provided outside on meter terminal block. Internal solid link having adequate capacity shall be provided.

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

16.8. The terminals shall be marked properly on the terminal block for giving external connections.

16.9. Detailed drawings of the terminal block shall be provided along with Meter.

17. TERMINAL COVER

17.1. The terminal cover shall be made of transparent engineering polycarbonate.

17.2. The terminal cover and meter base shall be extended such that when the terminal cover is placed in position, it is not possible to approach the connections or connecting wires.

17.3. Suitable cut-outs to be provided for cable entry.

17.4. The following shall be marked on the terminal cover

17.4.1. Manufacturer's name or Logo

17.4.2. Connection diagram

17.5. The marking shall be indelible, distinct & readable from outside the meter.

17.6. Detailed drawings of the terminal cover and sealing arrangement on the meter shall be provided.

17.7. The terminal cover shall be separate from the meter body and shall be of removable type for ease of installation/maintenance.

18. SEALING ARRANGEMENT

18.1. The meter cover shall not be removable without breaking the same& leaving the significant evidence. In case of opening of the cover, necessary indication is required to be appeared on the display. The meter cover shall have at least two sealing arrangements on either side, each having two sealing holes for applying polycarbonate seals. If sealing screws are provided, the same shall be made of brass and capable of being tightened from the rear.

18.2. Separate sealing arrangements shall be provided for terminal cover and communication port.

18.3. The sealing arrangement on meter shall be suitable for application of polycarbonate seals as well as hologram seals. Adequate plain surface shall be made available on the sides of the meter to facilitate application of hologram seals.

18.4. The manufacturer shall provide one polycarbonate seal on Meter. The seal shall be applied on the left side of the meter.

18.5. The manufacture shall provide one hologram / stick seal on meter. The seal shall be applied on the right side of the meter.

19. NAMEPLATE AND MARKING

19.1. Meter shall have a nameplate clearly visible and effectively secured against removal, indelibly and distinctly marked with all essential particulars as per relevant standards.

19.2. The rating plate of the meter shall have distinct background color.

19.3. The marking on every meter shall be in accordance with IS: 13779:1999. In addition to the standard, following shall be marked on the nameplate.

19.3.1. Manufacturer's name and place of manufacture

19.3.2. Meter type

19.3.3. Number of phases and wires

19.3.4. Alphanumeric serial number (It shall have letter height of minimum 5mm)

19.3.5. Bar code (Code 128/ Type 3 of 9) of the serial number

19.3.6. BIS mark

19.3.7. Month and Year of manufacture

19.3.8. Reference voltage & frequency

19.3.9. Principal unit in which the meter reads (kWh, kVArh, kVAh)

19.3.10. Rated Current (Basic current & Maximum current)

19.3.11. Meter constant (Imp/kWh & Imp/kVArh)

19.3.12. Accuracy Class of the meter

19.3.13. Symbol of Ultrasonic Welding

19.3.14. Sign of Double square for Insulation encased meter

19.4. The marking shall be indelible, distinct & readable from outside the meter.

20. CONNECTION DIAGRAM

20.1. Meter shall be indelibly marked with connection diagram showing the phase/neutral sequence for which it is intended and shall be attached to the inner side of the extended terminal block cover.

20.2. In case of any special precautions need to be taken at the time of testing the meter, the same may be indicated along with the circuit diagram.

20.3. Drawings of the connection diagram shall be furnished along with the meter.

21. MEASUREMENT OF ENERGY

21.1. The meter shall be capable of measuring total energy consisting of fundamental energy and harmonic energy. Total displayed energy shall be including of harmonic energy i.e. Total Energy (Active, reactive or Apparent) = Fundamental Energy + Harmonic Energy

21.2. The details as to how harmonic energy is to be measured shall be provided.

21.3. KVAh calculation should be the vector sum of kWh, kVArh (Lag) and kVArh (Lead)

22. MAXIMUM DEMAND REGISTRATION

22.1. The metering module shall continuously monitor and calculate the average demand in kW and kVA during the integration period set and the maximum, out of these shall be stored along with date and time of occurrence in the meter memory.

22.2. The rising demand under the current integration period shall be displayed along with the elapsed time.

22.3. The meter shall memorize maximum demand data (together with date and time of occurrence) for last 12 months on FIFO basis.

22.4. The integration period shall be 30 minutes.

22.5. MD Reset:

The meter shall have any and combinations of the following MD resetting options. It shall not be possible, in any case, to reset MD through push button.

22.5.1. Automatic reset on a particular day of the month.

22.5.2. At the end of every month i.e. 24 00 Hrs of last day of the month

22.5.3. Resetting through a hand held terminal or Computer capable of communicating with the meter with explicit password protection. Software module specifically for resetting MD through MRI / Computer shall be provided.

22.6. The time measurement shall be independent of line frequency.

22.7. The meter shall memorize the Cumulative Maximum Demand (CMD) and the same shall be available in meter display and BCS.

22.8. The meter shall also memorize and display the MD reset counts.

23. TIME OF DAY (TOD) TARIFF / DEMAND

23.1. The meter should be capable of registering time of day energy consumption on stand-alone basis.

23.2. The meter shall be suitable to measure and record kW / kVA demand and active and apparent energies consumed during various time blocks of the day. It should be actuated by an inbuilt real time clock which has the capability of being set to indicate time zones in a 24 hour cycle with adjustable duration of time zone. The registers shall indicate all parameters mentioned in this specification above for every time zone.

23.3. It shall be possible to set minimum of 8 time zones in a 24 hour cycle and two seasons in a year.TOD times and definition of seasons are mentioned in Annexure - B.

23.4. It shall be possible to change the time for TOD recordings through CMRI in the meter itself with proper security.

23.5. Time of day register shall be provided for active energy/ apparent energy and demand data (kW, kVA). Meter should indicate activeness through the current time of day register on display.

23.6. It shall be possible to retrieve this data through communication port.

23.7. TOD time zone shall be programmable as per the requirement of purchaser.

24. LOAD SURVEY & DAILY ENERGY

a) The meter shall log energy and demand for active, reactive and apparent for each integration period of 30-minute, for a minimum of 90 days. However, the meter resident software shall be reconfigurable in order to select any one or a group of above parameters for load survey.

b) The meter shall log the following parameters in the load survey for each Integration period of 30-minute

- Average Voltage (R)
- Average Voltage (Y)
- Average Voltage (B)
- Average Current (R)
- Average Current (Y)
- Average Current (B)
- Active Energy (kWh)
- Apparent Energy (kVAh)
- Reactive Energy – Lag (kVArh)
- Reactive Energy – Lead (kVArh)

In addition, the BCS shall also display the following parameters in load survey

- Active Demand (kW)
- Apparent Demand (kVA)
- Reactive Demand – Lag (kVAr)
- Reactive Demand – Lead (kVAr)
- Power Factor

c) Following Daily energy/ data at midnight cross-over shall be recorded (cumulative values) for 180 days

- C-kWh
- C-kVAh
- C-kVArh-Lag
- C-kVArh-Lead

d) Data logging should be on first in first out basis.

e) It should be possible to transfer this data on computer and to a hand held Meter Reading Instrument / Data Collection Device.

25. QUANTITIES TO BE DISPLAYED

25.1. The meter shall be capable of measuring and displaying the electrical quantities mentioned in Annexure – A within specified accuracy limits for all loads and power factors.

25.2. It shall be possible to configure the display sequence either in auto-scroll mode or manual push button mode.

25.3. The meter shall have facility for a manual mode where the parameters can be read by push button operation. The manual display shall switch over to auto-display mode automatically after 30 idle minutes.

25.4. It shall be possible to lock / freeze the display of any parameter by long pressing of the pushbutton for monitoring the parameter.

25.5. It shall be possible to unlock the parameter by long pressing of the pushbutton.

26. TAMPER AND FRAUD PROTECTION

The meter shall have the following special features to prevent / to detect tampering of metering system:

26.1. The meter shall not get affected by the action of any remote control devices including injection of high frequency voltage surges / spikes. Meter shall log event with snap shot of parameters when meter accuracy or component's function get affected by such tampering attempts.

26.2. The meter shall record at rated voltage, unity power factor and I_{max} under the influence of external AC/DC/ permanent magnetic field irrespective of actual load. The meter shall run as per actual load once the external magnet is removed. Persistence time for magnetic tamper logging shall be 10 seconds. Event shall be logged with snap shot. Meter shall record energy in main register as well as in defraud register. Defraud resister shall be available in BCS and meter display.

26.3. The meter shall record an event when average kW or kVA drawn by the consumer during an Integration period is more than the specified threshold value of kW and kVA. The event shall be supported by date & time and average load for that integration period.

26.4. The meter shall be capable of recording & displaying tamper information along with the date and time of all tamper occurrence and restoration including initial & final tamper for the following:

26.4.1. Phase wise voltage failure

26.4.2. Voltage unbalance

26.4.3. CT Short/ Bypass

26.4.4. Phase wise CT Open

26.4.5. Current Unbalance

26.4.6. Phase wise Current reversal

26.4.7. Over load

26.4.8. Meter cover open

26.4.9. Magnet tamper

26.4.10. Neutral Disturbance

26.4.11. HV / HF (ESD)

26.4.12. Power-Off

26.5. The meter shall work accurately irrespective of phase sequence of the mains supply.

26.6. The meter shall remain powered up and functional in presence of any two wires.

26.7. The meter shall continue to record accurately even if the neutral of supply gets disconnected.

26.8. The meter shall record correct energy in forward direction in case of current reversal of one or more phases.

26.9. The measurement by meter shall not get influenced by injection of AC Voltage / Chopped signal / DC signal and Harmonics

26.10. Minimum 500 tamper events with date and time shall be stored on first in first out basis and made available through the CMRI. The total number of tamper events shall also be available. The tamper events shall be registered in sequential block storage. The size of the block for each of the tamper shall be as follows:

Sr. No.	Tamper type	Block
1	PT Missing, Invalid voltage, Voltage Unbalance	200
2	CT Reversal, CT bypass/ CT Short, CT Open, Current Imbalance, Over Load	150
3	Neutral disturbance, Magnet	50
4	Power On/ Off	90
5	Cover open, ESD	10

26.11. Meter shall record all the above mentioned events on first in first out basis along with date & time and snapshots (Occurrence and Restoration) of instantaneous parameters (Individual Voltage, Individual Current and Power factor), Active energy, Reactive & Apparent energy for Phase wise voltage failure, Voltage unbalance, CT short / Bypass, Phase wise CT open, Current unbalance, Phase wise current reversal, Over load, Meter cover open, Magnet, Neutral Disturbance, HV / HF & Meter working without load.

26.12. All these information shall be available in simple and easily understandable format and shall be possible to export in industry standard office suites. The software shall include various summary reports on tamper events.

26.13. It shall be possible to retrieve the tamper data through optical port to a common meter-reading instrument or directly to the computer.

26.14. The details as to how their meter is able to detect / protect / recording the above tamper along with the threshold values and fraud features with sketches and phasor diagram wherever necessary should be furnished.

26.15. Moreover the meter should give information of instantaneous voltages, currents, power factor, frequency, power etc. while downloading the meter data through Meter Reading Instruments / Data Collection Device.

27. COMPATIBILITY TO EXTERNAL INFLUENCING SIGNALS

27.1. The meter shall be capable to protect against adverse effect of AC/DC/ Permanent abnormal external magnetic field of minimum 0.5 Tesla. Meter shall log event with snap shot when meter accuracy or component's function get affected by such event.

27.2. The meter shall be capable to protect against the action of any remote control devices including injection of high frequency, high voltage surges / spikes, Electro Static Discharge more than 35 KV & HF up to 10 GHz

27.3. The meter shall be capable of protecting and archiving all the data in case of any tamper which affects the memory, power supply units, microcontroller, RTC etc.

27.4. The meter shall be designed in such a way that conducted or radiated electromagnetic disturbance as well as electrostatic discharge do not damage or substantially influence the meter and its performance. The disturbance to be considered are:-

27.4.1. Harmonics

27.4.2. Voltage dips and short interruptions

27.4.3. Conducted transients

27.4.4. DC and AC magnetic fields

27.4.5. Electromagnetic fields

27.4.6. Electrostatic discharges

27.4.7. High voltage/ High Frequency sparks

27.5. The performance of meter should be as per IS: 13779, IEC: 62053-21 and CBIP technical report No. 325 and latest version thereof.

27.6. The meter shall not generate noise, which could interfere with other equipment.

28. SELF-DIAGNOSTIC FEATURES

28.1. Indications to show the satisfactory performance of the meter shall be provided in the meter. The meter shall have capability to check its circuits for any malfunctioning. There should be a defined diagnostic cycle, for instance every one hour, and if some malfunctioning occurs, the meter may display the malfunctioning of the meter.

28.2. The meter shall have internal diagnosis feature to monitor micro control functions to ensure correct operation of demand interval time by quartz crystal timer.

28.3. Minimum features of internal diagnosis to be provided are Time, calendar, RTC, RTC battery and NVM.

28.4. The meter shall also have self diagnostic feature to detect any increment in energy registers on no-load.

29. SOFTWARE

29.1. The following software shall be supplied along with the Meter

29.1.1. Software for downloading data from meter through meter reading instrument / computer/ AMR (PSTN/ GSM / GPRS/ CDMA).

29.1.2. Exclusive software for changing date of monthly MD reset

29.1.3. Exclusive software for changing the display sequence

29.1.4. Exclusive software for changing Integration period for max demand

29.1.5. Exclusive Software module for changing TOD / seasonal tariff timings.

29.1.6. Exclusive Software module for resetting tamper data and tamper counts

29.1.7. Software module for adjustment of real time of the meter through meter reading instrument with proper password protection.

29.1.8. Base Computer Software for accepting data from MRI and uploading instructions from base computer to MRI.

29.1.8.1. The BCS shall give complete details of the Energy and demand pattern both in numeric data form and in graphic form.

29.1.8.2. Energy and Demand data shall be displayed starting from 0000 to 2400 hours on daily basis in graphic form. Graphic software shall be capable of displaying different quantities in cumulative form and in any combination as per requirement. Graphic software shall be capable of displaying data in monthly, weekly and daily combinations.

29.1.8.3. BCS shall have facility to export data to ASCII and Spreadsheet compatible format.

29.1.9. Necessary software for loading application program via serial port/ Universal serial port.

29.1.10. Analysis software for data downloaded from meter. The software should provide necessary facility to export data to Microsoft Excel.

29.1.11. Other special application software for the Meter.

29.2. The meter shall be capable to communicate directly with meter reading instrument and laptop computers.

29.3. The meter shall support automated meter reading through optical port/RS 232 communication port. Details of all such software and facilities shall be furnished with the meter.

29.4. All the software modules shall have to be password protected and compliant with Microsoft Windows XP, Windows 7 and latest operating system.

29.5. All the software shall have to be hardware independent and any changes in software at a later date shall not be restricted by hardware used in the meter.

29.6. Software shall be suitable for all type of printers.

29.7. All the communications shall have to be done through open protocol. The details of protocol used for the communication to be provided.

29.8. The copies of all necessary software on compact discs & communication cables to be provided.

29.9. Necessary configurations files for communication between Meter, MRI and Base Computer Software shall be provided

30. INSTALLATION CHECK

30.1. After installation, the meter shall have a facility to check the correctness of connections to the meter and their polarity.

30.2. The meter shall also capable of checking phase sequence of voltage and current as well as phase association between voltage and current.

31. TESTS

For testing of meter, CBIP Report No. 325 and IS: 13779 shall be referred. A tentative recommended test sequence is given below.

31.1. Type Tests

31.1.1. Test of insulation properties

31.1.1.1. Impulse voltage test

31.1.1.2. AC High Voltage test

31.1.1.3. Insulation Resistance Test

31.1.2. Tests of accuracy requirements

31.1.2.1. Test on limits of errors

31.1.2.2. Test on meter constant

31.1.2.3. Test of starting condition

31.1.2.4. Test of no load condition

31.1.2.5. Repeatability of error test

31.1.2.6. Test of ambient temperature influence

31.1.2.7. Test of influence quantities

31.1.3. Test of electrical requirements

31.1.3.1. Test of power consumption

31.1.3.2. Test of influence of supply voltage

31.1.3.3. Test of influence of short time over-currents

31.1.3.4. Test of influence of self heating

31.1.3.5. Test of influence of heating

31.1.3.6. Test of influence of immunity to earth fault

31.1.4. Test for electromagnetic compatibility (EMC)

31.1.4.1. Radio interference measurement

31.1.4.2. Fast transient burst test

31.1.4.3. Test of immunity to electromagnetic HF fields

31.1.4.4. Test of immunity to electrostatic discharge

31.1.5. Test of climatic influences

31.1.5.1. Dry heat test

31.1.5.2. Cold test

31.1.5.3. Damp heat, cyclic test

31.1.6. Tests of mechanical requirements

31.1.6.1. Vibration test

31.1.6.2. Shock test

31.1.6.3. Spring hammer test

31.1.6.4. Tests of protection against penetration of dust and water.

31.1.6.5. Test of resistance to heat and fire

31.2. Acceptance Tests

31.2.1. Tests of insulation properties

31.2.1.1. A.C. High Voltage test

31.2.1.2. Insulation Resistance Test

31.2.2. Tests of accuracy requirements

31.2.2.1. Test on limits of errors

31.2.2.2. Test on meter constant

31.2.2.3. Test of starting condition

31.2.2.4. Test of no load condition

31.2.2.5. Repeatability of error test

31.2.3. Test of electrical requirements

31.2.3.1. Test of power consumption

31.2.4. Tests of mechanical requirements

31.2.4.1. Vibration test

31.2.4.2. Shock test

31.2.5. Inter-terminal voltage test

31.2.5.1. Applying 600 volts continuously across voltage circuit for 4 hours

31.3. Routine Tests

31.3.1. Tests of insulation properties

31.3.1.1. A.C. High Voltage test

31.3.1.2. Insulation Resistance Test

31.3.2. Tests of accuracy requirements

31.3.2.1. Test on limits of errors

31.3.2.2. Test on meter constant

31.3.2.3. Test of starting condition

31.3.2.4. Test of no-load condition

31.4. Meter shall pass the entire acceptance and routine tests as laid down in this specification (Reference standard IS: 13779 & CBIP Report No-325)

In addition to the above, meter shall be tested for tamper conditions as stated in this specification.

32. MINIMUM TESTING FACILITIES

32.1. The manufacturer should possess fully computerized minimum 0.05 class meter test bench system for carrying out routine and acceptance tests. In addition this facility should produce Test Reports for each and every meter.

32.2. The supplier should have the necessary minimum testing facilities for carrying out the following tests

32.2.1. A.C. High Voltage test

32.2.2. Insulation Resistance

32.2.3. Test on limits of errors

32.2.4. Test on meter constant

32.2.5. Test of starting condition

32.2.6. Test of no-load condition

32.2.7. Repeatability of error test

32.2.8. Test of power consumption

32.2.9. Vibration test

32.2.10. Shock test

32.2.11. Tamper conditions as per the specification.

32.3. The manufacturer should have duly calibrated Standard meter of Class 0.05 or better accuracy.

33. TEST CERTIFICATES:

33.1. The meter shall be fully type tested as per relevant standards IS: 13779 and CBIP report No. 325. The type test reports (not older than 2 years) of the meter shall be submitted.

33.2. The type test report for 10kV surge immunity test 1.2 / 50 micro second in case of open circuit voltage and 8/20 micro second in case of short circuit current as per IEC: 1000-4-5 Standard ,shall be submitted.

33.3. The test reports for tamper resistance features as stated in the specification.

33.4. The test report for immunity of meter against external AC/DC/ permanent magnet, EMF of minimum 0.5 Tesla and High Voltage Spark discharge to be provided.

33.5. Routine test reports in hard and soft copy shall be submitted along with the meter.

34. INFORMATION TO BE SUBMITTED WITH THE METER

The following shall be furnished with the meter:

34.1. Catalogues describing the equipment and indicating the type and model number

34.2. Constructional features, materials used and relevant technical literature

34.3. Complete dimensional drawings

34.4. The details of the information indicated on the rating plate

34.5. Type Test Certificates from a recognized independent testing authority

34.6. Wiring diagram

34.7. Service manual

34.8. Quality systems and Quality Assurance Plan

35. DEVIATIONS:

It is not allowed to deviate from the principal requirements of the specifications. However, it is required to submit detailed list of all deviations without any ambiguity. Unless otherwise brought out separately in the schedule of deviations, the energy meter shall conform to the specification scrupulously. The discrepancies between the specification and the catalogues or literature submitted as part of the meter shall not be considered al valid deviations unless specifically brought in the schedule of deviations.

ANNEXURE – A (DISPLAY PARAMETERS)

Display parameters shall be customized as below

A.1. Surat Unit

a. Auto display

i. Cumulative Active Energy (kWh) (6+1 digits) (09 Sec)

ii. Previous month MD (History) (kVA) (2+3 digits) (9 seconds)

iii. Tamper Status (Status YES/NO) – At the time of occurrence of any tamper, display shall show "Tamper – Yes", else, it should display "Tamper – No"

b. Manual Display

i. LCD Display Segment Test

ii. Meter serial number

iii. Real Date & Time

iv. Cumulative active Energy (kWh) (6+1 digits)

v. Cumulative apparent Energy (kVAh) (6+1 digits)

vi. Cumulative reactive Energy (kVArh) (Lag) (6+1 digits)

vii. Cumulative reactive Energy (kVArh) (Lead) (6+1 digits)

viii. Cumulative Maximum Demand (kW) (3 + 3 Digits)

ix. Rising demand with elapsed time (kW) (2 + 3 Digits)

x. Rising demand with elapsed time (kVA) (2 + 3 Digits)
xi. Cumulative Maximum Demand (kVA) (3 + 3 Digits)
xii. History-1 : Cumulative Active Energy (kWh) (6 + 1 Digits)
xiii. History-2 : Cumulative Active Energy (kWh) (6 + 1 Digits)
xiv. History-3 : Cumulative Active Energy (kWh) (6 + 1 Digits)
xv. History-4 : Cumulative Active Energy (kWh) (6 + 1 Digits)
xvi. History-5 : Cumulative Active Energy (kWh) (6 + 1 Digits)
xvii. History-6 : Cumulative Active Energy (kWh) (6 + 1 Digits)
xviii. Current Month Maximum Demand (kW) (2 + 3 Digits)
xix. Current Month Maximum Demand (kVA) (2 + 3 Digits)
xx. History-1 : Maximum Demand (kW) (2 + 3 Digits)
xxi. History-2 : Maximum Demand (kW) (2 + 3 Digits)
xxii. History-3 : Maximum Demand (kW) (2 + 3 Digits)
xxiii. History-4 : Maximum Demand (kW) (2 + 3 Digits)
xxiv. History-5 : Maximum Demand (kW) (2 + 3 Digits)
xxv. History-6 : Maximum Demand (kW) (2 + 3 Digits)
xxvi. History-1 : Cumulative apparent Energy (kVAh) (6+1 digits)
xxvii. History-2 : Cumulative apparent Energy (kVAh) (6+1 digits)
xxviii. History-3 : Cumulative apparent Energy (kVAh) (6+1 digits)
xxix. History-4 : Cumulative apparent Energy (kVAh) (6+1 digits)
xxx. History-5 : Cumulative apparent Energy (kVAh) (6+1 digits)
xxxi. History-6 : Cumulative apparent Energy (kVAh) (6+1 digits)
xxxii. History-1 : Maximum Demand (kVA) (2 + 3 Digits)
xxxiii. History-2 : Maximum Demand (kVA) (2 + 3 Digits)
xxxiv. History-3 : Maximum Demand (kVA) (2 + 3 Digits)
xxxv. History-4 : Maximum Demand (kVA) (2 + 3 Digits)
xxxvi. History-5 : Maximum Demand (kVA) (2 + 3 Digits)
xxxvii. History-6 : Maximum Demand (kVA) (2 + 3 Digits)
xxxviii. Instantaneous load (active, reactive & apparent) (2+3 digits)
xxxix. Instantaneous voltage (phase wise) (3+2 digits)
xl. Instantaneous current (phase wise) (2+2 digits)
xli. Instantaneous Power Factor (1+3 digits)

xlii. Instantaneous frequency (2+3 digits)

xliii. MD reset count (Billed)

xliv. Cumulative Magnet tamper count (2 + 0 Digits)

xlv. Magnetic tamper cumulative Defraud Energy (kWh) (6+1digits)

xlvi. Phase Sequence

xlvii. Potential tamper status

xlviii. Current related Tamper

status xlix. Other tamper status

l. First occurrence tamper ID

li. Date & time of first occurrence

lii. Last occurrence tamper ID

liii. Date & Time of last occurrence

liv. Last restoration tamper ID

lv. Date & Time of last restoration

lvi. Cumulative tamper occurrence count

lvii. Connection check

lviii. Power Off Hours – Current Month

lix. Power Off hours – previous month

lx. Tariff Details (Auto MD Reset date)

c. High Resolution Display (2+4 digits)

i. Cumulative active Energy (kWh)

ii. Cumulative apparent Energy (kVAh)

iii. Cumulative reactive Energy (kVArh) (Lag)

iv. Cumulative reactive Energy (kVArh) (Lead)

Annexure – B (TOD SLOTS AND SEASONS)

TOD time and season definitions shall be customized as below.

B.1. Surat Unit

a. Season 1 # April, 01 to Oct, 31

b. Season 2 # Nov, 01 to March, 31

c. Following time zone shall be programmed in the meter

TOU Zone	**April to October**	**November to March**
TOU Zone-1	07:00 Hrs to 11:00 Hrs	07:00 Hrs to 11:00 Hrs
TOU Zone-2	11:00 Hrs to 18:00 Hrs	11:00 Hrs to 18:00 Hrs
TOU Zone-3	18:00 Hrs to 22:00 Hrs	18:00 Hrs to 22:00 Hrs
TOU Zone-4	22:00 Hrs to 06:00 Hrs	22:00 Hrs to 06:00 Hrs
TOU Zone-5	06:00 Hrs to 07:00 Hrs	06:00 Hrs to 07:00 Hrs
TOU Zone-6	-	-
TOU Zone	**April to October**	**November to March**
TOU Zone-7	-	-
TOU Zone-8	-	-

d. Tariff : Lag only