



# PASCHIM GUJARAT VIJ COMPANY LIMITED

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## TECHNICAL SPECIFICATIONS FOR 3 PHASES, 4 WIRE A.C. STATIC WHOLE CURRENT TRIVECTOR ENERGY METER OF ACCURACY CLASS 1.0 WITH DLMS (Category-C2)

### 1.SCOPE:

This specification covers design, engineering, manufacture, testing, inspection and supply of ISI marked static whole current electronic meter of Class 1.0 accuracy of current range 10-60 Amps for tariff purpose along with other associated component as per requirement given in this specification which is based on IS-13779/99, however meters matching with requirements of IEC-61036/2000, or other international standards which ensure equal or better performance than the standards mentioned above shall also be considered.

i) The meter shall be 3 phase 4 wire type suitable for connection to LT 3x240V, 3 phase 4 wire systems with DLMS(Category-C2). The meter shall be suitable for balanced as well as unbalanced load at all power factors i.e. Zero lag-Unity -Zero lead. The meter shall be capable to record and display kWh, KVARH, KVAH and maximum demand in kW for 3 phase 4 wire AC balanced/unbalanced loads for a power factor range of zero (lagging), unity and zero (leading) as per requirement given in this specification.

ii) It is not the intent to specify completely herein all the details of the design and construction of meter. The meter shall, however, conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing for continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject the meter which is not in accordance therewith. The offered meter shall be complete with all accessories, hardware, software and components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

(iii) The original manufacturer of LT AC Static Energy Meters who is registered vendor shall only quote against this tender. It is mandatory that in case of Indian manufacturer, the offered meter shall be ISI marked and bidder shall have to furnish valid BIS certification along with the offer and in case of foreign bidder the meter shall comply either BIS standard or standard of International Electro technical Commission, i.e. relevant IEC, shall be marked with the same and bidder must furnish valid BIS or IEC certification along with the offer, however the meter must comply this specification.

(iv) The 3 phase 10-60A whole current meter for DLMS Protocol should comply as per IS 15959: 2011 for category 'C2'. **The bidder will have to submit the certificate of CPRI/ERDA/NABL accredited laboratory conforming above BIS with the tender documents.** If the certificate/relevant documents are not submitted, the bid will not be considered for further evaluation. However, the necessary documents, certification and samples to be submitted along with the technical offer should be conforming and compliant to DLMS as

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per IS 15959: 2011. The offers, not complying to above, shall be rejected without any further correspondence.

## 2. STANDARDS APPLICABLE:

Unless otherwise specified elsewhere in this specification, the performance and testing of the meters shall conform to the following Indian/International Standards and all related Indian/International standards to be read with up To-date and latest amendments/revisions thereof:

| Sr. No. | Standard No.                  | Title  |
|---------|-------------------------------|--|
| 1.      | IS 13779/1999                 | Specification of AC Static Watt hour meters, class 1.0 & 2.0.                                |
| 2.      | CBIP Technical Report No.325  | CBIP guide on static energy meter specifications & testing                                   |
| 3.      | CBIP Technical Report No. 111 | Specification for Common Meter Reading Instrument.   |
| 4.      | IEC 61036-2000                | Specification for AC static Watt-hour Meters, Class 1 & 2.                                   |
| 5.      | IS : 9000                     | Basic Environmental Testing Procedures for Electronic & Electrical items.                    |
| 6       | IEC 1036                      | Static Energy Meters   |
| 7       | IEC 62052-11                  | Electrically Metering equipment(AC)-General Requirement, Test & Test condition               |
| 8       | IEC 62053-21                  | Static Energy Meters for Active Energy   |
| 9       | IS 12346                      | Specification for testing equipments for ac energy meters                                    |
| 10      | IS 15959: 2011                | Data Exchange for electricity meter reading, tariff & load control companion specifications. |

When the equipment offered by the bidder conforms to standards other than those specified above, salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule.

## 3. CLIMATIC CONDITIONS:

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

|    |   |                                 |
|----|---|---------------------------------|
| a) | Maximum ambient air temperature in shade.           | 50° Cent.                       |
| b) | Minimum ambient temperature                         | (-) 5° Cent.                    |
| c) | Maximum relative humidity                           | 95%                             |
| d) | Minimum relative humidity                           | 10%                             |
| e) | Max Height above mean sea level                     | Up to 1000 meters.              |
| f) | Dust storms likely to occur                         | Between March to July in a year |
| g) | Average number of thunder storm days per annum      | 40                              |
| h) | Average number of tropical monsoon months per annum | 4 months                        |

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|    |                                   |                     |
|----|-----------------------------------|---------------------|
| i) | Annual rain fall                  | 10 cms. to 150 cms. |
| j) | Seismic level(Horizontal accn)    | 0.30g               |
| k) | Iso-ceramic level (days per year) | 50                  |
| l) | Maximum wind pressure             | 150 kg/sqmt         |

The temperature range and relative humidity for performance of meters shall be as per relevant standards.

#### 4.GENERAL AND CONSTRUCTIONAL REQUIREMENTS:

- 4.1. Meter shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However, the following shall be ensured.
  - 4.1.1. Personal safety against electric shock
  - 4.1.2. Personal safety against effects of excessive temperature
  - 4.1.3. Protection against spread of fire
  - 4.1.4. Protection against penetration of solid objects, dust and water
- 4.2. 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.
- 4.3. The meter shall be designed and manufactured using SMT (Surface Mount Technology) components.
- 4.4. All insulating material used in the construction of meter shall be non-hygroscopic, non-ageing and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.
- 4.5. The meter shall have an operation indication device such as a blinking LED. The operation indicator shall be visible from the front window and capable of being monitored conveniently with suitable testing equipment.
- 4.6. The meter shall conform to the degree of protection IP 51 of IS: 12063/IEC: 529 for protection against ingress of dust, moisture and vermin's.
- 4.7. The meter shall be supplied with a transparent extended terminal block cover (ETBC). Extended length of terminal cover should be minimum 40 mm from ending edge of terminal block.
- 4.8. The polycarbonate material of only following manufacturers shall be used.

- |                  |  |
|------------------|--|
| a) GE PLASTICS   | LEXAN 943A FOR COVER AND TERMINAL COVER/<br>LEXAN 503R FOR BASE & TERMINAL BLOCK |
| b) BAYER         | GRADE CORRESPONDING TO ABOVE   |
| c) DDW CHEMICALS | -DO-   |
| d) MITSUBISHI    | -DO-   |
| e) TEJIN         | -DO-   |
| f) DUPONT        | -DO-   |

The meter base shall be manufactured from high quality industrial grade material viz. Polycarbonate with 10 % glass filled which shall meet following properties to ensure higher reliability and long life of the meter base.

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1) Meter base & cover and 2) terminal cover shall conform to the following.

| Sr. No. | Test   | 10% Glass filled non-transparent material for meter base & terminal block | Transparent material for meter cover & terminal cover                    |
|---------|--|---|--|
| 1       | UV ageing 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--60695-10-2                                    | 125° C +/- 2° C   | 125° C +/- 2° C  |
| 4       | Flammability Test<br>(a) As per UL 94 or<br>(b) As per IS 11731(Part-2) 1986 | VO<br>FVO   | VO<br>FVO  |
| 5       | Glow wire test<br>IS:11000(part 2/SEC-1) 1984 OR IEC PUB,60695-2-12          | 960 ±15° C<br>(For terminal block)  | 650 ±10° C<br>(For Terminal cover and meter case)                        |
| 6       | Heat deflection Temp.(HDT)<br>HDT/Ae, 1.8MPa edge(100mm) As per ISO 75/Ae    | 132° C  | 125° C   |

4.8.1 The terminal block shall be of high grade non-hygroscopic, fire retardant, low tracking fire resistant, reinforced poly-carbonate or equivalent high grade engineering plastic which shall form an extension of the meter case and shall have terminal holes and shall be of sufficient size to accommodate the insulated conductors & meeting the requirement of IS 13779:1993.

4.8.2 The meter cover shall be fully transparent. However, in case of non transparent cover the window shall be of fully transparent Polycarbonate material for easy reading of all the displayed values/ parameters, name plate details and observation of operation indicator. The fixing of the window with the cover in the later case shall be temper proof, dust proof & moisture proof.

4.8.3 The meter cover and base shall be suitably shielded with metallic material so as to protect the meter from adverse effect of AC/DC Abnormal external magnetic field. The meter shall meet the requirements for immunity against continuous magnetic induction as per requirement given in clause no.15.10 of this specification. **Meter top cover should be ultrasonically welded OR break to open type arrangement.**

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

4.9 The terminals shall have suitable construction with barriers and cover to provide firm and safe connection of current and voltage leads of stranded copper conductors or copper reducer type terminal ends (thimbles). The manner of fixing the conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. The internal diameter of the terminal holes shall be 8.5 mm minimum. The clearance and creep distance shall conform to relevant clause of IS 13779:1999

4.10 The meter shall be compact in design. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.

4.11 All parts that are likely to develop corrosion shall be effectively protected against corrosion. The construction of the meter shall be such as to be sealed independently and prevent unauthorized tampering.

#### 4.12 PRINTED CIRCUIT BOARD:

The fully tested double layered glass epoxy shall be used. The latest technology such as hybrid microcircuit or application specific integrating circuit (ASIC) shall be used to ensure reliable performance. The mounting of components on the PCB shall be SMT (Surface Mounted Technology) Type. The electronic components used in the meter shall be of high quality from world renowned manufacturers and there shall be no drift in accuracy of the meter for at least up to Guarantee period. The make/grade and the range of the components should be from the following list.

| Sr. No. | Component function   | Requirement  | Makes and Origin   |
|---------|----------------------|--|--|
| 1       | Current Transformers | If the Meter is with one current transformers as measuring elements. The current transformer should withstand for the clauses under 5&9 of IS- 13779 /1999 | ORIGIN CONFORMING TO IS-2705 OR RELEVANT STANDARD.                                     |
| 2       | Measurement Chips    | The measurement or computing chips used in the Meter should be with the Surface mount type along with the ASICs.   | USA: Anolog Devices, Cyrus Logic, Atmel, Philips<br>South Africa :SAMES<br>Japan : NEC |
| 3       | Quartz Crystal       |  | AVX, VANLONG, ADVANCED CRYSTAL etc.  |

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| Sr. No. | Component function    | Requirement   | Makes and Origin   |
|---------|-----------------------|---|--|
| 4       | Memory chips          | The memory chips should not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. There shall be security isolation between metering circuit, communication circuit & power circuit.   | USA: Atmel, National Semiconductors, Texas Instruments, Philips, ST, Japan : Hitachi   |
| 5       | Display modules       | a) The display modules should be well protected from the external UV radiations.<br>b) The display visibility should be sufficient to read the Meter mounted.<br>c) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display ( PIN Type).<br>d) It should be trans- reflective STN type industrial grade with extended temperature range. | Display TEK/KCE/RCL<br>Display /Suzhou heng<br>Xiamen instruments/<br>Veritronics/ Bona- fide/<br>Jebon<br>VIZ.<br>Hongkong : Genda<br>Singapore: Bonafied<br>Technologies.<br>Korea: Advantek<br>China : Success<br>Japan : Hitachi, Sony.<br>TIANMA,Haijing, Holtek, |
| 6       | Communication Modules | Communication modules should be compatible for the optical port for communication with meter reading instruments.   | USA: National ,<br>Semiconductors HP,<br>Optonica.Holland/ Korea<br>: Phillips Japan : Hitachi<br>Taiwan: Ligitek  |
| 7       | Communication port    | Optical port should be used to transfer the meter data to meter reading instrument.<br>The mechanical construction of the port should be such to facilitate the data transfer easily. The Optical Port should not be adversely affected by influence of electromagnetic field, Static discharge.  | USA: National<br>Semiconductors HP Agilent<br>Holland/Korea : Phillips<br>Japan : Hitachi<br>Taiwan: Ligitek   |
| 8       | Power supply          | The power supply should be with the Capabilities as per the relevant standards. It should not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections  | SMPS Type or better  |
| 9       | 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<br>Semiconductors, Atmel,<br>Philips, Texas Instruments,<br>Siemens<br>WELWYN,VISHAY   |

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| Sr. No. | Component function      | Requirement  | Makes and Origin   |
|---------|-------------------------|--|--|
|         |                         |  | DRALORIC, YAGEO, KOA, ROHM, PHYCOMP, FAIRCHILD, PHILIPS, VISHAY SEMICONDUCTOR, TEXAS INSTRUMENT, EPCOS, OSRAM, INFINION, NATIONAL SEMICONDUCTOR etc.<br>Japan : Toshiba, Hitachi, Oki, AVZ or Ricon Korea; Samsung |
| 10      | Battery                 | Chargeable maintenance free guaranteed life of 10 years.               | Varta, Tedirun, Sanyo or National, Panasonic, Renata   |
| 11      | RTC & Micro controller. | The accuracy of RTC shall be as per relevant IEC/ IS standards.        | USA : Philips, Dallas, ST, Xicor Atmel, Motorola, Microchip<br>Japan : NEC or Oki.<br>Taiwan : Prolific Technology Inc.  |
| 12      | PCB                     | Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm. | A class vendor   |

Note: The makes of components mentioned in tender specifications are only indicative. The bidder can utilize better or equivalent make of components and they have to submit make of above mentioned components in Schedule:B of technical bid. It is mandatory. The list of components shall be provided by the supplier at the time of Proto as well as Lot inspection.

The physical verification of make of components of meter shall be carried out at discretion of company at any stage (sample, proto, lot).

#### 5.SAMPLING RATE AND DERIVATION OF BASIC MEASURABLE QUANTITIES:

The actual supply wave of related voltages and currents shall be sampled out at the rate of minimum 3000 samples per second and shall provide integrated values of each actual voltage and current (available on display in push button mode) while deriving actual basic active (cosine part measurable component) and reactive (sine part measurable component) energies (with respect to relevant voltage wave and current wave) even under presence of harmonics.

The meter shall have internal Real Time Clock with the back up of a Lithium maintenance free battery of minimum shelf life of Ten (10) years for operation of the time clock. The Real Time Clock shall be based on Quartz crystal timer so as to make it independent of line frequency variations.

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**6. QUANTITIES TO BE MEASURED, MONITORED AND MEMORISED:**

6.A. The meter shall be capable of measuring and storing in the memory and displaying the following electrical quantities within specified limits of error for poly phase supplies [i.e. 3-phase, 4 wire system with star point (neutral) solidly grounded or floated] of 3-phase Delta or Star connected load having a floating or a grounded Star point with balanced or unbalanced loads at all power factors. Apparent demand and energy shall be derived from active energy (cosine part recording arrangement) and reactive energy (sine part lagging and leading power factor recording arrangement) through vector summation of active energy and only lagging reactive electrical energies traversed for 30 minutes integration period.

The meter shall also be capable of measuring, monitoring and storing in the memory minimum FOUR (4) time zone (TOD) electrical quantities for pre-specified periods of the day. However, since at present the features of TOD energy measurement are required for four time zones only, provision shall be made so that the same can be programmed up to eight (8) zones through MRI/PC at site as and when required in the future.

The four time zones to be provided in the meter and its sequence is as under. In MRI data TOD energy and demand report should be available for Nos. of time zone

| Sr. No. | TOD Details      | Timings   | Total Hours in TOD |
|---------|------------------|---|--------------------|
| 1.      | TOD-1 (Peak)     | 07:00 Hrs. to 11:00 Hrs. Plus<br>18:00 Hrs. to 22:00 Hrs. | 8                  |
| 2.      | TOD-2 (Night)    | 00:00 Hrs. to 06:00 Hrs. Plus<br>22:00 Hrs. to 24:00 Hrs. | 8                  |
| 3.      | TOD-3 (Rest)     | 06:00 Hrs. to 07:00 Hrs                                   | 1                  |
| 4.      | TOD-4 (Off Peak) | 11:00 Hrs. to 18:00 Hrs.                                  | 7                  |

programmed (Presently only 4 Nos. to be available in the MRI report)

TOD timing shall be printed/pasted on plate/meter body in easily interpretable form.

6.A.1. Active energy: Total Forward Cumulative kWh energy.

6.A.2. Reactive energy: Cumulative KVARH lagging with respect to Active energy.

6.A.3. Apparent energy: Cumulative KVAH derived by vector from lagging Reactive and Active energy.

6.A.4. Maximum Demand: Active MD KW demand derived from total forward cumulative active energy with integration period of 30 minutes.

6.A.5 HIGH RESOLUTION MODE FOR TOTAL KWH, FUNDAMENTAL KWH, KVAH & KVARH(LAG)

Recording of active energy (KWH) for billing purpose.

The Meter should record and display maximum demand in KW and Total forward KWH (i.e. Fundamental plus Harmonics energy)

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It should measure and record cumulative KVAH energy also derived from vectorial summation of Total cumulative KWH (fundamental + harmonic energy) and cumulative KVARH energy (lag only).

Meter should also record KVA demand derived from total KVAH energy with integration period of 30 minutes.

The high resolution display having of minimum seven digit (minimum two digits before decimal points & minimum five digits after decimal points e.g. xx.xxxxx) for Total KWH, Fundamental KWH, KVAH, KVARH (lag) shall be provided under mode-3 for the accuracy checking of meter in the field.

The meter shall have 3 modes for display. Display parameters in all 3 modes shall be as per Annexure-1 in following manner

MODE 1: Parameters of this mode should display on auto scrolling as well as manually up & down scrolling using push button. However, repeated parameters shall not display in push button mode.

MODE 2 & 3: Parameters of these modes should display manually up & down scrolling using push button

- Meter shall have separate push button for up and down scrolling
- MD reset button shall be exclusive for MD reset. Functional marking shall be provided for all push buttons (e.g. up scroll, down scroll, MD Reset etc.)

Last parameter should stay on display for five minutes after last press of push button, and then, display should automatically switch over to auto scrolling mode (Mode-1).

Display mode shall change by simultaneous pressing of up scroll and down scroll button for five seconds.

Mode-1, Mode-2 & Mode-3 header should also display at the time of Mode changing by Buttons.

In absence of power supply, display shall be available by push button.

Internal power source for the display should be such that ,in case of power failure, even for the period for six months, display can be seen by push button and data can be retrieved.

6.B. The meter shall keep following quantities recorded and memorized in its Non Volatile memory chip for ever, so that in event of failure/damage of the meter the last reading of billing quantities would not be lost.

Cumulative energies from the date of installation -

6.B.1. Total forward Cumulative KWH energy.

6.B.2. Cumulative KVARH lag

6.B.3. Cumulative KVAH energy.

#### 7. SEALING OF THE METER:

Reliable sealing arrangement shall be provided with sealing screw to make the meter tamperproof and to avoid fiddling or tampering by unauthorized persons. For this, at least two (2) Nos. seals on meter body, two (2) No. seals on meter terminal cover, one (1) No. seal on communication port and one (1) No. seal on MD reset button (if such button is

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provided) shall be provided. All the seals shall be provided on front side only. Rear and in-side sealing arrangement shall not be accepted. The bidder in their offer shall explain the sealing arrangement. The sealing screw should be unidirectional and arrangement of sealing screw shall be as per standard practice with two holes at bottom and two holes at top of screw for sealing arrangement.

At least two sealing screws of Nickel plated brass/steel shall be provided for proper fixing of meter cover. Each sealing screw shall have two independent sealing holes. Two holes should be provided in the head and Two in the bottom portion, so that two separate seals can be provided. The diameter of the hole shall be 2.0 mm and 1.5 mm for the head and bottom portion respectively. The length of the sealing screw shall be long enough to flush with the ground or any other sealing arrangement which will meet our requirement.

The supplier shall have to provide two polycarbonate Plastic seals on the meter body of each meter before dispatch of the meter. The plastic seal shall have embossing of the supplier's logo & sr. no. of seal. Sr. no. of seal is to be provided on both male & female part of the seal.

#### 8. BOUGHT OUT ITEMS:

A detailed list of bought out items, which are used in the manufacture of the meter, shall be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought out items.

#### 9. OUT PUT DEVICE:

The meter shall have a test output accessible from the front and be capable of being monitored with suitable testing equipment. The operation indicator must be visible from the front. Test output device shall be provided in the form of LED output device for KWH and KVARH measurement.

The relation between test output shall comply with the marking on the name plate or with the indication on display, if so provided in addition to details on name plate i.e. pulse per KWH/KVARH or KWH/KVARH per pulse.

#### 10.COMMUNICATION PORT:

The meter shall be provided with two ports for communication of the measured/collected data as per IS: 15959 (including amendment 2), i.e. a hardware port compatible with RS 232 specifications which shall be used for remote access through suitable Modem (GPRS/GSM/EDGE/CDMA/PSTN/LPR) and an Optical port complying with hardware specifications detailed in IEC-62056-21. This shall be used for local data downloading through a DLMS compliant HHU.

The RS 232 port shall support the default and minimum baud rate of 9600 bps. The PIN configuration for RS 232 port shall be as under:

|                                  |                                       |
|----------------------------------|---------------------------------------|
| <b>RS 232 Port</b>               |                                       |
| <b>RJ10 (4 PIN 4 connection)</b> | <b>1GND, 2Rx, 3TX, 4Vcc</b>           |
| <b>OR</b>                        |                                       |
| <b>RJ11 (6 PIN 4 connection)</b> | <b>1NC, 2GND, 3Rx, 4TX, 5Vcc, 6NC</b> |

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The meter shall be capable of executing instructions from base computer service center only after due authentication through protected two level pass word, for the following:

- i) Change in integration period
- ii) Change in automatic re-setting for billing data, date & time.
- iii) Activation of TOD energy measurement OR Modifications in TOD timings if required in future.

The meter shall thereafter communicate above information while off-loading the data to computer through hand-held meter reading instrument (MRI) with either relevant billing quantities or relevant energy audit/load survey data.

#### 11.MARKING OF METER:

The meter terminal marking and mounting arrangement shall be as per Indian Standard/IEC. The marking on every meter shall be in accordance with IS 13779/1999 or IEC.

The meter shall have name plate beneath the meter cover such that the name plate cannot be accessed without opening the meter cover and without breaking the seals of the meter cover and the name plate shall be marked indelibly. The name plate marking shall not fade with lapse of time.

The basic marking on the meter nameplate shall be as under:

- Manufacturer's name and trade mark
- Type designation
- Number of phases and wires
- Serial number
- Month and Year of manufacture
- Reference voltage
- Rated Current
- Principal unit(s) of measurement
- Meter constant (imp/kWh)
- 'BIS' Mark
- Accuracy Class of meter (class-1.0)
- "Property of PGVCL."
- Purchase Order No. & date
- Guarantee period
- Category of the meter and corresponding IS 15959 : 2011

Only one meter Sr. no which is provided by the PGVCL must be on name plate. Unique procedure of Meter Sr. no. having Alfa-numeric character will be decided by PGVCL and will be given at the time of placing Order so that 7 digit numeric part will appear on meter display and Alfa-numeric part will appear in BCS (MRI data) as well as on name plate.

#### 12.CONNECTION DIAGRAM, PHASE SEQUENCE & TERMINAL MARKINGS:

Clear indication of phase sequence shall be marked and connection diagram relevant to meter must be permanently embossed/engraved/pasted (manufactured from good quality plastic sticker material) on the inside of extended transparent terminal cover.

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**13.ELECTRICAL REQUIREMENTS:****13.1 SUPPLY SYSTEM**

|                      |  |
|----------------------|--|
| Rated voltage (Vref) | 3x240V-Phase to Neutral (3 phase 4 wire system)<br>3 x 415 V- Phase to Phase |
| Rated current (Ib)   | Basic current 10A (Ib), Maximum current-60 Amps (I <sub>max</sub> .)         |

**13.2 POWER FACTOR RANGE:**

The meter shall be suitable for full power factor range from zero (lagging) through unity to zero (leading).

**13.3 POWER SUPPLY VARIATION:**

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

|                           |                               |
|---------------------------|-------------------------------|
| Specified operating range | 0.7 to 1.2 V ref.             |
| Frequency                 | 50 Hz +/-5% (As per standard) |

For influence quantities like voltage variation, frequency variation, voltage unbalance etc. the limits of variation in percentage error shall be as per IS:13779.

**13.4 ACCURACY:**

Class of accuracy of the meter shall be 1.0.

**13.5 POWER CONSUMPTION**

13.5.1 Voltage Circuit: The active and apparent power consumption in each voltage circuit including the power supply of meter at reference voltage, reference temperature and reference frequency shall be as per the provision of IS-13779 /IEC(latest amendment)

13.5.2.Current Circuit: The apparent power taken by each current circuit at basic current, reference frequency and reference temperature shall be as per the provision of IS-13779/IEC(latest amendment )

**13.6 STARTING CURRENT:**

The meter shall start registering the energy at 0.2% of Ib and unity power factor.

**13.7 MAXIMUM CURRENT:**

The rated maximum current for the meter shall be 60 Amps (600 % Ib) at which the meter purports to meet the accuracy requirement.

**13.8 IMPULSE VOLTAGE:**

-The meter shall withstand 1.2/50 microsecond impulse voltage of peak value 10 KV Peak without any damage in line with Clause 12.7.6.2 of IS 13779:1999. Error at Ib,Upf before & after will be measured & after the test, variation in % error of the meter shall not exceed 50 % of class of index .

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**13.9 REPEATABILITY TEST:**

The test shall be carried out at 5% lb and lb at UPF - six readings at the interval of 5 minutes. The difference between maximum and minimum error shall not be more than 0.5. The test shall be conducted on the three sample selected from the eight meters selected for accuracy test as per clause no. 12.7 of IS 13779.

**14.SOFTWARE:**

Licensed copies of Software shall be installed in CMRI & BCS free of cost by the meter manufacturer and its nos. will be decided by the PGVCL.

The above software shall be suitable for the operating system of the associated PGVCL's computers:

- (i) Software for reading the meter contents in the MRI.
- (ii) Base Computer Software (BCS) for accepting data from MRI and down loading instructions from Base Compute to MRI. Windows based BCS for receiving data from CMRI and downloading instructions from BCS to CMRI. This BCS shall have, amongst other requirements and features and facilities described later in this specification, the facility to convert meter reading data into user definable ASCII file format so that it may be possible for the user to integrate the same with the user's billing data and process the selected data in desired manner. The report should be export to excel and pdf format.
- (iii) The meter should be capable to communicate directly to Lap Top /Desktop computer.

Any other special applications software and additional software not mentioned above but necessary for functioning of the system should also be supplied free of cost.

The above software shall be suitable for the operating system of the associated PGVCL's computers.

Windows based Base Computer Software (BCS) for receiving data from CMRI and downloading instructions from base computer software to CMRI. This BCS should have, amongst other requirements and features and facilities described later in this specification, the facility to convert meter reading data into user definable ASCII file format so that it may be possible for the user to integrate the same with the user's billing data and process the selected data in desired manner.

After successful downloading data either from the meter or MRI, Meter Sr No. must be added in the available list, and on the selecting particular meter, what ever data available shall be display/shown. i.e. No procedure regarding the upload the meter from "add to data" like option is to be carry out.

There shall be provision of filter for finding the particular meter Viz. one can find the meter on the basis of date, Month, Sr No, etc.

**15.SALIENT FEATURES:**

The meters shall have the following additional salient features.

- 15.1 The meter shall have provision to read in absence of power through an internal power source.
- 15.2 The meter shall work accurately irrespective of phase sequence of the mains supply.
- 15.3 The meter shall remain powered up and functional in presence of any two wires.

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- 15.4 The meter shall continue to record accurately as per prevailing electrical conditions even if the neutral of supply gets disconnected.
- 15.5 The meter shall record correct energy in case of current reversal of one or more phase.
- 15.6 The measurement by meter shall not get influenced by injection of AC Voltage/ Chopped signal/DC signal and Harmonics in floating neutral leads of the meter. The facility for suitable testing of the same shall be made available for inspecting officer at the time of lot inspection and acceptance testing. Meter should record energy with maximum error of (+) 6% to (-) 4% on Injection of DC (+) ve & DC (-) ve in neutral & injection of chopped AC in neutral. Tests in this respect will be conducted for chopped AC injection & steady DC injection. DC voltage will be rectified from a single phase power supply. Wiring diagrams of chopped AC signals and pulsating DC signals are mentioned herewith as per **Annexure-III** and **Annexure-IV**.
- 15.7 The potential link shall neither be provided external or internal. Link less terminal block shall be provided.
- 15.8 The meter should be programmed for both KVA MD and KW MD. How ever other programmable parameters should be made available as per IS 15959: 2011.
- 15.9 The meter shall record and display total forwarded energy including forwarded Harmonic energy in following conditions. ( This is special requirement of DISCOM )
- (a) Voltage and current both in phase
  - (b) Voltage and current both out phase
  - (c) Voltage in phase and current out phase
  - (d) Voltage out phase and current in phase

Above tests shall be carried out at Ref. voltage, 0.5 I<sub>max</sub> and UPF with 10 % 5th harmonics in voltage and 40% 5th harmonics in current.

In all above conditions, meter shall record total energy = 1.04 (± 0.008) times of fundamental energy.

- 15.10 The working of Meter under different magnetic influence condition is as under for Active energy.
- a) Meter must be immune to the continuous D.C. stray magnetic field of 67mT± 5%. Method for the testing & obtaining magnetic field should be as per CBIP 325 clause No 5.6.2.1, Table : 17 & its notes.
  - b) Meter must be immune to the A.C. stray magnetic field of 0.5mT± 5%. Method for the testing & obtaining magnetic field should be as per CBIP 325 clause No 5.6.2.3, Table : 17 & its notes.
  - c) Meter should be immune to the continuous D.C. abnormal magnetic of 0.2 Tesla± 5%. In case of if it is not immune than Meter should switch over to 100% I<sub>max</sub>, UPF. Method for the testing & obtaining magnetic field should be as per CBIP 325 clause No 5.6.2.2, Table: 17 & its notes.
  - d) Meter should be immune to the A.C. abnormal magnetic of 10mT. In case of if it is not immune than Meter should switch over to 100% I<sub>max</sub>, UPF. Method for the testing & obtaining magnetic field should be as per CBIP 325 clause No 5.6.2.4, Table: 17 & its notes.

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- e) Meter should be immune to the A.C. abnormal magnetic of 0.2 Tesla $\pm$  5%. In case of if it is not immune than Meter should switch over to 100% I<sub>max</sub>, UPF.  
Method of testing & obtaining magnetic field shall be as under.  
The abnormal A.C. magnetic induction emanating from a circular air cored coil (O.D. 200 mm, I.D. 38 mm, Depth 50 mm, 14 SWG, 20000 ampere-turns) producing 0.2 Tesla $\pm$  5% in the central region of its either surface shall be applied successively to all the surfaces of the meter and under the most unfavourable conditions of phase and direction to determine any abnormality under its influence.
- f) Meter should be immune to permanent magnet of 0.5 T of minimum size 70 x70 x 50 mm. In case of if it is not immune than Meter should switch over to 100% I<sub>max</sub>, UPF.

Tests at above sr.no.(e) & (f) are special requirement of DISCOM and for testing below mentioned test conditions are applicable.

In the event of logging of presence of abnormal magnetic induction with date and time, the positive variation of error may be beyond the limit of 4% but not exceeding a value (e) as given in Note 3.2 under Table 17 of CBIP 325, corresponding to nominal registration of the meter at reference voltage, 100% maximum current and  $\cos\Phi=1$ .  
During the test(s) no abnormality like movement of digits, flickering/ switching on- off of display abnormal heating and perceptible change of error should occur. After the test(s) there should not be any permanent change of error exceeding half the accuracy class index at I<sub>max</sub>,  $\cos\Phi = 1$  and 0.5 inductive and at 5% lb,  $\cos\Phi = 1$ .

#### 16.DISPLAY OF MEASURED VALUES:

16.1. The measured values shall be displayed on SEVEN segment minimum SEVEN digit (each digit having equal height of minimum 10 mm ) Liquid Crystal. Display (LCD) with backlit unit, having minimum character height of 10 mm. Good quality display shall be used to enable correct reading even from distance.

If display having seven Digit than KWH, KVARh lag, lead & KVAh reading shall be XXXXXX.X (6 +1 decimal points)

If display having eight Digit than KWH, KVARh lag, lead & KVAh reading shall be XXXXXX.X (7 +1 decimal points)

16.2.The data shall be stored in non-volatile memory (NVM). The NVM shall retain data for a period of not less than 10 years under un-powered condition.

16.3.It shall be possible to easily identify the displayed parameters through symbols/legend on the meter display itself.

16.4.In case of multiple values presented by a single display, it shall be possible to identify each displayed value/parameter through separate symbol/legend to be made available on the display itself.

16.5.Meter should have suitable arrangement to show at least (1) Cumm. Total forward KWH (fundamental+harmonics) (2) Cumm. Forward KVARh lag (3) Maximum demand of previous Month in kw permanent or at an interval of 1 minute during power OFF condition of 18 hours without use of push button.

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**17.METER SERIAL NUMBER:**

In addition to providing serial number of the meter on meter display and meter name plate, the same shall also be programmed into meter memory for identification through CMRI/meter reading printout.

**18.MAXIMUM DEMAND (MD) REGISTRATION:**

The meter shall monitor and calculate the average demand in KW established during pre-specified integration period set and record/display the maximum registered value and the same shall be stored along with date and time when it occurred in the meter memory. The rising demand under the current integration period shall be displayed along with elapsed time. The integration period shall be capable of making adjustment with duration of 15 or 30 minutes with due authentication

**19.MAXIMUM DEMAND RESET:**

The meter shall have the following maximum demand resetting arrangements:

- (a) Automatic resetting at the end of pre-specified date of every calendar month (e.g. 00.00 hours on first day of every month).
- (b) A provision for revising the resetting cycle for modifying the date and time of automatic resetting through base computer service center or via hand-held meter reading instrument only after using protected pass word through authenticated BCS should be available.
- (c) Provision for Manual Resetting of the monthly Max Demand with adequate sealing arrangement must also be made.

**20.LOAD SURVEY CAPABILITY & BILLING POINT REQUIREMENTS:**

Meter shall record load survey of minimum 180 days (Power-On days) for KWH and KVAH (energy & demand) with integration period of 30 minutes. It shall be possible to select either demand or energy view at the BCS end (Load survey report should be available for the available parameters only). However Supplier /bidder may provide more Nos. of parameters including at least KWH & KVAH in load survey report. There shall be provision of selection of either single parameters or more Nos. of parameters in software. There shall also be provision of particular date /day selection in software. There shall be provision to see the LS report on daily basis, weekly basis or monthly basis.

The load survey data shall be available in the form of bar charts as well as in spread sheets. The BCS shall have the facility to give complete load survey data both in numeric and graphic form.

The load survey data must be available in FIFO manner (First In First Out)

It shall be possible to retrieve these data via communication port on to hand-held meter reading instrument (MRI) and it shall be possible to off load these data on to IBM compatible computer and get complete details of the load/demand pattern in terms of KW/KWh both in numeric data form and in graphic form for all the 24 hours a day divided as per the pre-set integration period of 30 minutes in each individual case. Necessary software for this purpose must be provided by the supplier. The total time in minutes to be taken by meter for retrieval of all above data shall have to be clearly indicated in offer.

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Energy and demand values and its consumption for last twelve resets should be available with time stamp. (This is special requirement of PGVCL).

Daily load profile shall be given at 00:00 Hrs. of every day for RTC, Cumulative KWh and Cumulative KVAh as per IS:15959.

#### 21.SELF DIAGNOSTIC FEATURE:

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of date memory location all the time. The meter shall provide information for unsatisfactory/non-functioning/malfunctioning of the following.

- a. Time and date
- b. All display segments as per the requirement
- c. Real Time Clock (RTC)
- d. Non Volatile Memory (NVM)

If possible, the details of malfunctioning shall be recorded in the meter memory.

#### 22.TAMPER AND FRAUD PROTECTION:

The meter shall have features to detect and logging of the occurrence and restoration of tamper as per Annexure-II.

However, the meter must provide Summary Report for logged tamper events with duration in BCS data.

All tamper data separately for each event shall be made available with its time of occurrence and time of restoration and in no case shall be made available to reset to ZERO. The bidder must also specify Nos. of tamper events that the meter is capable to store.

Additional features any in the meter may also be highlighted.

- A) Snap Shots (numerical values) of voltage, current, power factor and energy (KWH) readings as well as the date and time of logging of the occurrence and restoration of tamper events, subject to meter-memory space as described herein under, should be logged in the meter memory and available for retrieving through the meter's optical port via CMRI and downloading to the BCS.
- B) Minimum of total four hundred (400) events (occurrence and restoration) of all types of tamper with date and time shall be available in compartment in the meter memory on first in, first out basis. Compartments classified as under.
  1. For voltage related event- 150 events (occurrence and restoration)
  2. For current related event- 150 events (occurrence and restoration)
  3. For other remaining events- 100 events (occurrence and restoration)

Moreover, minimum 25 power fail events with duration is required in BCS data.

At occurrence of Top Cover Open tamper, meter display shall show "Cover Open" permanently in auto mode during power ON and OFF both conditions. No display parameter should scroll in auto mode. However meter shall continue to record energy and

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display parameter shall available in push button mode. Snap shot value for occurrence and restoration of event should be available together in the report.

It shall be possible to retrieve the tamper data along with all related snap shots data through the meter's optical port with the help of CMRI and download the same to the BCS where it shall be available for viewing. All this information shall be available in simple and easily understandable format.

The threshold values for voltage, current and P.F. etc. for the purpose of logging occurrence and restoration of various types of tamper will be as per Annexure-II attached herewith. The supplier shall give their confirmation for these values in their offer.

### 23.TAMPER LOGIC:

Tamper logic shall be as per Annexure -II

### 24.TAMPER PERSISTENCE TIME:

The tamper persistence time for logging/registration of an occurrence & restoration time of tamper i.e. recovery time shall be as per Annexure-II.

### 25.ACCURACY REQUIREMENT:

The accuracy of parameters measured by meters shall be tested in accordance with the relevant standards described in clause 2.0 of this specification.

The test shall be carried out for balanced load and unbalanced current load i.e. individual phase.

### 26.ELECTRICAL REQUIREMENT:

The electrical requirement of meters shall be as specified in the relevant standards described in clause 2.0 of this specification.

### 27.ELECTROMAGNETIC COMPATIBILITY AND INTERFERENCE REQUIREMENT:

The meter shall meet EMI/EMC requirements as specified in the relevant standards described in Clause 2.0 of this specification.

ESD withstand limit shall be minimum 35 KV. The meter should be preferably immune to any abnormal frequency/voltage device/jammer. Meter should not stop recording energy under such condition.

Application of abnormal voltage/frequency.

The accuracy of the meter should not be affected with the application of abnormal voltage/frequency such as spark discharge of approximately 35 KV in any/all of the following manner for total 10 minutes:

- i) On any of the phases or neutral terminals OR without connecting neutral.
- ii) On any connecting wires of the meter.
- iii) Voltage discharge with 0-10 mm spark gap.
- iv) At any place in load/supply circuit.
- v) Spark on meter body.

However, during the test, function of the meter shall be verified by visual inspection of pulse output. KWH should not be changed during the test & shall be verified before and after test.

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**28.MECHANICAL REQUIREMENT:**

The meter shall meet the mechanical requirements as specified in the relevant standards described in clause 2.0 of this specification.

**29.CLIMATIC INFLUENCE REQUIREMENT:**

The meter shall meet Dry Heat/Cold/Damp heat cycle test requirement as per the relevant standards described in clause 2.0 of this specification.

**30.MINIMUM TESTING FACILITIES:**

The Bidder shall have the necessary minimum testing facilities for carrying out the following tests:

1. AC voltage test
2. Insulation resistance test
3. Test of limits of errors
4. Test of meter constant
5. Test of starting condition
6. Test of no load condition
7. Repeatability of error test
8. Test of power consumption
9. Tamper conditions - as per this specifications
10. ESD Test for 35 KV as per clause no.27
11. Test of Influence quantities as per IS 13779
12. DC and even harmonics in AC current circuit test (As per IS 13779)
13. Test of Total energy as per clause no. 15.9 of the technical specification.
14. AC, DC and permanent magnet test.

The manufacturer shall have duly calibrated ERS meter of Class 0.1 accuracy or better. Manufacturer also shall possess automatic computerized meter test bench system for carrying out the relevant routine/acceptance tests as well as facility to generate test reports for each and every meter tested.

**31.TESTS:****31.1 Type Tests:**

The bidder should submit Type Test Reports for all tests as per schedule of IS -13779/99 for the tests having been conducted on the sample meter, not older than 7 (seven) years from the scheduled date of opening of the tender, from reputed third party Govt. approved/ NABL Accredited laboratory viz. CPRI, ERTL, ETDC, NPL, ERDA etc. All the type tests must have been conducted within One year's tenure and on the sample as specified under cl. No: 12.2.2.1 of IS-13779-1999. Offers without the Type Test reports shall be rejected. The type test report submitted shall be of the same type and design of the meter offered. Please note that the bidder in case of supplier having own NABL accredited lab, the type test certificate furnished with tender from such lab shall not be accepted.

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### 31.2 Tender Sample

The supplier shall submit three nos. samples of meters of offered rating at the time of offer. Offer without sample will not be scrutinized on the strength of GTP. The samples are to be delivered to The Deputy Engineer (RSO), Regional Store Officer, Dudhsagar Road, PGVCL, Rajkot, Gujarat. Bidder has to submit the tender samples with DLMS as per IS-15959 & Display parameters as per Annexure-1 and tampers as per Annexure-2. The samples shall be tested at ERDA/CPRI/NABL accredited lab for following tests. If the sample found failed in any of the test carried out at ERDA/ CPRI/NABL accredited lab, the offer of that bidder shall be considered disqualified. However, the decision of the company shall be final and binding to all the bidders.

List of tests to be conducted on tender sample/s as per IS 13779/99, IEC 62053-21 (2003) and as per the specification, wherever specified.

- 1) Insulation resistance test as per IS 13779
- 2) AC high voltage test method as per IS-13779 but shall be taken at 4 KV for one minute.
- 3) 10 KV impulse voltage test as per cl .no.13.8 of specification.
- 4) ESD Test for 35 KV as per cl .no.27 of specification
- 5) AC, DC and permanent magnet test as per as per specification clause no.15.10
- 6) DC and even harmonics in ac current circuit - Phase wise (DC immunity)-As per IS-13779
- 7) Dry heat test as per IS-13779
- 8) Test for total forward energy (Fundamental + Harmonics) as per specification clause no.15.9
- 9) Test of effect of Influence quantity as per IS-13779
- 10) Test of no load condition as per IS-13779
- 11) Test of starting condition as per specifications
- 12) Test for limit of error as per IS-13779 (for active & reactive including 0.25 lag and 0.5 lead pf)
- 13) Interpretation of test results ,if required
- 14) Test of meter constant as per IS-13779
- 15) Repeatability of error test as per IS-13779
- 16) Test of power consumption in voltage and current circuit as per IS-13779
- 17) Short time over current test as per IS-13779
- 18) Test for terminals and screws at 150% I<sub>max</sub> for two hours.
- 19) Verification of display parameters and functional requirements
- 20) Verification of Tamper conditions - as per Annexure II

### 31.3 Prototype Sample

The supplier shall also have to manufacture 3 nos. of prototype sample meters complying to all above technical specification, type, rating, functional requirements, tamper features, display design etc. and shall have to offer for inspection within 30 days from the date of placement of LOI and before commencement of bulk supply.

During the proto type sample following test shall be carried out as per the specifications at supplier's works.

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1. AC high voltage test
2. Insulation resistance test
3. Test of limits of errors for active & reactive including 0.25 lag and 0.5 lead pf.
4. Test of meter constant
5. Test of starting condition
6. Test of no load condition
7. Repeatability of error test
8. Test of power consumption in voltage and current circuit.
9. ESD Test for 35 KV as per specification.
10. Test for total forward energy (Fundamental + Harmonics) in the Presence of Harmonics in Voltage and Current Circuits as per specification clause no. 15.9
11. DC and even harmonics in ac current circuit - (DC immunity)-As per IS 13779
12. Test of effect of Influence quantity as per IS 13779.
13. AC, DC and permanent magnet test as per specification clause no.15.10
14. Test for terminals and screw at 150% I<sub>max</sub> for two hours.
15. Verification of Tamper conditions - as per Annexure-II
16. Verification of display parameters as per Annexure-I
17. Physical verification of meter as per specification including sealing as per tender sample.

Purchaser reserves all rights to get any meter out of any lot offered be tested at CPRI/ERDA for conformance of common protocol with IS 15959 : 2011. All expenses i.e. transportation and testing of meter at CPRI(Bangalore/Bhopal), ERDA in respect of DLMS conformance testing shall have to be borne by the supplier.

The bulk manufacturing must be commenced only after confirmation from PGVCL authority. The three no. of prototype samples prepared as above shall have to be preserved till the completion of the supply of last lot.

The supplier shall also have to offer one no. of MRI for functional testing and verifications /testing of related software.

#### 31.4 Routine Tests

All routine tests as stipulated in the relevant standards shall be carried out and routine test-certificates/reports shall be submitted along with inspection call letter in the form of composite disk (CD) and on the CD, A/T No. serial no. of meters to be offered etc. shall be provided with sticker pasted on the CD, to the purchaser for approval and also placed inside individual meter packing.

#### 31.5 Acceptance Tests

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

1. AC high voltage test
2. Insulation resistance test
3. Test of limits of errors for active & reactive including 0.25 lag and 0.5 lead pf.
4. Test of meter constant
5. Test of starting condition
6. Test of no load condition
7. Repeatability of error test

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8. Test of power consumption in voltage and current circuit.
9. ESD Test for 35 KV as per specification.
10. Test for total forward energy (Fundamental + Harmonics) in the Presence of Harmonics in Voltage and Current Circuits as per specification clause no. 15.9
11. DC and even harmonics in ac current circuit - (DC immunity)-As per IS 13779
12. Test of effect of Influence quantity as per IS 13779.
13. AC, DC and permanent magnet test as per specification clause no.15.10
14. Test for terminals and screw at 150% I<sub>max</sub> for two hours.
15. Verification of Tamper conditions - as per Annexure II
16. Verification of display parameters as per Annexure I
17. Physical verification of meter as per proto sample approval including sealing as per proto type sample.

The meter should pass all above acceptance tests during inspection. If the facility for any of the tests are not available at supplier's works, the testing shall be arranged at any of the NABL approved lab. viz, ERDA, NPL, ETDC, ERTL, CPRI only and for such tests all the expenditures i.e. test charges etc. shall have to be borne by the supplier.

In case order is placed on part or full quantity, PGVCL reserves right to select sample as per relevant IS/IEC from the first lot (minimum 20% of the ordered quantity) offered by party and the samples will be tested at any Govt. approved laboratory which is approved by PGVCL for type tests and on successful passing the test the lot will be accepted or otherwise the whole lot will be rejected and in that case testing charges shall have to be borne by the party concerned.

#### 31.6. AUDIT TESTING :

From any dispatched lot, eight (8) nos. of meters shall be randomly selected jointly with supplier & sent for audit testing at any NABL Lab. decided by PGVCL & on receipt of test reports acceptability of lot will be decided. Following tests are to be carried out during the audit testing

1. AC high voltage test
2. Insulation resistance test
3. Test of limits of errors for active & reactive including 0.25 lag and 0.5 lead pf.
4. Test of meter constant
5. Test of starting condition
6. Test of no load condition
7. Repeatability of error test
8. Test of power consumption in voltage and current circuit.
9. Test for total forward energy (Fundamental + Harmonics) in the Presence of Harmonics in Voltage and Current Circuits as per specification clause no. 15.9
10. Test of effect of Influence quantity as per IS 13779.
11. AC, DC and permanent magnet test as per specification clause no.15.10
12. Verification of Tamper conditions - as per Annexure II
13. Verification of display parameters as per Annexure I

#### 32.INSPECTION:

The purchaser may carry out the inspection at any stage of manufacturing. The manufacturer shall grant access to the purchase's representative at a reasonable time

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when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing the meters in accordance with the specification and shall not prevent subsequent rejection if the meters are found to be defective.

All acceptance tests and inspection shall be made at the place of manufacturer works unless otherwise especially agreed upon by the bidder and purchaser at the time of purchase. The bidder shall offer the inspector representing the purchaser all responsible facilities without charge, to satisfy him that the equipment is being furnished in accordance with this specification.

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

In case of non availability of meter during the visit of inspection of the lot offered, the visit shall be considered as unfruitful visit and all charges of this visit shall be deducted from the bill of the supplier.

The purchaser reserves the right to carry out type tests of any meter selected from the lot/meter received at stores of PGVCL.

### 33.QUALITY ASSURANCE PLAN:

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

- 1.The structure of organization.
- 2.The duties and responsibilities assigned to staff ensuring quality of work.
- 3.The system of purchasing, taking delivery and verification of materials.
- 4.The system of ensuring quality of workmanship.
- 5.The quality assurance arrangement shall confirm to relevant requirements of ISO : 9001/9002 as applicable.
- 6.Statement giving list of important raw materials names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of Bidder's representative, copies of test certificates etc.
- 7.Information and copies of test certificates as above in receipt of bought out accessories.
- 8.List of manufacturing facilities available.
- 9.Level of automation achieved and lists of area where manual processing exists.
- 10.List of area in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- 11.List of testing equipment available with the bidder for final testing equipments specified and test plant limitation. If any vis-a-vis the type, special acceptance and routine tests specified in the relevant standards, these limitations shall be very clearly brought out in schedule of deviations from specified test requirements.

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33.2 The offer will be accepted only from the original manufacturer. The manufacturer must be having at least five years experience of manufacturing and operation of similar type of tri vector meters.

33.3 BIS MARK- The offered meter shall be ISI marked and bidder shall have to furnish valid BIS license for 10/60 A meters along with the offer. Manufacturer having ISO:9001/9002 shall be preferred.

**34.GUARANTEE:**

The meter shall be guaranteed for the period of five years from the date of commissioning or five and half year from the date of delivery whichever is earlier. The meters found defective within above guarantee period shall be replaced/ repaired by the supplier free of cost. After intimation from the any PGVCL offices regarding collection of defective meters, same are to be collected within fifteen days invariably. If defective meters are not replaced/repaired within one month from the date of the receipt of the intimation, PGVCL shall recover an equivalent amount of meter plus 15% supervision charges from any of the bills.

**35.PACKING:**

The meters shall be suitably packed in order to avoid damage or disturbance during transit or handling. Each meter may be suitably packed in the first instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit.

User manual to be provided with each master cartoon. Hard copy of Routine test certificate is to be provided with individual meter.

**36.SERVICES:**

The bidder shall provide following services:

- a) Services free of cost during guarantee period.
- b) To train PGVCL staff for installation and handling of these meters.
- c) To assist PGVCL lab staff to install, calibration, checking etc.
- d) To assist the PGVCL staff for taking MRI reading, theft wrapped meter analysis etc. At free of cost.
- e) To assist the PGVCL staff for installing, using and operation of software.

**SCHEDULE-A**

**GUARANTEED TECHNICAL PARTICULARS-(GTP)**

| SR. NO. | DESCRIPTION  | AS PER PGVCL'S REQUIREMENT                                   | AS OFFERED BY PARTY |
|---------|--|--|---------------------|
| 1.      | Type of meter<br>i)Basic current (A)<br>ii)Maximum current | LT Whole Current Meter<br>Ib : 10 Amps.<br>Imax : 60 Amps.   |                     |
| 2       | Standards to which the meter conform                       | All standards as mentioned in clause no. 2 of specifications |                     |

|                       |                      |       |        |
|-----------------------|----------------------|-------|--------|
| Signature of Tenderer | Company's Round Seal | Date: | Place: |
|-----------------------|----------------------|-------|--------|



| SR. NO. | DESCRIPTION  | AS PER PGVCL'S REQUIREMENT   | AS OFFERED BY PARTY |
|---------|--|--|---------------------|
| 3       | Overload capacity  | 600% of Ib   |                     |
| 4       | Dynamic range  | 0.2% to 600% of Ib   |                     |
| 5       | Power supply variation<br>(i)Specified operational range<br>(ii)Limit range of operation<br>(iii) Frequency  | 0.7 to 1.2 V ref.<br>0.7 to 1.2 V ref.<br>50 HZ $\pm$ 5%   |                     |
| 6.      | Accuracy class   | Class 1.0  |                     |
| 7.      | P.F. Range   | Zero lag -unity-Zero lead.   |                     |
| 8.      | Variation of voltage at which meter functions normally   | +20% to -30% of Vref.  |                     |
| 9.      | Power Consumption per phase<br>(i)Voltage circuit<br>(ii)current circuit   | To be specified by bidder  |                     |
| 10.     | Minimum starting current of the meter (%Ib)  | 0.2% of Ib   |                     |
| 11      | Impulse voltage  | 10 KV  |                     |
| 12.     | Display parameters as per Annexure-I   | To be confirmed  |                     |
| 13.     | Operational indication LED   | To be provided   |                     |
| 14      | (a)Material for base/terminal block<br>(b)Material for meter cover/terminal cover  | 10% glass filled nontransparent poly carbonate -LEXAN-503R<br>Transparent poly carbonate - LEXAN-943A  |                     |
| 15.     | a) Meter terminal block having sealable extended terminal cover<br>b) No. of seals to be Provided<br>c) Connection diagram inside the terminal cover<br>d) Maximum safe current the terminals and screws shall carry | To be provided<br><br>2 nos. on meter body, 2 nos. on terminal cover, 1 no on optical port, 1 no on MD reset button<br><br>To be Provided.<br><br>150% of I <sub>max</sub> for 2 hours |                     |
| 16      | Two communication port (Optical Port & RS232 Port)   | To be provided   |                     |
| 17      | REAL Time Clock With back up battery Life of battery   | To be provided<br>10 Years (minimum)   |                     |
| 18      | Non volatile memory retention time in absence of power   | To be specified by bidder.   |                     |
| 19.     | Memory capacity (KB)   | To be specified by party   |                     |

Signature of Tenderer

Company's Round Seal

Date:

Place:

| SR. NO. | DESCRIPTION   | AS PER PGVCL'S REQUIREMENT   | AS OFFERED BY PARTY |
|---------|---|--|---------------------|
| 20.     | (i)Details of tamper and fraud provisions<br>(ii) DC IMMUNITY   | To be provided as per ANNEXURE-II<br>Meter shall record accurately.  |                     |
| 21      | <b>SALIENT FEATURES</b><br>(1)Meter shall have provision to read in the absence of power<br>(2)Meter shall work accurately irrespective of phase sequence of the main supply.<br>(3)Meter shall remain powered up and functional in presence of two wires<br>(4)Meter shall record accurately even if neutral is disconnected<br>(5)Meter shall record correct energy in case of current reversal of one or more phases<br>(6)Measurement by meter shall not get influenced by injection of AC voltage/ chopped signal/DC signal & harmonics<br>(7)Meter shall register accurate energy even if load is drawn partially or fully through local earth.<br>(8) Meter should record and display MD in KW as well as KVA for 30 minute integration period<br>(9) Meter should record and display TOD energy. However, TOD MD in MRI report should be available. | To be provided<br><br>To be provided<br><br>To be provided<br><br>To be provided<br><br>To be provided<br><br>To be provided |                     |
| 22      | MD reset  | Auto as well as manual.<br>(Separate/exclusive button to be provided for MD reset)   |                     |
| 23      | Self diagnostic feature   | To be provided   |                     |
| 24      | Load Survey in graphical as well as in tabular form   | Minimum RTC, KWH & KVAH parameters (energy and   |                     |

Signature of Tenderer

Company's Round Seal

Date:

Place:

| SR. NO. | DESCRIPTION                             | AS PER PGVCL'S REQUIREMENT  | AS OFFERED BY PARTY |
|---------|---|---|---------------------|
|         |   | demand) for 180 days with 30 minute integration period in FIFO Manner.                            |                     |
| 25      | Snap Shot Facility                      | Voltage, current, power factor, KWH with date & time of occurrence & restoration of tamper event. |                     |
| 26      | No of tamper events                     | Minimum 400   |                     |
| 27      | Tamper persistence and restoration time | As per Annexure- II   |                     |
|         | <b>TESTS</b>                            |   |                     |
| 28      | Routine tests                           | As per IS 13779 and specification   |                     |
| 29      | Acceptance tests                        | As per IS 13779<br>And as per PGVCL requirement   |                     |
| 30      | Type tests                              | To be submitted   |                     |
| 31      | Testing facilities                      | Fully Automatic test bench as per cl. no 30 of this specification                                 |                     |
| 32      | BIS license                             | To be submitted-BIS no. & date of validation to be mentioned.                                     |                     |
| 33      | ISO 9001/9002                           | ISO No & validity is to be specified.   |                     |
| 34      | Guarantee                               | 5 Years from the date of commissioning or 5½ years from the date of delivery.                     |                     |
| 35      | After services as per Cl. No.36         | To be confirmed   |                     |

### SCHEDULE - B

#### SOURCE OF MATERIAL AND PLACES OF MANUFACTURING, TESTING AND INSPECTION

| Sr. No | Item part            | Name of manufacturer | Place of manufacturer | Place of testing and inspection | Source of procurement of material not manufactured |
|--------|----------------------|----------------------|-----------------------|---------------------------------|--|
| 1      | Current Transformers |                      |                       |                                 |  |
| 2      | Measurement Chips    |                      |                       |                                 |  |
| 3      | Quartz Crystal       |                      |                       |                                 |  |
| 4      | Memory chips         |                      |                       |                                 |  |

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Date:

Place:

|    |                         |  |  |  |  |
|----|-------------------------|--|--|--|--|
| 5  | Display modules         |  |  |  |  |
| 6  | Communication Modules   |  |  |  |  |
| 7  | Optical port            |  |  |  |  |
| 8  | Power supply            |  |  |  |  |
| 9  | Electronic components   |  |  |  |  |
| 10 | Battery                 |  |  |  |  |
| 11 | RTC & Micro controller. |  |  |  |  |
| 12 | PCB                     |  |  |  |  |

Note: Supplier should ensure that components of above mentioned make shall be utilized in tender sample & prototype samples. It is also ensured that in entire supply of meters, make of components shall not be differed from make used in proto type sample.

SIGNATURE OF BIDDER  
NAME  
DESIGNATION

### ANNEXURE-I

| DISPLAY SHEET OF 10-60 WHOLE CURRENT METER   |   |                  |
|--|---|------------------|
| AUTO MODE (MODE-1): Parameters of this mode should display on auto scrolling as well as manually up & down scrolling using push button |   |                  |
| SR. NO.  | PARTICULAR  | HOLD TIME IN SEC |
| 1  | DISPLAY CHECK                                       | 10               |
| 2  | METER SERIAL NUMBER                                 | 10               |
| 3  | R-PHASE VOLTAGE                                     | 10               |
| 4  | Y-PHASE VOLTAGE                                     | 10               |
| 5  | B-PHASE VOLTAGE                                     | 10               |
| 6  | R-PHASE CURRENT                                     | 10               |
| 7  | Y-PHASE CURRENT                                     | 10               |
| 8  | B-PHASE CURRENT                                     | 10               |
| 9  | FRQUENCY  | 10               |
| 10   | INSTANT AVERAGE POWER FACTOR WITH LAG / LEAD legend | 10               |
| 11   | INSTANT LOAD IN KW                                  | 10               |
| 12   | RTC ( Date and time)                                | 10               |
| 13   | RISING MD IN KW WITH ELASPED TIME                   | 10               |
| 14   | MAXIMUM DEMAND OF CUURENT MONTH IN KW               | 10               |

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Company's Round Seal

Date:

Place:

|    |                                  |    |
|----|----------------------------------|----|
| 15 | CUMMULATIVE MAXIMUM DEMAND IN KW | 10 |
| 16 | NO OF RESET COUNT                | 10 |
| 17 | TOTAL FORWARD NIGHT HOURS KWH    | 10 |
| 18 | TOTAL FORWARD OFF PEAK HOURS KWH | 10 |
| 19 | TOTAL FORWARD PEAK HOURS KWH     | 10 |

**Note:**

➤ Following parameters should be repeated after each above parameters in auto mode.

1. CUMM. FORWARD KWH ( FUNDAMENTAL+HARMONICS)
2. CUMM. FORWARD KVARH LAG
3. MAXIMUM DEMAND OF PREVIOUS MONTH IN KW

However, during manually up & down scrolling using push button in this mode, these Three parameters should be displayed single time and not repeated.

➤ The persistent tamper event indication/icon shall be displayed in auto mode.

|  |   |  |
|--|---|--|
| PUSH BUTTON DISPLAY(MODE-2): Parameters of this mode should display manually up & down scrolling using push button |   |  |
| 1  | TOTAL FORWARD PEAK HOURS KWH            |  |
| 2  | TOTAL FORWARD NIGHT HOURS KWH           |  |
| 3  | TOTAL FORWARD REST HOURS KWH            |  |
| 4  | TOTAL FORWARD OFF PEAK HOURS KWH        |  |
| 5  | CUMM. FORWARD KVARH LEAD                |  |
| 6  | CUMM. FORWARD KVAH                      |  |
| 7  | MAXIMUM DEMAND OF CUURENT MONTH IN KVA  |  |
| 8  | MAXIMUM DEMAND OF PREVIOUS MONTH IN KVA |  |
| 9  | CUMMULATIVE MAXIMUM DEMAND IN KVA       |  |
| 10   | PHASE WISE VOLTAGE FAILURE COUNT        |  |
| 11   | PHASE WISE CURENT FAILURE COUNT         |  |
| 12   | VOLTAGE UNBALANCE COUNT                 |  |
| 13   | CURRENT UNBALANCE COUNT                 |  |
| 14   | CURRENT BYPASS COUNT                    |  |
| 15   | PHASE WISE CURRENT REVERSAL COUNT       |  |
| 16   | NEUTRAL DISTURBANCE COUNT               |  |
| 17   | TOTAL MAGNET TEMPER COUNT               |  |
| 18   | TOTAL TAMPER COUNT                      |  |
| 19   | METER VERSION                           |  |
| 20   | TOTAL POWER ON TIME IN HRS.             |  |
| 21   | TOTAL POWER OFF TIME IN HRS.            |  |

Signature of Tenderer

Company's Round Seal

Date:

Place:

| HIGH RESOLUTION (MODE-3): Parameters of this mode should display manually up & down scrolling using push button |                 |  |
|---|-----------------|--|
| 1   | TOTAL KWH       |  |
| 2   | FUNDAMENTAL KWH |  |
| 3   | KVARH LAG       |  |
| 4   | KVAH            |  |

## ANNEXURE - II

## Tamper Logic &amp; threshold values for 3 Ph. 4 Wire 10-60 Amp whole current static energy meters

| Sr. No. | Type of Tamper     | Requirement | Tamper Logics / Conditions & (Occurrence & Restoration) Persistence Time                                 |  |              |   |  |              |
|---------|--------------------|-------------|--|--|--------------|---|--|--------------|
|         |                    |             | Occurrence   |  |              | Restoration   |  |              |
|         |                    |             | Voltage  | Current  | Persist Time | Voltage   | Current  | Persist Time |
| 1       | Missing Potential  | Phase wise  | $V_x < 40\%$ of $V_{ref}$ irrespective to any other phase voltage  | $I_x > 10\%$ of $I_b$ i.e 1 Amp  | 5 Minutes    | $V_x > 75\%$ $v_{ref}$ i.e. 180 V irrespective to any other phase voltage |  | 5 Minutes    |
| 2       | Current open       | Phase wise  | All voltages $> 75\%$ of $V_{ref}$ .   | $I_r$ or $I_y$ or $I_b < 2\%$ of actual max. current and any one phase has value $> 10\%$ $I_b$ i.e. 1 Amp   | 5 Minutes    |   | $I_r$ or $I_y$ or $I_b > 2\%$ of actual max. current and any one phase has value $> 10\%$ $I_b$ i.e. 1 Amp | 5 Minutes    |
| 3       | Voltage Unbalance  | -           | $(V_{max} - V_{min}) > 10\%$ of max Voltage of 3 phase voltages and all voltages $> 60\%$ of $V_{ref}$ . | $I_x > 10\%$ of $I_b$ For at least any one phase   | 5 Minutes    | $(V_{max} - V_{min}) < 10\%$ of max voltage of 3 phase voltages           |  | 5 Minutes    |
| 4       | Current Unbalance  | -           | All voltages $> 75\%$ of $V_{ref}$ .   | (Diff. of Actual Max current & Actual Min current ) $> 30\%$ of Actual maximum current and all phase has value greater than $10\%$ $I_b$ i.e 1 Amp | 5 Minutes    |   | (Diff. of Actual Max current & Actual Min current ) $< 30\%$ of Actual maximum current                     | 5 Minutes    |
| 5       | Current reversal   | Phase wise  | All voltages $> 75\%$ of $V_{ref}$ .   | $I_x > 10\%$ of $I_b$ , direction of current reverse and PF value $> 0.2$  | 5 Minutes    |   | $I_p > 10\%$ of $I_b$ , direction of current forward and PF value $> 0.2$                                  | 5 Minutes    |
| 6       | Magnetic Influence | -           | as per clause no. 15.10 of   | When magnet influence  | 1 Minute     |   | When magnet  | 1 Minute     |

Signature of Tenderer

Company's Round Seal

Date:

Place:

## ANNEXURE - II

## Tamper Logic &amp; threshold values for 3 Ph. 4 Wire 10-60 Amp whole current static energy meters

| Sr. No. | Type of Tamper      | Requirement | Tamper Logics / Conditions & (Occurrence & Restoration) Persistence Time  |   |              |  |   |                |
|---------|---------------------|-------------|---|---|--------------|--|---|----------------|
|         |                     |             | Occurrence  |   |              | Restoration  |   |                |
|         |                     |             | Voltage   | Current   | Persist Time | Voltage  | Current   | Persist Time   |
|         |                     |             | the specification   | start affecting the accuracy, meter should start recording at 100% I <sub>max</sub> , UPF   |              |  | influence stop affecting the accuracy, meter should start recording at actual load              |                |
| 7       | Neutral Disturbance | -           | By injection in neutral, Phase to Neutral voltage for any two phases is > 350 volts and for remaining phase is < 50V. In any case Phase to Phase voltage should not more than 440V.   | I <sub>x</sub> > 10% of I <sub>b</sub><br>i.e 1 Amp   | 5 Minutes    | Phase to Neutral voltage for all the 3 phases > 75 % V <sub>ref</sub><br>i.e 180 volts |   | 5 Minutes      |
| 8       | Low Voltage         | -           | V <sub>x</sub> > 40% of V <sub>ref</sub> &<br>V <sub>x</sub> < 75 % of V <sub>ref</sub>   | I <sub>x</sub> > 10% of I <sub>b</sub><br>For at least any one phase  | 5 Minutes    | V <sub>x</sub> > 75 % of V <sub>ref</sub>  |   | 5 Minutes      |
| 9       | High Voltage        | -           | V <sub>x</sub> > 115% of V <sub>ref</sub>   | I <sub>x</sub> > 10% of I <sub>b</sub><br>For at least any one phase  | 5 Minutes    | V <sub>x</sub> < 110% V <sub>ref</sub> ( 264 V)  |   | 5 Minutes      |
| 10      | Current Bypass      | -           | All voltages > 75 % of V <sub>ref</sub> .   | Meter is connected to a 3 phase 4 wire system. Vectorially I <sub>r</sub> +I <sub>y</sub> +I <sub>b</sub> +I <sub>n</sub> > 10% I <sub>b</sub> , and I <sub>r</sub> & I <sub>y</sub> & I <sub>b</sub> > 2% I <sub>b</sub> | 5 Minutes    |  | Vectorially I <sub>r</sub> +I <sub>y</sub> +I <sub>b</sub> +I <sub>n</sub> < 10% I <sub>b</sub> | 5 Minutes      |
| 11      | Top cover open.     | -           | At occurrence of Top Cover Open tamper, meter display shall show "Cover Open" permanently in auto mode during power ON and OFF both conditions. No display parameter should scroll in auto mode. However meter shall continue to record energy and display parameter shall available in push button mode. |   |              | Immediately  |   | No restoration |

Signature of Tenderer

Company's Round Seal

Date:

Place:

1. During Neutral disturbance tamper, all voltage related tampers (i.e. Voltage Failure, Voltage Unbalance, High Voltage & Low Voltage) shall not be logged.
2. During High Voltage & Low Voltage tampers, Voltage unbalance tamper shall not be logged.
3. During Voltage failure Tamper, Voltage Unbalance & Low Voltage tamper shall not be logged.
4. During current failure Tamper and Current Bypass Tamper, Current Unbalance tampers shall not be logged.
5. During current bypass Tamper, Current fail Tamper and Current Unbalance tampers shall not be logged.
5. During power failure duration, if any tampers persisting, those tampers shall not get recovered until it meets the logic for restoration and duration of respective tamper shall be from occurrence of that tamper irrespective of power failure duration.
6. For tamper events logging, snap shot data i.e. instantaneous parameters, active energy register reading (Total kwh) and date & time should be corresponds to starting of occurrence and starting of restoration.
7. Snap shot of date and time should be available for occurrences and restorations of events.

**BIDDERS ARE REQUESTED TO READ THE FOLLOWING AS THE PART OF TENDER TECHNICAL SPECIFICATIONS DOCUMENT.**

[A] As per tender technical specification and tender document tender sample(s) shall have to be submitted the following conditions are mandatory.

[1] The sample(s) submitted shall have ISI marking as well as relevant IS Number”.

[2] The sample(s) not complying the above condition shall not be tested and shall be rejected and no further correspondence shall be made in this regard.

[B] At the end of the tender technical specification, following paragraph should be added and read as under.

The material supplied shall be conforming to Indian Standard Specification and also with ISI marking and even after inspection of the lot, if the material received at site is found without ISI marking , the lot shall be rejected and no further correspondence shall be entertained in this regard.

|                       |                      |       |        |
|-----------------------|----------------------|-------|--------|
| Signature of Tenderer | Company's Round Seal | Date: | Place: |
|-----------------------|----------------------|-------|--------|



[C] Security Seal

In addition to 2 Nos. of polycarbonate seals, further 2 Nos. of tamper proof void seals are to be provided on the Meter body in such a way that both the side covers shall be sealed by the tamper proof void seals. The tamper proof void seals to be provided on Meters shall be as per the following specification:

[1] Size of the seal -- 3 x 1 inches.

[2] The seal should be digitally printed on white VOID film having UV destructive inks printed with thermal resin ribbon technology.

[3] The seal should be water proof and should withstand all the weather conditions. The seal should have adhesive of sufficient strength to avoid peeling off under extreme temperature and environmental conditions.

[4]The seal should be sticker type seal and applied on both the side of the Meter which connects the body and the box.

[5]If some one lifts the seal, “VOID” impression should be transferred on the meter and if this is applied back, “VOID” impression should be readable from the surface of the seal.

[6]The disturbed portion of the seal should glow under UV light if the seal is disturbed from any part.

[7]Barcodes of serial numbers should be printed on the seals and the barcodes should be readable with a barcode scanner.

[8]The seals should have continuous variable serial numbers along with security codes of last three digits of serial numbers printed in black and the same serial numbers along with code of serial numbers shall also be printed in a vertical semi circular shape which should be visible only under Ultra-violet (UV) light.

[9]Two security cuts should be given on the seal on both the sides, and if some one tries to lift the seal it should tear off from the security cuts. The security cuts should be made with a computer controlled plotter which should put the security cuts on the same position on each seal.

[10]The name of the supplier and supplier logo along with the security warning or any other information in any language as given by the company should be printed on the sea.

[11]There should be a provision of incorporating officers’ signature on the seal as given by the company.

[12]If some one tries to remove the seal by allying heat, the printing should get disturbed and the shape of the seal should change if more heat is applied.

The seals to be used for sealing of Meters are to be fixed after inspection is over.

|                       |                      |       |        |
|-----------------------|----------------------|-------|--------|
| Signature of Tenderer | Company’s Round Seal | Date: | Place: |
|-----------------------|----------------------|-------|--------|