

TECHNICAL SPECIFICATIONS OF SINGLE PHASE 2 WIRE; 5-30 AMP. FULLY STATIC WATT HOUR METER CLASS 1.0 WITH LCD DISPLAY AND FACILITY FOR DATA DOWN LOADING FOR SOLAR ROOF TOP (BIDIRECTIONAL)

1. SCOPE:

- (a) This specification covers design, engineering, manufacture, and testing of ISI marked A.C. single phase two wire solid state (static), bidirectional/fully electronic energy meters of accuracy class 1.0 and current rating 5-30 Amps for single phase with back lit LCD display as per requirement given in this specification.

The single phase meter should be single phase two wire, two element type without DLMS capable to record and display energy in KWh and demand in KW for single phase two wire A.C. loads respectively for power factor range of Zero Lag-Unity-Zero Lead, as per requirement given in this specification. Meter should record total energy (fundamental energy + harmonic energy) having facility/capability for recording tamper information in LT 1-phase Consumers.

- (b) It is not the intent to specify completely herein all the details of the design and construction of material. However the material shall conform in all respects in high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation. It is mandatory that, the meter shall be ISI marked.

The meter shall have to be procured from the original manufacturer who is registered vendor of MGVCCL or other subsidiaries of GUVNL.

2. STANDARD APPLICABLE:

While drawing these specifications, reference has been made to following Indian and International Standard specification. In case certain details are not covered in these specifications, the relevant Indian and International Standard shall be applicable.

IS 13779 (1999)	:	A.C. Static Watt hour meter class 1.0 and Class 2.0
IS 9000	:	Environment testing
IS 12346 (1988)	:	Specification for testing equipment for A.C. Electrical energy meter.
CBIP – No.325	:	CBIP guide on static energy meter specifications & testing
IEC 62052-11 (2003)	:	Electricity Requirements (AC) General Requirements, Tests and Test conditions for A.C. Static Watt hour meter for active energy Class 1.0 and 2.0.

IEC 62053-21 (2003) : A. C. Static Watt hour meter for active energy Class 1.0  
and 2.0

CEA Regulation on installation and operation of meters Dtd: 17/03/2006, 04/10/2010 &  
26/11/2014.

G.R. NO. SLR-11-2015-2442-B DTD 13th August 2015 from Government of Gujarat Energy  
and Petrochemical department

NOTE: Unless otherwise specified elsewhere in this specification the meter shall conform  
to the latest version available of the standard as specified above. If above IS/IEC reports  
are amended, reference has to be made to Amended IS/IEC/Report.

### 3. SYSTEM VARIATION:

- 3.1 Voltage range: -30% to +20% of ref. voltage
- 3.2 Frequency: 50 Hz +5.0% to -5.0 %.
- 3.3 Temperature & Temp. co efficient: -10 deg. C. to 70 deg.C. with temp. Coefficient  
as 0.05
- 3.4 Humidity: 95% (sometimes approaches to saturation)

### 4. ELECTRICAL REQUIREMENT:

- 4.1 Standard reference voltage: 240V
- 4.2. Standard Basic Current: 5 Amp.
- 4.3 Rated Max. Current: 30 Amp. (600% Ib)
- 4.4 Standard frequency: 50 Hz.
- 4.5 Power consumption of voltage Circuit: As per IS -13779(1999),  
IEC 62053-21(2003).
- 4.6 Power Consumption of current Circuit: As per IS -13779(1999), IEC 62053-21(2003)
- 4.7 Resistance to Surge voltage of 1.2/50 micro sec: 10 KV Peak

### 5. GENERAL AND CONSTRUCTIONAL REQUIREMENT:

The meter shall comply all general and constructional requirements as per IS 13779  
(1999), IEC 62053-21(2003) and latest amendment.

- 5.1 Meter shall be designed and constructed in such a way to ensure especially personal  
safety against electric shock, effect of excessive temperature, safety against spread of  
fire and protection against solid objects, dust and water etc. All parts, which are

subject to corrosion under normal condition, shall be effectively protected. Any protective coating shall not be liable to damage by ordinary handling nor damage due to exposure under normal working condition.

- 5.2 The meter shall be projection type and dust and moisture proof. The meter base & cover shall be made out of unbreakable, high grade, fire resistant, reinforced Polycarbonate material so as to give it tough and non-breakable qualities. The meter body shall be type tested for IP 51 degree of protection as per IS 12063 against ingress of dust, moisture & vermin.
- 5.3 Standard terminal block as per IS: 13779/1999 (amended up to date) shall be provided. Molded terminal block for current and voltage connections conforming to relevant standard to meet the requirement of terminal connection arrangement shall be provided. The termination arrangement shall be provided with a transparent terminal cover and shall be sealable independently to prevent unauthorized tampering.
- 5.4 All insulating materials used in the construction of the meter shall be substantially nonhygroscopic, non-ageing and of tested quality.
- 5.5 All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results.
- 5.6 The thickness of material for meter body should be 2.0 mm minimum for polycarbonate material.
- 5.7 The meter should have internal Real Time Clock with the backup of a Lithium maintenance free battery of minimum 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. The clock shall be factory calibrated. The clock accuracy shall not vary more than  $\pm 3$  min per year and it will be temperature compensated from  $0^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ .
- 5.8 The provision shall be made on the Meter for at least two seals to be put by utility user. However the supplier shall have to supply meter dully sealed with two nos. of Polycarbonate seals having supplier's logo and serial numbers.
- 5.9 The meter shall be provided with flashing LED to represent the pulse output for testing the meter by suitable testing equipment. The operation indicator must be

visible from the front.

5.10 It shall be possible to check the accuracy of active energy measurement in both the directions i.e for Import & Export both of the meter in the field by means of LED output. Resolution of the test shall be sufficient to enable the starting current test in less than 10 minutes and accuracy test at the lowest load shall be completed with desired accuracy within 5 minutes.

5.11 CURRENT AND VOLTAGE ELEMENTS:

The meter should have either one CT & one shunt OR one shunt & one sensor OR two shunts or two CTS, having CTs with adequate magnetic shielding.

5.11.1 For Shunt type meter, the single phase meter shall be based on a E-beam shunt in the phase element and a Current Transformer/Shunt/Hall effect sensor in the neutral element. Alternatively, measurements in both the phase and neutral elements may be done using shunts with proper isolation. However, in case of using one CT the same shall be used in neutral element. The short time current rating shall be as per IS: 13779: 1999.

5.11.2 PT less design is highly preferred i.e. for power supply to PCB, in place of conventional electromagnetic VTS; use of potential divider is preferred.

5.12 The meter shall also be capable to withstand phase to phase voltage (440V) if applied between phases to neutral for minimum 2 hours.

5.13 In meter, power supply unit should be micro control type instead of control transformer type to avoid magnetic influence.

5.14 The RTC battery & the battery for display in case of power failure should be separate. Battery for the display should be such that (a) In case of power failure, even for the period for six months display can be seen by push button and data can be retrieved through battery mode. (b) Meter should have suitable arrangement to show at least "Cumulative Active Energy KWh" permanent or at an interval of 1 minute during power OFF condition of 18 hours without use of push button.

5.15 Display parameters in the meter should not be accessible for reprogramming at site.

5.16 The measurement by meter shall not get influenced by injection of AC chopped signal/ DC signal and harmonics on the terminals of the meter. Complete metering system & measurement shall not be affected by the external electromagnetic

interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc.

The meter shall meet the requirements for immunity against continuous magnetic induction as per requirement given in clause no.11.4 of this specification.

5.17 The meter should have facility for data retrieval through optical port using CMRI or Laptop PC. Sealing arrangement for Optical port shall be provided.

5.18 The meter shall record and display total energy including Harmonic energy  
As per IEC61053-21 clause No.8.2.1 & Table: 8

5.19 Self Diagnostic Features.

The meter shall keep log in its memory for unsatisfactory / nonfunctioning of the following

- (a) Time and date on meter display
- (b) All display segments on meter display
- (c) Real Time Clock (RTC) status in meter reading prints out at BCS end
- (d) Nonvolatile Memory (NVM) status in meter reading prints out at BCS end
- (e) Battery status

5.20 Supplier shall have to submit predefined copies of all the software's, i.e. meter reading software for CMRI, Base computer software for meter data analysis and technical details etc.

5.21 The meter shall have provision to be read, in the absence of power. A backup of suitable capacity be included in the circuit which may provide energy for reading the meter display in absence of main power supply.

5.22 The meter shall be software calibrated at factory end and shall be supplied with certificate along with dispatch. However modification of calibration should not be possible at site. The meter should not have any form of mechanical adjustments such as trippots potentiometer etc. for calibration. The meter shall be tested, calibrated and sealed at manufacturer's works before dispatch. Further, no modification of calibration shall be possible at site by any means what so ever. .

5.23 Meter shall be capable of withstanding switching and transient surges so as to protect the internal meter circuit.

5.24 The minimum dimensions (WidthxHeightxDPTH) of meter with -3 mm tolerance are as under.

Basic Meter Part: 95 mm (W) x 115 mm (H) x 65 mm (D)

Terminal Cover with Terminal block: 100 mm (W) x 75 mm (H) x 40 mm (D)

Display Window: 50 mm (W) x 20 mm (H)

- 5.25 Recording of energy is according to higher current flow either in the Phase or Neutral element.

## 6. METER WITH POLY CARBONATE BASE & COVER

### 6.1. (a) MATERIALS OF BASE/COVER/TERMINAL COVER:

- The construction of the meter shall be suitable for its purpose in all respects and shall be given reasonable assurance of continuous performance in all mechanical, electrical and magnetic adjustments. The construction shall be such that the meter is not prone to produce audible noise in use. The meter cover & terminal cover shall be of injection molded in transparent UV stabilized polycarbonate in a natural transparent colour.
- The meter base, cover and terminal block cover (ETBC) shall be injection molded and made of unbreakable high grade flame retardant polycarbonate having good dielectric and mechanical strength to ensure high reliability and long life. The construction of the meter shall be suitable for its purpose in all respects. The meter shall be compact & reliable in design & shall be immune to vibration & shock involved in transportation/handling. The entire design and construction shall be capable of withstanding the severe stresses likely to occur in actual service.
- Polycarbonate material of only following manufacturers shall only be used:

a) GE PLASTICS	LEXAN 943A FOR COVER AND TERMINAL COVER LEXAN 503R FOR BASE
b) BAYER	GRADE CORRESPONDING TO ABOVE
c) DOW CHEMICALS	-----do -----
d) MITSUBISHI	-----do -----
e) TEJIN	-----do -----
- The meter base shall be manufactured from high quality industrial grade material viz. Polycarbonate with 10 % glass filled or better which shall meet following

Specification for Bidirectional 1 Phase static meter

properties to ensure higher reliability and long life of the meter case. Meter base, cover & terminal cover shall conform to the following:

Sr No	Test	10% Glass filled for meter base & terminal block	Transparent 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(10MIN)	No softening & whitening & No change in colour, shape, size & dimensions	No softening & whitening & No change in colour, shape, size & dimensions
3	Drop Test from 2 MTRS height-only for casing i.e. base + cover + terminal block + terminal cover, (Without inside assembly)	Shall not crack or break	Shall not crack or break
4	Glow wire test IS:11000 (part 2/SEC-1) 1984 OR IEC PUB,60695-2-12	960 ±15° C (For terminal block)	650 ±10° C (For Terminal cover and meter case)
5	Heat deflection Temp.(HDT) HDT/Ae, 1.8MPa edgew (100mm) As per ISO 75/Ae	132° C	125° C
6	Ball pressure test as per IEC-60695-10-2	125°C +/- 2°C	125°C +/- 2° C
7	Flammability Test (a) As per UL 94 or (b) As per IS 11731(Part-2) 1986	VO FVO	VO FVO
8	Minimum Thickness	2.0 mm	2.0 mm

- The thickness of casing, base & terminal cover shall be minimum 2.0 mm. Sufficient clearance shall be allowed between terminals. Further, the supporting webs between the two terminals of the terminal block should be sufficiently high to ensure that the two Neighboring terminals do not get bridged by dust or it is not possible to have flash over between adjacent terminals of terminal block.
- The terminals shall be of suitable rating to carry 150% of I<sub>max</sub> and made of electroplated (or tinned) brass. For verification the test will be conducted at V<sub>ref</sub>, 150% I<sub>max</sub>, UPF for two hours. After the test no physical damage should occur &

% error should not exceed accuracy class of the meter.

- All connection screws and washers should be tinned/nickel plated brass. The terminal screws shall not have pointed end at the bottom. All terminals will have two screws. The terminals shall be properly bound in the insulation. Sufficient clearance can be provided between terminals to avoid possible flash over.
- The shunt shall be preferably directly terminated on terminal block without using lug. Alternatively, the termination of current wires on the terminal block should be through lugs and washers of proper size. The loop length of the primary current circuit should be kept minimum.
- The embossing/engraving/ permanent marking shall be provided on meter base, meter cover and terminal cover as under – ‘UV STABILISED’ and manufacturer’s logo/ trade name.

(b) METER COVER FIXING ARRANGEMENT:

At least two sealing screws of Nickel plated 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.

(c) METER BASE FIXING ARRANGEMENTS:

Meter shall have minimum two fixing holes, one at top & other at bottom. The top screw hole shall be provided on back of the meter so that screw head are not accessible after the meter is fixed. Lower hole shall be provided inside the terminal compartment so as to make them in accessible to an unauthorized person after terminal cover is fixed.

(d) SEALING ARRANGEMENT.

The sealing screw used for the meter cover shall be fixed upside down so that these are tightened from the rear. The sealing screw shall be BRASS or Nickel plated steel. In addition to the sealing screws provided for the meter cover, there shall be one or two similar tinned brass or nickel plated steel sealing screw



for the terminal cover.

(e) INSULATION MATERIALS:

All insulation materials used in the construction of meter shall be substantially non hygroscopic.

(f) PROTECTION OF PARTS:

All parts, which are subjected to corrosion under normal working condition, shall be effectively protected against corrosion due to atmospheric condition. The protection coating shall not be liable to damage by ordinary handling or injuriously affected by exposure to air under normal condition of service in actual practice in Gujarat state.

(g) SCREW /INSULATION:

All electrically live screws shall be of heavily tinned brass or nickel plated steel. All other screws shall be electroplated. The terminal should be properly bound in the insulation.

(h) TERMINAL BLOCK

The terminal block shall be of POLYCARBONATE of FR & glass filled quality & shall fulfill requirements: (as per table given under clause no 6.1 (a)).

(i) TYPE OF TERMINAL COVER:

The Terminal cover shall be transparent, hinged and extended type & shall enclose terminal compartment except for the provision of conductor entry at the bottom for incoming & outgoing leads.

(j) LENGTH AND MATERIALS OF TERMINAL:

The length of terminal in the terminal block shall be adequate to have a proper grip of the conductor with the help of the screw.

The internal diameter of terminal holes should be 4 to 6 mm. The materials of the terminals shall be of appropriately plated brass.

(k) TYPE OF TERMINALS:

The terminals shall be suitable to carry rated continuous maximum current and short time overload current & be made of brass. PC ends shall be provided with lugs.

(l) TERMINAL SCREWS:

The terminal screws shall be of brass and shall not have a thread sizes less than M4 and less than 5 mm dia. The screws shall not have pointed end of threads.

(m) CLEARANCE BETWEEN ADJACENT TERMINALS:

The minimum center to center clearance between the adjacent terminals shall be 13 mm.

(n) THE TOP COVER SHOULD BE ULTRASONICALLY WELDED OR break to open type arrangement

6.2 NAME PLATE:

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
- Serial number
- Month and Year of manufacture
- Reference voltage
- Rated & Maximum Current
- Principal units of measurements (KWH)
- Meter constant (imp/kWh)
- 'BIS' Mark (Applicable for Indian meter manufacturers only)
- Accuracy Class of meter (class-1.0).
- Bar Code identification shall contain details of (i) The make, (ii) Sr no and (iii) Model/type

BIDIRECTIONAL METER

6.3 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

Specification for Bidirectional 1 Phase static meter

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 South Africa :SAMES Japan : NEC
3	Shunt Bimetal	E-beam welded shunts shall be provided in the phase element and CT / Shunt / Hall effect sensor may be provided in the neutral. Alternatively, both the current elements (phase & neutral) shall have E-beam welded shunts with proper isolation.	Redbourn Engg /Isabelle/ Shivalik / NCR
4.	Quartz Crystal		AVX, VANLONG, ADVANCED CRYSTAL etc
5	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
6	Display modules	a) The display modules should be well protected from the external UV radiations. b) The display visibility should be sufficient to read the Meter mounted. c) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display ( PIN Type). d) It should be trans- reflective STN type industrial grade with extended temperature range.	Display TEK/KCE/RCL Display /Suzhou heng Xiamen instruments/ Veritronics/ Bona-fide/ Jebon VIZ. Hongkong : Genda Singapore: Bonafied Technologies. Korea: Advantek China : Success Japan : Hitachi, Sony. TIANMA,Haijing, Holtek,
7	Communication Modules	Communication modules should be compatible for the optical port	USA: National , Semiconductors HP,

Specification for Bidirectional 1 Phase static meter

		for communication with meter reading instruments.	Optonica. Holland/ Korea : Phillips Japan : Hitachi Taiwan: Ligitek
8	Optical port	Optical port should be used to transfer the meter data to meter reading instrument. The mechanical construction of the port should be such to facilitate the data transfer easily. The Optical Port should not be adversely affected by influence of electromagnetic field, Static discharge.	USA: National Semiconductors HP Agilent Holland/Korea : Phillips Japan : Hitachi Taiwan: Ligitek
9	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
10	Electronic components	The active & passive components should be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	USA: National Semiconductors, Atmel, Philips, Texas Instruments, Siemens WELWYN, VISHAY DRALORIC,YAGEO,KO A,R OHM,PHYCOMP,FAIR CHI LD,PHILIPS,VISHAY SEMICOND, TEXAS INSTRUMENT,EPCOS, OSRAM,INFINION,NA TIO NAL SEMICOND etc. Japan : Toshiba , Hitachi, Oki, AVZ or Ricon Korea; Samsung
11	Battery	Chargeable maintenance free guaranteed life of 10 years.	Varta, Tedirun, Sanyo or National, Panasonic, Renata
12	RTC & Micro controller.	The accuracy of RTC shall be as per relevant IEC/ IS standards.	USA : Philips, Dallas, ST, Xicor Atmel, Motorola, Microchip Japan : NEC or Oki. Taiwan :Prolific Technology Inc.
13	PCB	Glass Epoxy, fire resistance grade	A class vendor

## Specification for Bidirectional 1 Phase static meter

		FR4, with minimum thickness 1.6 mm.	
--	--	-------------------------------------	--

Note: The makes of components mentioned are only indicative. The supplier can utilize better or equivalent make of components.

### 6.4 DISPLAY OF MEASURED VALUE:

6.4.1 The 6 Digit LCD display having minimum 10 mm height for all digits shall be provided. The Push Button for Manual scrolling in addition to Auto scrolling with a persistence time of 10 seconds for each parameter shall be provided.

6.4.2 The display shall be permanently backlit LCD. It should be visible in daylight. The decimal units shall not be displayed for Cumulative kWh in auto scroll mode. However it shall be displayed in push button mode for high resolution display for testing.

The meter shall have bright LCD Electronic display with back lit. The back lit should not glow during power off condition. The LCD shall be of STN (super twisted nematic type) constructing suitably for temperature withstand of 80°C (storage) & 65°C (operation) i.e. (i) When the meter is placed over at a constant temperature of 65°C for a period of 30 minutes, the character of LCD should not deform. (ii) After keeping the meter at a constant temperature of 80°C for a period of 30 minutes and when restores at normal temperature, LCD display should work satisfactorily. The LCD display should have a wide viewing angle of 120° and up to one meter distance, for clear visibility of the display of the meter reading at distance. Large viewing area with large display icons is preferred. The registered parameters shall not be affected by loss of power. The display shall not be affected by electrical and magnetic disturbances. The meter shall make use of nonvolatile memory capable of storing and retaining all the data required to be stores, without the help of any power source or battery backup and shall have a minimum retention time of 10 years under unpowered condition. Dot Matrix type LCD display is not acceptable.

6.4.3 The single phase meter shall be capable to measure continuously “Total Active Energy kWh” at all loads and power factors i.e. zero lag unity zero lead. The meter should also have provision for automatic recording of cumulative kWh at 24.00 Hrs on the last day of the month for each calendar month and the same should go to

memory.

6.4.4 [A] On auto scrolling mode following parameters should be scrolled continually.

- 1) Date
- 2) Cumulative Active Energy KWh( For import )
- 3) Cumulative Active Energy KWh( For Export)
- 4) Past Maximum Demand KW ( For import only) (Maxi. recorded during last two reset )
- 5) Instantaneous voltage
- 6) Cumulative Active Energy KWh( For import )
- 7) Cumulative Active Energy KWh( For Export)
- 8) Past Maximum Demand KW ( For import only) (Maxi. recorded during last two reset )
- 9) Instantaneous phase current with sign(+/-)
- 10) Cumulative Active Energy KWh( For import )
- 11) Cumulative Active Energy KWh( For Export)
- 12) Past Maximum Demand KW ( For import only) (Maxi. recorded during last two reset )
- 13) Instantaneous neutral current with sign(+/-)
- 14) Cumulative Active Energy KWh( For import )
- 15) Cumulative Active Energy KWh( For Export)
- 16) Past Maximum Demand KW ( For import only) (Maxi. recorded during last two reset )
- 17) Instantaneous active load in Kw with sign(+/-)
- 18) Cumulative Active Energy KWh( For import )
- 19) Cumulative Active Energy KWh( For Export)
- 20) Past Maximum Demand KW ( For import only) (Maxi. recorded during last two reset )

[B] PUSH BUTTON. (Manual) Scrolling

Following parameters one after another through push button should be provided on the meter display.

- a) LCD segment check
- b) High resolution display for total active energy (KWh) 1.2345 (for

dial test for Import & Export both)

- c) Date and time
- d) Serial no. of meter
- e) Instantaneous voltage
- f) Instantaneous phase current
- g) Instantaneous neutral current.
- h) Instantaneous active load in Kw
- i) Cumulative Active Energy KWh (For import)
- j) Cumulative Active Energy KWh( For Export)
- k) Past Maximum Demand KW ( For import only) (Maxi. recorded during last two reset )
- l) Present Maximum Demand KW (since last reset)
- m) Past Maximum Demand KW (Maxi recorded during last two resets)
- n) Total Cumulative Active Energy for each calendar month for previous six months. (For Import & Export both)
- o) Tamper wise nos. of count with easily interpretable notations.
- p) Top cover open

If the "Top cover open" tamper occur, C-OPEN should only to be displayed during power ON and OFF both conditions. Display should stuck (i.e. No Scrolling of any parameters.). However, meter should record energy continuously & KWH reading shall be access/available by use of Push button. After five minutes again Display should stuck & C-OPEN should only to be displayed on Display.

The meter shall be change over to auto scroll mode 5 mins. after manual operation.

6.4.5 Meter should have suitable arrangement to show at least "Cumulative Active Energy KWh" permanent or at an interval of **2 minutes** during power OFF condition of 18 hours without use of push button. (For Import & Export **both for 10 sec. each**)

6.4.6 The meter should record Total cumulative KWh reading and KW MD at pre-programmed date and time of the month for minimum last TWELVE calendar months and stored in NVM. Meter shall be capable to record & store daily

midnight data for cumulative kwh & it should be available in base computer. (For Import & Export both)

- 6.4.7 The energy meter shall continuously monitor and calculate the average maximum demand for each demand for time interval of 30 minutes and maximum of these in a calendar month shall be stored. There shall be NO Resetting button for MD. 30 years calendar shall be programmed by manufacturer.
- 6.4.8 The meter shall be capable to measure and display (I) Cumulative Total (Fundamental+ Harmonics energy) KWh for tariff billing purpose, Instantaneous KW, Instantaneous Voltage, Instantaneous line current, MD KW, time and date.
- 6.4.9 The maximum demand shall automatically be reset at 24.00 hours of the last day of each calendar month. No reset push button shall be provided.
- 6.4.10 Maximum Demand Integration Period: Integration period for KWMD should be of 30 minutes real time based. However the same shall be programmable through CMRI or Laptop for 15/60 minutes with the help of BCS/CMRI software through authenticated password only.
- 6.4.11 The meter shall also be capable of measuring, monitoring and storing in the memory minimum four (4) zones of time of day electrical quantities for pre-specified periods of the day. TOD TIMINGS: The meter should have eight time zones; however it should be configured for following four zones.

1 – 06:00 to 19:00 Hrs. Solar Hr.

2 – 19:00 to 06:00 Hrs. Non Solar Hr.

#### 6.5 OUTPUT DEVICE:

- 6.5.1 The meter shall have suitable blinking LED test output accessible from the front.
- 6.5.2 The test output should be suitable for use with sensing probe used with test bench or Electronic Reference Standard Meter.
- 6.5.3 The test output should also work as operating indicator for meter.
- 6.5.4 Output device shall be suitable for optical scanning for test purpose.

#### 6.6 Communication Capability / Communication Port:

##### 6.6.1 Optical Port:

The meter shall has a galvanically isolated optical communication port as per IEC PACT/



ANSI/ IEC 1107/ provided on the front of the meter to facilitate downloading the billing and history data to a CMRI / Base computer.

6.6.2 It should be possible to download the following data from the meter memory through the optical port.

- i. Serial Number of meter
  - ii. Cumulative total active energy (KWh) (For Import & Export both)
  - iii. Cumulative total Active energy (KWh) for the last 12 calendar months) (For Import & Export both)
  - iv. Maximum Demand KW with date & time for last 12 calendar months with 30 Minutes integration period) (For Import)
  - v. Maximum Demand KW since last reset) (For Import )
  - vi. Instantaneous voltage
  - vii. Instantaneous phase current
  - viii. Instantaneous neutral current
  - ix. Instantaneous load in Watt/KW
  - x. Daily midnight data for cumulative kWh energy for 12 months) (For Import& Export)
  - xi. The Tamper events like Magnet, Earth load, One line drawl ( neutral missing), neutral Disturbance ( for tamper No. 10 to 15) should be logged with date and time ( Occurrence & Restoration. 20 nos of each event should be recorded.
  - xii. Top cover open tamper indication shall be logged permanently
  - xiii. Status of NVM, RTC, battery & programming count
- 6.7 LED / LCD INDICATORS: Meter should indicate following indicators of size 5 mm.
- i) LED indicator for Meter calibration (RED)
  - ii) LCD indicator for Earth Tamper Indication.
  - iii) LCD indicator for One line drawl (neutral missing) Tamper Indi.
  - iv) LCD indicator magnetic influence Tamper Indication.
  - v) LCD indicator for top cover open. It should be continuously blinking.

The LCD notation must be easily interpretable.

## 6.8 SOFTWARES

6.8.1 Licensed copies of the software shall be made available to MGVC **OR it should be**

**compatible with software available with** MGVCL for installation on HHT or common meter reading instrument (CMRI) and Base computer software (BCS) by the supplier.

6.8.2 Windows based user interactive Base Computer Software (BCS) for receiving data from HHT or CMRI and downloading instructions from base computer software to CMRI.

6.8.3 Necessary software for loading application program into meter via CMRI.

6.8.4 The supplier should ensure that software supplied with this package works properly with HHT or CMRIs of other manufacturers.

6.8.5 The downloaded data shall be converted to the ASCII or database file format for easy integration with the existing billing software of GUVNL. It should be user configurable as per selective parameters. It should be group ASCII & scalable.

After successful downloading data either from the meter or MRI, Meter data should be automatic uploaded to BCS without any separate procedure to upload data. Meter List shall be shown on computer Display screen.

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.

#### 6.9 SELF DIAGNOSTIC FEATURE

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

- (a) Time and date on meter display
- (b) All display segments on meter display
- (c) Real Time Clock (RTC) status in meter reading prints out at BCS end
- (d) Nonvolatile Memory (NVM) status in meter reading prints out at BCS end.
- (e) Battery status

#### 7 ELECTROMAGNETIC COMPATIBILITY AND INTERFERENCE REQUIREMENT

The meter shall meet EMI/EMC requirements as specified in the relevant standards and shall also be protected against radiated interference from either magnetic or radio frequency sources. The meter shall be designed in such a way that the conducted or radiated electromagnetic disturbance as well as electrostatic discharge do not damage or

substantially influence the meter. The disturbance(s) to be considered are:

- (i) Harmonics
- (ii) Voltage dips and short interruptions
- (iii) Fast transient burst test
- (iv) External D.C. and A.C. magnetic fields
- (v) Electromagnetic H.F. fields
- (vi) Electrostatic discharges & HVHF Field
- (vii) Radio frequency interference suppression

## 8 INSULATION REQUIREMENTS:

### 8.1 Insulation Resistance.

The Insulation resistance between both current circuits and voltage circuit connected together and earth (Frame) shall be more than 5 Mega Ohms.

### 8.2 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.

### 8.3 A.C. VOLTAGE:

The meter shall withstand 4 KV A.C. Voltage for one minute.

## 9 ACCURACY REQUIREMENTS:

9.1 Limits of Error: The meter shall comply all the requirement of limits of error as per IS 13779/99 on all the points mentioned in table no.15 of IS including special test at 0.25 lag & 0.5 lead. % error at 0.25 lag and 0.5 lead is  $\pm 3.5\%$  and  $\pm 2.5\%$  respectively for range from 0.1Ib to I<sub>max</sub> Same tests are to be carried out on neutral circuit also with the procedure and limits as per phase circuits.

### 9.2 Meter Constant:

Meter constant shall comply relation between test output and indication in the display with marking on the Name Plate. The manufacturer shall state necessary number of pulse / count to ensure measuring accuracy of at least 1/10 of the accuracy class at different test points.

9.3 Starting: The meter shall start and continue to register at 0.2% of basic current at reference voltage and unity power factor.

9.4 Running with no load: This test shall be carried out as per provision of IS 13779/99 or IEC 62053-21 (2003).

#### 9.5 ELECTRICAL REQUIREMENT:

9.5.1 Power Consumption of voltage circuit: The power consumption in voltage circuit of meter at reference voltage, reference temperature and reference frequency shall be in accordance with IS –13779 (1999) or IEC 62053-21 (2003).

9.5.2 Power Consumption of current circuit: The power consumption in each voltage circuit of meter at reference voltage, reference temperature and reference frequency shall be in accordance with IS –13779(1999) or IEC 62053-21 (2003).

9.5.3 Auxiliary Power: The meter shall draw power for working of electronic circuit from phase & neutral

9.5.4 Short Time over current:

The meter shall be able to carry short time over current of  $30 I_{max}$  for half cycle at rated frequency.

9.5.5 Initial start of the meter: The meter shall be fully functional within five second after the rated voltage is applied to the meter terminals.

#### 9.5.6 INFLUENCE QUANTITIES:

The meter shall work satisfactory with guaranteed accuracy as per limit of IS:13779 , IEC 62053-21 (2003) under presence of the following quantities:-

- (i) External magnetic field (AC, DC, Permanent)
- (ii) Radio frequency interference
- (iii) Vibration
- (iv) Harmonics
- (v) Voltage fluctuation
- (vi) Electro static discharge & Electromagnetic high frequency field
- (vii) DC Immunity

Note:

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

#### 10. TEMPERATURE RISE:

(a) Under normal conditions of use, measuring element and insulation shall not reach a temperature, which might adversely affect the operation of the meter.

(b) With each current circuit of meter carrying rated maximum current and with each voltage circuit (and those auxiliary voltage circuits which are energized for periods of longer duration than their normal time constant) carrying 1.25 times the reference voltage, the temperature rise of the respective parts shall not exceed the value given below over and above an ambient temperature of 50°C.

(i) Measuring element: 50°C

(ii) External surface of the case: 15°C

#### 11 TAMPER PROOFING FEATURE: (FOR IMPORT MODE ONLY)

11.1 Meter shall record correct energy when load is connected to earth instead of neutral. The indication of such event shall be provided by way of LCD on Display.

11.2 Flashing LED pulse output (with meter constant) for testing shall be provided by way of LED on front panel.

#### 11.3 : Tamper Conditions :

11.3.1 – The meter shall indicate nos. of Tamper conditions illustrated in the attached drawing.

11.3.2 - The meter shall record all energy consumed accurately (i.e. accuracy should be +/- 1.0 %) under 1 to 15 tamper conditions. Testing of tamper conditions no. 10 to 15 and injection of chopped A.C./Pulsating D.C. in neutral will be done at 240 V, actual current & UPF and for these conditions, the accuracy of meter should not be poorer than -2.5%. Also for the tamper conditions no 7 the difference of Phase current & neutral current should be preferably 5%. The error of the meter should be measured only after logging of the tamper condition.

For all above tamper conditions, meter display should be ON and output pulse should be available with push button.

11.3.3 – The all 15 tamper conditions should be tested for maximum three minutes and at  $V_{ref}$ , unity pf and at least 1 amp current. All types of tempers must be logged, if tamper persists for one minute. The restoration time should be also one minute.

11.3.4 - The tamper conditions no. 10 to 15 are pertains to neutral disturbance and for these tamper conditions, neutral disturbance event should be logged.

11.3.5 – Top cover open tamper shall be logged permanently.

11.4 The working of Meter under different magnetic influence conditions is as under for Active energy.

When the meter shall not immune to the magnetic field the energy recording on 100%  $I_{max}$  shall only in Import mode. In no case export energy shall be recorded on 100%  $I_{max}$  under magnetic influence.

- a) Meter must be immune to the continuous D.C. stray magnetic field of  $67\text{mT} \pm 5\%$ . 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  $0.5\text{mT} \pm 5\%$ . 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  $0.2\text{ Tesla} \pm 5\%$ . In case of if it is not immune than Meter should switch over to 100%  $I_{\text{max}}$ , 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  $10\text{mT}$ . In case of if it is not immune than Meter should switch over to 100%  $I_{\text{max}}$ , UPF. Method for the testing & obtaining magnetic field should be as per CBIP 325 clause No 5.6.2.4, Table: 17 & its notes.
- e) Meter should be immune to the A.C. abnormal magnetic of  $0.2\text{ Tesla} \pm 5\%$ . In case of if it is not immune than Meter should switch over to 100%  $I_{\text{MAX}}$ , 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  $0.2\text{ Tesla} \pm 5\%$  in the central region of its either surface shall be applied successively to all the surfaces of the meter and under the most unfavorable 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 x 70 x 50 mm. In case of if it is not immune than Meter should switch over to 100%  $I_{\text{max}}$ , 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  $I_{\text{max}}$ ,  $\cos\Phi = 1$  and 0.5 inductive and at 5%  $I_b$ ,  $\cos\Phi = 1$ .

**NOTE:** Persistence time for occurrence and restoration of magnet event is one minute

11.5 The meter shall also be capable of withstanding the effects of Harmonics i.e. the test under the influence of quantities as per clause no 11.2 of Table no 17(iii) of IS

13779/99 and IEC 62053-21.

11.6 The performance of meter shall not be affected under the influence of external DC/AC and permanent magnetic field of high intensity as mentioned in clause no 11.5.

11.7 The meter shall not be susceptible to spurious signal / voltage (up to 100%) injected on neutral wire of the meter.

11.8 The meter shall also be capable of withstanding DC injection and also meter shall not generate conduct or radiated noise, which would interface with the other requirements. The above shall confirm to requirements as per IS 13779/99. and IEC 62053-21.

11.9 DC Immunity : The meter should not saturate on passage of direct current which can cause the meter either to stop recording or record inaccurately as per IS:13779 (latest version). The DC injection will be tested on both the phase and neutral circuit. The procedure and limit for both circuits shall be as per phase circuit.

11.10 Measurement of total energy.

The meter shall record total energy i.e. fundamental + harmonics to be used for tariff billing purpose for all conditions mentioned in cl.no.5.18.

11.11 Application of abnormal voltage/frequency:

Meter should not be affected/or hanged by nonstandard equipment like jammer. The accuracy of the meter should not be affected with the application of abnormal voltage/frequency such as spark discharge of approximately 35KV in any/all of the following manner for total 10 minutes:

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

“After the application of spark discharge meter should operate normally and meter should register the correct energy”

11.12 Meter shall record correct energy on reference voltage, actual current & unity power factor in absence of neutral, LCD indication of such tamper shall be provided

on display & it shall start recording energy at min.1 Amp.

12. SUBMISSION OF METER AND TEST CERTIFICATE:

12.1: The consumer shall have to submit meter to MGVCL NABL accredited laboratory for the following tests as per IS 13779/99, IEC 62053-21 (2003) and as per MGVCL 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. 35 KV Test as per cl no. 11.12 of Specification
4. Test for influence of AC / DC magnetic field as per cl no. 11.4 of specification.
5. Test for DC injection in both phase and neutral cl no. 11.9 of specification.
6. Test for total energy i.e. fundamental + harmonics as per Cl. No.5.18 of specification.
7. Test for influence of quantities as per IS 13779
8. Test for Repeatability of error as per IS 13779
9. Test of no load condition as per IS 13779
10. Test of starting condition at 0.2 % of basic current as per specification
11. Test for limit of error as per cl no. 9.1 of specification
12. Interpretation of test results, if required
13. Test for meter constant as per IS 13779
14. Test of power consumption as per IS 13779
15. Test of Short time over current test as per IS 13779
16. Test of terminals for withstanding 150 % I max as per Specification for Two hours
17. Test for withstanding phase to phase voltage (440V) between phase to neutral for minimum two hours as per cl no. 5.12
18. Verification of Display parameters, meter dimensions and Functional requirement
19. Tamper condition tests 1 to 15 as per cl no. 11.3 of specification, top cover open tamper, injection of chopped A.C./Pulsating D.C. in neutral

12.2 Meter will have to be submitted to MGVCL NABL accredited approved lab for testing of tests mentioned in cl.no.12.1 as per relevant standard. In event of failure of the Meter during any of the tests, the Meter will be considered as "REJECTED".



However, the decision of the Company shall be final and binding to the consumer.

13. TYPE TEST CERTIFICATE:

The supplier shall have all type test certificates from the Govt. approved laboratory viz: CPRI, NPL, ERTL, ETDC & ERDA for Indian supplier and for foreign supplier the certificate should be from recognized Govt. approved lab. of that respective country, as per IS No.13779 /1999 or IEC 62053:21 as the case may be. Type test should not be older than 3 years. **The supplier shall have** also the type test certificate as per clause No. 11.6 i.e. AC/DC magnetic influence test and Cl. No: 11.10, i.e. total energy test on the same rating of meter.

14. Routine Tests: Meter shall undergo the routine tests as well as functional tests as per IS: 13779/1999. The consumer shall produce Test reports for the following tests.

- (a) AC High Voltage test
- (b) Starting and No load tests.
- (c) Insulation Resistance Test.
- (d) Limits of error test.

15. 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 someone 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 semicircular 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 someone 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 seal.

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

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

BIDIRECTIONAL 1-Ph Static Meter

DRAWING FOR TAMPER CONDITIONS FOR SINGLE PHASE METER

	Phase - Neutral Connection Normal	Phase - Neutral Connection Reversed
NORMAL WIRING NOT TAMPERED	 CONDITION - 1	 CONDITION - 2
FULL LOAD EARTH RETURNED TAMPER	 CONDITION - 3	 CONDITION - 4
PARTIAL LOAD EARTH RETURNED TAMPER	 CONDITION - 5	 CONDITION - 6
CURRENT BYPASSED TAMPER	 CONDITION - 7	
NEUTRAL REMOVAL TAMPER	 CONDITION - 8	 CONDITION - 9
NEUTRAL DISTURBANCE TAMPER	 CONDITION - 10	 CONDITION - 11
NEUTRAL DISTURBANCE TAMPER	 CONDITION - 12	 CONDITION - 13
NEUTRAL DISTURBANCE TAMPER	 CONDITION - 14	 CONDITION - 15

LEGEND : R DIRECTION REVERSED    E EARTH TAMPED    NM NEUTRAL DISTURBANCE

\*\* For Fig. 10 to 15, Due to application of diode, resistance or variable capacitor, if phase to neutral voltage reduce less than 230V, meter should detect these as neutral disturbance & recording of meter should be at 240V, actual current & UPF. It is desired to have two indications viz. 'NM' and 'Earth' & logging of neutral disturbance event preferably. However indication of either one with logging of event thereof will also be considered.