TECHNICAL SPECIFICATIONS FOR 0.5S ACCURACY CLASS POWER ANALYZER ENERGY METERS, SUITABLE FOR ENERGY ACCOUNTING & POWER ANALYSING

SCOPE:

This specification covers the design, engineering, manufacture, assembly, inspection and testing supply and installation at site/ NESCO distribution area of class 0.5 s accuracy (kWh). The meters shall be used for Energy Accounting/Auditing and also Interface meters in NESCO system, along with the operating software.

One of each meter shall be installed at each of the feeders, as a self contained device for measurement of current, power (real power, reactive power, apparent power, power factor, harmonic reactive power) with an measuring intervals of 10 (50 Hz) or 12 (60 Hz) periods (200 ms).

The number of meters and their secondary rating (1 amp) to be installed and commissioned at each feeder of the substation shall be informed to the successful bidders. The meter should be 3 phase 4 wire type suitable for connection to 3 phase 4 wire as well as 3 phase 3 wire system.

It is not the intent to specify completely herein all the details of the design and construction of material. The material shall, however, conform in all respects to the best industry standards of engineering, design and workmanship and shall be capable of performing for continuous commercial operation in a manner acceptable to the purchaser. The offered equipment shall be complete in all respects including all components/ accessories for effective and trouble free operation according to the specifications. Such components shall be deemed to be within the scope of this specification irrespective of whether those are specifically brought out or not.

The meter shall comply to open protocol for 0.5S class Energy Meters.

The Bidder also to carryout the installations of the meters as per the requirement of NESCO and the Annual maintenance work of the meters so installed and monitor for one year.

APPLICABLE STANDARDS

STANDARDS

The equipment shall conform (for testing, performance and accuracy) in all respects the relevant Indian/ International metering standards with latest amendments thereof unless otherwise specified.
<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Standard No</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IEC6205622 &amp; IEC 6205322</td>
<td>AC meters for active energy, class 0.5s.</td>
</tr>
<tr>
<td>2</td>
<td>IEC 6205623 &amp; IEC 6205323</td>
<td>NOT REQUIRED</td>
</tr>
<tr>
<td>3</td>
<td>IEC 6205631</td>
<td>Electricity metering : Data exchange for meter reading, tariff &amp; load. Use of LAN</td>
</tr>
<tr>
<td>4</td>
<td>IEC 6205211</td>
<td>General requirement of electricity metering equipment, tests and test conditions.</td>
</tr>
</tbody>
</table>

Equipment matching with requirements of other national or international standard which ensure better performance than the standards mentioned above shall also be considered. When the equipment offered by the bidder conforms to standards other than those specified above, salient points of difference between standards adopted and standards specified in this specification shall be clearly brought out in the relevant schedule and copy of such standards along with their English translation shall invariably be furnished along with the offer.

**CLIMATIC CONDITIONS**

The meters to be supplied against this specification shall be required to operate satisfactorily and continuously under the following tropical conditions of hot, humid, dusty, rust and fungus prone environment.

1. Max. ambient air temperature (°C) : 50
2. Min. ambient air temperature (°C) : (-)5
3. Average daily ambient air temp. (°C) : 32
4. Max. Relative Humidity (%) : >95
5. Min. Relative Humidity (%) : 10
6. Max. Altitude above mean sea level (m) : 1000
7. Average Annual Rainfall (mm) : 1200
8. Max. wind pressure (Kg/Sq.m) : 195
9. Isoceraunnic level (days per year) : 50
10. Seismic level (Horizontal Accn. in g) : 0.3
**PRINCIPAL PARAMETERS**
The energy meter shall be installed outdoor, required IP protection and suitable boxing with sealing provision to be provided by the bidder. The Box should be installed in a single pole structure and should be mounted suitably.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Item</th>
<th>Specification</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Type of Installation</td>
<td>Outdoor</td>
</tr>
<tr>
<td>2</td>
<td>VT Secondary</td>
<td>3x110/√3 V Phase to Neutral (3P,4W) or 3x110 V Phase to Phase (3P3W) (as per requirement)</td>
</tr>
<tr>
<td>3</td>
<td>CT Current</td>
<td>1 AMP</td>
</tr>
<tr>
<td>4</td>
<td>Auxiliary AC Supply</td>
<td>110 V (15% to +10%)</td>
</tr>
<tr>
<td>5</td>
<td>Auxiliary Supply</td>
<td>220 V DC(10% to +10%)/ 230 V AC (15% to +10%).</td>
</tr>
<tr>
<td>6</td>
<td>System Frequency</td>
<td>50HZ +/-5%</td>
</tr>
<tr>
<td>7</td>
<td>Earthing System</td>
<td>Solidly Grounded</td>
</tr>
</tbody>
</table>

The meter should be suitable for working with above supply variations without image and without degradation of its meteorological characteristics.

**TECHNICAL REQUIREMENTS**

**POWER FACTOR RANGE**

The metering system shall be suitable for full power factor range from zero (lagging) through unity to zero (leading). The metering module shall work as an active energy import. The energy measurement should be true four quadrant type.

Power Supply Variation:

The metering system should be suitable for working with following supply system variation as per relevant clause of IS:14697.
Specified operating Range: 0.8 to 1.15 Un
Limit Range of operation: 0.7 to 1.2 Un.

**ACCURACY**

Class of accuracy of the metering system shall be 0.5s for active energy measurement. The accuracy should not drift with time.
POWER CONSUMPTION OF METER

Voltage Circuit: The active and apparent power consumption in each voltage circuit including the power supply of metering module at reference voltage, reference temperature and reference frequency shall not exceed 1 Watt per phase and 4 VA per phase respectively.

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

STARTING CURRENT

The metering module should start registering the energy at 0.1% Ib(base current) and unity power factor.

MAXIMUM CURRENT

The rated maximum current of the metering module shall be 120% of basic current.

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

GENERAL CONSTRUCTIONAL REQUIREMENTS

Meters 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 should be ensured:

I. Personnel safety against electric shock.
II. Personnel safety against effects of excessive temperature.
III. Protection against spread of fire.
IV. Protection against penetration of solid objects, dust and water in normal working condition.

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

The meters shall be designed with application specific integrated circuits. The electronic components shall be mounted on the printed circuit board using latest Surface Mount Technology (SMT).
All insulating materials used in the construction of meters shall be non hygroscopic, non aging and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

MANUFACTURING ACTIVITIES
Meter should be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process; the Bidder should own such facilities. Quality should be ensured at the following stages:

At PCB manufacturing stage, each board shall be subjected to computerized bare board testing.

At insertion stage all components should undergo computerized testing for conforming to design parameters and orientation.

Complete assembled and soldered PCB should undergo functional testing using Automatic Test Equipment.

Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant morality.

The calibration of meters shall be done in house.

SEALING
Proper sealing arrangement (for front, rear and port etc) shall be provided in metering system.

SEALING & LOCKING ARRANGEMENT
On opening of the meter case, relevant display like cover open count, last cover open date and time shall be updated and events shall be logged permanently as per DLMS.

MARKING OF METER
The marking on every meter shall be in accordance with IS 14697/ IEC6205322. The basic marking on the metering module name plate shall be as follows:

i. Manufacturer's name and trade mark
ii. Serial Number
iii. Year of manufacture
iv. Type Designation
v. Number of phases and wires
vi. VT commissioning information
vii. CT commissioning information
viii. Reference frequency
ix. Accuracy Class

Additionally, following information shall also be available on name plate.
The connection diagram of the metering module shall be shown on inside portion of the terminal cover via suitable means. The meter terminals shall be properly marked.

The meters shall be suitable for being connected directly through its terminals to VT’s having a rated secondary line to line voltage of 110 V& Line to Earth 63.5 V, and to CTs having a rated secondary current of 1A. Any further transformers/ transducers required for their functioning shall be inbuilt in the meters. Necessary isolation and/or suppression shall also be built in, for protecting the meters from surges and voltage spikes that occur in the VT and CT circuits of extra high voltage switch yards.

The active energy measurement shall be carried out on 3 phase, 4 wire principle with an accuracy as per class 0.5s of IEC 6205622. The meters shall compute the active energy and load import; active energy from the substation bus bars during each successive 15 minute integration period block and store it in its non volatile memory.

The meter shall compute the average frequency during each successive 15 minute block and store in its memory.

Active and Apparent energies shall also be made available by meter in separate energy registers as –

(i) Active energy Import
(ii) Apparent energy (while active import)

**Meter shall have provision to compute apparent energy based on lag only or lag+ lead. The same shall be configured at factory end. The meter should be having the provision to compute 1 ... 25 Harmonics of current, voltage, real- and reactive power. THD-value of V and A.**

The meter shall normally operate with the power drawn through the auxiliary AC or DC supply. The metering system design should enable the auxiliary supply to be switched automatically between the AC and DC voltage, depending upon their availability. Typical auxiliary voltages available are 230V AC and 220V DC. The system shall continue to work even if any one of the above auxiliary supply (AC/ DC) is present.

Each metering module shall have a built in calendar and clock, having an accuracy as per latest BIS or IEC standard which ever is better. The calendar and clock shall be correctly set at the manufacturer’s works. An automatic backup for continued operation of the meter’s calendar clock shall be provided through a long life battery, which shall be capable of supplying the required power for at least two years under meter unpowered conditions. The meters shall be supplied duly fitted with the batteries, which shall not require to be changed for at least ten years, as long as total supply interruption does not exceed two years.

Following provisions shall be available for MD reset in meter –
(I) Auto billing at predefined date and time.
(ii) Authenticated transaction through suitable high level software/ MRI (optional)

Billing parameters & Energy accounting/ auditing: The predefined date and time for registering the billing parameters shall be 00.00 hours of the first day of each calendar (billing) month. Each meter shall store the following parameters corresponding to defined bill dates for up to last Twelve (12) months:
   I. Active energy import
   II. Apparent energy (while active import)

Daily midnight parameters: The metering modules shall store following end day parameters for last Sixty (60) days:
   I. Active energy import

DATA COMMUNICATION CAPABILITY: The metering system should have multiple communication ports for local reading and remote communication facility.

Meter shall have RJ 11 or RS232 communication port FOR COMMUNICATING DATAS to the serve as the interface between meter and PC loaded with Base Computer Software. It shall also be possible to download meter data via this port by connecting laptop computer directly. The overall intention is to tap the data stored in meter once a week/month and transmit the same to PC with BCS for view and print.

The meter shall comply to DLMS (Device Language Message specification) open protocol for 0.5S class Energy Meters. The meter shall have ethernet port for reading the meter over DLMS. Meter shall have RS232 (in & out) for online monitoring (MODBUS)/meter reading (DLMS). Meter shall have sufficient battery backup for display in absence of mains and auxiliary supply.

The metering system shall provide a communication port compatible to RS232 port for online data transfer to a central location. This port shall be capable of data transfer to a main computer on real time basis using suitable communication network (VSAT/ Leased line/ OFC) via compatible hardware (interfacing equipment/ communication cables etc. as required). MODBUS RTU protocol shall be implemented over RS232 port.

Each meter shall have a unique identification code i.e. serial number, which shall be marked on name plate as well as in its memory. Further all meters of the same model shall be totally identical in all respects except for their unique identification codes.

The meters shall safely withstand the usual fluctuations arising during faults etc. In particular, 115% of rated VT secondary voltage applied continuously and 190% of rated voltage applied for 3.0 seconds, and 20 times of rated CT secondary current applied for 0.5 seconds shall not cause any damage to or malfunctioning of the meters. Further the immunity of metering system to external magnetic field shall be as per latest CBIP recommendations.

Each meter shall have a non volatile memory (NVM) in which the parameters as
mentioned in this specification shall be stored. The non volatile memory shall retain the data for a period not less than 10 years under un powered condition; battery back up memory shall not be treated as NVM.

Meter shall have the capability and facility to compensate for errors of external measurement transformers ie. CT and VT:

I. Linear compensation for measurement PT errors (ratio and phase); there shall be linear adjustment which shall be applied across the complete measurement range of the transformer.

II. Nonlinear compensation for measurement CT errors (ratio and phase) compensation; this shall allow multiple ratio and phase adjustments to be applied for different load points per phase input of the meter. It should be possible to program the errors of CT and VT in meter through front optical communication port using compatible high level software.

Metering system design should support this feature and further it shall be possible to configure & incorporate this feature in meter at later stage whenever required.

The meters shall be draw out type with automatic CT shorting feature so as to ease the testing/ replacement of meters without disturbing the system. 4.38 Meter shall be provided with compatible software for time synchronisation

ANOMALY DETECTION FEATURES

The meter shall have features to detect and log the occurrence and restoration of following anomalies, along with date and time of event:

Tamper& ANTI-Fraud detection/evidence features
Total no of temper events logged by meter shall be at least 200 nos, compartment wise division of each event and their persistence time shall be indicated at the time of finalizing GTP. The meter shall not get affected by any remote control devices and shall continue recording energy under anyone or combinations of the following conditions:

Phase sequence reversal: The meters shall work accurately irrespective of the phase sequence of the supply.

Detection of missing potential: In case someone intentionally takes out as potential lead, the date and time of such occurrence shall be recorded by the meter. The last restoration of normal supply shall also be similarly recorded. The threshold of the voltages should be programmable.

Voltage Unbalance : The meter shall detect voltage unbalance if there is unbalance in voltages.

Current Unbalance : The meter shall detect current unbalance if there is unbalance in load conditions. Meter should ensure true system conditions before going for current unbalance checks.
V. CT Miss: The meter shall detect current miss if the current is below a defined threshold, provided the phase voltage is above a specified threshold.

Snapshots of phase wise voltage, phase wise active current and phase wise power factor shall be provided with above specified anomaly events. Further, each meter module shall record the following events along with total Duration.

Reversal of C.C. Polarity: Meter shall record the reversal of C.C. polarity with time and date, and also the time of restoration. Meter shall however register the energy consumed correctly with any one, or all two phase c.c. reversal.

Power on/Off:- Meter shall detect power OFF (minimum power off period5 minutes) if any of phase voltages are not present. This event shall be recorded at the time of each power OFF. At the same time power ON event shall recorded. This logging shall be available in Tamper details along with cumulative time of failure.

Feeder Supply Fail: This event shall be logged when feeder supply, i.e. all the voltages goes below certain threshold. No snapshot shall be logged with this event. Last hundred (200) events (occurrence + restoration), in total, shall be stored in the meter memory on first in first out basis. There shall be four separate compartments for logging of different type of anomalies:

Compartment No.1 60 events for Voltage related
Compartment No.2 60 events for Current related
Compartment No.3 60 events for other related
Compartment No.4 20 events for Power failure

Once one or more compartments have become full, the last anomaly event pertaining to the same compartment shall be entered and the earliest (first one) anomaly event should disappear. Thus, in this manner each succeeding anomaly event shall replace the earliest recorded event, compartment wise. Events of one compartment/ category should overwrite the events of their own compartment/ category only. Anomaly count should increase as per occurrence of anomaly events. Total no. of counts shall be provided on BCS.

Snap shots: Meter shall log all three phase voltage, current, power factor etc. At the time of tamper attempt for all such occurrences.

External Magnetic tamper: Meter should logon the events of attempt of tampering by external magnetic field & should function as mentioned in the CBIP Technical report no. 88 with latest amendments.

Influence Quantities: The meter shall work satisfactorily with guaranteed accuracy limit under the presence of the following influence quantities as per IEC-1036, and CBIP Technical Report No.88 with latest amendment.
The influence quantities are:
(a) External Magnetic field -0.2 tesla (with log on feature)
(b) Electromagnetic filed induction
(c) Radio frequency interference
(d) Unbalanced load
(e) Vibration etc.
(f) Wave form 10% of 3rd harmonics
(g) Phase sequence
(h) Voltage unbalance
(i) Electro Magnetic H.F. Field

RTC Drift:
In case of TOD tariff the proper RTC functioning will be of prime importance. In view of this a software to adjust the RTC drift to be provided along with.

TRANSACTIONS
The meter shall record critical events (as performed in authenticated manner) of Time set, MD reset operation and tariff change. These events shall be logged in roll over mode for up to twenty numbers.

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 in memory location all the time. The meter shall have indications for unsatisfactory/ non functioning/ malfunctioning of the following:
(ii) Non volatile memory
(iii) RTC battery
The above malfunctioning should be flagged in the meter memory and should be made available in meter reading data.

TYPE TEST CERTIFICATES.
The meters shall be fully type tested as per relevant standards IS 14697/ IEC 6205322. The type test report of the meters shall be submitted by bidder along with the offer. Type test reports shall not be more than 5 years old.

GURANTEED TECHNICAL PARTICULARS
Measurement functions:
- Automatic adaptation to mains frequency of 45 Hz ... 65 Hz
- Measuring intervals of 10 (50 Hz) or 12 (60 Hz) periods (200 ms)
- Continuous measurement and calculation of the following values:
  - Voltage L-N (L1 ... L3), Star point voltage and unbalance voltage L-L
  - Frequency
  - Current, L1 ... L3 and N (calculated by L1 .. L3)
  - Power
- Summary of L1 ... L3 of above mentioned parameters
- Real energy (consumed and delivered)
- 1 ... 25 Harmonics of current, voltage.
- THD-value of V and I

Capturing and recording:
- Minimum, maximum and average values of the measurement parameters with user defined measurement intervals
- Under- and overvoltage per period

Energy consumption (real- reactive consumed and delivered)

Interface RS485, Modbus RTU

Dimensions: maximum width = 71,5mm x height = 90mm, depth = 46mm

Measurement voltage:
L-N = 50 - 300V AC, L-L = 85 .. 520V AC

Mains frequency: 45 - 65 Hz

Nominal current: 5A (6 A) or 1 A (1,2 A)

Accuracy: Voltage and current: +0,2%, real energy class 0.5S (kWh)

Software: shall be included in content of delivery
Including:
Programming and analysis software GridVis-Basic