

# New Delhi Municipal Council

## TECHNICAL SPECIFICATION FOR THREE PHASE WHOLE CURRENT FOUR WIRE ELECTRONIC NET ENERGY METERS

(Applicable from above 5 kW upto 30 kW)

### 1.0 SCOPE OF WORK: -

- This specification covers design, manufacture, supply & testing of Three Phase Four Wire electronic Net Meter for energy measurement of dual energy sources (Import & Export mode for supply of NDMC & Solar system).
- The system shall be A.C Three Phase 4-Wire 3X240V, line to neutral, 50 Hz with effectively grounded neutral.
- The Net Meter should be suitable for 10-60 Amp current rating. Base current of the meter shall be 10 amperes. The meter shall work accurately at 120% of I-max as per IS.
- The Net Meter shall be capable of measuring kWh, kVAh & MD in kW of Import and Export respectively.
- The Net Meter shall be supplied with suitable tamper proof enclosure along with optical cable fitted for data downloading through CMRI.
- The Net Meters should be compatible with latest Linux/MS-DOS / Windows based CMRI (Sands, Analogies, Genus make or equivalent) for data downloading. The Net Meter should be physically and optically compatible with existing CMRI & optical cable (RS.232 compatible) used in NDMC.
- The meter must work satisfactorily under balanced or un balanced load.

### 2.0 APPLICABLE STANDARDS: -

- The Net Meters should conform to requirement of IS 13779 / IEC 62052-11 & 22 / CBIP – 304 Technical report and alongwith latest amendments.
- The meters shall adheres to the standards as specified in CEA (Installation and Operation of meters) Regulations 2006 and (Installation and operation of meters) Regulation, 2010 as amended from time to time.
- These Net Meters shall have Type test certificate from an independent Govt. NABL accredited test house such as ERDA, NPL, CPRI, ERTL etc.- The type test report shall not be older than 03 years.

### 3.0 CLIMATIC CONDITIONS OF THE INSTALLATION

- The Net Meters to be supplied against this specification shall be suitable for satisfactory continuous operation without change in their error parameters under the climatic conditions detailed in the table below:-

Sr. No.	Description	Values
1.	Maximum ambient temperature	60 <sup>0</sup> C
2.	Maximum ambient temperature in shade	45 <sup>0</sup> C
3.	Minimum temperature of air in shade	(-) 2.5 <sup>0</sup> C
4.	Maximum daily average temperature	45 <sup>0</sup> C
5.	Relative Humidity	10 to 95%
6.	Maximum annual rainfall	1450mm
7.	Maximum wind pressure	120 Kg./m.sq.
8.	Seismic level (Horizontal acceleration)	0.3g

### 4.0 FUNCTIONAL SPECIFICATION

Sr. No.	Function/ Feature	Technical Requirements
1	Voltage	240volt (P-N) should and over all 440 V continuously stand (+ 20% to -40%).
2	Display	(a) LCD (Six digits) (b) Viewing angle Min. 160 degrees
3	Power factor range	Zero lag-unity-zero lead

4	Display parameters	<p><b>MODE-I</b></p> <p>The Meter shall display the following parameters in auto scroll mode as given below:</p> <ol style="list-style-type: none"> <li>1) Real time and date.</li> <li>2) Import cumulative active energy. (KWH)</li> <li>3) Export cumulative active energy. (KWH)</li> <li>4) Net cumulative active energy (KWH) (if export active energy is greater than import energy then minus sign should be displayed).</li> <li>5) Import cumulative apparent energy. (KVAH)</li> <li>6) Export cumulative apparent energy. (KVAH)</li> <li>7) Net cumulative apparent energy (KVAH) (if export apparent energy is greater than import energy then minus sign should be displayed).</li> <li>8) Average import power factor since last reset.</li> <li>9) Import Maximum Demand in KW since last reset</li> <li>10) Export Maximum Demand in KW since last reset</li> <li>11) Instantaneous voltage and instantaneous current, instantaneous active load in Kilo Watt in all the three phases separately.</li> </ol> <p><b><u>MODE II : PUSH BUTTON DISPLAY</u></b></p> <ol style="list-style-type: none"> <li>1) LCD check.</li> <li>2) Meter Serial number</li> <li>3) Instantaneous voltages &amp; current for R,Y,B(Separate display for V &amp; I)</li> <li>4) Instantaneous power factor for R, Y, B &amp; system PF (with Lag &amp; Lead sign ).</li> <li>5) Instantaneous power in KW for R, Y, B and total.</li> <li>6) Date&amp; time of last reset.</li> <li>8) Meter covers open tamper with date &amp; time.</li> <li>9) Import cumulative active energy. (kWh)</li> <li>10) Export cumulative active energy. (kWh)</li> <li>11) Net cumulative active energy (kWh) (if export active energy is greater than import energy then minus sign should be displayed).</li> <li>12) Import cumulative apparent energy. (kVAh)</li> <li>13) Export cumulative apparent energy. (kVAh)</li> <li>14) Net cumulative apparent energy (kVAh) (if export apparent energy is greater than import energy then minus sign should be displayed).</li> <li>15) TOD readings</li> <li>16) Import Average power factor.</li> <li>17) Export Average power factor.</li> <li>18) Power OFF hours since last reset billing period.</li> <li>19) Frequency.</li> <li>20) Magnetic interference indication.</li> <li>21) SEQ V: RYB (Phase sequence check).</li> <li>22) Import Maximum Demand in KW since last reset</li> <li>23) Export Maximum Demand in KW since last reset</li> <li>24) Tamper data. <ol style="list-style-type: none"> <li>a) Occurrences of tamper with date and time.</li> <li>b) Restoration of tamper with date and time.</li> <li>c) No. of tamper events.</li> </ol> </li> </ol>
5	Power Consumption	As per IS13779
6	Starting current	As per IS13779
7	Frequency	50 Hz with +/- 5%

<b>8</b>	Test output device	Flashing RED LED visible from the front																																						
<b>9</b>	Billing data	<p>1) LCD check.</p> <p>2) Meter Serial number</p> <p>3) Instantaneous voltages &amp; current for R,Y,B(Separate display for V &amp; I)</p> <p>4) Instantaneous power factor for R, Y, B &amp; system PF (with Lag &amp; Lead sign ).</p> <p>5) Instantaneous power in KW for R, Y, B and total.</p> <p>6) Date&amp; time of last reset.</p> <p>7) MD reset count - cumulative.</p> <p>8) Meter covers open tamper with date &amp; time.</p> <p>9) Import cumulative active energy. (kWh)</p> <p>10) Export cumulative active energy. (kWh)</p> <p>11) Net cumulative active energy (kWh) (if export active energy is greater than import energy then minus sign should be displayed).</p> <p>12) Import cumulative apparent energy. (kVAh)</p> <p>13) Export cumulative apparent energy. (kVAh)</p> <p>14) Net cumulative apparent energy (kVAh) (if export apparent energy is greater than import energy then minus sign should be displayed).</p> <p>15) Import cumulative reactive energy. (kVARh)</p> <p>16) Export cumulative reactive energy. (kVARh)</p> <p>17) voltage and phase sequence</p> <p>18) TOD readings</p> <p>19) Import Average power factor since last reset</p> <p>20) Export Average power factor since last reset</p> <p>21) Power OFF hours since last reset billing period.</p> <p>22) Frequency.</p> <p>23) Magnetic interference indication.</p> <p>24) SEQ V: RYB (Phase sequence check).</p> <p>25) Import Maximum Demand in KW since last reset</p> <p>26) Export Maximum Demand in KW since last reset</p> <p>27) Tamper data.</p> <p>a) Occurrences of tamper with date and time.</p> <p>b) Restoration of tamper with date and time.</p> <p>c) No. of tamper events.</p> <p>28) All these data shall be accessible for reading and further billing by downloading through RS232 optical port with CMRI and Laptop computers at site.</p>																																						
<b>10</b>	MD Registration	Meter shall store MD in every 30 min. period along with date & time. At the end of every 30 min. new MD shall be computed and compared with previous MD and store whichever is higher and the same shall be displayed. It is preferred that MD is computed using separate counter rather by difference by initial and final energy counter.																																						
<b>11</b>	Auto Reset of MD	Auto reset date for MD shall be 00:00 Hrs at the end of every month default and provision shall be made to change MD reset date through CMRI even after installation of meter on site.																																						
<b>12</b>	TOD metering	<table border="1"> <thead> <tr> <th>Tariff</th> <th>Timings</th> <th>1<sup>st</sup> April to 30September</th> <th>1<sup>st</sup> Oct to 31<sup>st</sup> December</th> <th>1<sup>st</sup> Jan to 31<sup>st</sup> March</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>00:00 to 06:00</td> <td>Tnp</td> <td>Tnp</td> <td>Tnp</td> </tr> <tr> <td>2</td> <td>06:00 to 09:00</td> <td>Tn</td> <td>Tn</td> <td>Tn</td> </tr> <tr> <td>3</td> <td>09:00 to 15:00</td> <td>Tn</td> <td>Tn</td> <td>Tn</td> </tr> <tr> <td>4</td> <td>15:00 to 17:00</td> <td>Tp</td> <td>Tn</td> <td>Tn</td> </tr> <tr> <td>5</td> <td>17:00 to 23:00</td> <td>Tp</td> <td>Tp</td> <td>Tp</td> </tr> <tr> <td>6</td> <td>23:00 to 24:00</td> <td>Tp</td> <td>Tnp</td> <td>Tnp</td> </tr> </tbody> </table>	Tariff	Timings	1 <sup>st</sup> April to 30September	1 <sup>st</sup> Oct to 31 <sup>st</sup> December	1 <sup>st</sup> Jan to 31 <sup>st</sup> March	1	00:00 to 06:00	Tnp	Tnp	Tnp	2	06:00 to 09:00	Tn	Tn	Tn	3	09:00 to 15:00	Tn	Tn	Tn	4	15:00 to 17:00	Tp	Tn	Tn	5	17:00 to 23:00	Tp	Tp	Tp	6	23:00 to 24:00	Tp	Tnp	Tnp	Meter shall be capable doing TOD metering for kWh & kVAh and MD in kW		
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		<p>for both Import and Export metering with 6 time zones (programmable on site through CMRI). Following are the defaults TOD time zones.</p> <p>Note – Tnp – TOD zone for non peak, Tn – TOD zone for normal, Tp – TOD zone for Peak.</p> <p>NET meter should have the provision of software to enable to record the reading on the basis of TOD schedule as per the requirement of DERC tariff order for FY 2012-13.</p>
13	Security feature	Programmable facility to restrict the access to the information recorded at different security level such as read communication, communication to write etc.
14	Memory	Non volatile memory independent of battery backup, memory should be retained upto 10 year in case of power failure.
15	Software communication compatibility	<p>a) Optical port (RS. 232 compatible) to transfer the data locally through Linux / MS DOS / Windows based CMRI &amp; remote through GSM/GPRS/ CDMA / any other technology to the main computer.</p> <p>b) The meter shall be suitable for CMRI software as mentioned in the Design &amp; Scope. The meter shall be Meter reading instrument (MRI) complied or Automated Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) complied for recording meter readings. Software should be compatible for up gradation from time to time.</p> <p>c) Meter shall have open meter reading protocol /API (Application Program Interface)</p> <p>d) Manufacture shall provide suitable enclosure along with communication cable fitted with every meter for data downloading purposes.</p> <p>e) Meter should contain software for Comma Separated value file, capability of various parameters for billing purpose as per annexure-“B”.</p>
16	Climatic conditions	As per IS 13779
17	Calibration	Meter shall be calibrated at factory only and modification in calibration shall not be possible at site by any means.
18	Read without power	The meter should have internal rechargeable battery (Ni-Cd) to display the reading in case of power failure. Readings should be available with pressing & releasing of button and meter will then power off after completion of auto mode display cycle.
19	Load Survey	<p>Last 60 Days Load Survey with 30 min integration period having Cumulative Export kWh, Cumulative Import kVAh, Cumulative Export kVAh, Daily Import kWh, Daily Export kWh, Daily Import kVAh, Daily Export kVAh, Daily average V&amp;I profile.</p> <p>Demand in kW for Import and Export, date and time, Inst. Voltage and Inst. Current.</p>
20	Communication Port	<p>Optical Port –</p> <ol style="list-style-type: none"> <li>1. Meter shall have optical communication port as per IEC1107 for data communication through latest Linux/MS-DOS/ /Windows based CMRI.</li> <li>2. Both Meter and sensor should have a mechanical fitment provision, so that sensor can be fitted on meter adequately</li> </ol> <p>Wired Port –</p> <ol style="list-style-type: none"> <li>1. Wired RS232 port shall be under T-cover which can be sealed.</li> <li>2. Both optical and wired port should work independently.</li> <li>3. Failure of One Port (including display) should not affect the other port downloading capabilities.</li> </ol>

## 5.0 CONSTRUCTIONAL SPECIFICATIONS: -

- i) **Terminal block** - It should be made of Polycarbonate/PBT with properties of V0 inflammability level or equivalent. It shall also be capable to withstand 120% of I<sub>max</sub>
- ii) **Terminal cover** – It shall be made of Polycarbonate. The meter shall have a case, which can be sealed in such a way that the internal parts of the meter are accessible only after breaking the seal(s),
- iii) **The meter top cover** shall not be removable without the use of a tool. The meter top cover shall overlap on base such as any attempt to cut and open the meter cover will be clearly evident. Further the meter cover shall be ultrasonically welded to meter base. Unidirectional type sealing screws / break to open welded arrangement shall be provided on meter cover.
- III) **SEALING OF METER**-The sealing arrangement should be as per IS-13779 and CEA Regulations 2006. It should be provided to make the meter tamper evident and avoid fiddling or tampering by unauthorized persons. For this, at least two (2) Nos., seals on meter body, One (1) No. Seal on meter terminal cover should be provided. All the seals should be provided on front side only. Rear side sealing arrangement shall not be accepted.
- iv) The meter base shall be manufactured from high quality industrial grade material viz. Polycarbonate as per ISO- 75.

## 6.0 TERMINALS ARRANGEMENTS

1. The terminals shall be marked properly on the terminal block for giving external connections.
2. The terminal cover shall be extended such that when it is placed in position, it is not possible to approach the connections or connecting wires. Proper cut out to be provided on terminal cover for the cable entry.
3. The terminal and connections shall be suitable to carry upto 120% of the I<sub>max</sub> continuously. (Continuous current carrying capacity of 100 Amps. as per meter ratings).
4. The meter top cover shall be transparent. Window shall be of transparent Polycarbonate material for easy reading of all the displayed values/parameters, nameplate details and observations of operation indication.
5. The terminal block, the Extended terminal block and the meter case shall ensure reasonable safety against the spread of fire. They should not be ignited by thermic overload of live parts in contact with them.
6. The manner of fixing the conductors to the terminal block shall ensure adequate and durable contact such that there is no risk 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 as per IS. The clearance and creepage distance shall conform to relevant clause of IS 13779:1993/CBIP technical report No.88 (latest version).

## 7.0 Protection against penetration of dust and water.

The meter shall conform to the degree of protection IP51 as per IS12063

## 8.0 TAMPER & ANTI-FRAUD DETECTION/EVIDENCE FEATURES

8.1	<b>Low Voltage Logging</b> Event shall be logged in memory along with Occurrence and restoration event data. Threshold should be below 180 V (P-N).
8.2	<b>Protection against HV spark-</b> Meter shall continue to record energy or log the event, in case it is disturbed externally using a spark gun/ ignition coil up to 35 kV meter should remain immune.
8.3	<b>Neutral disturbance</b> When the neutral from both incoming and outgoing side are disturbed. Meter shall record correctly in case AC/DC high frequency signal is injected in the neutral circuit of the meter.
8.4	<b>External Magnetic Interference</b> a. Meter should either be immune or should log the events of attempt of tampering by external magnetic field as per IS13779/ CBIP 304 with latest amendments.

	<p>b. Meter should record energy at I<sub>max</sub> during the influence of external magnetic field. The meter shall record this abnormal energy in separate register. The meter shall record energy as per actual load once the magnetic field is removed.</p> <p>c. The MD computation during magnetic interference shall not be recorded</p>
8.5	<p><b>Top cover open</b> Meter shall have top cover open detection once top cover is removed and shall be logged. Detection and logging mechanism shall work even when the meter is de-energized.</p>
8.6	<p>Power On/ Off Meter shall detect power off if the phase voltage is absent for 10 minutes. This event should be recorded at the time of each power off along with date and time. Power On event and cumulative time of failure should also be recorded.</p>
8.7	<p><b>Connection Related Tamper Conditions</b> The meter shall not get affected &amp; continue recording energy under any one or combinations of the following conditions from 8.8 to 8.12</p>
8.8	<p>Two Wire Tamper Meter should log this tamper when one phase and neutral is absent.</p>
8.9	<p><b>Low power Factor</b> Meter should log Low Power factor when the power factor falls below the permissible limit.</p>
8.10	<p><b>Current reversal Phase wise</b> Meter should log current reversal when the direction of current has been reversed.</p>
8.11	<p><b>I/C (Phase &amp; Neutral) Interchanged, Load Connected To Earth.-</b> Meter should record forward energy within limits of accuracy class 1.0</p>
8.12	<p><b>Phase Miss</b> Meter should record phase miss when the voltage goes beyond specified limits.</p>
8.13	<p><b>Total events logging:</b> Tamper Logging Last 150 nos. tamper events shall be recorded in meter memory on FIFO basis.</p>
8.14	<p><b>Parameter Snapshot</b> Snapshot of Date, time, Voltage, Phase Current/ Neutral Current, Power Factor, Active Power, Cumulative kWh etc. should be recorded for each tamper event in case of export as well as import mode.</p>
8.17	<p><b>Tamper Indication:</b> Appropriate Indications/Icons for all tampers should appear on the meter display either continuously or in auto display mode.</p>
8.18	<p><b>Tamper Logics:</b> The Net Meter shall be tested as per relevant IS and Tamper conditions &amp; shall work satisfactorily as per NDMC requirements/ specifications.</p>

### **Additional Requirements:**

A). **Temperature logging-** The meter should have capability to measure inside temperature and can log high temperature Events

B). **Low Power factor logging-** The meter shall have feature to record low power factor as a separate event.

C). **Mid Night Data:** The meter should record mid night, cumulative kVAh & kWh with import & export energy register

D). **Abnormal Power OFF:** Incase meter micro observes a power off even though the AC supply is available, the event shall be recorded as “Abnormal Power OFF”. Meter shall detect & log such events.

### **9.0 Influence & parameters**

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.

- External Magnetic Field
- Electromagnetic field induction.
- Radio frequency interference.
- Vibration etc.
- Waveform 10% of 3 rd harmonics.
- Voltage variation.

- Frequency variation.
- Electro magnetic H.F field.
- D.C immunity test (Both phase and neutral circuits)

#### **10. Accuracy requirements: -**

The meter should be of class 1.0 accuracy as per IS: 13779

#### **11. Name plate and marking.**

Meters shall have a name-plate clearly visible and effectively secured against removal. Indelibly and distinctly marked with all essential particulars as per relevant standards.

- The manufacturer's meter constant shall be marked on the name-plate.
- The marking on every meter shall be in accordance with clause 13779/1999. In addition to the standard, the following shall be marked on the name plate.
- Manufacturer's name.
- Type.
- Number of phases and wires.
- Serial number
- Month and Year of manufacture
- Reference voltage
- Rated current
- Meter constant (imp/kwh)
- 'BIS' mark.
- Class index of meter.
- Guarantee period.
- Accuracy Class

The following will be printed in bar code on the meter name plate.

- Manufacturer's Meter Sr.No.
- Month/Year of manufacture.

#### **12.0 GUARANTEE:**

The meter shall be guaranteed for the period of 05 years.

#### **13 RECOMMENDED MAKES-----**

**Approved "A" category make of meters.**

- 1) **L&T**
- 2) **Secure**
- 3) **Genus**
- 4) **HPL**
- 5) **Landis+Gyr**