

(VOLUME-'A')

TECHNICAL SPECIFICATION FOR A.C. STATIC THREE PHASE, FOUR WIRE, HAVING DLMS PROTOCOL WITH OPTICAL & ADDITIONAL RS-232 PORT 10-60A RATING WHOLE CURRENT, CLASS 1.0 ACCURACY, KWH ENERGY METERS HAVING POLYCARBONATE METER CASE AND BACKLIT LCD DISPLAY WITH SEPARATE MOULDED POLYCARBONATE CUPBOARD AGAINST TN-1291.

1.0 SCOPE:

- a) This specification covers the design, engineering, manufacture, assembly stage-testing, inspection and testing before supply of A.C. three phase, four wire, having DLMS protocol whole current static energy meters of accuracy class 1.0 and current rating 10-60 Amps, with backlit LCD display with separate moulded poly-carbonate cupboard as per requirement given in this specification. These meters should be provided with one optical communication port & one RS-232 port which should be suitable for establishing local communication with CMRI. The meter shall be supplied in suitable packing so as to withstand transit shock.

The three phase, four wire, three element type meter should be capable to record and display energy in kWh, demand in kW and power factor for three phase four wire A.C. balanced / unbalanced loads for power factor range of zero lag – unity zero lead, as per requirement given in this specification.

- 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 of high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the right to reject any work or material which in his judgment is not in accordance therewith. The offered materials shall be complete with all components, accessories necessary for their effective and trouble free operation of the system for energy measurement. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.

The bidder shall have BIS Certification for offered item as on date of bid opening and copy of which must be submitted along with the bid, failing which offer of the bidder shall be treated as non-responsive.

2.0 REQUIREMENT : The requirement of 3 x 240 Volt 50 Hz A.C. Static Three Phase 10-60 Amp. rating whole current Energy Meters of accuracy class 1.0 with optical port and one additional RS-232 port which should be suitable for establishing local communication with CMRI along with separate meter box is as under-

Total- 30,000 Nos.

3.0 STANDARDS APLICABLE :

Unless otherwise specified elsewhere in this specification, the meter(s) shall conform to relevant requirement including performance and testing thereof to the following Indian / International Standards to be read with upto-date and latest amendments / revisions thereof.

S.No.	Standard No.	Title
1.	IS:13779-1999 (with latest amendments)	Specification for AC static watt hour meters Class 1 & 2
2.	IEC 62052-11	Electricity metering equipments (AC) – General requirements & test conditions Part 11. metering equipments
3.	IEC 62053-21	Electricity Metering equipments (AC)- particular Requirements – Part – 21 Static meters for active Energy (class 1 & 2)
4.	IEC – 61000-4-5 (2001-04)	Electromagnetic capability, Testing and measurement Techniques, Surge immunity test
5.	IEC 61358:1996	Acceptance inspection for direct connected AC static Watt hour meter for active energy (class 1 & 2)
6.	Central Board of Irrigation and Power New Delhi technical Report No. 325 read with latest amendments issued till date	Specification for AC static electrical energy meters.
7.	IS : 9000	Basic Environmental testing Procedures for Electronic & Electrical items.
8.	IEC 62053-61	Electricity Metering Equipment (a.c)- Particular requirement- Part- 61 – Power consumption and voltage requirements
9.	IEC-62056-21 (Latest Version)	Data exchange for meter reading and direct local data exchange.

10	IEC – 15707 , 2006	Testing Evaluation, Installation and Maintenance of A.C. Electricity Meters. CODE OF PRACTICE.
11	IS:12346(1988)	Specification for testing equipment for AC Electrical energy meter
12	CEA Regulation	On installation and operation of meters dated 17.03.2006.
13	RERC Regulation	On installation and operation of dt. 29.5.2007.
14	IS:15959:2011	Data Exchange for Electricity Meter Reading, Tariff And Load Control Companion Spec having all amendment.

In case of any conflict or discrepancy the order of precedence shall be (i) IS (ii) IEC (iii) CBIP technical report-325 (read with latest amendments). In case of any difference between the provisions of these standards and the provisions of this specification, the provisions contained in this specification shall prevail.

4.0 **SERVICE CONDITIONS (CLIMATIC CONDITIONS)**

The meters to be supplied against this specification should be capable of performing and maintaining required accuracy under extreme hot, cold, tropical and dusty climate and solar radiation typically existing in state of Rajasthan (India). The meter shall be required to operate satisfactorily and continuously under the following tropical climatic conditions.

a.	Maximum ambient air temperature	55 deg.C
b.	Maximum ambient air temperature in shade	45 deg.C
c.	Maximum temperature attainable by the meter exposed to sun	60 deg. C
d.	Minimum ambient temperature	(-) 5 deg.C
e.	Average daily ambient air temperature	40 deg.C
f.	Maximum relative humidity	95 %
g.	Number of months of tropical monsoon condition	4 months
h.	Maximum altitude above mean sea level	1000 meters
i.	Average annual rain fall	10-100 cm
j.	Maximum wind pressure	200 kg/sq.m
k.	Isoceraunic level (days per year)	40
l.	Seismic level (horizontal accn.)	0.30 g
m.	Permitted noise level	45 db

Principal Parameters

The meter shall conform to following parameters

5.0

<u>S.No</u>	<u>Item</u>	<u>Specification</u>
1.	Type of installation	Outdoor installation inside box
2.	System Voltage	3x240 V, -40% to +20%
3.	System frequency	50 Hz ± 5%
4.	No. of phases	Three phase four wire
5.	System of earthing	Solidly grounded

6.0 **Technical Requirements**

a.	Rated voltage (Vref)	3X240 V phase to neutral, (3phase 4wire system) 3X415 V phase to phase
b.	Rated current	Basic current 10A (Ib), Max. current 60A (Imax)

6.1 **Supply System & Power Supply Variation**

The supply system shall be LT 240 volts phase to neutral, three phase four wire.

The extreme power supply variation for which an operating meter should withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its normal operating conditions shall be as follows.

Specified operating range 0.80 to 1.1Vref

Limit range of operation 0.60to 1.2 Vref. However, the bidder can offer meters which can withstand higher variations.

The limits of error for +20% to -40% Vref. variation shall be as under:

Influence quantities	Value of current	Power factor	Limits of variation in % error
i) Voltage variation between -40% to +20%	Ib	1	0.7
	Ib	0.5 lag	1.0
ii) 10% of 3 rd harmonic in current circuit	0.6 Ib	UPF	0.6
	0.6Imax	UPF	0.6

The meter shall be functional & able to register energy even if the voltage falls up to 60% of the rated voltage i.e. 96 Volts at 500 mA at balance load condition (no accuracy is required).

6.2 **Power Factor Range**

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

6.3 **Accuracy**

Class of Accuracy of the meter shall be 1.0. The accuracy should not drift with time.

6.4 **Power Consumption**

a. Voltage circuit: The active and apparent power consumption in each voltage circuit including the power supply of meter at reference voltage, reference frequency and reference temp. shall not exceed 1.5 Watts per phase and 8 VA per phase respectively **on balance load condition**.

b. Current circuit: The apparent power taken by each current circuit at basic current, reference frequency and reference temp. shall not exceed 0.5 VA.

6.5 **Starting Current**

Meter should start registering the energy at 0.2% Ib at UPF in each phase.

6.6 **Running with No – Load**

When 70% and 120% of rated voltage is applied with no current flowing in current circuit, the test output of the meter shall not produce more than one pulse / count. The minimum test period for this test shall be as per relevant clause 8.3.2 of IEC 62053-21-2003.

6.7 **Auxiliary Power**

The power shall be drawn from any of three phases and the meter should be able to remain powered up if any two phases or any one phase and neutral are available. Maximum power consumption of the Auxiliary Ckt shall be 5 watt.

7.0 **General and Constructional Requirements**

Meter shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. The following should be ensured

- 1 Personnel safety against electric shock.
- 2 Personnel safety against effects of excessive temperature.
- 3 Protection against spread of fire.

- 4 Protection against penetration of solid objects, dust and water
- 5 Protection against fraud
- 6 Prevention against pilferage

7.1 Meter Case

- a. Meter case (base and cover) and extended terminal block cover (ETBC) shall be made of unbreakable high grade flame retardant poly carbonate of good dielectric and mechanical strength with minimum thickness of 2.0 mm, however, due to manufacturing process, the negative tolerance of 0.2 mm may be allowed.
- b. Meter case (base and cover) and extended terminal block cover (ETBC) should be injection moulded in UV stabilized poly-carbonate. The base of meter shall be of any colour & cover shall be transparent easy to reading of all the displayed values/ parameters, nameplate details and calibrating LED. The ETBC shall also be kept fully transparent. The moulded meter case should not change in colour, shape, size, dimensions when subjected to 200 hrs on UV test as per ASTM D 53. It should withstand 650 deg. C. glow wire test and heat deflection test as per ISO 75.
- c. The manufacturer shall emboss/Laser marked/engraved on the base and cover the name of the material they have used in an abbreviated form e.g. PCFR (to denote what they have used - flame retardant poly carbonate).
- d. The meter cover shall be permanently fixed to the base by heat staking / ultrasonic welding in such a manner that cover can not be opened without breaking i.e. the meter should be break to open type. The meter base and top shall have distinct contour to identify, if any tampering attempt has been made or opening of cover with some tool or by using hot wire or similar device. In case any attempt to open the meter cover from base, there should be visible evidence of opening / tampering of ultrasonic welding.
- f. The meter case shall have the following properties of plastic material

<u>S.No.</u>	<u>Property</u>	<u>Units</u>	<u>Value</u>	<u>Standards</u>
1	Physical water absorption	%	Max. 0.35	ASTM D 570/ IS:5133(part 2) :1969
2	Electrical Dielectric strength at 90 deg. C. in oil.	KV/M M	Min 16	ASTM D 149
3	Thermal HDT	Deg.C	Min. 125	ASTM D 648/ ISO 75

4	Flammability			
	a) Rating		FV 2	UL94/ IS:11000(part 2-sec-1)
	b) Glow wire test 650 deg.C.		Passes	IEC-60695-2-1-12 & IS:11000-2-1
5	Mechanical			
	a) Tensile strength	MPa	Min. 50	ISO 527 / any equivalent standard
	b) Flexural strength	MPa	Min. 90	ISO 178 / any equivalent standard
	c) Modulus of Elasticity	MPa	Min.	ISO 178 / any equivalent standard
	d) Izod impact strength notched 23 Deg. C.	KJ/ Sq.M	2000 Min. 8	ISO 180/1A or any equivalent standard

7.2 Terminal block, Terminal and Extended Terminal Block cover

1. The terminal block shall be moulded type made of non-hygroscopic, flame-retardant material having good dielectric and mechanical strength. The moulded terminal block shall be made from best quality phenol formaldehyde/Polycarbonate conforming to IS:13779 -1999 (latest amended) having adequate insulating properties and mechanical strength with brass inserts for connecting terminals.
2. The terminal block should satisfy all the conditions specified in IS:13779 and IEC 62052 - 11. The material of the terminal block should fulfill the requirement of following tests
 1. The flame retardant rating of V0 as per UL 94 testing
 2. The glow wire test for temperature of 960 deg. C as per IS:11000 (Part - 2/Sec.1) or IEC 60695-2-1
 3. Heat deflection temperature (HDT) test of 135 deg. C. as per ISO 75 or ASTM D-648
 4. Ball pressure test at 125 deg. C. as per IEC 60335-1
3. The base of the meter should extend to enclose the three sides (back and two sides) of the terminal block.
4. The current circuit conductors of the meter shall be connected to its current terminals from inside the meter terminal block adopting procedure prescribed in either B-1 or B-2 of the recommended methods under IS:13779. Any other method which meets these requirements in a better manner/way shall also be considered. The bidder should elaborate the arrangement adopted.
5. The meter terminal block shall have nickel/ tin-plated brass terminal inserts. The terminals shall have suitable construction with barriers and cover to provide firm

and safe connections of incoming and outgoing leads. The terminal screws shall have flat bottom so as not to pierce in the external conductors. The terminals shall be of suitable rating to carry continuously 150% I_{max}. Current and made of electroplated (or tinned) brass. Any other provision which meets this in a better manner / way shall also be considered. The bidder should elaborate the provision adopted.

6. The manner of fixing the external conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. All parts of each terminal shall be such that the risk of corrosion is minimized. Two screws shall be provided in each incoming and outgoing terminal for effectively clamping the external leads. Each screw shall engage at least 3 threads in the terminal. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. The manner of fixing of incoming and outgoing leads into the terminals shall be through thimbles/lugs/reducer type terminals and the supplier shall supply the same alongwith each meter without any extra cost.
7. The internal diameter of the terminal holes should be not less than 9.5 mm and adequately designed for inserting 6 mm² to 25 mm² stranded copper/aluminum armoured PVC cable and shall be capable of carrying continuous current up to 150% of I_{max}. The holes in the insulation material of the terminal block, which form an extension of the terminal holes, shall be of sufficient size to accommodate the insulation of the conductors also. The clearance and creepage distances shall not be less than values specified in clause 6.6. of IS:13779:1999. 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 a flash over does not take place.
8. The voltage circuit and the current circuit shall be solidly connected inside the meter body without any link. A firm connection shall be established within the meter case to energize the voltage circuit.
9. The termination of current circuit wires, if used, inside the meter (i.e. CT primary conductor / shunt) on the terminal block should be through lugs and washers of proper size. The shunt used shall be high precision, low temperature coefficient, high stability of electric resistance, low watt loss and are magnetically tamper proof. The loop length of the primary current circuit should be kept minimum. Alternatively the CT primary conductor / shunt may be flattened to form a 'lug' like shape for proper terminating on terminal block without using lug or any other better arrangement may also be provided.
10. The meter shall be supplied with extended terminal block cover (ETBC). The ETBC shall be extended by minimum 50mm below the plane surface of the

terminal block with suitable sealing arrangement of terminal cover for providing numbered double anchor polycarbonate lash wire seal, which shall be supplied loose by the bidder as per the Tech. Spec. of Polycarbonate Seal.

- 11 The ETBC shall be designed such that the meter's internal parts are not accessible for tempering etc. without breaking seals.
- 12 Suitable barriers in moulding shall be provided such that direct access to incoming/outgoing terminals is not possible through gaps left in cable entry holes after insertion of main/load side cables
- 13 **The terminal cover shall be engraved / embossed/ laser marked with logo of manufacturer & word AVVNL/logo of purchaser, which should be clearly visible.**
14. The terminal cover of the meter should be hinged either at the top or left side so that it opens from bottom to top or hinged at the left side so that it opens from right to left of the meter.

7.3 Display Parameters and Type of Display:

- A)** The meter should have bright LCD electronic display with backlit having minimum description of parameters (e.g. words like kwh, Kw, Power factor etc)/ legends (alphabets) height X width of 5mmx3mm minimum and with minimum 7 whole digits (numerals) of size 10mmX5mm in auto scroll mode.

The decimal digit shall be of smaller but not less than 5 mm X 3 mm and shall be clearly distinguished from integral digits or if the digits size is same then the decimal digit shall be clearly distinguished from the integral digits.

The LCD shall be of STN (Super Tested Kneumatics) or FSTN types, construction suitable for temperature withstand of 80 deg. C (storage) and 65 deg. C (operation). The LCD Display should have a wide viewing angle of 45 deg to 60 deg cone, up to one metre distance.

LCD Specifications:

Type: STN, FSTN, Seven segment type, Industrial Grade

Viewing angle: 45 deg to 60 deg cone

Background type: Yellow/Green/Grey/White

Connector: Pin Type

Polarizer mode: Transreflective/transmissive

Segment Colour: Black/Dark Blue

Life time: Preferably 12 years

Temp range Operative: - 20 to 65degC

Temp range Storage: - 40 to 80degC

Voltage: 3.0/5.0V

Drive method: 1/4 / 1/3 bias

Testing: High temp test as per specs for 72 Hrs
Low temp test as per specs for 72 Hrs
Temperature Shock Test: 10 cycles temperature shock of low and high temperature.

Result: After test the LCD should not get damaged.

The registered parameter shall not be affected by loss of power. The display shall not be affected by electrical & Mechanical disturbances. The Non-volatile Memory (NVM) shall have a minimum retention time of 12 years under un-powered condition i.e. the NVM shall have a storage life (without use) of 12 years. The battery back-up memory will not be considered as NVM. All important data such as calibration data, billing parameters and cumulative kWh should be stored in NVM internally to the main processing circuit and it should not be possible to change the data through any standard serial communication.

For clear visibility of the display of the meter reading at a distance, large viewing area with large display icons is preferred.

When the meter is placed in oven at a constant temperature of 65°C for a period of 120 minutes during power on condition, the character of LCD should not deform.

After keeping the meter at a constant temperature of 80°C for a period of 120 minutes during power off condition and when restored at normal temperature, the LCD should work satisfactorily.

The meter shall be capable to measure & display continuously 'Active energy KWH' at all the loads & 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 & the same should go to memory.

B) The accuracy of display parameters on LCD display for all parameters shall be matching with the accuracy Class of the meters as per IS, if not specifically mentioned elsewhere in this specification. This shall be verified during inspection/ testing of meters.

The display of various parameters in push button mode shall be scrolling one after another. The meter shall be capable to measure and display continuously "Active Energy KWh" at all loads and power factors i.e. Zero lag-Unity-zero lead.

Meter Data Display : The software shall show electrical condition existing at the time of reading the meter in tabular forms as well as graphical format (phase diagram) at BCS end.

C) Display Sequence:

The meter shall display the required parameters in two different modes. No additional display parameters (push button or auto) will be acceptable. The details are as follows:-

a) Continuous display:

- i. Current cumulative active forwarded energy (Total Energy) without decimal digit.
- ii. Cover open tamper status with date & time.
- iii. Magnet tamper details with date & time till the removal of magnet.

b) Push Button display:

The following parameters in the similar sequence shall be displayed one after the other, with press of push button each time. Each parameter shall display for minimum 10 seconds for respective measured values, except LCD Segment Check, which shall have display for 5 Seconds under auto scrolling of push button parameters. If the Push Button is pressed continuously for 5 minutes during power off condition then battery should become disabled till next push button operation..

1. LCD Segment Check.
2. S.No. of Meter.
3. Date and Time.
4. Current Cumulative active forward Energy (Total KWH) without decimal, minimum 7 whole digits.
5. Current Cumulative active Apparent forward Energy (Total KVAh) without decimal, minimum 7 whole digits.
6. Current Cumulative Reactive forward Energy (KVARh -lag) without decimal, minimum 7 whole digits.
7. Current Cumulative Reactive forward Energy (KVARh -lead) without decimal, minimum 7 whole digits.
8. Maximum demand in KW since last reset(2 whole digit + 2 decimal digit)
9. Instantaneous active load in KW with three Decimals.
10. Instantaneous Voltage per phase with one decimal.
11. Instantaneous current per phase with two decimal
12. Signed Instantaneous Avg. Power factor with three decimals.(Lag/Lead).
13. High resolution display of current cumulative active forwarded energy at least three digits after decimals.

14. **Cumulative active energy (KWh forwarded) reading of pre-defined date & time of previous month for Billing purpose (BP kWh), minimum 7 whole digits.**
15. **Cumulative apparent energy (KVAh forwarded) reading of pre-defined date & time of previous month for Billing purpose (BP kvah), minimum 7 whole digits.**
16. **Maximum demand (KW) of pre-defined date & time of previous month for billing purpose (BP KW), 2 whole digits plus 2 decimal digits.**
17. **Average power factor upto pre-defined date & time of previous month for billing purpose (BP Ave PF), one whole digit plus 3 decimal digits..**

D) LCD least count

The internal least count of energy recording shall not be more than 0.01kWh. Hence, every 0.01 kWh consumption will be internally stored. Also, there be no loss of energy registration on account of frequent power outages due to high start up time of the meter.

To verify the above, the meter will be switched ON/OFF 40 times at rated parameters and energy recording on display with decimal digit should be within 0.4 kWh of the energy, it should register, as per its accuracy at that load. This will be verified during inspection of meters.

E) Meter Reading at Power Outage:

Provision to read the meter in no power condition for displaying the push button parameters as well as auto scroll parameters shall be made. Such provision shall be provided in the form of Push Button activated Primary/Rechargeable Battery.

- I. No Power shall be consumed from this circuit when mains are available.
- II. **Under no power condition when the meter is powered through Battery, Back-Lit of LCD is not required.**
- III. **In any case, RTC battery power shall not be used for display under power off condition.**

F). TIME OF DAY TARIFF:

The meter shall have provision for registering energy (kwh &Kvah), maximum Demand(KW & KVA) and average PF and billing date. The data shall be registered in following five tariff registers:-

05.00 Hrs. to 06.00 Hrs.

06.00 Hrs. to 09.00 Hrs.

09.00 Hrs. to 18.00 Hrs.

18.00 Hrs. to 23.00 Hrs.

23.00 Hrs. to 05.00 Hrs.

This data for the last **12 months** shall be download by CMRI.

G). MAXIMUM DEMAND REGISTRATION AND MD RESETS :

Meter shall continuously monitor and calculate the average maximum demand of each demand interval time of 30 minutes and maximum of these in a calendar month shall be stored. The maximum demand shall automatically reset at 24.00 hrs. of the last date of each calendar month for which minimum 30 years calendar shall be programmed by the manufacturer. The cumulative kWh should also be recorded at 24.00 hrs. on the last date of each calendar month for previous **Twelve** months.

7.4 OUTPUT DEVICE:

The meter shall have a test output device in the form of calibration LED of red colour and minimum intensity 10 mCD (milli-Candela) accessible from the front and shall be capable of being monitored conveniently with suitable testing equipment while in operation at site. The location of calibration LED should be such that the calibration pulses can be sensed easily through the sensor. The clearance of calibration LED from any of the sides of window portion shall be approximately 20 mm.

The relation between test output and the indication on display shall comply with the marking on the name plate (impulse per kWh).

The bidder shall state the necessary number of pulse count(s) to ensure measurement accuracy of at least $1/10^{\text{th}}$ of class of the meter at the different test points.

The resolution of the test output pulse(s) should be sufficient to enable conduction of the starting current in less than 10 minutes and accuracy test at the lowest load with desired accuracy within 5 minutes.

7.5 COMMUNICATION CAPABILITY:

Meter Shall have Optical communication Port with one additional RS 232 port for facility of meter reading..

(A) Through Optical Communication Port and RS 232 port **:-:**

The meters shall have a galvanically isolated optical communication Port as per IEC-1107 provided on the front of the meter downloading the history data to a CMRI/Base computer. It shall not be possible to re-programme or make any change in the meter through CMRI.

• No editing shall be possible on CMRI and base computer by any means. The software shall have capability to convert the entire data into ASCII format.

The protocol used in the meter shall have to be provided at the time of supply for the purpose of automatic meter reading system. It shall be responsibility of the meter manufacturer to provide the required software and all the facilities free of cost to enable the use of optical port as well as RS 232 port facility for

reading and retrieving the data from the meter through CMRI and AMR to necessary upgrades of software shall be supplied free of cost for downloading simultaneously the existing parameters and any parameters added in future specifications of meters.

• Indication on CMRI shall be provided for confirmation of successful data transfer from meter to CMRI. During this period the energy recording should not be affected.

The software supplied by the bidder for common meter reading instrument should read various makes of static energy meters and should be capable to download the data in the computer station having manufacturer base computer stations for the purpose of exchange of data.

It shall be responsibility of the meter manufacturer to provide the required software and all the facilities required by AVVNL to use the CMRI for reading and retrieving the data from the meter and to download the data to PC free of cost up to guarantee period.

In case of failure of power supply, it shall be possible to download the reading at least two times in a interval of maximum 10 minutes through a in-built battery

Readings to be downloaded with CMRI through optical port and with additional RS 232 port:

In addition to all the above, the following parameters should be downloaded by CMRI

- Meter Sr. No.
- Time & Date.
- Instant per Phase Voltage, Current & Power Factor.
- Current cumulative forwarded KWH energy(total)
- Billing kWh (BP kWh) for the last 12 months at 0:00 hrs of the last day of the month.
- Overall MD KW with 30 min. integration on real time basis with date and time stamp for the last 12 months.
- Average power factor of the last consumption month upto pre-defined date & time for the last 12 months.
- Power on Hours and minutes for each of previous 12 months
- The snap shot of total events (minimum 40 events) with date and time (either occurrence or restoration considered as an event) except cover open tamper which is non roll over temper:
 - (i) The tamper data as per Cl. 7.6 (c),(g) & (h) of this specification
- Any other information if manufacturer proposes may indicate in their offer.

- The meter shall also have a storage capacity for 75 days load survey with 30 minute IP for the following parameters (as per table 28 provided in IS:15959:2011.)
 - 1) Real time clock, date and time
 - 2) Current Ir.
 - 3) Current Iy.
 - 4) Current Ib.
 - 5) Voltage Vrn.
 - 6) Voltage Vyn.
 - 7) Voltage Vbn.
 - 8) Block energy- Kwh.
 - 9) Block energy- KVARh(lag)
 - 10) Block energy- KVARh(lead)
 - 11) Block energy- Kvah.

At BCS end twelve month billing data with all energies including demand and all tamper event with their snap shot value should be provided.

The meter shall also have a storage capacity for at least 75 days in the non-volatile memory for recording, logging, and downloading of Power On hours per day starting from 00.00 to 24.00 hours. Such data shall be made available in the form of bar chart as well as spreadsheet. The BCS shall have the facility to give complete load survey data both in numeric and graphic form with option for either of them.

The meter shall possess a suitable fast reliable **optical communication port** for automatic transfer of data to CMRI and through CMRI to the base computer.

The CMRI shall possess easily replaceable battery and shall be capable of storing data for at least 200 Nos. meters at one time. It shall be possible to read the meter from outside the meter box. The data transfer (from meter to CMRI) rate of billing data downloading shall be 60 Seconds and for total data within 5 minutes for each meter.

The downloaded data along with date and time stamp of such reading shall remain on CMRI with suitable encryption and it shall not be possible to preprogram or manipulate the recorded data on the CMRI before downloading the same with the serial number of CMRI on computer. The CMRI shall also download the name of meter manufacturer and year of manufacture of meter. The Supplier shall supply Software (compatible with Windows 98 system or higher) and training free of cost for the use of software at multiple data collection and billing premises of the utility. The CMRI shall have a polling feature to read multiple meters within range without preprogramming the meter serial numbers on CMRI in advance.

After successful downloading of meters data to CMRI, the calibration LED shall continuously glow for a period of one minute/ any other indication on CMRI for confirmation of successful data transfer. During this period the energy recording should not be affected.

Necessary upgrades shall be possible in CMRI software and shall be supplied free of cost for downloading simultaneously the existing parameters and any parameters added in future specifications of meters. A copy of operation manual for each CMRI shall be supplied.

The Supplier shall provide meter reading protocols free of cost which shall not be complicated and easily understandable by utility officials to introduce compatibility between meters and CMRIs of different makes.

The bidder shall indicate relevant standard to which the protocol for communication between meter and CMRI shall comply.

The meter reading instrument shall be capable of retrieving data and capable of transferring them to the base computer service center for energy audit and billing purpose. The bidder shall quote for the 10-60 Amp. meters with LCD Display with communication facility for meter reading with Optical communication Port with one additional RS 232 port.

The meter shall be compatible for spot billing. The meter shall have facility for communicating with a Meter reading instrument through Optical communication Port with one additional RS 232 port with proper security & without error to facilitate for auto-reading and downloading the billing and history data to base computer. The interface for communication between CMRI & Base computer shall be supplied free of cost.

(i) It should not be possible to reset the energy reading in the meter with the CMRI.

(ii) The compatibility of CMRI with the meter and the base computer system due to any change in language or any other reasons, the manufacturer/ supplier shall modify it at their own cost within guarantee period. The CMRI along with battery charger and for direct communication cords shall be supplied free of cost in the ratio of one for each 500 Nos. meters supplied. The CMRI shall possess a specific Serial No. which cannot be changed. The guarantee of supplied CMRI would be 5 years.

(iii) The CMRI shall have facility to store 200 Nos. of meter data. Further, there should be facility to be provided to transfer the meter data to computer through RS 232 / USB Port.

(iv) The above mentioned all sorts of communication shall be of "One way" type i.e. one can download the meter data through CMRI and data alteration facility in CMRI and from CMRI to meter should not be possible in any case.

The bidder has to give an undertaking that the CMRI supplied by them shall be capable for downloading reading of other make of meters in the instant tender as well as for next 5 years of any make of meters as well as existing DLMS make three phase meters.

(B) General requirement for Optical Port & RS 232 port:-

I. The same CMRI should be capable of downloading and reading the meter data through for Optical Port & RS 232 port.

- II. 1 No. DOS based CMRI with optical port interface as well as RS 232 port communication Capability to read meters for communication between meter and CMRI along with communication cable & its accessories shall be supplied free of cost for every 500 Nos. meters supplied.

Minimum Salient features of CMRI shall be as under:-

- i) Display - 16 lines.
 - ii) Internal flash memory(RAM) -16.5 MB.(minimum)
 - iii) ROM- 8 MB(minimum)
 - iv) Speed of processor-400 MHz and above.
 - v) Battery backup-24 hours.
 - vi) Operating system-DOS
 - vii) Certified standard -CBIP -111
- III. It shall be the responsibility of the meter manufacturer to provide the required software and all the facilities required by purchaser to use the CMRI for reading and retrieving the data from the meter and to download the data to PC free of cost up to guarantee period.
- IV. Any other information if manufacturer proposes to record may indicate in their offer. The BCS shall have the facility to give complete load survey data both in numeric and graphic form with option for either of them.
- V. The CMRI shall possess' easily replaceable battery and shall be capable of storing data for at least 200 Nos. meters at one time. It shall be possible to read the meter from outside the meter box. The data transfer (from meter to CMRI) rate for Billing data downloading shall be less than 60 Sec. and for total data within 5 Minutes for each meter.

The Supplier shall supply Software (compatible with Windows 98 system or higher) and training free of cost for the use of software at multiple data collection and billing premises of the utility.

7.6 **Tamper and Fraud Protection**

The meter should have tamper and fraud protection features so as to continue to register active energy accurately under the following conditions:

- a. Interchange of Main & Load: Correct energy registration even interchange of one or more phases of main & load– the reverse indication in the form of

blinking LCD phase icon or blinking phase LED to indicate which phase is reverse.

- b. Meter should remain functional even when either of any phases or any one phase along with neutral is available to the meter and record correct energy.
- c. **The meter shall either remain immune to tamper through application of external magnetic field (AC electro magnet or DC magnet) as per value specified in CBIP 325 or if the metering gets affected then meter shall record energy at I_{max} , rated voltage and unity P.F. as per CBIP 325 and same should also be logged as event with date & time.**

Also In case of abnormal permanent magnetic field either meter shall either remain immune or if the metering gets affected then meter shall record energy at I_{max} , rated voltage and unity P.F and same should also be logged as event with date & time.

The meter shall be provided with built in logic/ indication and sensor to detect tamper beyond meter's magnetic immunity level and display of such occurrences. The meter accuracy or accuracy display shall not be affected by permanent magnetic field up to meter's magnetic immunity level.

At the time of occurrence of magnetic tamper, meter should record tamper event with **I_{max} , rated voltage and unity P.F** and at the time of restoration it should be logged with actual parameters

- d) The meter should work accurately irrespective of phase sequence of mains supply.
- e) The meter should record energy as per voltage measured between incoming phase and neutral terminals when DC signal is injected on the neutral terminal of the meter through Diode. The test in this condition will be carried out at V_{ref} applied to incoming phase & input terminal of diode.
- f) The accuracy of the meter should not be affected with the application of abnormal voltage/frequency generating device having spark discharge of approximately 35 KV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for the total period of 10 minutes:
 - i) On any of the phases or neutral terminals
 - ii) Spark on meter body .

The accuracy of meter shall be checked before and after the application of above device.

Also During application of Spark, no abnormality on functionality of meter should be observed, otherwise sample shall be treated as failed.

g). Cover Open Tamper: –

If the meter cover is opened, the meter shall log at BCS end this as tamper and shall display "Open" with date and time of such opening (in power on as well as power off condition) in blinking display on the LCD continuously with other display parameters so that it is immediately noticed by the meter reader.

The threshold values for different tamper features shall be as under:-

Occurrence time for logging of tamper shall be minimum 5 minutes. and restoration of tamper shall be less than 2 minutes except magnetic (approx. 15 seconds) and cover open tamper which shall be logged instantaneously.

Logging of snap shot values of tamper events at BCS end for occurrence & restoration should be as per minimum logging time of occurrence/ restoration of tamper events.

7.7 Sealing Arrangement of the Meter:

The meter cover shall be permanently ultrasonically welded to the meter base. It shall not be possible to open the meter cover without permanently damaging the meter cover or base, easily visible from the front. At least two one way driving head sealing screws of Nickel plated steel or Nickel Plated Brass shall be provided for proper fixing of meter cover. Each one way driving head sealing screw shall have an independent sealing hole. **However better alternate arrangement other than unidirectional sealing screws for sealing arrangement shall also be accepted after the approval of MM wing.** Manufacturer has to provide one polycarbonate seal on either side/front of the meter and two hologram sticker seals on both sides of meter **with word AVVNL/ logo of AVVNL and manufacturer** and the polycarbonate and sticker seals having the same number as that of the meter Sr. No. and one no. polycarbonate seal in loose condition to be provided for terminal cover of the meter. The manufacturer will also provide the software (25 Nos. or more) as per our requirement for tracking and recording of seals. **The Serial Number of Meter, Poly-carbonate Body Seal/Sticker Seal and Loose Seal for Terminal Cover shall be same.**

7.8 Fixing Arrangement of Meter

The meter shall have minimum three fixing holes, one at the top for mounting and two at the bottom, inside the terminal cover. The top hole shall be key-hole type on the back of the meter base so that hanging screw is not accessible after fixing of the meter and it shall not be possible to remove the meter from the hanging screw without removing the terminal cover and screws behind the terminal block cover. The lower fixing hole/s shall be provided under the ETBC. Any alternate better arrangement shall also be considered for acceptance. All the fixing holes shall be such designed that once the meter is mounted; the screw heads shall not be accessible.

Manufacturer shall provide the appropriate fixing screws along with the meters.

7.9 Marking of Meter

The meter terminal marking and mounting arrangement should be as per Indian installation practices. The marking on every meter shall be in accordance with IS:13779/IEC 62052-11.

Every meter shall have name plate beneath the meter cover window portionsuch that the name plate cannot be accessed without opening the meter cover. The marking on the name plate shall be indelible, distinct and readable from outside the meter and meter box. The name plate marking should not fade or otherwise be adversely affected by UV exposure with lapse of time. The basic markings on the meter name plate shall be as follows. **Additional parameters/ marking will not be acceptable on the name plate.**

- a. Manufacturer's name or trade mark and place of manufacture
- b. Designation of type
- c. Number of phases and wires for which the meter is suitable
- d. Serial number
- e. Month and year of manufacture
- f. Reference voltage and frequency.
- g. Basic current and rated maximum current in Amps
- h. Principal unit(s) of measurement
- i. Meter constant (imp/ kwh)
- j. Class index of meter
- k. "Property of AVVNL.
- l. Purchaser's order Number & date
- m. Guarantee period- 5 Years
- n. Bar Coding of serial number, month & year of manufacture of the meter
- o. Sign of insulation
- p. Ultrasonic welded.
- q. ISI mark with license number
- r. DLMS Meter
- s. **All communication mode.**

7.10 Connection Diagram and Terminal Markings

The connection diagram of the meter shall be clearly shown on the meter name plate and shall be of permanent nature. Alternatively, connection diagram can be permanently engraved/embossed/laser etched on the inside/outside portion of terminal cover.

8.0 Salient Features

The meter shall have following additional salient features

- a. The meter shall be compact in design. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough

handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.

- b. Even if phase to phase voltage i.e. 450volts is applied for 5 minutes between phase and neutral of the meter, the meter should not get damaged and continue to record correctly within class 1 accuracy after restoration of normal supply.
- c. The meter should not saturate up to 800% Ibif applied for 30 minutes and should record energy accurately for P.F. range zero lag – unity – zero lead.
- d. The short-time over current rating shall be 30 I_{max} for one half cycle at rated frequency as per clause No. 9.2.3 of IS:13779/ IEC 26053-21 Clause 7.2.
- e. The meter should not have any form of mechanical adjustments such as trim-pots 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. The meter should be software calibrated.

All important data such as such as calibration data, billing parameters, and cumulative kWh should be stored in NVM internal to the main processing circuit and it should not be possible to change it through any standard serial communication. This may be verified by removing the non-volatile memory of the meter and check the working of the meter during sample testing or inspection.

- f. The meter shall be provided with CT/shunt in all the 3 phases. The shunt used shall be high precision, low temperature coefficient, high stability of Electric Resistance, low watt loss and are magnetically tamper proof.

As the bidder shall use SMPS or better design for Power Supply to PCB.

Specific confirmation shall be submitted by the bidders that accuracy of measurement will not suffer due to utilization of shunt on account of thermal variation and temperature coefficient up to an operational temperature of 80 deg C.

- g. LEDs shall be provided for following indications
 - 1) Test output pulse – Red (imp/kwh)
 - 2) Indication for healthy PT/Voltage supply for each phase Red-Yellow-Green

LEDs can be alternatively provided as icons on the LCD display.

The location of calibration LED (preferably at the center) should be such that the calibration pulses can be sensed easily through the sensor.

Each new supplied lot shall be tested on Zera test bench of 0.02 class accuracy, the meters having accuracy results within +/- 0.5% shall be preferred.

- h. Each new supplied lot shall be tested on automatic test bench of 0.02 class accuracy in meter lab.
- i. Temperature rise – Under normal conditions of use at I_{max}. current and 1.2 times rated voltage, the winding and insulation shall not reach a temperature, which might adversely affect the operation of these LT Meters.
- j. Specific confirmation shall be submitted by the bidders that accuracy of measurement will not suffer due to utilization of shunt on account of thermal variation and temperature coefficient upto an operational temperature of 80 Deg.C.
- k. The communication software must be capable to transfer cumulative active energy with date and time and meter Sr. No. required for automatic spot billing using any standard optical port as well as other port enabled spot billing machine (SBM), within 60 seconds, to automatically generate the energy consumption bills at consumer's premises without any human intervention. The successful bidders should provide the protocol and other information to decipher the transmitted billing data and meter Sr. No. for the spot billing purpose through SBM. The data communication with the meter shall be encrypted so that there is no possibility of tampering with the downloaded data.
- l. **The meter shall display total energy on display and record fundamental & Total Energy(Fundamental + harmonics) at BCS end.**
- m. **The push button on meter cover & meter box cover should be designed such that it is not possible to remove / take out the push button by any means. There should not be any gap between push button & cover so that any possibility by fiddling any sharp object or needle from outside of the meter or meter box around push button is not possible.**

9.0 General:

- a. All electrically live screws shall be of brass/ nickel tin plated. All other screws shall be electro plated.
- b. The meter shall draw its power from all three phases, one phase and neutral or any two phases
- c. The terminal inserts shall be of heavily nickel /tinned brass.
- d. The meter shall conform to the degree of protection IP 51 of IS:12063/IEC.60529 and IEC 62052-11 clause 5.9, for protection against ingress of dust, moisture and vermin
- e. There should not be any creepage in the meter even at 120% & 70 % of supply voltage.
- f. The meter should be free from jumps during sudden switching of heavy loads / or transient voltage spikes
Meter shall display direct reading and without multiplying factor.

10. **Electromagnetic Compatibility and Interference requirement:**

The meter shall meet EMI/EMC requirements as specified in the relevant standards described in clause 3.0 of this specification and shall also be protected against radiated interference from either magnetic or radio frequency sources.

The offered whole current meter shall also withstand DC Immunity test as per relevant standard so as to ensure that the meter current circuits do not saturate on passage of direct current.

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:

- a. Harmonics
- b. Voltage dips and short interruptions
- c. Fast transient burst test
- d. External D.C. and A.C. magnetic fields
- e. Electromagnetic H.F. fields
- f. Electrostatic discharges
- g. Radio frequency interference suppression

11. **Manufacturing Activities**

All the materials, electronics and power components, ICs used in the manufacture of the meter shall be of highest quality and reputed make (as per Annexure-A-3) to ensure higher reliability, longer life and sustained accuracy. However, components of other reputed make also acceptable after prior approval of Purchaser. The verification of the components shall be carried out at manufacturer's works by purchaser before offering material for inspection for every lot. The supplier is required to intimate purchaser whenever any lot is taken up for manufacturing/ assembly. The Purchaser reserve the right to waive off the verification of manufacturing activity.

- a. The manufacturer should use application specific integrated circuit (ASIC) or Micro controller for metering functions.
- b. The electronic components shall be mounted on the printed circuit board using latest surface mounted technology (SMT) except power components by deploying automatic SMT pick and place machine and re-flow solder process. No wave soldering or solder bath will be used.

The electronic components used in the meter shall be of high quality and there shall be no drift in the accuracy of the meter at least upto 10 years. Further, the Bidder should own or have exclusive access (through hire, lease or sub-contract) of the afore-mentioned facilities.

Adequate documents regarding exclusive hire or exclusive lease shall be made available. In case of sub-contract, it shall be ensured that the sub-contractor is not carrying out sub-contracting for any other bidder in the above tender. The bidder shall indicate with the name and location of such facility alongwith an undertaking and certificate from the utility and any ambiguity on such a confirmation shall result in immediate disqualification of the bidder.

The above shall be verified during works inspection or material inspection also and if any ambiguity is found, it shall be considered as a breach of contract by the successful bidder.

Bidders without in-house design, development and manufacturing facility as above or who are buying populated PCBs will not be considered as meter manufacturers.

The PCB material should be of glass epoxy FR-4 grade conforming to relevant standards.

- c. All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts which are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.
- d. Quality should be ensured at the following stages
 - a. At PCB manufacturing stage, each board shall be subjected to bare board testing
 - b. At insertion stage, all components should undergo testing for conforming to design parameters and orientation
 - c. Complete assembled and soldered PCB should undergo functional testing using test equipments (testing jig).
 - d. Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant mortality.
- e. The calibration of meters shall be done in-house.
- f. The bidder should submit the list of all components used in the meter along with the bid.
- g. A detailed list of bought-out items which are used in the manufacture of the meter should be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality

assurance procedures followed by him in respect of the bought – out items

- h. The details of testing facilities available for conducting the routine and acceptance tests and other special tests on the meter shall be furnished with the bid. The facility available if any for conducting type test may also be furnished.

The components of the meters shall be as per specification (Annexure-'B')

12. Type Test

- a. The bidders shall be required to furnish valid type test reports in respect of 3 phase static energy meter with optical port as per requirement of IS13779:1999 from CPRI or ERDA only which should not be older than three years as on the date of opening of techno commercial bid. For this purpose date of conducting (test starting date) will be considered. Type test carried out after opening of techno-commercial Bid shall not be considered
- b. The type test certificates shall be furnished either in original or copy duly attested by notary
- c. The bids of only those bidders shall be considered to be meeting the type test criteria who furnishes complete type test certificates along with the bid as per above provision.

d. Verification of testing of materials supplied

- i) After receipt of approval of pre- commencement sample meters with Box (cup board) and seals, the successful bidder shall offer first lot of meters comprising minimum 5,000 Nos. of meters (or 20% of ordered quantity, whichever is less) within 30 days. After clearance from purchaser, the material shall be dispatched to Nigam's stores.
- ii) **After receipt of first lot of meters, samples shall be selected for all the Type Tests, additional type tests and Tamper Tests as incorporated in the technical specification from CPRI (Bhopal/Bangalore)/ ERDA only.**
- iii) Three samples for conducting tests as above shall be selected & sealed by a Committee consisting of XEn(O&M) to be nominated by the circle SE, XEN(M&P) to be nominated by the concern SE(M&P) and ACOS from the first lot received in the stores. The samples so selected shall be sealed by at least 3-4 seals/ stickers by the Committee Members. The selected samples shall be sent to SE(M&P) along with complete details of meters & seals (including manufacturer's seals) provided by the Committee members. The SE(M&P) shall further send the meters with complete details for type tests, additional type tests and tamper tests, as per specification at CPRI (Bhopal/Bangalore)/ ERDA only. The complete type test report under a cover of registered letter shall be sent directly to the purchaser.

- iv) In addition to above selected samples, two lot of three sample of meter and two lot of samples of 6 Kg. raw material of each of meter case, Meter Box and terminal block shall be drawn by the inspecting officers during the 1st inspection & sealed by the aforesaid procedure which shall be sent to CIPET/ any NABL accredited test house for verification of properties of plastic material used for base and cover of meter case (base & cover), Meter Box & Terminal Block as mentioned at clause 7.1 & 7.2 of specification.
- v) The type test charges shall be borne by the supplier. The purchaser however in first instance may pay testing charges to the testing agency which shall be recovered by Sr. AO(CPC) from the bill of the supplier alternatively a sum of Rs. 3 Lac may be got deposited by the supplier with first inspection call.
- vi) The supplies, at the option of purchaser, may be utilized in the field after successful testing of sample meters in respect of the tests as mentioned at clause 12.0 (d) (ix) below, at purchaser's MT lab. The supplier can continue supplying material in anticipation of successful type test(s) results. 70% of the payment shall be released after receipt of successful purchaser's MT lab tests report and balance payment shall be released after receipt of successful type test reports.
- vii) In case of successful type test results, supplies shall be continued. However, in case the meter(s) do not meet the requirement as per ISS/CBIP/ Specification in type test(s), three more samples shall be selected from the supplies already received to get them type tested as per clause 12 (d) (ii) **In case material fails in CIPET, another set of three meters sample and another lot of 6 kg sample already selected by inspecting officers be tested as per Clause 12 (b) (iv) above at supplier's cost.** In case of repeat failure in type test(s), the order of balance quantity including the quantity lying unused in the stores/ field shall be cancelled. The guarantee period of quantity already supplied & used shall be doubled and payment for used meters shall be arranged after deducting 10% cost.
- viii) However, purchaser may allow the supplier to re-offer the material after change/ modification in the design of meters. The balance material shall be accepted only after successful type testing. The type testing charges shall be borne by the supplier.
- ix) Besides above type tests, samples from each lot/ sub-lot shall be selected and subjected to the following test(s) at purchaser's lab on an automatic test bench of ERSS 0.02 class. The samples shall be as per sampling plan indicated at Annexure-H of IS:13779/1999 (considering lot of 10,000 Nos. meters) if quantity offered for inspection is 20,000 Nos. or more , if less than this, the lot shall remain 5,000 Nos.) on pro-rata basis. The samples shall be selected by the designated committee with the Computer PSUEDO –RANDOM method & be intimated to the concerning ACOS. The samples so selected shall be sealed by seals/ stickers by the ACOS and put in the primary packing of the meter (which shall be sealed by sticker seals) and then all the meters selected to be put in the primary packing corrugated box supplied with the meters and again sealed by sticker seals by the committee members consisting concern ACOS & AEN(MST) at ACOS Head Quarter. The selected samples shall be sent to SE(M&P), Ajmer along with complete details of meters & seals. The supplies shall be utilized in the field only after successful testing (in respect of under mentioned tests) of sample meters:-

S.No.	Particulars of Tests	No. of samples to be tested
1.	Starting Current Test and No Load Test.	32 Nos.
2	A.C. High Voltage Test, Limits of error, test of meter constant & Power consumption test for voltage and current circuits.	8 Nos. out of above 32 Nos.
3.	Repeatability of error.	3 Nos. out of above 8 Nos.
4.	Voltage Variation, Tamper & fraud protection, D.C. Component in A.C. Circuit for each phase (circuits), Magnetic Immunity Test (Permanent magnet test of 0.27 Tesla), Accuracy test after application of 450 Volts for 5 minutes, D.C. Injection at neutral using diode, Saturation test as per clause 8.0 (c) and high voltage / high frequency generating spark etc.test of specification,Cover open tamper.	3 Nos. out of above 8 Nos. subjected to the condition that all the 8 meters pass the tests at S.No. 2 above successfully otherwise whole lot shall be considered rejected without going for further testing.

The acceptability criteria of the lot or otherwise shall be generally as per relevant ISS :13779-99 (latest amended) for only the tests at at Sr. No. 1, 2 & 3 above. **In other tests, as mentioned in specification, if any meter fails then the lot shall be rejected**

- vii) In case of failure of samples of lot/ sub-lot in the test(s) detailed at clause No. (vi) above, the similar testing shall be repeated on fresh samples selected by the committee & fresh testing as mentioned at 1 to 4 above shall be carried out. If the samples meet the requirement of above tests, the lot shall be accepted and if it fails consecutive second time, the entire quantity of respective lot/sub-lot shall be rejected and shall have to be replaced by the supplier at his own cost. Repeated failure/ poor results in the testing may render cancellation of order.
- viii) Due notice shall be given to supplier for testing thereof to enable them to be present for the same if so desired by them. If the supplier or his authorized representative fails to attend the sample testing, the same shall be carried out unilaterally by the purchaser and the results thereof shall be binding upon the supplier.
- ix) The purchaser also reserves the right to get additional samples for all or any of the selected tests at purchaser's cost at any independent test house at any stage of supply if so considered necessary to ensure that the quality of meters being offered for inspection is same as already got type tested. In case of failure, the

guarantee period of the quantity already supplied by the supplier shall be doubled and purchaser reserve the right to cancel the balance quantity.

13. Guaranteed Technical Particulars

The bidder shall furnish all the necessary information as desired in the schedule of Guaranteed Technical Particulars and data, appended at Annexure- 'A', 'B' & 'C' of this specification. If the bidder desire to furnish any other information(s) in addition to the details as asked for, the same may be furnished against the last item of this Annexure.

14. Inspection and Testing

- (i) The third sentence of Cl. 1.27.4 (a) of the GCC (section-II) may be read as under : In case material/equipment is not found ready in good / acceptable condition by the representative(s) of the purchaser deputed for inspection to the extent of the quantity indicated in the inspection call with tolerance of (-) 10% or if the inspection is not got carried out by any reasons on account of the supplier an amount of Rs.7,500/- for the supplier's works located in Rajasthan, and an amount of Rs.15,000/- for the supplier's works located outside Rajasthan will become payable by the supplier on this account to the Sr. Accounts Officer (EA & Cash) Ajmer Discom, Ajmer.
- (ii) All Acceptance tests as laid down in the ISS/IEC and this tender specification shall be carried out. The supplier shall provide all routine test reports for entire offered quantity of energy meters in CD to the inspecting officers
- (iii) Following tests shall also be carried out as Acceptance tests by adopting methods specified in ISS:13779/IS:9000/relevant IEC standard/ CBIP325.
 - a. AC voltage test
 - b. Test of meter constant
 - c. Tests of limits of error as per cl. 11.11 of IS 13779 at 400%lb, 600% lb and 800 % lb at pf 0.5 lag, 0.8 lead & unity.
 - d. Vibration test
 - e. Shock test

Vibration & shock test shall be carried out as acceptance test by adopting procedure laid down in ISS: 13010/1990/IS-9000 and its latest amendments.

 - f. Test of Voltage variation as per this specification.

- g. Test of no load condition at 70% and 120 % of rated voltage. The minimum test period shall be as per Clause 8.3.2 of IEC : 62053 – 21-2003.
 - h. Test of DC components in AC circuits - The limit of variation in percentage error shall be 3.0% for class 1.0 meter as per Annex-D of IS: 13779 for each phase circuit.
 - i. Diode test
 - j. Accuracy tests under all anti tamper conditions, clause 7.6 of this specification.
 - k. Permanent magnet test (as specified in Clause 7.6(d) of this specification)
 - l. The inspecting officer shall verify that no DC supply/ signal is given to reference meter during the DC injection test.
 - m. Display parameters shall be verified at the time of inspection.
 - n. Test of application of abnormal voltage/frequency generating devices (electronic gadgets) as per this specification.
 - o. When the meter is placed in oven at a constant temperature of 65° C for period of 120 minutes during power ON condition, the character of LCD should not deform. After keeping the meter at a constant temperature of 80 ° C for period of 120 minutes during power OFF condition and when restored at normal temperature, the LCD should work satisfactorily.
 - p. Verification of continuous ultrasonic welding.
- (iv) Number of samples for test from each lot shall be selected as per provision of IS. The criteria for selection of No. of samples and for acceptance of lot will be as under.

S.No	Particular of tests	Sampling plan for the lot of 1001 and above	Criteria for acceptance of lot
1	HV. A.C. test & I.R. test. No load test and minimum starting current test	32 nos.	As per clause C-3.1 of ISS
2.	All other acceptance tests as per cl. 149b) above, vibration test and shock test in sequence to be mutually agreed between manufacturer and inspecting	8 nos out of 32 samples passing tests at s. no. 1.	As per clause C-3.2 of ISS Annex.C

	officer.		
3.	Repeatability of error test, vibration test and shock test, in sequence.	3 Nos. out of above 8 samples passing tests at S.No. 2	Each sample should pass all three tests.

The sampling plan shall be as per IS:13779 except that maximum lot size may be read as 10,000 Nos. meters in place of 5,000 Nos. meters only for minimum offered quantity of 20,000 Nos. for Inspection otherwise the maximum lot size shall remain 5,000 Nos. meters. The sub-lot size shall be taken accordingly i.e. either 5,000 Nos. or 10,000 Nos. as applicable.

32 Samples shall be selected at random from the each sub lot of meters and acceptance test as per relevant standards and additional acceptance tests as per technical specification shall be carried out on these samples.

15.0 Packing and forwarding of Energy Meters:

Each meter shall be packed in superior quality three ply corrugated cardboard carton or thermocol packing box. Such single cartons shall be additionally packed in five (5) ply corrugated cardboard carton accommodating 12-24 meters with meter boxes for easy transportation, storage & handling. **Foam/ any other mechanism should be supplied between meter box base and meter box cover so that during transportation meter box does not accidentally locks.**

16.0 SAMPLES:

- a) **Samples along with bid-** The bidder shall furnish Eight meters and one meter box conforming to this specification duly sealed along with routine test certificates in the office of SE(MM),AVVNL, Ajmer one day prior to the date of opening of Tender. If the samples are not received, the bid shall be considered as Non-responsive.

Out of the above Eight sample meters, Six sample meters (one set of 3 samples for Electrical testing and another set of 3 samples for Environmental & Mechanical tests) and one sample shall be tested as per IS 15959 for both port (optical port and RS-232 port) at CPRI, Bhopal/ Bangalore or ERDA, Vadodara in the presence of firm's representative. The testing charges shall be borne by the bidder. The tentative testing charges Rs. 6.5 lac shall be deposited by the bidder in the form of Demand Draft in favour of the Sr. Account Officer (EA & Cash), Ajmer Discom, Ajmer. In case sample meters submitted by the bidder with bid don't conform the Type tests, Addl. Type Tests and Tamper tests of specification/ IS, the financial bid of that bidder shall not be opened.

- (b) One sample meter with meter box shall be checked / tested for mechanical/ physical features in Nigam's Lab. Sample meter shall be broken to verify components of the meter.

Note:- The bidders are required to furnish one No. CMRI and RS-232 Module along with communication cables so that the bid stage samples may be got checked/ verified.

- (c) Bid stage samples shall be accepted in the office of SE (MM), AVVNL, Panchsheel, Ajmer, by the committee of following officers.
- i. XEn(NABL), AVVNL, Ajmer.
 - ii. XEn-TA to CE(MM), AVVNL, Ajmer or designated by CE(MM), AVVNL, Ajmer.
 - iii. Concern XEn (MM), AVVNL, Ajmer
 - iv. Concern AEn (MM), AVVNL, Ajmer.

The officers/committee which is authorised to accept the bid samples shall physically examine & match the details of sample items i.e. its make, SL. No., Seal no. etc. with the letter having the detail of the sample submitted by the bidder. RTC check shall also be performed on all sample meters while physically examining & accepting the bid stage samples. The received samples shall not be checked by powering up with AC supply.

After physically examining the details, the sample accepting officers/ committee & bidders representative shall put their signatures with permanent marker or provide sticker seals on the samples. There after samples of meter shall be packed by the committee, in the same carton boxes in which these were received from the bidder. The committee members & bidders representative will again put their signature/sticker seal on the sample carton box at various positions. This sample acceptance and sealing procedure shall be done one day before the bid opening date.

The committee shall prepare a sample sealing statement and hand over the sealed samples to AEn/XEN in-charge of sample room, for safe custody in the sample room.

There shall be a separate sample room with proper lock and key arrangement in the office of SE (MM) for safe custody of samples. It can only be opened by opening of two locks simultaneously, key of one lock will remain in the custody of concern XEN and key of other lock will remain in the custody of concern AEn in-charge of sample room.

In-charge of the sample room shall maintain a register and shall enter the detail of sample item, TN, Sl. No., Seal etc. in the register. When the independent test agency is decided, the in-charge of the sample room shall hand over the samples to the same committee which has accepted & sealed the samples for packing in big cartons for safe transportation. The committee shall get the samples packed in its presence and then hand over these packed samples to the courier agency for transporting these samples to the independent Test House.

Whenever, the sample room will be opened, the reason of opening with date and time of opening and closing and signature of persons in presence of room was opened will be recorded in register also. In case of delay in sending the packed samples by courier agency, the packed cartons will again be stored in the sample room.

At the independent test house the samples shall be opened in presence of Nigam's representative. After verification, the test house shall accept the sample for type test etc. and issue acknowledgment of receipt to the Nigam's representative.

(d) Additional type tests and Tamper Tests to be conducted on bid stage samples are as under:

- i) DC influence test as per IS:13779-1999 or as per relevant IEC standard in phase circuit(s).

- ii) The test of influence of supply voltage shall be carried out as per clause No.12.7.2.1 of IS:13779/1999, except the interruption time should be variable from 10 ms to 5 sec. instead of fixed time.
- iii) Test of voltage variation as per this specification.
- iv) Compliance of anti-tamper features as per Clause 7.6 of this specification.

(e) Sample before Commencement of supplies:

The supplier shall furnish duly sealed three sample meters along with CMRI having all the features conforming to specification within Fifteen days from the date of receipt of PO, for Electrical testing, verification of physical features and communication capability of meters in Nigam's lab. Sample meter shall be broken to verify components of the meter. In case of major deviation in Electrical testing , physical features and communication capability, the supplier be allowed to furnish second set of sample. In case of failure of second set of sample order may be cancelled.

The delay in submission of before commencement samples beyond Fifteen days from the date of receipt of PO will be supplier's account.

Before commencement, samples will be deposited by the supplier directly in the office of the concerning Superintending Engineer (MM) of Discom.

Note:- A committee comprising of M&P wing and IT wing will examine the Communication capability of sample meter and CMRI with different make of meters supplied in the Discom as per requirement of the technical specification at the time of approval of pre commencement sample. The bidders are required to furnish one No. CMRI along with communication **cables at the time of sample submission** so that the bid stage sample may be got checked/verified.

- (f) The samples furnished by bidders at various stages of tender and the samples selected for store testing shall be tested on automatic testing bench, which has accuracy of 0.02.

17.0 Replacement of Defective Meters:

The meters declared defective by the consignees and /or by meter testing lab shall be replaced by the supplier up to the full satisfaction of the purchaser at the cost of supplier as per clause no. 1.18 of GCC within one month of intimation by purchaser/stores officer.

18.0 Maintenance & Guarantee:

- (a) It shall be governed by clause 1.40 of GCC except that the guarantee shall be for a period of 5 years(**for meter as well as CMRI**) from the date of dispatch. The meter/ CMRI found defective within the guarantee period shall be replaced by the supplier free of cost within 45 days from the date of receipt of information. If defective meter/ CMRI is not replaced within the specified period as above, the cost of GP

failed meters shall be deducted from firm's financial hold and Performance Bank Guarantee shall be operated to recover the cost.

The meter will be declared defective within guarantee period after testing in the meter testing lab.

- (b) If the performance period of the supplied material is over and some quantity of guarantee period defective meters are still lying pending for want of repair / replacement than fresh Bank Guarantee equal to the cost of these guarantee period defective meters may be accepted by Nigam and original PBG shall be released.

19.0 Quality Assurance Plan:

The design life of the meter shall be minimum 20 years and to prove the design life, the firm shall have at least the following quality Assurance Plan:-

- (i) The factory shall be completely dust proof.
- (ii) The testing rooms shall be temperature and humidity controlled as per relevant standards.
- (iii) The testing and calibrating equipments should be automatic and all test equipment shall have their valid calibration certificates.
- (iv) Power supplies used in testing equipment shall be distortion free with sinusoidal wave- forms and maintaining constant voltage current and frequency as per the relevant standards.
- (v) During the manufacturing of the meters the following checks shall be carried out.
 - a) Meter frame dimensions tolerance shall be minimum.
 - b) The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.
 - c) The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any human errors.
- vi) The bidder shall invariably furnish the following information alongwith his bid, failing which his bid shall be liable for rejection. The information shall be separately given for individual type of material offered.
 - a) Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw material in presence of bidder's representative and copies of test certificates.
 - b) Information and copies of test certificates as in (i) above in respect of bought out accessories.
 - c) List of manufacturing facilities available.

- d) Level of automation achieved and list of areas where manual processing exists.
- e) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- f) List of testing equipment available with the bidder for final testing of equipment specified and test-plant limitations, if any, vis-a-vis the type, special acceptance and routine tests specified in the relevant standards and this specification. These limitations shall be very clearly brought out in schedule of deviations provided with the tender.

20.0 Accuracy of Meters:

The supplier shall furnish written undertaking on Rs. 500.00 Non Judicial Rajasthan Govt. Stamp paper that there will be no drift in the accuracy of the meters supplied against this purchase order for a period of 10 years from the date of supply. In case any drift is noticed/found beyond permissible limits during this period, they shall recalibrate such a meter for correct accuracy, and in the event recalibration is not possible, replace such meter(s) with new meter(s) without any extra cost.

21.0 Qualification Requirements

The qualification requirements shall be as per Schedule-III A.

22.0 Prices:

Tenderer must quote 'FIRM' prices. The quoted prices shall be exclusive of G.S.T. If no duty and/ or tax is applicable at concessional rate, the same shall be clearly mentioned.

23.0 DELIVERY SCHEDULE:-

Commencement period 30 days from the date of receipt of purchase order and completion within 7 months at equal monthly rate from the date of approval of pre commencement sample. Firm is required to furnish pre commencement sample within 15 days of receipt of purchase order. The delay in furnishing of pre-commencement sample beyond 15 days shall be on the part of the supplier and such delayed period shall be reduced from the stipulated delivery schedule. It will be ensured by Nigam to convey approval of pre-commencement sample within 15 days of receipt of sample.

24.0 General Information

- a) Frequent changes in specifications during currency of contract will be avoided and if required the same shall be effected on mutually agreed basis.
- b) Nigam is not averse to deciding tenders on differential prices to get better quality meters.

25.0 ADDITIONAL ORDER- Repeat orders for additional quantities, up to a maximum of 50% of original ordered quantities, may be placed by the Nigam, on the same rates, terms and conditions given in the contract

ANNEXURE-A-3**COMPONENT SPECIFICATION**

S. No	Component	Requirement	Makes & Origin
1.	Current Element	E-beam/spot welded shunts shall be provided in the phase element and C.T. in the neutral. Alternatively, both the current elements (phase & neutral) shall have shunts with proper insulation. The meters should be with the current transformers / shunt as measuring elements.	Any make or origin conforming to IS-2705 and other make i.e. RedbournEngg/Isabelle.
2.	Measurement of computing chips.	The measurement or computing chips used in the meter should be with the surface mount type along with the ASICs.	Analog Devices, Cyrus Logic, AMS, Atmel, Phillips, SAMES, NEC, Texas Instruments, Teridian-USA, Maxim USA, Renesas.
3.	Memory Chips.	The memory chips should not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges.	Atmel, National Semiconductors, Microchip, Texas Instruments, Phillips, ST Hitachi or Oki, Teridian, Renesas.
4.	Display modules	a) The display modules should be well protected from the external UV radiations. b) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display. c) The display should be clearly visible over an angle of at least a cone of 70°. c) It should be trans-reflective FSTN or STN Type industrial grade with extended temperature range.	Genda, Haijing, Holtek, Bonafied Technologies Korea : Advantek, Truly Semiconductor Success Hitachi, Sony. Tianma, RCL, Future S&T (Shenzen)
5.	Electronic Components.	The active & passive components should be of the surface mount type and are to be handled & soldered by	National Semiconductors, Atmel, Phillips, Texas

		the state of art assembly processes.	Instruments, Toshiba, Fairchild, Murata, Rohm, Siemens. Hitachi, Oki, AVX or Ricoh. Samsung, Panosonik. Vishay, Yageo, DiotecPhycom, O N semiconductor, Koshin
6.	Battery	Lithium with minimum guaranteed life of 15 years.	Varta, Tedirun, Sanyo or National, Durocell, Maxwell-Hitachi, Panasonic and Mitsubishi, Renata, Elegance.
7.	RTC& Micro Controller.	The accuracy of RTC shall be as per relevant IEC / IS Standards.	Phillips, Dallas Atmel, Motorola, Microchip. NEC or Oki. Renesas, Intersil, Analog Devices, Crystal:FRONTER ELECTRONICS, Roson Electronics.
8.	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm.	-
9.	Communication modules	Communication modules should be compatible for the RS232 ports	National Semiconductors, Hitachi, Texas Instruments, Philips, HP, Agilent, Everlight, Fairchild
10.	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.	National Semiconductors, Hitachi, Texas Instruments, Siemens, Agilent, Philips, Hp, Everlight.
11.	Power supply	The power supply should be with the capabilities as per the relevant	

		standards. The power supply unit of the meter should not be affected incase the maximum voltage of the system appears to the terminals due to faults or due to wrong connections.	
12	Mechanical parts	The internal electrical components should be of electrolytic copper & should be protected from corrosion, rust etc. The other mechanical components should be protected from rust, corrosion etc. by suitable plating/painting methods.	-

The components equivalent or better than those mentioned in the list of components of existing specification of Three Phase Meters are also acceptable.

ANNEXURE-A**GUARANTEED TECHNICAL PARTICULARS OF THREE PHASE STATIC ENERGY METERS OF RATING 10-60A WITH LCD BACK-LIT DISPLAY WITH METER BOX.**

SN.	Particulars	TO BE FURNISHED BY BIDDER
1.	Name & Address of Manufacturer	
2.	Work's Address	
3	Type / Designation of meter offered	
4	Class of Accuracy	
5	Standard Applicable	
6	Type of Meter (no. of phases & wire / elements)	
7	Rating and General Particulars	
a)	Reference Voltage	
b)	Basic current (I_b)	
c)	Maximum current (I_{max})	
d)	Maximum withstand current (i.e. 150% of I_{max})	
e)	Voltage with stand 450V for 5 minutes	
f)	Power supply variation (-40% to +20% V_{ref})	
8	Whether meter is suitable for working with following supply system	
i)	Specified operating range	
ii)	Limit range of operation	
iii)	Frequency	
iv)	Power factor range	
v)	Ambient temperature range	
9	Insulation resistance between:	
a)	Meter current circuit and voltage circuit	

	b)	Current and voltage circuit coupled and all non-current carrying parts connected together	
10		Min. starting current per phase (in Amps)	
11	Details of meter fixing arrangements:		
		Is the meter fixing arrangement with the base of meter box is as per the provision of this specification?	
12	A)	Detail of sealing arrangement:	
	i)	No. of Tamper proof transparent polycarbonate security seals provided on meter body and its colour /details of other sealing arrangement.	
	ii)	The monogram of AVVNL is laser etched printing / embossed on front side and month & year of manufacturer.	
	iii)	The Sr No on the seals is same as meter Sr No?	
	iv)	Is the Sr No. on seals is laser etched/ embossed?	
	B)	Whether base and cover are permanently fixed to the base by heat stacking / ultrasonically welding as per Clause 7.1(e) of Spec.	
	C)	Whether seals are visible from front side of meter?	
13.	Details of meter base and cover		
	a)	Degree of protection of meter case? (Whether Type Test Certificate enclosed)	
	b)	Thickness and material of Meter base and cover	
	c)	Whether the base of meter is in Grey colour and cover is transparent	
14	Details of terminals block and its cover		

	a)	Whether Material of terminal block used, conforms to clause 7.2.1 of this specification?	
	b)	Thickness and material of Terminal cover	
	c)	Minimum center to center distance between adjacent terminals	
	d)	Details of screws provided on each terminal for fixing aluminum / copper stranded wires (no. & dimensions)	
	e)	i)	Minimum internal diameter of terminal holes?
		ii)	Is it adequately designed to accommodate copper / aluminiumarmoured PVC cable of size up 6 sq mm to 25 sq. mm
	f)	Whether terminal cover is of extended type. Please give extended length of terminal cover below terminal block.	
15	Whether voltage & current circuits are solidly connected inside the meter body without any link?		
16	Whether window portion is as per specification?		
17	Details of CT's / Shunts provided		
	a)	CT(s)/ Shunt(s) provided in phase	
	b)	Size of secondary wire of CT / Size of Shunt(s) used	
	c)	No. of turns of secondary winding of CT	
	d)	Whether CTs and Shunts have been properly fixed on base/PCB/ current terminals?	
18	Whether components on the PCB are surface mounted except power components?		
19	Whether PCB material is glass epoxy FR-4 grade?		

20.	Whether all parts that are likely to develop corrosion effectively protected against corrosion?	
21	Whether the name plate provided on meter bears the following information in addition to marking required as per specification:	
	i) Manufacturer's name or trade mark and place of manufacturer	
	ii) Designation of type	
	iii) Number of phases and wires for which the meter is suitable	
	iv) Serial Number	
	v) Month and year of manufacture	
	vi) Reference voltage and frequency	
	vii) Principal unit(s) of measurement	
	viii) Basic current and rated maximum current in Amps	
	ix) Meter constant (Imp/kWh)	
	x) Accuracy class	
	xi) Property of AVVNL	
	xiii) Purchase Order Number and Date	
	xiv) Guarantee period	
	xv) The sign of insulation	
	xvi) Bar coding of Sr. No., month & year of manufacture of meter.	
	xvii) Ultrasonic welded	
	xviii) ISI mark with license number	
	xix) DLMS meter	
	xx) All communication ports	
22	Power consumption of voltage circuit per phase (Watt & VA)	
23	Power consumption of current circuit (VA)	
24	Overall dimension of the meter with \pm % tolerance	

25	Weight of the meter with \pm % tolerance		
26	Does meter has Short time over current withstand capability of 30 I _{max} for one half cycle at reference frequency?		
27	Does the meter comply with Impulse voltage withstand capacity of 6kV?		
28	a)	Does the meter have any type of mechanical adjustment (trim-pots, potentiometer etc) for calibration?	
	b)	Are the meters software calibrated? (Yes/No)	
29	A) Display sequence		
	a)	Continuous display: <ul style="list-style-type: none"> i. Current cumulative active forwarded energy (Total Energy) without decimal digit. ii. Cover open tamper status with date & time. iii. Magnet tamper status with date & time. 	
	b)	Push Button display:	
		1.	LCD Segment Check.
		2.	S.No. of Meter.
		3.	Date and Time
	4.	Current cumulative active forward energy (Total KWH) without decimal, minimum 7 whole digits.	

		5.	Current Cumulative active Apparent forward Energy (Total KVAH) without decimal, minimum 7 whole digits.	
		6.	Current Cumulative Reactive forward Energy (KVARh-Lag) without decimal, minimum 7 whole digits	
		7.	Current Cumulative Reactive forward Energy (KVARh-Lead) without decimal, minimum 7 whole digits	
		8.	Maximum demand in KW since last reset (2 Whole Digit+ 2 decimal digits)	
		9.	Instantaneous active load in KW with three Decimals.	
		10.	Instantaneous Voltage per phase with one decimal	
		11.	Instantaneous current per phase with two decimals	
		12.	Instantaneous Avg. Power factor with three decimals.(Lag/Lead).	
		13.	High resolution display of current cumulative active forwarded energy at least three digits after decimals. (OBIS code is required as same is not given in the IS 15959)	
		14.	Cumulative active energy(KWh forwarded) reading of pre-defined date & time of previous month for Billing purpose(BP kWh), minimum 7 whole digits.	

		15.	Cumulative apparent energy(KVAh forwarded) reading of pre-defined date & time of previous month for Billing purpose(BP kvah), minimum 7 whole digits.	
		16	Maximum demand(KW) of pre-defined date & time of previous month for billing purpose (BP KW), 2 whole digits plus 2 decimal digits.	
		17	Average power factor upto pre-defined date & time of previous month for billing purpose (BP Ave PF), one whole digit plus 3 decimal digits	
	B	In power-off condition, the above parameters shall be displayed on Push-Button Mode also.		
30	Display details			
	a)	Type of Display, minimum character height & no. of Digits		
	b)	Is the display having back lit?		
	c)	Does display have one decimal digit for cumulative Energy KWh in auto scroll mode .		
	d)	Is NVM having min retention time of 12 years provided?		
	e)	Accuracy of RTC (minutes/year)?		
	f)	Internal Least count of energy recording?		
	g)	Provision to read the Meter two times in no Power condition is provided with inbuilt Battery for taking Meter reading in Power-Off condition.		
		With primary / rechargeable battery for taking meter reading in power-off condition.		

			Is the above provision capable of 50,000 such operation during the meter life time of 15 years	
31.	For communication capability			
	A	i)	Whether It is possible to read the meter through optical port by CMRI.	
		ii)	Whether It is possible to read the meter through RS 232 port by CMRI	
		iii)	Whether It is possible to read the all make of meter through optical port & RS 232 port by connecting separate module of the respective make by CMRI.	
		vi)	Whether CMRI have facility to store 200 nos. of meter data	
		v)	Whether the following parameters can be downloaded by CMRI	
		a)	Meter Sr. Mo.	
		b)	Time and date	
		c)	Instant load in KW per phase, voltage, current and power factor	
		d)	Current forwarded energy(total) cumulative KWH	
		e)	Billing kWh (BP kWh) for the last 12 months	
		f)	MD KW with 30 min integration on real time	

		basis for each phase with date and time stamp for the last 12 months.	
	g)	Average power factor of the last consumption month upto pre-defined date and time for the last 12 months	
	h)	The tamper data as per Cl. 7.6 (c) & (g).	
	i)	Power-On hours and minutes for each of previous 12 months	
	j)	The snap shot of occurrence with date & time of minimum 40 events as per Clause 7.6(c) ,(g)& (h) of specification.	
	K)	<p>The meter shall also have a storage capacity for 75 days load survey with 30 minute IP for the following parameters (as per table 28 provided in IS:15959:2011.)</p> <ol style="list-style-type: none"> 1) Real time clock, date and time 2) Current Ir. 3) Current Iy. 4) Current Ib. 5) Voltage Vrn. 6) Voltage Vyn. 7) Voltage Vbn. 8) Block energy- Kwh 9) Block energy-KVARH-Lag 10) Block energy-KVARh-lead 11) Block energy- Kvah. 	

			<p>i)</p> <p>At BCS end twelve month billing data with all energies including demand and all tamper event with their snap shot value should be provided.</p>
	B		<p>1) Whether the following parameters can be downloaded by CMRI through RS 232 port.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Meter Sr. No. <input type="checkbox"/> Time & Date <input type="checkbox"/> Current cumulative forwarded KWH energy(total) <input type="checkbox"/> Billing kWh (BP kWh) for the last 12months. <input type="checkbox"/> Average power factor of the last consumption month upto pre-defined date & time for the last 12 months <input type="checkbox"/> The snap shot of occurrence with date and time of last tamper events for following tamper conditions: <ul style="list-style-type: none"> 1. The tamper data as per Cl. 7.6 (c), (g)&(h), of specification
	ii)	Whether total reading time for each meter does not exceed more than 60 seconds for billing data and 5 minutes for total data.	
32.	Whether indications provided for following:		
	a)	Red, Yellow, Blue LED for test output	

		pulse (Imp/kWh)		
	b)	LCD icon for healthy RYB phases		
33	a)	Year since when the design offered is in vogue		
	b)	Whether the offered design is completely type tested and certified by BIS		
34.	a)	Please confirm that meter does not get damaged even if 450V is applied for 5 minutes between phase and neutral and continue to record correctly after restoration of normal supply?		
	b)	Whether meter perform within class 1.0 accuracy up to 800% I_b for power factor range 0.5 lagging, 0.8 leading & unity?		
	c)	Whether meter remains functional and is capable to record energy even if voltage falls up to 60% of rated voltage at I_b to I_{max} .		
35.	Indicate guaranteed accuracy of meters at different ranges of voltages / P.F.			
36	Influence quantity		Current P.F.	Limits of variation of % error
	a)	Voltage variation between - 40% to + 20%	I_b unity I_b 0.5 lag	
37	Whether meter is packed in corrugated Box / Thermocol packing boxes as per specification			
38.	Does the meter comply to running with no load of 70% and 120% of rated voltage - as per this specification?			
39.	Mention the value up to which meter can withstand Direct Current in A.C. circuit without getting CT's saturated			

	resulting in measurement errors of more than permissible limit	
40.	<p>Doesthe metershall either remain immune to tamper through application of external magnetic field (AC electro magnet or DC magnet) as per value specified in CBIP 325 or if the metering gets affected then meter shall record energy at I_{max}, rated voltage and unity P.F. as per CBIP 325 and same should also be logged as event with date & time.</p> <p>Also In case of abnormal permanent magnetic field either meter shall either remain immune or if the metering gets affected then meter shall record energy at I_{max}, rated voltage and unity P.F and same should also be logged as event with date & time</p>	
41	Does the bidder own the facilities of SMT manufacturing or have access thru' hire, lease or sub-contract the facilities?	
42	Does the bidder have exclusive access to these facilities and have furnished adequate documents as proof?	
43	Does the bidder have in-house design, development and manufacturing facilities?	
44	<p>Cover open tamper occurred with date & time.</p> <p>Meter base cut tamper occurred with date & time.</p>	

45	The communication software must be capable to transfer the billing data and meter Sr.No. required for automatic spot billing using optical Port enabled to spot billing machine (SBM), within 60 seconds.	
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**TECHNICAL SPECIFICATION FOR PUSH FIT TYPE MOULDED METER BOX SUITABLE
FOR THREE PHASE STATIC ENERGY METERS AGAINST TN-1291.**

SECTION – III (VOLUME-'B')

1.0 SCOPE:

This specification covers the moulding and supply of moulded Meter Box suitable to house the Energy Meters. The Meter Box shall be suitable for wall mounting.

2.0 TECHNICAL REQUIREMENT & STANDARDS

2.1 MATERIAL AND STANDARDS

The Meter Box i.e. base and cover shall be made of injection moulded, unbreakable, high grade flame retardant polycarbonate with minimum thickness of 2.0mm having good dielectric and mechanical strength however, due to manufacturing process, the negative tolerance of 0.2 mm may be allowed.

The top cover of the Meter Box must be totally transparent without any provision of the separate window arrangement. The material must be 'UV' stabilized to ensure that the moulded Meter Box should not change in colour shape, size and dimension when subjected to 200 hrs. on U-V ageing test.

The Meter Box should have tapered surface / corners to prevent stay of rain water at the top of the meter cup board.

The cupboard should be capable of withstanding the mechanical, electrical and thermal stresses as well as the affects of humidity which are likely to be encountered in service, at the same time ensuring desired degree of safety. The plastic material should be adequately stabilized against detrimental effects of light and weather. The surface appearance of moulded part must be smooth, non-porous and homogenous, free of ripples, defects and marks. No fillers or fibers should be visible at any place. The Meter Box shall comply in all respect with the requirement of latest amended IS:14772/2000 "General requirements for enclosures for accessories for household and similar fixed electrical installations". Applicable degree of protection shall be IP 42 or better.

2.2 PROPERTIES OF PLASTIC MATERIAL

The plastic material which is to be used by the bidder for these moulded Meter Box, must have the following properties:

S.No	Property	Units	Value
1.	Physical Water Absorption	%	Max. 0.35
2.	Thermal HDT	Deg. C	Min. 125.
3.	Flammability a) Rating b) Glow wire test @ 650 Deg. C		FV 2 Passes

4.	Mechanical		
	a) Tensile Strength	MPa	Min. 50
	b) Flexural strength	Mpa	Min. 90
	c) Modulus of Elasticity	Mpa	Min. 2000
	d) Izod impact strength notched 23 deg. C.	KJ/Sq.m	Min 8

2.3 SERVICE CONDITIONS

- | | |
|---|---------------|
| a) Maximum ambient air temperature | :50deg.C |
| b) Maximum ambient air temperature in shade | :45deg.C |
| c) Maximum temperature attainable by the meter
exposed to sun. | :60 deg. C |
| d) Minimum ambient temperature | (-) 5 deg.C |
| e) Average daily ambient air temperature | :40deg.C |
| f) Maximum relative humidity | :95 % |
| g) Number of months of tropical monsoon condition | :4 months |
| h) Maximum altitude above mean sea level | :1000 meters |
| i) Average annual rain fall | :10-100 cms |
| j) Maximum annual rain fall | :1450 mm |
| k) Maximum wind pressure | :200 kg /sq.m |
| l) Isoceraunic level (days per year) | :40 |
| m) Seismic level (horizontal accn.) | :0.30 g |
| n) Permitted noise level | :45. Db |

2.4 GENERAL & CONSTRUCTIONAL REQUIREMENTS

2.4.1 DIMENSIONS

The size of Meter Box (length, breadth and height) shall be such that there should be a minimum of 20 mm clearance between outer most part of meter casing and inner most part of inside of meter box base on all sides from the meter sides except the bottom side of meter box base which should be minimum 75 mm from the plane surface of terminal block and 15 mm clearance on front and 10mm clearance from back of the meter.

2.4.2 BASE & COVER DETAILS

1. The cover shall be made overlapping type having collars on all four sides. The cover of the Meter Box shall be provided with semicircular / circular gasket of suitable size to completely fit in the grooves of the base. The gasket should be made of neoprene rubber. The base of the cupboard must have a groove to hold the gasket and the overlap of the top cover with the base must be minimum 6 mm (with gasket).

2. The meter box cover or base shall have a barrier so positioned that any possibility of fiddling the meter terminal from outside of the meter box through cable entry holes is not possible. The barrier shall have reinforce / located at both sides to restrict its movement up and down even by applying external pressure through any tools.

3. DATA DOWNLOADING THROUGH OPTICAL PORT:

An opening (with the arrangement of collar) shall be provided of suitable size on box cover in front of optical port of the meter for assessing CMRI to download the meter data. Suitable arrangement to cover the said opening by rubber/plastic cap attached with Box shall be provided. The rubber/plastic cap shall be hanging type connected with the collar.

4. Push Button :

The push button on meter box cover should be designed such that it is not possible to remove/take out the push button by any means and there should not be any gap between push button and cover. It should be access the push button of the meter without opening the main meter box cover and suitable arrangement for access to meter push button shall be provided.

2.4.3 METER BOX SEALING AND SELF LOCKING ARRANGEMENT

A) SELF LOCKING ARRANGEMENT

The cover should be fitted with base by non-detachable push fit type arrangement. It should have knobs provided with the cover such that if pushed once inside the arrangement in the main body of the base and fitted in the arrangement, it becomes integral part of Meter Box and cannot be detached from the base without breakage.

The cover shall rest on the base of Meter Box in such a way that any access from outside to the meter is not possible. The cover in closed position should be overlapped on collar of base such that direct entry of screw driver or any other tool/ wire is not possible.

A protective lock device shall be provided so that during transportation or before installing the Meter Box at site the lock should not operate. The device shall be disabled before the Meter Box is locked.

The snap fit lock (male part) must be inserted in groove (female part) by at least 5mm to ensure proper locking of the meter cup board.

The top cover when opened after installation must have visible cracks/damages to make visible that the meter cup board has been forcibly opened up.

Both male and female portions shall be an integral part of the meter box base and cover mould and not affixed separately by any method.

B) SEALING ARRANGEMENT

In order to make the above self locking arrangements of meter box fool proof from tampering, two numbers of push-fit moulded seals shall be provided on the meter case-cover boundary as below:

The meter box shall be sealed with two specially designed and moulded coloured polycarbonate tamper proof seals (lash wire seals are not allowed), to be inserted on each side of meter box case, with internal locking arrangement embossed or laser etched with serial number and AVVNL and manufacturer's logo visible from the front and matching with the serial number of the meter.

The provision of sealing shall be integral part of the meter box. The seal inserting arrangement shall also be integral part of moulded meter box. The push fit seals should have adequate barriers around the sealing arrangement such that any attempt to reach the sealing arrangement through wire etc. is not possible.

The seals shall become unserviceable and shall be irreplaceable in case of any attempt to tamper the meter box.

These seals shall be placed in the meter box at specified place (not in loose condition) for inserting them at site after installation.

The meter and terminals shall be rendered inaccessible after the meter box is self locked and sealed with such seals.

The serial number on seals shall be same as the serial number of the meter and meter box. Provision for all the seals should be made on front side of the meter box.

The serial number of meter shall be embossed or laser etched on the base as well as the cover of the meter box which can be easily viewed.

2.4.4 METER MOUNTING INSIDE THE METER BOX

The meter base support inside the box is raised by about 10mm in the box for ease of wiring. Fixing arrangement of meter to the base of meter box should be as per clause 7.8 of specification of Energy Meter.

2.4.5 INCOMING AND OUTGOING CABLE ARRANGEMENT

Suitable circular holes shall be provided at the bottom of the cupboard for inlet & outlet cables with suitable gland size to accommodate three & half core armoured aluminum cable(s) up to 25 Sq.mm made of engineering plastic for the cable securely fixed to the bottom of the cupboard on both sides by chucknuts. A suitable arrangement like clamping nut may be provided with the gland so that opening dia can be reduced to the size of cable.

2.4.6 FIXING ARRANGEMENT OF METRBOX

For fixing the Meter Box to wall or wooden board, 4 nos. holes (two top side holes to be keyholes) of minimum 6 mm dia, shall be provided at the four corners of Meter Box. The meter is to be installed in the Meter Box and the Meter Box in assembled condition shall have provision to fix it to a pole or on wall. The 4 nos. self threaded screws of min. size of 4mm dia and 25 mm long shall be provided with each Meter Box.

2.4.7 MARKING

The following information shall be clearly & indelibly **embossed/engraved** (not printed) on the cover and base of the Meter Box (except Sr. No. of the meter -

which may be indelibly printed inside the base of meter box and also on the meter box cover with laser marking). The meter box Sr. No. shall be same as of meter Sr. No. housed inside the particular meter box:

- i) TN-1291.
- ii) Property of AVVNL.
- iii) Name/ Brand name of Manufacturer.
- iv) Meter Sr. No. (printed on both the base & cover of meter box)
- v) Sign of danger

2.5 **DRAWING**

Detailed dimensional drawing & detailed leaflets showing clearly the dimensions & material for meter cup boards and its constructional features should be furnished with the tender offer.

2.6 **SAMPLE**

Furnishing of samples shall be as per clause No. 16.0 of technical specifications (Schedule-III- Volume-'A')

2.7 **PACKING**

Packing shall be as per clause No. 15.0 of technical specifications (Schedule-III- Volume-'A')

2.8 **TESTS**

A) Type Tests

The meter cup board offered shall be fully type tested as per relevant standards and this technical specification (table 2). The bidder must furnish one set of type test reports along with the technical bid or shall submit such type test reports within thirty days of technical bid opening in respect of material offered. The type test report should be from independent recognized testing laboratory / house whose calibration of testing instruments should have traceability to NABL/NPL/ or equivalent. The type tests mentioned below must not have been conducted earlier than three years from the date of opening of techno-commercial bid.

TABLE-2

LIST OF TESTS TO BE CARRIED OUT ON MOULDED METER BOX

S. No.	Name of Indian Standard/ Equivalent International	ClasueR ef.	Test requirement	Test particulars		
				Type	Routine	Accept- ance
1.	IS:14772	Clause 7	Marking	T		A
2.	As per Bidder's drawing		Dimensions	T		A
3.	IS:14772	Clause	Protection against	T	R	A

		9	electric shock			
4	IS:14772	Clause 11	Construction	T		
5.	IS 14772	Clause 12	Resistance to ageing, to humid condition, to ingress of solid object and to harmful ingress of water.	T		
6.	IS : 14772	Clause 13	Mechanical strength	T		
7.	IS :14772	Clause 14	Resistance to heat	T		
8.	IS:14772	Clause 16	Resistance to rusting	T		
9.	IS:14772	Clause 17	Resistance to tracking			
10.	IS:8620/1996		Test for resistance to heat & fire. Glow w/ire test at 650 deg. C as per cl. 4 to 10 of IEC 695-2-1	T		
11.	IS:13411	Annexure H	Heat deflection temperature (Min. 125 degC.)	T		
12.	IS : 4249		Self Extinguishing property of spirit burner test.	T		
13.	IS:8623/1993	(Part-1) 18.2.2.2	Verification of die electric properties, insulation test with 500V DC magger	T		
14.	CIPET/IR Spectrometry		Material identification.	T		
15.	IS:13411/1992	Annexure D	Test for water absorption (Max. 0.35)	T		

Note : Applicable degree of protection shall be IP 42 or better.

Legend :-

T = Type Test, R = Routine Test, A = Acceptance Test

B) Acceptance test

The acceptance test as indicated in the table 2 shall be carried out at the time of inspection of the offered material.

C) Routine test

The routine tests as stipulated in the table 2 shall be carried out and routine test certificates / reports shall be submitted to the purchaser's inspecting officer at the time of inspection of the offered material.

Notes:

1. Where facilities do not exist at supplier's works for carrying out one or more above tests such test(s) may be got carried out at any of the approved laboratories such as CIPET centers / IIT, Delhi / Shriram test house, Delhi.
 2. The sampling plan for carrying out the acceptance tests shall be same as in case of energy meters.
-

ANNEXURE-B**Guaranteed Technical and other Particulars of Moulded Meter Box suitable for Three Phase Energy Meters with Box.**

S. No.	Particulars				
1.	Material used for moulded meter box				
	a)	Base			
	b)	Cover			
2.	Thickness of moulded sheet in mm				
	a)	Base			
	b)	Cover			
3.	Properties of material for moulded meter box. (Indicate compliance Yes/No)				
	S.No	Property	Units	Value	
	i)	Physical: Water Absorption	%	Max. 0.35	
	ii)	Thermal HDT	Deg. C	Min. 125	
	iii)	Flammability			
		a)	Rating		FV2
		b)	Glow wire test @ 650 Deg. C		Passes
	iv)	Mechanical			
		a)	Tensile strength	MPa	Min. 50
		b)	Flexural strength	MPa	Min. 90
		c)	Modulus of elasticity	MPa	Min. 2000
		d)	Izod impact strength, Notched, 23 Deg. C	KJ/Sq M	Min. 8
	4.	Dimension of box in mm			
a)		Minimum clearance from meter on all 4 sides			
b)		Minimum clearance from meter on front			
c)		Minimum clearance from back of meter			
5.	Weight of complete box in Kg, with \pm % tolerance				
6.	Whether details of marking are as per				

	specification?	
7.	Is the cover overlapping type having collars on all four sides?	
8.	Is the cover/base provided with semi-circular / circular gasket of sufficient size to completely fit in the groove of the base?	
8(a))	Is the meter box having push button for access to the meter without opening of meter box cover.	
9.	Material of the gasket	
10.	Sealing and self locking arrangement	
i)	No. of transparent polycarbonate security seals provided and its colour.	
ii)	The name/ logo of manufacturer and purchaser are printed on the seals?	
iii)	The Sr No on these seals is same as meter Sr No?	
iv)	Is the Sr No. on seals is laser hatched?	
v)	Does the sealing holes provided on both sides of box, have min 2 mm dia and are in alignment at two places each in top and bottom pieces of meter box?	
vi)	Whether sealing arrangement is integral part of mould case. of meter box.	
viii)	Are the seals kept in un-sealed condition, to be sealed after installation of meter and box, in the field?	
viii)	Is the cover fitted with base by non-detachable push fit arrangement?	
ix)	No. of snap lock fitting arrangement in the box?	
11.	Dimensions of holes and screw for mounting meter box	
i)	Dimensions of holes for box fixing screw (in mm)	
ii)	Dimensions of box fixing screws (in mm)	
iii)	Total No. of fixing screws	
iv)	The top side two fixing holes are Key-holes?	
12.	Colour of base of the box	

13.	Details of Cable glands	
a)	Material	
b)	Whether Size of gland is as per specification ?	
c)	Whether a suitable arrangement like clamping nut has been provided with the gland so that opening dia can be reduced to the size of cable?	

SECTION-III(VOLUME-'C')

TECHNICAL SPECIFICATION FOR DOUBLE ANCHOR TAMPER EVIDENT POLYCARBONATE SEALS AGAINST TN-1291

SCOPE:

The specification covers the design, manufacture, testing at manufacturers works, supply and delivery at destination stores of Double Anchor Tamper Evident Poly-carbonate Seals for sealing of Meter body and terminal covers of energy meters, Meter Box, CT-PT Units etc. with non-corrosive, non-magnetic stainless steel sealing wire. These seals shall also be used for sealing the meters, metering equipments and inspected materials.

The Double Anchor Tamper Evident Poly-carbonate Seals shall conform to the Nigam's specification as under:

1. Material of Double Anchor Tamper Evident Poly-carbonate Seals :

The raw material used for Double Anchor Tamper Evident Poly-carbonate Seals shall be of M/s. Dow Caliber Ltd., Switzerland (Grade-201- 15), M/s.GE Plastic, Singapore (Grade 143R), M/s. Dupont, Japan (Grade IV-20) or any other manufacturer having better properties as under :-

Sr.No.	Properties	Poly-carbonate
1.	Melting temperature	280 ^o C to 295 ^o C
2.	USE	Engineering
3.	Softness	Hard
4.	Durability	Weather effect resistance
5.	Transparency	Fully transparent (long time transparency)

2. Service Conditions (Climatic Conditions) :

The material to be supplied against this specification should be capable of performing and maintaining required accuracy under extreme hot, cold, tropical and dusty climate and solar radiation typically existing in state of Rajasthan (India).

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

1	Maximum ambient air temperature	55 deg.C.
2	Maximum ambient air temperature in shade.	45 deg.C
3	Maximum temperature attainable by the meter exposed to sun.	60 deg.C.
4	Minimum ambient temperature	(-) 5 deg.C.

5	Average daily ambient air temperature	40 deg.C.
6	Maximum relative humidity	95%
7	Number of months of tropical monsoon condition	4 months.
8	Maximum attitude above mean sea level	1000 meters.
9	Average annual rain fall	10-100 cm.
10	Maximum wind pressure.	200 kg/sq.m

3. Colour of Seal :

The Polycarbonate Seal(s) shall be of anycolour and should be transparent (see through) type, which shall give complete visualization of its fixing mechanism and shall show clear indication if tampered.

4. Design and Construction of Seal :

- a) **Design:** The seal shall be Double Anchor (Push Fit) type tamper evident with double locking. The seal should be patented/ design registered. There shall not be any change in size, shape or design of the seal than the approved samples. If the seal is found different than the approved design / shape / size, the same shall be out rightly rejected. The double anchor should not be so soft that it can be easily pressed before sealing, so that after pressing the seal ca not be opened.
- b) **Thickness :** The wall thickness of seal should be minimum one (1)mm.
- c) **Serial No. of the Seal :** Non repeat seven digits Sr.Nos. with Code No. shall be laser etched / embossed during moulding (it shall not be screen printed) in contrast colour on one side of capsule body (female). The Sr. No. shall also be laser etched/ embossed on top of the male part. The laser etched printing shall be through complete thickness of the polycarbonate
- d) **Monogram :** The seal shall have embossed/ laser etched printed word AVVNL/monogram of AVVNL on front side and month and year of manufacture in figure embossed on the backside. The laser etched printing should be through complete thickness of polycarbonate.
- e) **Seal Wire :** The non-corrosive, non-magnetic stainless steel twisted wire (26 guage) confirming to IS : 280 shall be used . The seal wire shall not have affect of magnet i.e. it should not attract to magnet. The length of the sealing wire should be minimum 8" twisted two strand pull resistant stainless steel wire fixed to the seal. The diameter of each individual stand should be of 0.4 to 0.5 mm. dia and overall diameter of the seal wire shall be 0.9 to 1.0 mm. The No. of turns shall be minimum 20 per inch. The seal wire should be inserted at the female and male part during the process of moulding itself. It should be continuous and visible throughout the length of the wire. The wire shall be intact such that it can not be pulled out after sealing.
The seal wire insert hole should be just sufficient for passing the seal wire and hole of larger dia is discouraged.
- f) **Tolerance :-** Tolerance to the tune of +/- 10% is allowed in respect of various dimensions and number of turns per inch of seal wire

5. General Construction :

The seal shall be capable to withstand temperature upto 147⁰ C without any damage / deformation.

The seal shall be designed for a single use only and if tampered with the help of plier, knife or any other sharp instruments, the seal shall be damaged and due to its transparent property, the sign of internal tampering shall be easily detected. Also once opened, it can not be re-used. The seal shall be made in such a way that, it can be easily locked with the help of finger and thumb pressing no tools shall be required to close the seal in the laboratory or at site. Both the parts shall be designed in such a way that they can not be separated and the attachment shall be flexible and shall not break. After inserting the seal wire through female part, the cap of the male part shall be fitted in the female part in such a way that it should not leave any space to avoid insertion of any sharp tools for opening of seal body of the female part in hot or cold condition. The seal shall have also the following features:-

- a) Tamper resistance and reliable.
- b) Environmentally safe as it does not contain any lead.
- c) Withstand long-term exposure to direct sunlight.
- d) Required no tools for installation.
- e) Transparent.
- f) Heat resistance.

ANNEXURE-'C'

**GUARANTEED TECHNICAL PARTICULARS FOR DOUBLE ANCHOR TAMPER EVIDENT
TRANSPARENT POLYCARBONATE SEALS AGAINST TN-1291**

S.NO.	PARTICULARS	TO BE FURNISHED BY BIDDER
1	NAME & ADDRESS OF MANUFACTURER	
2	WORK'S ADDRESS	
3	RAW MATERIAL OF POLYCARBONATE SEALS	
4	PROPERTIES OF MATERIAL	
i)	USE	
ii)	SOFTNESS	
iii)	DURABILITY	
iv)	TRANSPARENCY	
5	COLOUR OF THE SEALS	
6	WHETHER DESIGN & CONSTRUCTION OF SEAL IS AS PER SPECIFICATION(GIVE DETAILS)	
7	THICKNESS OF SEAL	
8	WHETHER ETCHING/EMBOSSING OF SERIAL NO.IS AS PER SPECIFICATION (GIVE DETAILS)	
9	WHETHER PRINTING OF MONOGRAM IS AS PER SPECIFICATION	
10	MAX. WITHSTAND TEMPERATURE (UPTO 147DEG.C.)	
11	WHETHER SEAL HAVE FOLLOWING PROVISIONS	
a)	TAMPER RESISTANT AND RELIABLE	
b)	ENVIRONMENTALLY SAFE AS IT DOES NOT CONTAIN ANY LEAD	
c)	WITHSTAND LONG TERM EXPOSURE TO DIRECT SUNLIGHT	
d)	REQUIRED NO TOOLS FOR INSTALLATION	
e)	TRANSPARENT	
f)	HEAT RESISTANCE	
12	GUARANTEE OF SEAL (MIN. 5 YRS.)	
13	WHETHER SEAL IS PATENTED/ DESIGN REGISTERED & COPY OF SAME IS ENCLOSED	
14	WHETHER SEAL WIRE IS PROVIDED IN THE SEALS AS PER SPECIFICATION.	