# Technical Specifications for PR No: 6000003093

## 1.0. SCOPE:

| S.No | Brief Description of the Material | Material Code | Qty |
|---|---|---|---|
| I | **0.2S Class ABT Meter CT/PT Operated for 132KV, 150/1 CT, 132KV/110V PT, fully static AMR compatible & DLMS compliant. 1 Amp, Accuracy class 0.2S, optical port & RS 232 port, RS485 port & ethernet port.** | **CG3500208606** | **6 Numbers** |

| Sl. No. | Description | Required in Specification | Vendor to Confirm/Specify |
|---|---|---|---|
| 1 | 6 Numbers of ABT (Availability Based Tariff), Four Quadrant, Bi-Directional power flow, solidly earthed system with balanced and un-balanced load for a power factor range from zero to unity (lagging and leading), with accuracy **class 0.2s**.. | These are required for Open access system establishment and to be installed in BHEL-TSTRANSCO Substation. The below contains technical specification of the above equipment. The meters shall be suitable for being connected directly to voltage transformers (PT) having a rated secondary line-to-line voltage of 110v and to current transformers (CT'S) having a rated secondary current of 1A, 3 element 4 wire. The energy meter shall be suitable for rack/ panel/ metal box mounting.<br>It is not the intent to specify completely herein all details of the design and construction of equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous Operation in TSTRANSCO substation. The equipment offered shall be complete with all components necessary for its effective and trouble free operation in TSTRANSCO Substation. | |
| 2 | Name of the Manufacturer and Origin. | Vendor to specify | |
| 3 | Type of meter/model | 3phase,4wire | |
| 4 | Accuracy class | 0.2S | |
| 5 | Meter case | polycarbonate | |
| 6 | Battery life for clock | Vendor to specify | |
| 7 | Applicable standards: | IS:14697/1999<br>Reaffirmed 2004, CBIP publication<br>No 304, July 2008, IEC 62052-11, IEC 62053-22, IEC 62056 with latest amendments | |
| 8 | Climatic Conditions | Max. ambient air temp. ($^{o}$C) – 55 | |

| | | | |
|---|---|---|---|
| | | Min ambient air temp. (°C) – 5<br>Average daily ambient air temperature (°C) 35<br>Maximum Relative humidity (%) 74<br>Average annual rainfall (mm) 925<br>Max. wind pressure (Kg/sq.m.) 200<br>Max. altitude above mean sea level (Metres) 1000<br>Average No. of thunder storms days/year 40<br>Average No. of rainy days/year 90<br>Average No. of months/tropical monsoon condition per year 3<br>Noise level (db) 45 | |
| 9 | Supply voltage PT secondary | 3 Phase, Phase to Phase 110V with variation -30% to 20%. | |
| 10 | Frequency | 50 Hz, +/- 5% | |
| 11 | Power factor Range: | Zero lagging through Unity to Zero leading. | |
| 12 | Basic Current (Ib) | 1A | |
| 13 | Maximum Current (I max) | 120% of Ib. | |
| 14 | Starting Current (Is) | 0.1% of Ib at UPF. | |
| 15 | Power Loss | • Voltage Circuit: Shall not exceed 1W and 4 VA per Phase.<br>• Current Circuit: Shall not exceed 1VA per Phase. | |
| 16 | Clock Time Accuracy | +/- 2 minutes per year drift or better | |
| 17 | Meter case | The meter shall be made out of high quality materials to ensure higher reliability and long life with a polycarbonate meter casing. It should be compact and of reliable design to make it immune to vibrations and shocks in normal service and transportation and should be capable of withstanding several stresses likely to occur in actual service. The latest state of the art technology of surface mounting of components etc., may be used for the purpose. The soldering if any, shall be perfect without dry solders. The components shall be of high quality and comply with international industrial standard practices. The construction of the meter shall be such as to permit sealing of the meter cover, terminal cover etc. independently to ensure that the internal parts are not accessible for tampering etc. without breaking the seals. The meter window shall be transparent and made out of UV Stabilized material so that the window does not turn yellow after some years. | |

| | | | |
|---|---|---|---|
| | | The meter case and meter terminal block and cover shall meet the IS 14697 in all requirements like shock, dust proof, creepage distances and insulation etc., The meter shall be totally sealed and tamper proof. | |
| 18 | Type of installation | Outdoor | |
| 19 | Energy Measurement | • The active energy (Wh) and reactive energy (Varh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy as per class 0.2 S of IS 14697, the energy shall be computed directly in CT and VT secondary quantities, and indicated in watt-hours/varh. The harmonics shall be filtered out while measuring Wh, Var and VArh, and only fundamental frequency quantities shall be measured/computed.<br><br>• The 15-minute Wh shall have a +ve sign when there is a net Wh export from substation bus bars, and a –ve sign when there is a net Wh import. The integrating (cumulative) registers for Wh and Varh shall move forward when there is Wh/Varh export from substation busbars, and backward when there is an import.<br><br>• There shall be exclusive separate reactive energy registers in addition to all other billing parameters, one for the period when average RMS voltage is above 103% and the other for the period the voltage is below 97%. | |
| 20 | Immunity to External Factors | The meters shall be immune to external influences like magnetic induction, vibration, electrostatic discharge, switching transients, surge voltages, oblique suspension and harmonics. The meter accuracy shall not be affected by AC / DC magnetic field up to 0.2 Tesla on all the sides of meter i.e. front, sides, top and bottom of the meter as per CBIP publication No. 304 with latest amendments. Under influence of any magnetic field (AC / DC / Permanent) above 0.2 Tesla, if the accuracy of the meter gets affected, then the same shall be recorded as magnetic tamper event with date & time stamping. The energy recorded during such tamper shall be registered in a separate register in addition to main register. | |

| | | | |
|---|---|---|---|
| 21 | Sealing Points | Sealing provision shall be made available to the following:<br>• Meter body or cover<br>• Meter terminal cover<br>• MD reset button<br>• Communication ports | |
| 22 | Auxiliary power | The auxiliary power supply shall be drawn from V.T circuit from all the three phases, preferably equally, so as to ensure meter supply even if any/two of the three phases of the potential supply is lost at a time. | |
| 23 | Name plate and Marking of meter | It shall be as per IS 14697. | |
| 24 | Instantaneous parameters | <u>Parameters:</u><br><br>1. Unique identification number of the meter<br>2. Date<br>3. Time<br>4. Current - IR<br>5. Current - IY<br>6. Current – IB<br>7. Voltage - VRN for 3 Φ / 4W<br>8. Voltage – VYN for 3 Φ / 4W<br>9. Voltage – VBN for 3 Φ / 4W<br>10. Signed Power Factor – R phase<br>11. Signed Power Factor – Y phase<br>12. Signed Power Factor – B phase<br>13. System Power Factor – PF<br>14. Frequency<br>15. Signed Active Power – kW (+ Forward, - backward)<br>16. Signed Reactive Power – kVAr (+ Lag, - Lead)<br>17. Apparent Power – kVA<br>18. Cumulative Energy export – kWh<br>19. Cumulative Energy Import – kWh<br>20. Cumulative Energy – kVAh – export<br>21. Cumulative Energy – kVAh – import<br>22. Kvarh – Quadrant 1<br>23. Kvarh – Quadrant 2<br>24. Kvarh – Quadrant 3<br>25. Kvarh – Quadrant 4<br>26. Maximum demand – (kVA)export<br>27. Maximum demand – (kVA)import<br>28. Cumulative MD (MVA)export<br>29. Cumulative MD (MVA)import<br>30. Date and Time of Last MD reset<br>31. Cumulative MD reset count | |

| | | | |
|---|---|---|---|
| | | 32. Raising demand(KVA) and elapsed time<br>33. Average frequency of the previous 15-minute block<br>34. Net Wh transmittal in the previous 15-minute block, with +/-sign<br>35. Average percentage voltage<br>36. Voltage-high VArh register reading<br>37. Voltage-low VArh register reading.<br>38. Cumulative Power Down Time in DD:HH:MM<br>39. Total Voltage Harmonic Distortion VTHD<br>40. Total Current Harmonic Distortion ITHD<br>41. Cumulative tamper count<br>42. Cumulative programming count<br>43. Demand Integration Period<br>44. Programmed external CT and PT ratios set in the meter | |
| 25 | LOAD SURVEY PARAMETERS | 1. Average Frequency (Coded 00-99 for 49.00-51.00 Hz)<br>2. Average Power factor (Export)<br>3. Average Power factor(Import)<br>4. Net active energy<br>5. Active Energy (KW/kwh) Import<br>6. Active Energy (KW/kwh) Export<br>7. Apparent Energy (KVA/kvah) import<br>8. Apparent Energy (KVA/kvah) export<br>9. Kvar/ Kvarh Lag Export<br>10.Kvar/ Kvarh Lead Export<br>11.Kvar/ Kvarh Lag Import<br>12.Kvar/ Kvarh Lead Import<br>13.Percentage Voltage unbalance<br>14. Total harmonic distortion of voltage in percentage of fundamental<br>15. Total harmonic distortion of current in percentage of fundamental<br>16.Phase wise voltages and currents also shall be made available.<br>17.Date and time shall also be included<br>18.Serial number must be 10 digit only. | |
| 26 | Billing parameters | The parameters listed below for billing purpose and are logged at each day midnight (00.00Hrs) and stored in non-volatile memory for 45 days.<br><br>01. Cumulative Active Energy (kWh) – Import up to two decimal<br>02. Cumulative Active Energy (kwh) – Export up to two decimal<br>03. Cumulative Apparent Energy (kvah) – Import | |

| | | | |
|---|---|---|---|
| | | 04. Cumulative Apparent Energy (kvah) – Export<br>05. Cumulative Reactive Energy (kvarh) (Lag/Lead) - While KW is Import<br>06. Cumulative Reactive Energy (kvarh) (Lag/Lead) - While KW is Export<br>07. Kvarh during low voltage <97% }<br>08. Kvarh during high voltage >103% } *<br>09. T.O.D Parameters:<br>• Kwh and kvah- Export<br>• Kwh and kvah – Import<br>• MD in KVA<br>• Power Factor for programmed periods.<br>10. Power Down Time or Power Off Data (DD:HH:MM) | |
| 27 | Historical | Meter shall be capable of recording in its Non-Volatile (NVM) historical data consisting of billing energy, demand, TOD registers, minimum of six such data sets shall be stored and it should be possible to retrieve these data through communication port on common meter reading instrument (CMRI) or RMR. | |
| 28 | PROGRAMMABLE PARAMETERS | 1. Real time clock<br>2. Demand integration Period<br>3. Block Capture Time<br>4. Billing Date/MD reset date<br>5. Time Zones (1 to 8)<br>6. External CT/PT ratios.<br>7. events/tampers<br><br>Provisions shall be made to program the above parameters at sight using CMRI, Laptop or using Base computer software from remote station with proper security system. Logging of programmable parameter changed event (date & time) along with display of the same under On Demand Display Parameters & snapping of billing data at that time shall be stored and can be retrievable with CMRI and RMR and Laptop. | |
| 29 | Name plate details | 1 Manufacturer name<br>2 Meter serial number<br>The Meter serial Number must be in 10 digit Order only.<br>3 Firmware version for meter<br>4 Firmware version of communication software<br>The above parameters shall be displayed on demand | |

| | | | |
|---|---|---|---|
| 30 | Display | The meter shall have a display of liquid crystal display (LCD) for measured values with one digit indicating legend. The characters shall be clearly visible. Provision shall be made to read consumption in either whole units or decimal multiples or submultiples of one unit. The display shall be continuously with backlight digital type and with non-destructive read out.<br><br>In case of multiple values presented by a single display it must be possible to display the contents of all relevant memories. When displaying the memory, identifications of each tariff/parameter shall be available.<br><br>The register shall be able to record and display starting from zero, for a minimum of 1500 h, the energy corresponding to rated maximum current at reference voltage and unity power – factor. Register should not rollover in between this duration.<br><br>**RESOLUTION:**<br>1. Voltage = 0.1V<br>2. Current = 0.001A<br>3. P.F. = 0.001<br>4. Energy = 0.001 MWH<br>5. Demand = 0.1 KVA / KW=0.001 MVA/MW. | |
| 31 | Maximum Demand(MD) Recording | The maximum demand is to be monitored during each demand interval set with 15 minutes integration and the maximum of these in a month shall be stored. Whenever MD is reset the maximum demand value so registered shall be stored along with date and time. Under the current integration period, the rising demand should be displayed continuously along with the elapsed time. The registered demand and the number of times the MD is reset up to 10 shall be stored in the memory. | |
| 32 | MD Reset | The meter shall have the following provisions regarding MD reset.<br>a) Manually by operation of a button, which is to be covered and sealing provision available for such, cover.<br>b) Resetting shall also be possible through a hand held common meter reading instrument (CMRI), Widows based Laptop capable of communicating with the meter.<br>c) Provision for automatic resetting at the end of certain period may be made available and | |

| | | | |
|---|---|---|---|
| | | it should be possible to invoke this through CMRI, Widows based Laptop with date and time. | |
| 33 | Time Of Day Tariff (TOD)/Time of Use(TOU) | The meter shall contain provisions for differential pricing of energy and/or maximum demand. The meter shall be capable of being set in to minimum of 6 time zones **(00:00 to 06:00 Hrs, 06:00 to 10:00 Hrs, 10:00 to 14:00 Hrs, 14:00 to 18:00 Hrs, 18:00 to 22:00 Hrs, 22:00 to 24:00 Hrs)** optionally more time zones can be offered).The entire hours of one day or seven days of one week or 365 days of one year shall be grouped in specific time slots, each slot being associated with specific metered register(s). The meter shall have a real time clock based on a quartz crystal with a battery very independent of power supply.<br><br>It should be possible to change the time for the TOD recording through a CMRI, Laptop/remote communication using a proper security system. Meter shall be capable to log such changes with date and time stamping. The main control for this change shall be available in the base computer system. | |
| 34 | Communication Capability | The meter may be provided with two ports for communication of the measured / collected data, i.e. hardware ports. The meter shall have a galvanic ally isolated optical communication port as per IEC 1107/ANSI and additional communication port RS 232/RS 485 should be provided for remote meter reading purpose with open standard protocols. Both the ports shall communicate simultaneously. Both the ports shall be of universal type conforming to relevant standard so that these can be easily connected to a DCD, CMRI, MODEM (e.g. GSM, GPRS, CDMA, PLCC, Microwave, Radio, VSAT, Leased Line, PSTN, VPN, Ethernet etc.), Laptop, PC, GPS Time device for data communication/ time synchronization etc. The ports shall be integral part of body and sealable. All of the parameters available in the register of the meter shall be user selectable through CMRI and also with laptop.<br><br>The manufacturer shall supply the meter compatible software, Protocol software required for Windows based Laptop, CMRI, Base Computer, RMR. It is the responsibility of the meter manufacturer to provide the required software and | |

| | | | |
|---|---|---|---|
| | | all the facilities required by the TSTRANSCO to use the Windows based Laptop, DOS based hand held CMRI for reading and retrieving the data from the meter or to retrieve the available data through P&T lines, GSM, VSAT to the central computer station and regenerating appropriate reports required by the TSTRANSCO. After loading the software in the purchaser's base computer station/ central computer station, the meter manufacturer shall demonstrate the data transfer through hand held CMRI, Windows based Laptop, P & T lines, GSM, VSAT and regeneration of appropriate reports to BHEL.<br>The data element size and its over head speed of transmission shall be such that the entire billing data can be transferred within maximum time of 5 minutes. The baud rate preferable is 9600.<br><br>It should not possible to change software configuration and recorded data edit in the meter by any means except for programmable parameters agreed.<br>**"The successful Vendor need to supply required APIs to read meters data though GSM/GRPS to AMR project implementers to collect the online MRI data of all boundary meters."**<br>**Communication cable:**<br><br>The Energy meter communication cable of 1500mm length for communicating with Energy meter and Windows based Laptop (Optical to USB) shall be supplied. The cable should be flexible shielded and the two ends of the cable shall be stress relieved. | |
| 35 | Tamper Events Records | The following shall be captured when event occurrence and restoration and for each of event Captured "Cumulative tamper count" value shall be incremented.<br><br>**Events** **Description**<br>1 R-Phase – PT link Missing (Missing Potential) – Occurrence<br>2 R-Phase – PT link Missing (Missing Potential) – Restoration<br>3 Y-Phase – PT link Missing (Missing Potential) – Occurrence | |

| | | | |
|---|---|---|---|
| | | 4 Y-Phase – PT link Missing (Missing Potential) – Restoration<br>5 B-Phase – PT link Missing (Missing Potential) – Occurrence<br>6 B-Phase – PT link Missing (Missing Potential) – Restoration<br>7 Phase – R CT reverse – Occurrence<br>8 Phase – R CT reverse – Restoration<br>9 Phase – Y CT reverse – Occurrence<br>10 Phase – Y CT reverse – Restoration<br>11 Phase – B CT reverse – Occurrence<br>12 Phase – B CT reverse – Restoration<br>13 Phase – R CT Open - Occurrence<br>14 Phase – R CT Open - Restoration<br>15 Phase – Y CT Open - Occurrence<br>16 Phase – Y CT Open - Restoration<br>17 Phase – B CT Open - Occurrence<br>18 Phase – B CT Open - Restoration<br>19 Influence of AC / DC or permanent magnet - Occurrence<br>20 Influence of AC / DC or permanent magnet - Restoration<br>21 Power failure – Occurrence<br>22 Power failure – Restoration<br>**Tamper Information:** Minimum 100 events (occurrences and restoration) with date and time of event shall be recorded. The Information shall be logged on first in first out basis and total number of tamper events during the period. All these information should be available in simple and easily understandable format i.e. slot wise (i). Voltage tampers (ii). Current tampers (iii) Other tampers. | |
| 36 | Self Diagnostics Features | The meters shall have indications for unsatisfactory/non-functioning of the following.<br>1. Time and calendar<br>2. Real Time clock(RTC)<br>3. RTC battery<br>4. Non-Volatile Memory<br>5. All display segments | |
| 37 | Calendar | 30-year calendar with automatic leap year adjustment | |
| 38 | Pulse Outputs | The meter shall have a test output (pulses) accessible from the front and be capable of being monitored with suitable testing equipment. The operation indictor must be visible from the front. The resolution of the test output shall be sufficient to conduct satisfactorily accuracy test at the lowest | |

| | | | |
|---|---|---|---|
| | | load in less than 5 minutes and starting current test in less than 10 minutes. Test outputs are required for both kwh, and kvarh. | |
| 39 | Type tests | Four copies of Type test reports shall be furnished with the Bid for meters manufactured with same voltage and current reference of this specification. The type tests must have been conducted not earlier than 2 years from the date of opening of the Bid. The Bids received without type tests reports will be treated as non-responsive. | |
| 40 | Acceptance tests | The acceptance tests as stipulated in IS 14697 shall be carried out by the supplier in the presence of purchaser's representative. No of samples and criteria for conformity from each lot offered for inspection is also as per IS14697.<br>1. 15 minutes block average frequency registration.<br>2. 15 minutes block net active power registration.<br>3. Net kVArh High registration in all four quadrants when voltage is above 103% of VREF.<br>4. Net kVArh registration in all four quadrants when voltage is at VREF.<br>5. Net kVArh Low registration in all four quadrants when voltage is 97% of VREF.<br>6. Net kVArh Low registration in all four quadrants when voltage is below 97% of VREF.<br>7. Test for confirmation of midnight energy banking in power ON & power OFF conditions. | |
| 41 | Routine tests | The routine tests as stipulated in IS 14697 shall be carried out by the supplier for 100% meters supplied and test certificates, technical leaflet shall be enclosed along with each and every meter. | |
| 42 | INSPECTION: | The inspection may be carried out by the BHEL/TSTRANSCO at any stage of manufacture. The manufacturer shall grant free access to the BHEL/TSTRANSCO's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by BHEL, shall not relieve the supplier of his obligation of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective. | |

| | | | |
|---|---|---|---|
| | | The supplier shall keep BHEL informed in advance, about the manufacturing program so that arrangement can be made for inspection.<br><br>BHEL along with TSTRANSCO reserves the right to insist for witnessing the routine testing of the bought out items. The supplier shall give 15 days advance intimation to enable BHEL to depute his representative for witnessing the acceptance and routine tests.<br><br>In the event of order, Supplier shall have to get type tests conducted as per the requirement of relevant standards . Material shall be despatched only after approval of these test reports and granting of despatch clearance. After completion of Type testing and acceptance by BHEL/TSTransco, payment for the delivered consignment against despatch instructions of the Lot will be made." Payment terms will be as per BHEL norms. | |
| 43 | Training of Personnel | The Supplier shall provide necessary facilities for training of personnel of BHEL at their works/Principal Works relating to design, manufacture, assembly, testing and operation & maintenance of static meters for 4 personnel free of cost including boarding and lodging. However travel and incidental charges of the personnel will be borne by BHEL. | |
| 44 | DOCUMENTATION | 9.1 All drawings shall conform to International Standards Organization (ISO) `A' series of drawing sheet India Standards Specifications IS: 656. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units. Also a soft copy of Drawings shall be submitted.<br><br>9.2 List of drawings and documents:<br><br>The bidder shall furnish the following along with bid.<br>• Two sets of drawings showing clearly the general arrangements, fitting details, electrical connections etc.,<br>• 5 sets of Technical leaflets (users manual) giving operating instructions.<br>• The manufacturing of the equipment shall be strictly in accordance with the | |

| | | | |
|---|---|---|---|
| | | approved drawings and no deviation shall be permitted without the written approval of BHEL. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the supplier's risk.<br>• Approval of drawings/work by BHEL shall not relieve the supplier of his responsibility and liability for ensuring correctness and correct interpretation of the Drawings for meeting the requirements of the latest revision of application standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and BHEL shall have the power to reject any work or materials which, in his judgment is not in full accordance therewith.<br>• The successful Vendor shall, within 2 weeks of placement of order, submit three sets of final versions of all the drawings as stipulated in the purchase order for BHEL's approval. | |
| 45 | GUARANTEE | **The meters should be guaranteed for satisfactory operation for a period of <u>5 years</u> from the date of receipt of material at destination stores by the consignee in good condition**. During the guarantee period if the meter while in its normal operation is found defective, it shall be replaced by the supplier with a new meter free of cost with in 15 days. if the meter is not replaced within 30 days of intimation the supplier should note that the guarantee period will be extended to that extent by the number of days delayed beyond 30 days. If the tenderer does not replace within 180 days the cost of the meter(s) will be recovered from the Bank Guarantees available with the BHEL. | |

| S.No | Brief Description of the Material | Material Code | Qty | Vendor to confirm | Remarks |
|---|---|---|---|---|---|
| 2. | Pre wired metering cubicle suitable for the ABT meters. Arrangement: two meters in one panel (main & check). As per TSTRANSCO norms. | CG3500208622 | 2 Numbers | Vendor to confirm | |
| 3 | Pre wired metering cubicle suitable for the ABT meters. Arrangement: one meter in one panel (standby meter). As per TSTRANSCO Norms. | CG3500208630 | 2 Numbers | Vendor to confirm | |

## PQ & Other Terms and Conditions

| S.No | PQ & Other Terms and Conditions | Vendor Remarks |
|---|---|---|
| 1. | Prequalification Criteria<br>Vendor shall have successfully supplied ABT meter atleast 1 number to AP/TS TRANSCO (or) to Industries with AP/TS TRANSCO metering facility. Vendor shall submit proof for the same. Along with the above Commissioning/Performance certificate of the equipment from AP/TSTRANSCO/ Industries needs to be Submitted. | |
| 2 | Vendor shall offer inspection of the above material to TSTRANSCO officials and BHEL officials. Only after clearance from TSTRANSCO official's material will be accepted. | |
| 3 | Third party testing charges are to be quoted separately by vendor and shall be conducted as per TSTRANSCO norms. (NABL accredited labs only) | |
| 4 | 4 sets of test reports of each item to be submitted. | |