BIHAR GRID COMPANY LIMITED
Joint Venture of Bihar State Power (Holding) Co. Ltd. & POWERGRID

Technical offer for Supply, Installation, Testing & Commissioning of Interface Energy Meters (IEM) along with Automated Meter Reading (AMR) as per SAMAST guidelines at various

Substations of

Bihar Gird Company Ltd

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1 Background

1.1 The National Grid comprising of regional and State power systems is operating as a single synchronous system since December 2013. While the grid reliability and management has improved significantly along with the frequency profile, several building blocks of the developed grid are yet to be put in place. One of them is comprehensive accounting and settlement system that streamlines trade and exchange of power across States and regional boundaries. Government of India put an ambitious target for ramping up the RES capacity to 175GW by 2022. Taking cognizance of the variable and uncertain nature of solar and wind sources, the Central Electricity Regulatory Commission (CERC) notified the 'Framework on Forecasting, Scheduling and Imbalance Handling for Variable Renewable Energy Sources (Wind and Solar)' on 07 August 2015.

1.2 In this context, it is to mention here that The Central Electricity Regulatory Commission (CERC) has also adopted the recommendations by Technical committee of the Forum of regulators (FOR) suggested vide the "Scheduling, Accounting , Metering and settlement of Transactions in Electricity (SAMAST)"report published in July 16 and has suggested for implementation of the recommendations of this report by State Load dispatch Centers/State Transmission Utilities under the supervision of respective State regulatory commissions.

1.3 BGCL intends to implement an AMR system for transmission & sub transmission system whose scope of work is supply, installation & commissioning of necessary hardware and software (from 400KV level up to 33/22/11kV feeder level in the respective substations) throughout the geographical domain of BGCL.

1.4 A large number of SEM's installed in the state are more than 5 / 10 years old and are due for testing / replacement. Now, it has decided to replace the entire fleet of existing SEMs (15-min recording) with Interface Energy Meters-IEM (5-min interval) and implement the Automated Meter Reading, Meter Data Processing & energy accounting system under recommendations of the FOR Report (Scheduling, Accounting, Metering and Settlement of Transactions in Electricity (SAMAST).

1.5 BGCL wants to implement IEM metering, AMR system for transmission & sub transmission system whose scope of work is supply, installation & commissioning of necessary hardware and software (from 220kV level up to 33kV feeder level in the respective substations) throughout the geographical domain of the project.

2 Scope of activities

2.1 Considering the above mentioned requirements, following activities are envisaged by BGCL against the scope of work:

    2.1.1 Supply, installation/replacement and commissioning of IEM as per the specification attached.

    2.1.2 Supply, installation/replacement and commissioning of IEM with class A power quality monitoring features in compliance with CEA Technical Standard for Connectivity to the Grid (Amendment 2019) as per specification attached.

    2.1.3 Supply, installation and commissioning of DAS/AMR system for meter data

    2.1.4 AMC for hardware and ATS for software for 5 years

3 Deployment architecture

3.1 The ABT grid metering system needs to be recognized as an integrated metering system, where all meters need to act in synchronism to deliver comprehensive benefits. There is a need of a system architecture as mentioned in the below Figure

3.2 There should be Automatic meter data collection (AMR/DAS) module to cover all business requirements of SLDC of the state

3.3 Scheme shown below is tentative and only pictorial representation. Actual no. of infrastructure and solution shall be provided in price bidding document.
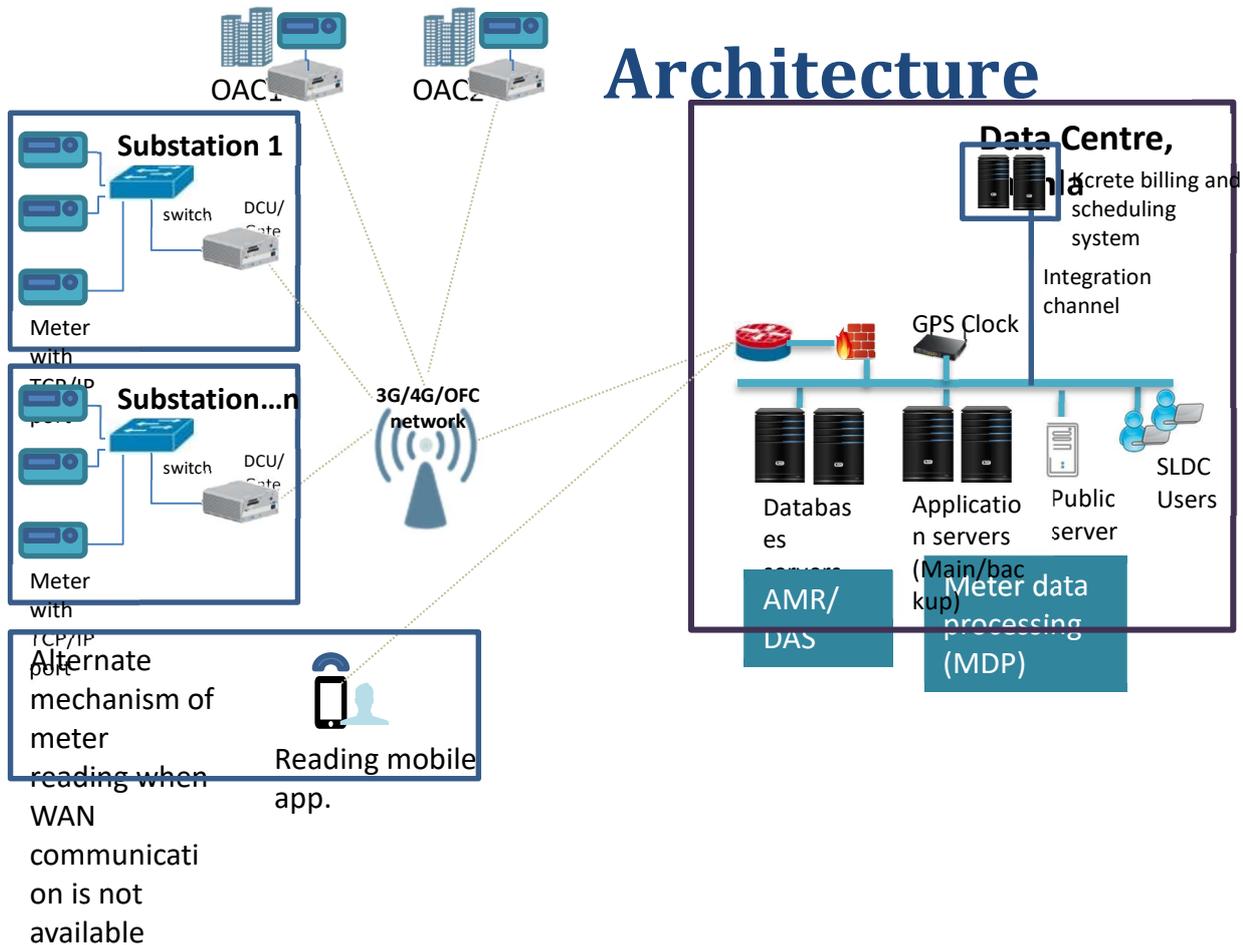

Figure 1 : Deployment architecture at substation and data centre

3.4 **At Local Substation:**

(i) **Substation meter:** IEM meters at each substation having the facility of additional TCP/IP port to provide reliable and fast communication network at substation.

(ii) **LAN switches/routers /firewalls:** These devices at each substation are required to provide the connectivity of OFC/OPGW/OPGW/4G network from each substation to central data centre for data acquisition and analysis purpose.

(iii) **DCU/gateway:** Data concentrator unit (DCU)/communication gateway shall also be installed at each substation. In view of robust and reliable monitoring requirements, DCU/gateway needs to be considered for each substation.

3.5 **Central Data Centre:**

(i) **Database Server:** There is a single database server maintained for complete system for "AMR/DAS" for data storage and backup/stand by server shall also be installed to increase the reliability of the system.

(ii) **Application Server:** Since the applications should be web/browser based, an Internet Information Server needs to be deployed on a separate server named as application server.

(iii) **Monitoring server:** To monitor the status of the meters/DCU and servers, a separate system shall be installed to show the online status of the IP based devices in a dashboard for corrective actions.

(iv) **Client PCs/Users:** It shall be possible to access the application through a web link (internet/intranet) from remote and viewing the data based on the application deployment/modules.

(v) **GPS Clock :** One GPS clock shall be installed at central location from which DB/application server shall get sync regularly and then all devices like DCU and meter shall also be synced on daily basis.

4 Supply, installation and commissioning of IEM at all substations

4.1 Conducting metering feasibility survey for all/sample identified substations of different voltage levels (combinations of 220/132/66/33kV) which include the no. of feeders in each substation, collecting the drawings of each substation, assessing the space available to install the hardware and communication setup at substation etc.

4.2 Supply of the meters shall be as the specification agreed and as attached with the tender document.

4.3 Based on the actual survey, installation and commissioning of the meters shall be executed by bidder's team as per the standard installation practices.

4.4 Detailed specification of the required interface meters are attached in **Annexure I.**

5 Supply, installation and commissioning of AMR/DAS system for meter data collection

5.1 The intent of meter data collection (AMR/DAS) scheme proposed in this document is to automate the task of data collection from each meter/location to the Central Data Collection System (CDCS) followed by validation, processing and generation of customized reports. The data shall be stored in Standard RDBMS such as SQL/ORACLE etc. database located at State Load Dispatch Centre located at Patna.

5.2 **Energy Meters**: Energy Meters to be covered under proposed AMR/DAS system are Interface Energy Meters (IEMs) manufactured as per Technical Specification attached with the tender.

5.3 **Scheme with DCU/gateway at substation:** All meters having TCP/IP port, should be connected to the central data centre through OFC/OPGW//3G/4G network and data acquisition of all IEM meters should also be performed from CDC. Provision of necessary communication links like OFC/OPGW/ 3G/4G shall be in utility's scope.

5.4 DCU/Gateway at each substation shall also be installed and connected to the same ethernet switch for increasing the reliability & availability of meter data. DCU/gateway shall have capability of storing the acquired meter data and in case of non-availability of network link, DCU/gateway shall kept the data and transfer when ever link shall be available.

5.5 DCU/gateway should have the capability to read the meters through communication interface of RS485/LAN with local personal computer and central server.

5.6 DCU/gateway should send the data to the central server through communication available like OFC/OPGW/3G/4G on hourly basis for further processing and analysis.

5.7 Same architecture shall be followed at each substation and through Network switches & routers, meter data can be sent to the central data centre (CDC).

5.8 Therefore, DCU/gateway should have the following functionality:

5.8.1 Acquiring energy data from energy meters

5.8.2   Providing energy data to central server

5.8.3   Intelligence to synchronize IEMs clock with GPS clock located at CDC

5.9   Detailed technical hardware and functional requirements of DCU/gateway are attached in **Annexure II.**

5.10   **Communication system:** Communication system to be used for transfer of data from DCU/gateway to central server at CDC may be Optic Fibre-OFC/OPGW/OPGW/VSAT/MPLS/GPRS/3G/4G. Bidder is free to suggest alternative communication media if it is more efficient and cost effective.

5.11   **Central meter data collection system (AMR/DAS):** A Central meter data collecting system to be provided at SLDC should manage all functionalities of collection of data through DCUs/gateways, validation and verification of the data, storage of the data in Standard RDBMS such as SQL/ORACLE etc. database and management of the complete AMR system.

5.12   The responsibility of providing data up to CDC (including all the hardware in between) shall be the responsibility of the bidder only.

5.13   All required hardware devices like Database servers, applications servers, routers, firewall etc. shall be supplied, installed and commissioned by bidder at central data centre (CDC).

5.14   A back-up/redundant server is required to reduce the risk of the data loss due to undefined failures at the central data centre. Backup server needs to take the regular backup of the data on a pre-defined time from the main DB server. Whenever any failures happen to the main server, back-up server can be used to run the application and regular activities but it may take 30min. to 1 hr. time for configure the back-up server as a main server for some duration and whenever the main server shall restore then application starts using the main server.

5.15   A GPS clock shall also be installed at CDC and bidder's system responsibility is to perform the time sync of all servers, DCU and meters on a predefined frequency by refereing GPS clock time.

5.16   An application of meter data collection (AMR/DAS) shall be installed at central data centre to get all meter data (instantaneous, energy etc.) from each substation through 3G/4G/OFC/OPGW/OPGW network at a desired frequency of say daily. Software shall display the data in tabular, graphical format for easy viewing. Meters have the capability to log the load survey data at every 5/15 min so load survey data reading shall be used for further DSM reporting.

5.17   All meters shall be assigned with an individual IP over TCP/IP port and same configurations shall be provided at central server and then in DCU/gateway.

5.18   In case, some meter data is not possible to get from central server due to any communication and other issues then substation PC can also be used to access a weblink to upload the CMRI and converted data in to the system/weblink which provide automatically provision to send the meter data the central server.

5.19   A monitoring application (NMS) shall be provided to track the IP based device & system status for health monitoring at central data centre. This application shall help user to check the status of the connected and disconnected devices like IEMs, DCU, switches, servers etc.

5.20   There are other utility offices which may need the meter data for some specific purpose and the accessibility of the limited part of the application with limited user rights to those offices shall also be available like for Transco, SLDC and Discom users etc.

5.21   Deployed system shall be capable to cater 100 DCUs (considering 10 meters per DCU) and CDCs application shall have a provision to handle max. 1,000 no. of meters. Data collection frequency is considered hourly from data centre (instant, LS, event etc.) while 1/5min. at each substation (instant and event).

5.22 As the end-to-end metering system shall be supplied by the single successful bidder and all meters data shall be available at CDC through AMR/DAS system.

5.23 While performing meter data collection activities, any discrepancy or missing of data in any particular block or wrong raw data format shall be displayed and downloaded in the form of a report. And bidder has the responsibility to recollect the meter data to ensure the weekly DSM billing and provided to other systems through interfaces.

5.24 Software shall have the options to generate the list of Meter IDs whose data is not available, List of meter IDs whose data is available for day wise for the required period.

5.25 Validated data shall be provided to the DSM module (third party) which shall compute deviation of regional entity by comparing the actual injection/drawal with its interchange schedule. It shall also compute the applicable deviation charges and generate the reports that include time block wise normal deviation charges, additional deviation charges, capped deviation charges, aggregate deviation charges etc.

Integration with DSM module may require some development and customisation by the bidder which shall be discussed during detailed engineering.

5.26 SLDC/Tranco users may require different set of reports and dashboards for different users and perspective therefore during detailed engineering, all requirements shall be discussed and finalised before final deployment by our service team.

6 Transition and integration phase:

6.1 Detailed engineering phase should be considered to identify the detailed requirements of project implementation for transition and final deployment. It should also identify the integration requirements with existing & to be deployed system for DSM computation, billing and energy audit systems etc.

6.2 During this phase, integration points of DAS module with other third party module along with integration methodology should be mutually agreed and finalised.

6.3 Presently the time period for scheduling and settlement at ISTS level is 15-min. Until the amendments for 5-min settlement in the appropriate regulations come, the settlement at the interstate level shall continue to be done at 15-min interval.

7 Delivery plan:

7.1 All required software module like DAS shall be installed and commissioned at SLDC Patna and all customer specific database creation and configurations shall be done at site only.

7.2 Before the commissioning and final configurations, Bidder's execution team shall share the inception report of the project which shall cover deployment architecture, flow of data acquisition process, integration techniques, dashboards and shall also discuss the expected changes so that customer specific reports can be created.

7.3 Detailed requirement understanding shall be developed with SLDC and BGCL team during detailed engineering.

7.4 Bidder's team shall work on customer specific requirements and perform factory acceptance (FAT) test then shall deploy the final solution field/site.

7.5 After commissioning, some identified users of utility team shall validate the application module against the requirement captured which shall be considered as site acceptance test (SAT).

7.6 Project execution duration should be 12 months from the date of LOA till the handover and training activities.

8 AMC and ATS for 5 years

8.1 Annual maintenance contract (AMC) for supplied hardware and Annual technical support (ATS) for software shall be provided by the successful bidder.

8.2 A web based problem/defect reporting tool where SLDC officials/bidder's team (at site) who shall execute the system, can log the issues with the flag of the severity level by using provided user name & pwd.

8.3 Bidder's team shall check the issues and try to resolve as per the process and escalate to another level if not resolved by that level of user.

8.4 A dedicate manpower shall be available at SLDC central office during this AMC/ATS tenure for coordination with substation personal, SLDC users and backend team of bidder for issue resolution on time. He/she is also being responsible to support SLDC officials for the day to day activities using system deployed at data centre.

Annual maintenance contract (AMC) for supplied hardware for 3 years

8.5 Annual maintenance contract (AMC) .

8.6 The aim of AMC is to ensure the proper functioning of the supplied devices either through rectification/correction or via replacement under the specified network environment.

8.7 Initially, this contract shall be for 3 years from the date of service agreement and can be further extended on mutually agreed terms & conditions.

8.8 The consumables and operating expenses are not covered in maintenance cost. ex. printer drum and ink charges, Stationeries, Batteries maintenance, data network charges etc. these items shall be managed by utility only.

8.9 Service and support shall be provided to utility in accordance with the terms indicated in this document/tender. In case, any service is chargeable / out of scope then it shall not be part of technical support. Support availability for a particular product version is subject to change at any time without prior notice. To fix any service request if any upgrade is required then new version shall be provided based on agreed terms and conditions only.

8.10 The law of force measure is applicable on AMC i.e. any damage caused due to short circuit, earth leakage, earthquake, fire etc. would be out of maintenance contract.

8.11 Adequate safety and security measures shall be in customer account, any theft, damage by mishandling etc. by unauthorized person shall not be covered in the maintenance contract.

8.12 If any seals are found to be broken during maintenance period then, warranty of those items shall be ceased to exist with immediately.

8.13 Hardware technology downgrade/upgrade is not the part of the AMC contract as a common practice but it is only as per contract conditions or mutually agreement between both the parties.

8.14 **Hardware maintenance:** (if supplied by us only)

- Corrective maintenance
  - Trouble shooting of failure of implemented functionality
  - Identify, isolate, and rectify a fault so that the failed equipment, machine, or system can be restored to an operational condition.
  - Hardware can be replaced with the same spec. and upgraded spec. which is fully compatible with the existing system after mutual agreement.

8.15 Hardware specific activities:

Following are the list of activities that should be carried out during AMC period:

Activity	Scope Description
Hardware installations	• Replacement of faulty hardware (with warranty items/ spares whichever applicable) including meters, N-port (if any), DCU/gateway, routers, servers, switches and firewall etc. (if provided by bidder only). • Any alteration or site shifting during maintenance period is not covered in scope. In addition of new substation, installation shall be done by bidder's team as per separate commercials. • New sites addition/sites swapping cases should be discussed and based on mutual agreement maintenance and support shall be provided to new/swapped sites. • Plan for material and coordinate with end user and vendor
Hardware configuration	• The Procedure for site configuration shall be followed for each of the device and configured accordingly. There shall be mechanism to verify the successful configuration done manually. • Re-configuration of hardware at site like modems, DCU/gateway, routers etc. to take care the change management like new meter configurations in DCU/application. • Ensure its connectivity with central server and raise the network issue to utility team & communication provide/vendor.
Maintenance and Support of brought out items	• The third party hardware to be repaired/replaced as per warranty clauses provided by them only. Bidder to ensure that system is up and running after taking the corrective measures. • Antivirus/SQL/MS office and all other third party licenses shall also be monitored by ATS team during regular visits and interaction with customer and renew of all licenses on time but commercial arrangement shall be mutually discussed with utility for license renew as per the agreement with third party provider. • Adequate number of third party supplied devices to be kept in reserve/stock against the devices whose failure may stop the business operations completely. Ex. Converters, Switch, Moxa, SIMS, Data cards, DCU/gateway etc.

Annual technical support (ATS) for software

8.16 Provide the annual technical support against all supplied software applications to run the project for next 5 years (as per contractual agreement).

8.17 The renewal of the ATS contract, if agreed by customer, shall be received 3 month prior to the expiry of the ATS support contract.

8.18 Remote access: Remote access shall be provided to technical support team for remote support, troubleshooting etc. During the entire phase of AMC/ATS support services. It may require additional tools to be installed in the server or a desktop for remote access, troubleshooting and over the air updates to connected nodes such as meters or communication devices depending upon the scope and capability of the system deployed.

8.19 **Application software maintenance activities**

Following are the list of activities that shall be carried out during the ATS project support:

Activity	Scope Description
Execution & Status Monitoring	• One person shall be available at data centre to execute the application for regular activities. • He shall also monitor data centre and substations applications (if applicable) (from remote or can get the feedbacks from substation person) on regular basis for scheduled maintenance and health monitoring of the application performances like services, database, logs status etc. • Application modules shall execute time sync through existing GPS clock on regular basis but ATS team on monthly basis shall ensure the time sync process and also plan field visit in case of time sync issue with the meters and DCU/gateway at any substation to resolve the issue on monthly basis. • Running daily back up automatically from main server to backup server but bidder's ATS team shall also monitor the data centre regularly to ensure the back-up activity and also check the healthiness of server and log files.
Maintenance	• Rectify bugs that prevent the software from being available / reported by the utility/project team during the usage of the system with respect to each software/deliverables under normal use of the hardware for which it was designed. • Resolution of the bug identified in any type of execution of the software, shall be provided as per below defined process. • Rectification of the bugs shall be provided through patches which shall be installed and checked by ATS team only. • In case of changes of DSM rules from CERC/SERC then ATS team shall implement the

	new rules and regulation during ATS period (this is not applicable as only DSM module is not in the scope of this tender but anything related to DAS module shall be applicable). • Trouble shooting of failure of implemented functionality. • Identify the problem if data doesn't acquire from some of meters and application features are not working. • Application configuration (If required) likes VL configuration change and mapping etc. • Testing / User Training / Deployment of patches.
Application installation support	• Installation and commissioning to be done on agreed new sites (over and above the specified quantities in order) and linking with central application etc. on chargeable basis. • Provide the software upgrades, patch updates in case of any issue identified or bug resolution. These would be updated at all the places of installations. • In case, due to any unavoidable reasons, utility has to relocate the data centre to other location then operation team should provide all the technical support only to transfer the hardware and software comprising set-up infrastructures, configurations and setting up the same process at new location.
Application configuration support	• Support in configuration management - alarm rules changes/user access rights if required. • During the specified and agreed period for maintenance and support, there may be chances to add/replace the new metering nodes in existing substations to the system then ATS should also cover the addition of the new metering nodes and related activities to add in the complete process but hardware arrangement to add new meters need some raw material which shall require commercial consideration.

Project monitoring & SLA reports	▪ On monthly basis, ATS team should generate a summary report including list of activities conducted for the above sections during ATS support.
	▪ In case project has some defined SLA for the ATS support then team shall maintain the SLA as well and adhere to SLA for service support.
	▪ It should cover
	   ▪ Monthly project status report
	   ▪ Monthly ATS support report

	▪ Monthly field visit report ▪ Monthly SLA status report
Meter reading	▪ Regular execution of the application modules, monitoring and report generation is also in ATS team scope. ▪ Automatic application shall be deployed but in case of meter data missed for load survey (required parameters) then manual meter reading through CMRI/laptop/mobile app. of all meters at substations shall be done on weekly basis by 2nd day of every week to ensure the DSM reporting on weekly basis. Bidder's team can take help of the substation staff to get the timely meter reading for missed data.

8.20   **Exclusions from scope of AMC/ATS:**

1. **Hardware-**
   - Major enhancement/ development more than defined limit or defined man days as per the signed contract. Any work involving efforts more than the agreed man days shall have financial impact (to be discussed and agreed internally).
   - Technology migration / upgrade (to be driven by the signed contract and agreement)
   - Third party installed hardware in the field (to be discussed and elaborated).
   - Any civil work required unless and until specified.
   - Hardware failures in the computer systems, any hardware damage due to force majeure conditions.
   - Any new addition within the substation shall be covered in the existing ATS activity (work such as addition of new feeder, new meter replacement and related application activities) but any new addition of the substation or any new geographical area shall have financial implication. Malfunctioning of meters or site material arising due improper earthing of electrical systems by Utility (in case not installed & commissioned by bidder).
   - To ensure the working of CT/PT etc. is in the scope of client.

2. **Application software service -**
   - Any modification in software / development activity more than defined man efforts
   - Customization / enhancements (new feature/new report/dashboard/new UI) having development need more than the defined limit in above clauses.
   - Any new integration requirements other than the part of contract,
   - New module/application development
   - Implementation of new packaged application
   - Technology migration / upgrades
   - Multi language development and support. Any audit related and consulting activities for process improvements/re-engineering.

3. **Project Field Maintenance**

- All activities under project services shall go through change management. For those activities under project services, ARC (Additional Resource Charge) would apply for the same. The pricing shall be mutually discussed and shall be agreed upon case to case basis before initiating the activity.
- Scope of this contract is limited to the equipment supplied against this contract only. Any new hardware / software supply & installation shall not be covered under this scope. For this, utility shall place purchase orders separately.
- The contract is limited against any defect arising due to design and manufacturing defects. Any defect arising due to operational fault or damage or natural calamity shall not be covered under this contract. This Contract does not cover any defect in the product caused by accident, misuse, neglect, alteration, modification or substitution of any of the components or parts, or any attempt at internal adjustment by unauthorised service personnel, external faults or usage other than specified. Any defects / breakages observed out of the warranty period shall be attended on chargeable basis and the same shall be decided on mutually agreed terms & conditions.

8.21 Dependencies

- The end user does not change /alter any hardware and software provided by bidder in the field at its own.
- The performance and availability of the data from field devices and meters heavily depends on maintaining the healthiness of the allied hardware and connections by the end user in the field
- The field problem resolution response shall depend on the cooperation by end user.
- Dependency for Shutdown shall be on Utility.
- To provide base data like CT/PT ratio, transformer capacity, substation details etc. shall be provided by utility only.

9 Annexure I : Specification of Interface Energy Meter (IEM)

TECHNICAL SPECIFICATIONS FOR 0.2s ACCURACY CLASS AC STATIC TRIVECTOR ENERGY METERS, SUITABLE FOR INTER UTILITY METERING, BULK CONSUMER METERING, RING FENCING METERING AND AVAILABILITY BASED TARIFF (ABT)/ DSM (Deviation Settlement Mechanism) METRING

1.0 SCOPE

This specification covers the design, engineering, manufacture, assembly, inspection and testing before supply and delivery at site/ FOR destination of class 0.2s accuracy static HT tri-vector CT/ VT operated meters, along with other associated equipments as per details given in this specification. The meters shall be used for commercial/ tariff metering for inter utility power flows/ bulk consumers as well for Availability Based Tariff (ABT) application.

The meter shall be complied with DLMS ICS specification. The meter records parameters under import and or export conditions.

One static type composite meter shall be installed for each circuit, as a self-contained device for measurement of power transmittals, as described herein, in each successive 15 minute block, and certain other functions, detailed in the following paragraphs. Meter shall have provision for in site configuration of 5 mins in future to comply with statutory requirements.

The metering system shall be housed in rack with draw out type feature capability for inserting the meter module. Current terminal connection must be shorted when module is drawn out. The rack shall have facility to accommodate either one or two individual 0.2s accuracy class meter modules for supporting the single and multiple points of installation practices respectively.

The meter shall have wide secondary current range support i.e. same meter shall be put up for 1A or 5A rating as per field availability of CT's. The meter shall support 200% Ibasic. Meter required to be commissioned at each substation shall be of 3 phase 4 wire.

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

2.0   APPLICABLE STANDARDS

2.1 STANDARDS

The equipment shall conform (for testing, performance and accuracy) in all respects the relevant Indian/ International metering standards with latest amendments thereof unless otherwise specified.

S. No.	Standard No.	Title
1.	IS 14697	AC static transformer operated Watt-hour and VAR-hour meters for class 0.2s and 0.5s
2.	CBIP technical report no. 304 (magnet immunity)	Specification for AC static electricity energy meters Immunity against magnetic interference up to 0.27T

3.	IEC 62052-11	Electricity metering equipment (AC) – General requirements, tests and test conditions
4.	IEC 62053-22	Static meters for active energy (class 0.2 S and 0.5 s)
	IEC 62056	The standard for Electricity metering – Data exchange for meter reading, tariff and load control.
5.	IS 15959 DLMS companion Standard (ICS)	AC static transformer operated Watthour and VAR hour meters for class 0.2s category B (ABT compliant) metering

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

3.0 CLIMATIC CONDITIONS

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

i)   Max. ambient air temperature (°C)   : 55
ii)   Min. ambient air temperature (°C)   : (-) 5
iii)   Average daily ambient air temp. (°C)   : 32
iv)   Max. Relative Humidity (%)   : 95
v)   Min. Relative Humidity (%)   : 10
vi)   Max. Altitude above mean sea level (m) : 1000
vii)   Average Annual Rainfall (mm)   : 1200
viii) Max. wind pressure (Kg/Sq.m)   : 195
ix)   Isoceraunic level (days per year)   : 50
x)   Seismic level (Horizontal Accn. in g)   : 0.3

4.0 PRINCIPAL PARAMETERS

The energy metering rack with meters shall be indoor type connected with the secondary side of outdoor current and voltage transformers and mounted in suitable panel/ cubicles.

S. No.	Item	Specification
1.	Type of Installation	Indoor panel/ cubicle mounted
2.	VT secondary	3x110V/√3 Phase to Neutral (3P4W) Variation -30% to +20%
3.	CT secondary	3 x /-1 Amps or 3 x /-5 Amps (configurable in field as per requirement)
4.	Dual Auxiliary AC/ DC Supply	60-240 V AC/DC ± 20%, 50/60 Hz or 24-48 V DC ± 20%

		Note: Any of the one or two auxiliary supply option shall be available
5.	System frequency	50HZ +/- 5%
6.	Earthing System	Solidly Grounded

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

5.0 TECHNICAL REQUIREMENTS

5.1 DISPLAY

The meter shall have Graphical LCD with backlight for proper depicting of values in user friendly manner like values with unit, OBIS codes, favourite page etc.

5.2 POWER FACTOR RANGE

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

5.3 ACCURACY

Class of accuracy of the metering system shall be 0.2s for energy measurement. The accuracy should not drift with time.

5.4 POWER CONSUMPTION OF METER

i) The meter must be capable to operate with the power drawn from the Auxiliary Power supply (AC/DC) instead of Station VT power supply.

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

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

5.5 STARTING CURRENT

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

5.6 MAXIMUM CURRENT

The rated maximum current of the metering module shall be 200% of basic current (Ib).

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

5.8 GENERAL CONSTRUCTIONAL REQUIREMENTS

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

i) Personnel safety against electric shock
ii) Personnel safety against effects of excessive temperature
iii) Protection against spread of fire
iv) Protection against penetration of solid objects, dust and water in normal working condition

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

The meters shall be designed with application specific integrated circuits. The electronic components shall be mounted on the printed circuit board using latest Surface Mount Technology (SMT).

All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

The metering system when mounted in panel shall conform to the degree of protection IP53 in the normal working condition of IS 12063/ IEC 529 for protection against ingress of dust and moisture.

5.9 MANUFACTURING ACTIVITIES

Meter should be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process; the Bidder should own such facilities.

Quality should be ensured at the following stages:

i) At PCB manufacturing stage, each board shall be subjected to computerized bare board testing.
ii) At insertion stage all components should under go computerized testing for conforming to design parameters and orientation.
iii) Complete assembled and soldered PCB should under go functional testing using Automatic Test Equipment.
iv) Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant morality.
v) The calibration of meters shall be done in-house.

5.10 SEALING

Proper sealing arrangement shall be provided in metering system as follows:

i) Two numbers sealing screws shall be provided on the front cover of metering module.
ii) Provision shall be available to seal the back connections on the metering rack using the back plate.
iii) Provision shall be available to seal optical port.

The sealing arrangement should be suitable for application of Polycarbonate seals.

5.11 MARKING OF METER

The basic marking on the metering module name plate shall be as follows:

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

Additionally, following information shall also be available on name plate.
i) Property Of "Purchaser name"
ii) P.O. No. "Number"

5.12 The connection diagram of the connecting 3P4W meter shall be depicted via suitable sticker pasted on meter. The meter terminals shall be properly marked to identify voltage, Current, Auxiliary and communication ports.

5.13 The meters shall be suitable for being connected directly through its terminals to VT's having a rated secondary line- to- line voltage of 110 V, and to CTs having a rated secondary current of 1A or 5A. Any further transformers/ transducers required for their functioning shall be in-built in the meters. Necessary isolation and/or suppression shall also be built-in, for protecting the meters from surges and voltage spikes that occur in the VT and CT circuits of extra high voltage switchyards.

5.14   The active energy measurement shall be carried out on 3 phase, 4 wire principle with an accuracy as per class 0.2s of IS14697. The meters shall compute the active energy and load import; active energy and load export from the substation bus bars during each successive 15 minute integration period block and store it in its non volatile memory.

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

5.16   The meter shall have Inputs/ Outputs pulsing pins availability. This shall help in transferring the same Energy parameters being recorded inside the meters on pulse output as well for SCADA application at remote distance.

5.17   The meter shall compute the reactive power on 3-phase, 4-wire principle, with an accuracy as per relevant IS/ IEC standards, and integrate the reactive energy algebraically into two separate reactive energy registers, one for the period for which the average RMS voltage is greater than 103% (Reactive High), and the other for the period for which the average RMS voltage is below 97.0% (Reactive Low). When lagging reactive power is being sent out from substations bus bars, reactive registers shall move forward. When reactive power flow is in the reverse direction, reactive registers shall move backwards.

5.18   Further, the reactive energy shall also be available in four different registers as-
i)   Reactive import while active import
ii)   Reactive import while active export
iii)   Reactive export while active import
iv)   Reactive export while active export.

5.19   Active and Apparent energies shall also be made available by meter in separate energy registers as –
i)   Active energy Import
ii)   Active energy Export
iii)   Apparent energy (while active import)
iv)   Apparent energy (while active export)

5.20   Meter shall have provision to compute apparent energy based on lag only or lag+lead. The same shall be configured at factory end.

5.21   The meters shall be compatible with ABT tariff as well as TOD tariff.

5.22   For reactive power and reactive energy measurement, limits of errors all the four quadrants shall be in accordance to IS14697 / IEC 62053-23.

5.23   Each meter shall have a calibration LED (visual) for checking the accuracy of active energy measurement. Further, it shall be possible to switch over the same test output device to reactive energy via suitable means provided on the metering system. This LED shall be visible from the front side.

The metering system shall normally operate with the power drawn through the auxiliary AC or DC supply. The metering system design should enable the auxiliary supply to be switched automatically between the AC and DC voltage, depending upon their availability. Typical auxiliary voltages available are 60-240 V AC/DC ± 20%, or 24-48 V DC ± 20% .*The system shall continue to work even if any one of the above auxiliary supply (AC/ DC) is present.*

5.24   Each metering module shall have a built-in calendar and clock, having an accuracy of one (1) minute per month or better. The calendar and clock shall be correctly set at the manufacturer's works.

An automatic backup for continued operation of the meter's calendar-clock shall be provided through a long life battery, which shall be capable of supplying the required power for at least two years under meter un-powered conditions. The meters shall be supplied duly fitted with the batteries, which shall not require to be changed for at least ten years, as long as total supply interruption does not exceed two years.

5.25   TOD (Time of day registers): The meter shall have TOD registers for active energy import and export, apparent energy import and export and apparent MD import and export. Maximum eight time of day registers including universal (0-24 hrs) register can be defined. It shall be possible to program number of TOD registers and TOD timings through suitable high level software/ MRI as an authenticated transaction.

5.26 Maximum Demand (MD) Registration: The meter shall continuously monitor and calculate the average demand of configured parameter during the integration period set and the maximum, out of these shall be stored along with date and time when it occurred in the meter memory. The maximum demand shall be computed on fixed block principle. The maximum registered value shall be made available in meter readings. The integration period shall be set as 15 minutes that shall be capable to change to other integration period (30/ 60 minutes), if required, through suitable high level software/ MRI as an authenticated transaction.

5.27 Maximum Demand Reset: Following provisions shall be available for MD reset in meter –

i)   Auto billing at predefined date and time
ii)   Manual via common MD reset button (optional)
iii)   Authenticated transaction through suitable high level software/ MRI (optional)

5.28   The display shall be of Graphical LCD type with colored back-lit and soft push button. Individual display shall be provided for all the meters housed in a metering rack.

The display shall indicate direct values (i.e. without having to apply any multiplying factor) of measured/ computed parameters as per the meter commissioning. It should be possible to easily identify the single or multiple displayed parameters through legends on the metering system display like OBIS codes etc.
The register shall be able to record and display starting from zero, for a minimum of 1500 hours, the energy corresponding to rated maximum current at reference voltage and unity power factor. The register shall not roll over in between this duration.

5.29   Each of the metering module shall display on demand & in Auto scroll mode the following quantities/ parameters:

i)   LCD segment check
ii)   Date
iii)   Time
iv)   Cumulative active energy import
v)   Cumulative active energy export
vi)   Cumulative net active (Import – Export) energy
vii)   Cumulative reactive energy lag while active import
viii)   Cumulative reactive energy lead while active import
ix)   Cumulative reactive energy lag while active export
x)   Cumulative reactive energy lead while active export
xi)   Cumulative apparent energy (while active import)
xii)   Cumulative apparent energy (while active export)
xiii)   Cumulative Reactive High energy
xiv)   Cumulative Reactive Low energy
xv)   Last 15 minutes block average of active import energy
xvi)   Last 15 minutes block average of active export energy
xvii)   Last 15 minutes block average of the net active (Import – Export) energy
xviii)   Last 15 minutes block average frequency
xix)   MD reset count
xx)   Maximum demand apparent (while active import) for current month (0-24 hrs)
xxi)   Maximum demand apparent (while active export) for current month (0-24 hrs)
xxii)   Cumulative active import energy reading of predefined date and time for monthly billing purpose
xxiii)   Cumulative active export energy reading of predefined date and time for monthly billing purpose
xxiv)   Cumulative net active (Import – Export) energy reading of predefined date and time for billing purpose
xxv)   Cumulative apparent energy (while active import) reading of predefined date and time for monthly billing purpose
xxvi)   Cumulative apparent energy (while active export) reading of predefined date and time for monthly billing purpose
xxvii)   Maximum demand for apparent (while active import) of predefined date and time for monthly billing purpose
xxviii) Maximum demand for apparent (while active export) of predefined date and time for monthly billing purpose
xxix)   Present anomaly status
xxx)   Date of first occurrence of anomaly
xxxi)   Time of first occurrence of anomaly
xxxii)   Time of last restoration of anomaly
xxxiii) Date of last restoration of anomaly

xxxiv)   Total anomaly count

There should a facility to configure the display parameters in favorite pages.

5.30   Load Survey: Each metering module shall have a non-volatile memory in which the following shall be automatically stored for each successive fifteen (15) minute block:

i)   Active import
ii)   Active export
iii)   Average frequency
iv)   Apparent while active import
v)   Apparent while active export
vi)   Reactive High energy
vii)   Reactive Low energy

15-minute average of the above parameters shall be available for last thirty five (35) days. It shall be possible to select either energy or demand view at Base Computer Software (BCS) end. The load survey data should be available in the form of bar charts as well as in spreadsheets. The BCS shall have the facility to give complete time synchronized load survey data both in numeric and graphic form.

5.31   Billing parameters: The predefined date and time for registering the billing parameters of shall be 00.00 hours of the first day of each calendar (billing) month. Each meter shall store the following parameters corresponding to defined bill dates for up to last six (6) months:

i)   Active energy import
ii)   Active energy export
iii)   Apparent energy (while active import)
iv)   Apparent energy (while active export)
v)   Maximum demand Apparent (while active import)
vi)   Maximum demand Apparent (while active export)

5.32   Daily midnight parameters: The metering modules shall store following end day parameters for last thirty five (35) days:

i)   Active energy import
ii)   Active energy export
iii)   Reactive high energy
iv)   Reactive low energy

5.33   Data Communication Capability:

The metering system should have a suitable communication ports for local reading, remote and on-line communication facilities.

Each metering module shall have an optical galvanically isolated serial communication (in the form of 1107 port) & USB port on its front for tapping all the data stored in its memory. For the purpose of local meter reading Pen drive shall used. It shall be possible to download meter data via Optical port by connecting laptop computer directly. The overall intention is to have the local ports is to tap the data stored in meter once in a week/month and transmit the same to PC with BCS for view. Both optical and USB port shall have sealing provisions.

The metering system shall further provide a serial RS232, RS485 (In & Out) and Ethernet communication TCP/IP port for remote data transfer to a central location. This port shall be capable of data transfer to a remote computer over suitable communication media (GPRS/VSAT/ Leased line/ OFC) using suitable communication hardware (modems/ multiplexer/ communication cables etc.) as required for proper functioning of remote meter reading scheme. All port shall communicate simultaneously. TCP/IP shall have provision for configuring multiple open protocol like MODBUS and DLMS using two separate channel simultaneously.

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

5.35   The meters shall safely withstand the usual fluctuations arising during faults etc. In particular, 115% of rated VT secondary voltage applied continuously and 190% of rated voltage applied for 3.0 seconds, and 20 times of rated

CT secondary current applied for 0.5 seconds shall not cause any damage to or malfunctioning of the meters. Further the immunity of metering system to external magnetic field shall be as per latest CBIP recommendations.

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

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

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

   ii.   Non-linear compensation for measurement CT errors (ratio and phase) compensation; this shall allow multiple ratio and phase adjustments to be applied for different load points per phase input of the meter.

It should be possible to program the errors of CT and VT in meter through front optical communication port using compatible high level software. Metering system design should support this feature and further it shall be possible to configure & incorporate this feature in meter at later stage whenever required.

5.38   The metering modules shall be draw out type with automatic CT shorting feature so as to ease the testing/ replacement of meters without disturbing the system.

5.39   The meter display should depict the total harmonic distortion (THD) of current and voltages up to 31st level of power quantity for providing the feature of supply monitoring to Utility.

6.0 ANOMALY DETECTION FEATURES

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

i)   Phase wise Missing Potential – The meter shall detect missing potential (1 or 2 phases) provided the line current is above a specified threshold. The voltage at that stage would be below a specified threshold.
ii)   Phase wise Current Circuit Reversal – The meter shall detect reversal of polarity provided the current terminals are reversed. This shall be recorded for 1 or 2 phase CT reversal.
iii)   Voltage Unbalance – The meter shall detect voltage unbalance if there is unbalance in voltages.
iv)   Current Unbalance – The meter shall detect current unbalance if there is unbalance in load conditions. Meter should ensure true system conditions before going for current unbalance checks.
v)   CT Miss – The meter shall detect current miss if the current is below a defined threshold, provided the phase voltage is above a specified threshold.

   Snapshots of phase wise voltage, phase wise active current and phase wise power factor shall be provided with above specified anomaly events.

   Further, each meter module shall record the following events along with total duration:
i)   Power On/Off – The meter shall detect power off if both the auxiliary supplies fail. The event shall be recorded on the next power up. At the same time power on event shall be recorded. No snapshot shall be logged with this event.
ii)   Feeder Supply Fail -This event shall be logged when feeder supply, i.e. all the voltages goes below certain threshold. No snapshot shall be logged with this event.

6.2   Last two hundred (200) events (occurrence + restoration), in total, shall be stored in the meter memory on first in first out basis.

6.3   There shall be five separate compartments for logging of different type of anomalies :

Compartment No.1	100 events of Missing Potential
Compartment No.2	100 events of CT Reversal
Compartment No.3	100 events for Power Failure / Power On-Off
Compartment No.4	50 events of Transaction related changes as per ICS Category B

Once one or more compartments have become full, the last anomaly event pertaining to the same compartment shall be entered and the earliest (first one) anomaly event should disappear. Thus, in this manner each succeeding anomaly event shall replace the earliest recorded event, compartment wise. Events of one compartment/ category should overwrite the events of their own compartment/ category only. In general persistence time of 5 min. for occurrence and restoration respectively need to be supported in meter.

6.4   Anomaly count should increase as per occurrence (not restoration) of anomaly events. Total no. of counts shall be provided on BCS.

7.0 TRANSACTIONS

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

8.0 SELF DIAGNOSTIC FEATURE

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

i)   Non volatile memory
ii)   RTC battery

The above malfunctioning should be flagged in the meter memory and should be made available in meter reading data.

9.0 TYPE TEST CERTIFICATES

The meters shall be fully type tested as per relevant standards IS 14697. The type test report of the meters shall be submitted by bidder along with the offer. Type test reports shall not be more than 2 years old.

GURANTEED TECHNICAL PARTICULARS

S. No.	Technical Specification Requirements	Bidder's Offer
1.	Manufacturer's name & Country	
2.	Type of Meter	
3.	Name and model no. of offered product	
4.	Standards to which meter complies	
5.	Accuracy class • Active energy measurement • Reactive energy measurement	
6.	Metrology indicator provided on meter and switching facility for reactive & apparent energy	
7.	Variation of voltage at which system functions normally	
8.	Minimum Starting current	
9.	Maximum current	
10.	P.F. range	
11.	Power consumption per phase • Voltage Circuit • Current Circuit	
12.	AC and DC Auxiliary supply ratings for powering up the metering system	
13.	Sealing arrangement	
14.	Energy parameters recorded in meter	
15.	ABT compatibility	

16.	TOD compatibility	
17.	MD Reset provisions • Auto • Manual	
18.	Demand integration period	
19.	Load survey parameters recorded in meter	
20.	Billing parameters recorded in meter	
21.	Daily Midnight parameters recorded in meter	
22.	Communication Capability for • Local reading • On demand Remote reading	
23.	Facility of external CT/ VT error compensation	
24.	Anomaly detection features	
25.	Self diagnostics features	
26.	Magnetic immunity	
27.	Maximum nos of communication ports i.e. Optical, USB, RS232 etc.	

Annexure: - II

TECHNICALSPECIFICATION OF ABT meter with Class A POWER QUALITY measurement features.

Technical specification for accuracy class "0.2S" AC static Tri-vector energy meter with class "A" power quality measurement

1.0   SCOPE

1.1   This specification covers the design, engineering, manufacture, assembly, inspection and testing before supply and delivery at site/ FOR destination of class 0.2S accuracy along with this Class A conforming to latest edition of IEC 61000-4-30 HT tri-vector CT/ VT operated meter. The meters shall be used for commercial/ tariff metering for inter utility power flows/ bulk consumers as well for Availability Based Tariff (ABT) application.

Meter shall be suitable for power quality measurements, monitoring and recording as per latest international standards which shall support high sampling rate of 1024 samples/ cycle, extensive data logging capabilities, big intuitive display and high end communication capabilities. It shall have capabilities to capture, log and report PQ events, provide necessary data for analysis and assessment of power quality compliance to prevailing international standards.

1.2   The meter shall have wide secondary current range support i.e. same meter shall be put up for 1A or 5A rating as per field availability of CT's. The meter shall support 200% Ibasic. The meter shall supply in 3-phase 4-wire mode. However, provision shall be there to configure the meter in 3-phase 3-wire type, as & when required, through authenticated/secured command.

1.3   The metering system shall be housed in rack with draw out type feature capability for inserting the meter module. Current terminal connection must be automatically shorted when module is drawn out.

1.4   The meter shall be self-powered. The meter shall normally operate with the power drawn from the VT secondary circuits, without the need for any auxiliary power supply. However, there shall be provision of functioning of the meter with the help of auxiliary supply, both AC & DC. The power supply in self powered condition shall be from all the three phases of VT secondary, preferably equally, to ensure meter power supply when VT fuse(s) failures happen in one or two phases.

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

2.0   APPLICABLE STANDARDS

2.1   STANDARDS

The equipment shall conform (for testing, performance and accuracy) in all respects the relevant Indian/ International metering standards with latest amendments thereof unless otherwise specified.

IEC 61000-4-30 edition 3	Electromagnetic compatibility (EMC)-Testing and measurement techniques-Power quality measurement methods
IEC 62586-1	Product and performance requirements for PQ instruments
IEC 62586-2	Functional tests and uncertainty requirements

IEEE 519-2014	Recommended Practices and Requirements for Harmonic. Control in Electrical Power Systems.
EN 50160	Expected limits for the power quality parameters in a public distribution network.
IEC 61000-4-7	Measurement method and limits for harmonics and inter harmonics
IEC 61000-2-4	Limits for conducted disturbances for harmonics and inter harmonics
IEC 61000-3-8	Mains signaling voltage on the supply voltage for mains signaling frequencies over 3kHz
IEC61000-4-15	Flicker Measurement
IEC 62052-11	Electricity metering equipment (AC)-General requirements, tests and test conditions- Part 11: Metering equipment
IEC62053-22	Electricity metering equipment (AC) – Particular requirement –Static meters for active energy (class 0.2S and 0.5S)
IEC62053-24	Electricity metering equipment (AC) – Particular requirement Static meters for reactive energy (class 2 and 3)
IS 14697	AC static transformer operated Watt-hour and VAR-hour meters for class 0.2S
IS 15959	DLMS Indian Companion Standard – Category 'B' for Boundary/Bank/Ring/ABT Metering

3.0 CLIMATIC CONDITIONS

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

i) Max. ambient air température   : 55 ºC
ii) Min. ambient air temperature   : (-) 5 ºC
iii)   Average daily ambient air temp   : 32 ºC
iv)   Max. Relative Humidity   : 95 %
v) Max. Altitude above mean sea level   : 2000 m
vi)   limit range of operating   : (-)40ºC to +70 ºC
vii)   Storage temperature range   : (-)40ºC to +70ºC
viii)   Operating temperature range   : (-)20 to +60
ix)   Display operating temperature range : (-)10 to +60

4.0 PRINCIPAL PARAMETERS

The energy meter shall be indoor type connected with the secondary side of outdoor current and voltage transformers and mounted in suitable panel/ cubicles.

S. No.	Item	Specification
1.	Type of Installation	Rack Type, Indoor/outdoor installation
2.	VT secondary	HV 3x110V/√3 V Phase to Neutral (3P4W) 3x110V V Phase to Neutral (3P3W) Variation -30% to +20%
3.	CT secondary	Ib: 1A, Imax: 2A

		or Ib: 5A, Imax: 10A Site configurable
4.	Power Supply	Self Powered Auxiliary AC/ DC Supply 60 to 230 V AC/DC, +/- 20%, 50/60 Hz
5.	System frequency	50 Hz +/- 5%

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

5.0   TECHNICAL REQUIREMENTS

5.1   POWER FACTOR RANGE

The metering system shall be suitable for full power factor range from zero (lagging) through unity to zero (leading). The meter shall work as an active energy import and export meter along with reactive (lag and lead) meter. The energy measurement should be true four quadrant type.

5.2   ACCURACY

Class of accuracy of the metering system shall be 0.2S for energy measurement along with confirming to Class A as per IEC 61000-4-30 and IEC62586-2 (Edition 3). The accuracy should not drift with time.

5.3   POWER CONSUMPTION OF METER

The meter must be capable to operate with the power drawn from the Auxiliary Power supply (AC/DC) instead of Station VT power supply.

5.4   STARTING CURRENT

The meter should start registering the energy at 0.1% Ib and unity power factor.

5.5   MAXIMUM CURRENT

The rated maximum current shall be 200% of basic current (Ib) as per the configuration.

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

5.7   GENERAL CONSTRUCTIONAL REQUIREMENTS

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

i)   Personnel safety against electric shock
ii)   Personnel safety against effects of excessive temperature
iii)   Protection against spread of fire
iv)   Protection against penetration of solid objects, dust and water in normal working condition

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

All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

The metering system when mounted in panel shall conform to the degree of protection IP54 in the normal working condition for protection against ingress of dust and moisture.

5.8   SEALING

Proper sealing arrangement shall be provided as follows:

i)   2 nos. sealing arrangement at back side of the meter.
ii)   2 nos. sealing arrangement between meter and rack at front.
iii)   2 nos. sealing, back terminals of product with terminal cover

The sealing arrangement should be suitable for application of Polycarbonate seals.

5.9   MARKING OF METER

The marking on every meter shall be in accordance with IEC. The basic marking on the meter name plate shall be as follows:

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

Additionally, following information shall also be available on name plate.
i) Property Of "Purchaser name"
ii)P.O. No. "Number"

5.10 The connection diagram of the connecting 3P4W/3P3W meter shall be depicted on meter. The meter terminals shall be properly marked to identify voltage, Current, Auxiliary and communication ports.

5.11 The meters shall be suitable for being connected directly through its terminals to VT's having a rated secondary line- to- line voltage of 110 V, and to CTs having a rated secondary current of 1A or 5A. Any further transformers/ transducers required for their functioning shall be in-built in the meters. Necessary isolation and/or suppression shall also be built-in, for protecting the meters from surges and voltage spikes that occur in the VT and CT circuits of extra high voltage switchyards.

5.12 The active energy measurement shall be carried out on 3 phase, 4 wire principle with an accuracy as per class 0.2S for active energy. The meters shall compute delta values of energies and store in the nonvolatile memory at each successive integration period block. The period should be configurable from 1 to 60 minutes. The instant parameter values shall be configurable to store in nonvolatile memory as well at each successive integration period block. It shall be configurable to select minimum/maximum/average/instant values to log for the instantaneous parameters.

5.13 The meter shall have Inputs/ Outputs pulsing pins availability. This shall help in transferring the same Energy parameters being recorded inside the meters on pulse output as well for SCADA application at remote distance. 4 pulse pins will be fixed for output functionality and 4 pulse pins can be configured for input or output functionality. Potential free pulse output shall withstands 6kV impulse.

5.14 The meter shall have Inputs/ Outputs pulsing pins availability. This shall help in transferring the same Energy parameters being recorded inside the meters on pulse output as well for SCADA application at remote distance. Pulse output shall be configurable for following power quality parameters and general parameters.

Power quality parameters at output	General parameters at output
High THD power	Energy pulse on channels
High harmonic voltage	End-of-SIP,DIP Pulse
High harmonic current	End-of-DIP pulse
Frequency healthy	Rate and MD register change
Phase wise Voltage THD (%)	Remote Control
Phase wise Current THD (%)	Average voltage healthy
Phase wise voltage healthy	All phase voltage healthy

6.0 POWER QUALITY AND ANOMALY DETECTION FEATURES

6.1 Power Quality Meter shall be Class A conforming to IEC 61000-4-30 edition 3

6.2 The meter shall have capability to detect and log power quality parameters as defined in IEC61000-4-30 as per the methods specified therein and as well complying with requirements of IEC 62586-2.

- Supply Frequency
- Magnitude of supply Voltage
- Magnitude of supply Current
- Flicker
- Voltage harmonics
- Current harmonics
- Voltage inter harmonics
- Current inter harmonics
- Over voltage deviation
- Under voltage deviation
- Voltage Unbalance
- Mains signaling voltage

6.3 The meter shall have feature to detect and log the occurrence and restoration of power quality events as defined in IEC61000-4-30 along with date and time of event.

- Voltage Sag or Dip
- Voltage Swell
- Interruption
- Rapid voltage change

6.4 The meter shall store following power quality parameters (10 minute aggregated values) data for analysis and meter shall store at least for 30 days.

- THD Voltage (phase wise)
- Flicker

● Supply Frequency
● Voltage unbalances (u2)
● Voltage harmonics L1 (2 to 25th)
● Voltage harmonics L2 (2 to 25th)
● Voltage harmonics L3 (2 to 25th)
● Current harmonics L1 (2 to 25th)
● Current harmonics L2 (2 to 25th)
● Current harmonics L3 (2 to 25th)
● L1 Flicker (Pst)
● L2 Flicker (Pst)
● L3 Flicker (Pst)

6.5 Waveform and RMS value capturing
For analysis, the meter shall have provision to log 10 cycle pre and post waveforms with RMS value for following events:
● Voltage Sag or Dip
● Voltage Swell
● Interruption

Software shall have provision of direction analysis of event as upstream and downstream

6.6 TDD and K-factor
The meter shall have provision for monitoring following:

● % TDD current phase wise
● K- factor
● Crest factor

6.7 Power quality compliance:
Meter shall have capability to log all the parameter required to generate compliance report as per EN50160 & IEEE 519. Limits should be configurable using configuration tool and this stored data in the meter shall be used to generate compliance report.

Meter shall also support the data required to generate ITIC curve using software.

6.8 Web server for remote display:
Meter shall have built in web server to enable viewing of basic Instantaneous parameters and cumulative energy registers data.

6.9 The meter shall have feature to detect and log the occurrence and restoration of anomalies along with date and time of event.

Following configurable events shall be provided in meter for which the persistence/restoration time can be configured through BCS:
● Over voltage
● Under voltage
● Current circuit open
● Current terminal shorting
● Reverse current direction (phase wise)
● Current missing (phase wise)
● Current unbalance
● Power fail
● Neutral Disturbance
● Magnet Interference
● Missing voltage (phase wise)

● Voltage unbalance
● Invalid Phase Association
● Invalid Voltage
● Feeder Supply Fail

Following quality parameter events shall be provided for which % occurrence/restoration limit and time can be configured through BCS:

● Phase wise Voltage THD
● Phase wise Current THD

Last thousand (1000) events (occurrence + restoration), in total, shall be stored in the meter memory on first in first out basis.

6.10 DISPLAY PARAMETERS

Meter display shall be Intuitive, easy to use and understand. The meter shall have minimum 4.3 inch graphical Color display with High resolution.
Meter shall support following display parameters:

1. Voltage (Phase wise)
2. Current (Phase wise)
3. Power (Phase wise)
4. Vector diagram
5. Voltage wave form (Phase wise)
6. Current wave form (Phase wise)
7. Voltage-Current wave form (Phase wise)
8. Voltage %THD (Phase wise)
9. Current %THD (Phase wise)
10. Current %TDD (Phase wise)
11. Voltage harmonic for 3rd order (phase wise)
12. Voltage harmonic for 5th order (phase wise)
13. Voltage harmonic for 7th order (phase wise)
14. Current harmonic for 3rd order (phase wise)
15. Current harmonic for 5th order (phase wise)
16. Current harmonic for 7th order (phase wise)
17. Instant voltage harmonic graphical trend up to 50th order (Phase wise)
18. Instant current harmonic graphical trend up to 50th order (Phase wise)
19. Flicker (phase wise)
20. Voltage crest factor (Phase wise)
21. Current crest factor (Phase wise)
22. Voltage deviation (Under & Over)
23. Voltage unbalance (% value)
24. Current unbalance (% value)
25. Main Signaling voltage
26. Voltage sequence component
27. Current sequence component
28. Cumulative active energy import
29. Cumulative active energy export
30. Cumulative net active (Import – Export) energy
31. Cumulative reactive energy lag while active import
32. Cumulative reactive energy lead while active import
33. Cumulative reactive energy lag while active export
34. Cumulative reactive energy lead while active export
35. Cumulative apparent energy (while active import)
36. Cumulative apparent energy (while active export)
37. Cumulative Reactive High energy

38. Cumulative Reactive Low energy
39. Last block average of active import energy
40. Last block average of active export energy
41. Last block average of the net active (Import – Export) energy
42. Last block average frequency
43. Maximum demand apparent (while active import) for current month (0-24 hrs)
44. Maximum demand apparent (while active export) for current month (0-24 hrs)
45. Cumulative active import energy reading of predefined date and time for monthly billing purpose
46. Cumulative active export energy
47. Cumulative net active (Import – Export)
48. Cumulative apparent energy (while active import)
49. Cumulative apparent energy (while active export)
50. Maximum demand for apparent (while active import)
51. Maximum demand for apparent (while active export)
52. Total event count
53. Present event status
54. Time of last restoration of event
55. Date of last restoration of event
56. Meter information
57. Configuration page for network setting

6.11 Active and Apparent energies shall also be made available by meter in separate energy registers as –
i) Active energy Import total
ii) Active energy Export total
iii) Active energy Import fundamental
iv) Active energy Export fundamental
v) Active energy import total (phase wise)
vi) Active energy export total (phase wise)
vii) Net active energy
viii) Apparent energy (while active import)
ix) Apparent energy (while active export)

6.12 The reactive energy shall also be available in eight different registers as-
i) Reactive import while active import
ii) Reactive import while active export
iii) Reactive export while active import
iv) Reactive export while active export
v) Reactive import
vi) Reactive export
vii) Reactive inductive
viii) Reactive capacitive
ix) Net reactive energy
x) Net Reactive high and low
xi) Reactive high import and export

6.13 Meter shall have provision to compute apparent energy based on lag only or lag+lead. The same shall be configured at factory end.

6.14 For reactive power and reactive energy measurement, limits of errors all the four quadrants shall be in accordance to IEC 62053-23 and IEC62053-24.

6.15 The metering system shall normally operate with the power drawn through the auxiliary AC or DC supply. The metering system design should enable the auxiliary supply to be switched automatically between the AC and DC voltage, depending upon their availability.

6.16 Meter shall have a built-in calendar and clock, having an accuracy of <2 min/year or better. The calendar and clock shall be correctly set at the manufacturer's works.

6.17 TOD (Time of day registers): The meter shall have TOD registers for below energies and MD values:

    i)   Active energy Import total
    ii)   Active energy Export total
    iii)   Active energy Import fundamental
    iv)   Active energy Export fundamental
    v)   Apparent energy (while active import)
    vi)   Apparent energy (while active export)
    vii)   Reactive import while active import
    viii)   Reactive import while active export
    ix)   Reactive export while active import
    x)   Reactive export while active export

Meter shall have support of eight configurable demand registers. It shall be possible to program number of TOD registers and TOD timings through suitable high level software/ MRI as an authenticated transaction.

6.18 Display sequences: Meter shall have color graphical display. The meter shall have all screens by default in manual sequences; user can configure auto screens using manual button / software. Meter shall have provision to configure favorite page with the screens available in manual mode. The cycling delays shall be configurable. The configuration option shall be available in the meter with password protection.

The display shall indicate direct values (i.e. without having to apply any multiplying factor) of measured/ computed parameters as per the meter commissioning. It should be possible to easily identify the single or multiple displayed parameters through legends on the metering system display.

6.19 Data loggers (Load survey): Meter shall have a non-volatile memory with two individual loggers to store the delta energy values, instantaneous parameter and power quality data values for each successive configurable integration period block. The integration period shall be configurable for each logger. It can be configured for 5, 15, 30 or 60 Minutes.

Minimum 60 days with 5 minute interval shall have support in meter.

Following parameters shall have provision for logging:
a)   Energy parameters
b)   Voltage (Phase wise)
c)   Current(Phase wise)
d)   Phase voltage
e)   Line Voltage
f)   Frequency
g)   Power factor (Phase wise)
h)   Power factor (Phase wise)
i)   Phase angle (Phase wise)
j)   Voltage THD (Phase wise)
k)   Current THD (Phase wise)
l)   Power THD (Phase wise)
m)   Voltage harmonic up to 50th order (Phase wise)
n)   Current harmonic up to 50th order (Phase wise)
o)   Voltage inter- harmonic up to 50th order (Phase wise)
p)   Current inter- harmonic up to 50th order (Phase wise)

The instantaneous parameters can be configured for minimum/maximum/average or instant values for the configured integration period.

It shall be possible to select either energy or demand view at Base Computer Software (BCS) end. The logger data shall be available in the form of bar charts as well as in spreadsheets. The BCS shall have the facility to give complete time synchronized load survey data both in numeric and graphic form.

6.20 Daily snapshot parameters: The meter shall store the snapshot (or value) of configured parameters (out of 28 energy parameters) at configured time for last hundred 65 days. The BCS will provide facility to configure the parameters and time.

6.21 Data Communication Capability: The metering system shall have following communication ports for local/remote reading. All the communication channels shall be capable of simultaneous and independent communication.

- IEC1107 optical port
- RS232 port (for remote communication or dedicated to Modem)
- RS485 port (should be configurable on DLMS/MODBUS)
- Ethernet port (DLMS TCP/MODBUS TCP)
- USB (micro B connector) for meter reading or configuration through Laptop or Tab device.

6.22 Meter shall have provision for PQDIF (Power Quality Data Interchange Format) for integration with any power quality analysis and reporting software. It shall have minimum provision of following power quality data:
- PQ events (Sag, Swell and Interruption)
- Voltages phase wise (10 min aggregation parameters)
- THD Voltages phase wise (10 min aggregation parameters),
- Voltages unbalance (10 min aggregation parameters)

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

6.24 Meter shall have a non-volatile memory in which the parameters as mentioned in this specification shall be stored. The non-volatile memory shall retain the data for a period not less than 10 years under un-powered condition; battery backup memory shall not be treated as NVM.

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

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

  ii. Non-linear compensation for measurement CT errors (ratio and phase) compensation; this shall allow multiple ratio and phase adjustments to be applied for different load points per phase input of the meter.

7.0 Software package

7.1 Software should be support with a powerful multi-user web-based over intranet software package to configure and setup the power quality meter. In addition, the software should provide tools for analysing the measured data. Generally, the following capabilities should be maintained by the software packages:
- EN 50160 reports/Customized limits report
- IEEE 519 (2014) report
- PQ report
- BIS PQ report

8.0 TEST CERTIFICATES

- Power quality compliance certificate as per IEC 61000-4-30 Ed. 3, IEC62586-2 (Class-A)
- Type test report (IS 14697)
- DLMS ICS compliance (IS 15959)

GURANTEED TECHNICAL PARTICULARS

S.N	Technical Specification Requirements	
1.	Manufacturer's name & Country	
2.	Type of Meter	

3.	Name and model no. of offered product	
4.	Standards to which meter complies	
5.	Power quality Class	
6.	Accuracy class	
7.	Metrology indicator provided on meter and switching facility for reactive & apparent energy	
8.	Voltage and frequency range	
9.	Maximum current	
10.	Variation of voltage at which system functions normally	
11.	Minimum Starting current	
12.	P.F. range	
13.	Power consumption per phase • Voltage Circuit • Current Circuit	
14.	AC and DC Auxiliary supply ratings for powering up the metering system	
15.	Sealing arrangement	
16.	Size (W x H x D) in mm Weight Mounting	
17.	Digital input/output	
18.	Communication ports i.e. Optical, USB, RS232, RS485 and Ethernet etc.	
19.	Communication protocol	
20.	IEC 61850	
21.	IEEE 1159.3 (PQDIF)	
22.	HTTP web server	
23.	EN 50160 - PQ report	
24.	Sampling rate	
25.	Data update rate	
26.	Time syncing options	
27.	Memory	
28.	Anti-alias filter provision	
29.	Power quality parameters: • *Supply Frequency* • *Magnitude of supply Voltage & Current* • *Flicker* • *Voltage & Current harmonics* • *Voltage & Current inter harmonics* • *Over & Under voltage deviation* • *Voltage Unbalance* • *Mains signaling voltage*	
30.	Fixed power parameter logger:	
31.	Power quality Events: (with 10 cycle pre and post waveforms with RMS value)	

32.	*TDD, K-Factor and Crest factor*	
33.	Power quality displays • *Flicker* • *Voltage crest factor* • *TDD* • *K-factor* • *Crest factor* • *Current sequence component* • *Mains signaling voltage* • *PQ frequency* • *Voltage unbalance ratio* • *Current unbalance ratio* • *Voltage deviation* • *Voltage sequence component* • *Voltage harmonics* • *Current harmonics* • *THD*	
34.	Trends (up to 50th order) on meter display	
35.	Individual Harmonics (both Voltage and Current): Up to 50th order	
36.	9.1 Two independent Loggers Configurable for interval 1, 5, 10, 15, 20, 30 or 60 Minutes.	
37.	Anomaly detection features	
38.	IS15959 compliance and category	
39.	Energy parameters recorded in meter	
40.	ABT compatibility	
41.	TOD compatibility	
42.	MD Reset provisions: Auto or Manual	
43.	Demand integration period	
44.	Energy parameters for Loggers, Billing and Midnight	
45.	Facility of external CT/ VT error compensation	

10 Annexure II : Specification of DAS and DCU/Gateway

Specification of DCU/Gateway and Data acquisition system (DAS) module

Intent of DAS

The intent of DAS scheme is to automate the task of energy meter data collection from each meter/location from the Central Data Centre (CDC) followed by meter data validation, processing and generation of customized reports and integration with other modules. Collected data should be stored in database central data centre. DAS module should have following different capabilities to cater the requirements.

1. Communication with meters and DCU/gateway

2. Event notification and alarming

3. DCU/Gateway functional specification

4. DCU/Gateway hardware specification

Detailed working features of each function are described in the following sections:

1. Communication with meters and DCU/gateway

1. Data acquisition module should be capable to get the meter data directly from meters or via DCU/gateway for selected/configured metering location periodically on schedule basis.

2. All boundary meters at each substation having RS485 or TCP/IP port (preferred with TCP/IP port, if available in meter) should be connected to the LAN switches to make the network and finally connected to the DAS system installed at CDC through DCU/gateway therefore software must be able to support all data reading from each type of feeder meters (viz. instantaneous, energy, load survey, event etc.) with time stamping read using MODBUS/DLMS protocol at hourly reading frequency (user configurable to daily/weekly).

3. Gateway should have further facility to connect to the DAS server at CDC either through cellular 2G/3G/4G communication media or via dedicated OFC/MPLS network.

4. DCU/Gateway should be responsible to collect the data from meters and sent same to DAS server at CDC. DCU should also be responsible to send the data to the local system installed at each substation for the purpose of local substation meter data monitoring.

5. DAS application after collection of data from DCU, should store the data into database like SQL/Oracle at CDC.

6. Communication of data transfer from DCU/Gateway to DAS server at CDC should be encrypted and secure.

7. DCU/gateway configurations and re-configurations should be managed from central data centre like reading frequency, reading schedule change etc. through web portal.

8. DAS should have the facility to fill the non read meter data via some auto fill mechanism so that 100% data of 5/15min. load profile parameters for billing purpose can be acquired. Missing data filling process via DLMS should be auto scheduling as per the availability of the network communication media.

9. DAS application should be web based (intranet) application to be accessed through user id and pwd from the network connected with the CDC server over intranet.

10. DAS system should implement highly efficient WAN data transfer protocol (as used by global IT companies) to CDC which reduces bandwidth requirements, hardware requirements and enhances reliability.

11. Software should be able to consider the configuration changes like CT/PT ratios, meter change etc. for accurate analysis reports.

12. Software should also have a built-in mechanism for data backup and cleaning, with retrieval mechanism for configurable number of days.

13. **Time synchronization:** DCU/gateway shall be able to auto sync regularly from the CDC server which will further connected to the reliable time reference like GPS clock and NTP server and then DCU/Gateway shall be able to auto sync the meter clock time (if the time difference lies between minimum and maximum threshold value of the time difference) on a predefined frequency.

2. Event notification and alarming

14. DAS system should have the provision to send the notification of any identified events like
    a. High/low limit violation of instantaneous parameters
    b. Limit violation alarms for virtual groups also
    c. Events logged by the meter
    d. Communication failure

15. At the time of any event occurrence, it should generate a visual alarm on the screen of monitoring software at data centre. Notification may include email and recipients should be pre-configurable according to the utility to one/multiple users.
16. Software should be able to maintain all generated alarm history which can be seen by user based on the selection criteria.

3. DCU/gateway functional specification

17. DCU firmware shall be developed on Linux platform and compatible to Linux kernel 4.X series.
18. DCU/Gateway should be capable to acquire meter data from different protocols i.e. MODBUS, DLMS over different communication ports i.e. RS485 and ethernet.
19. DCU/Gateway should be capable to acquire all type of meter data like Instantaneous parameter at the time of collection, energy data, Load survey profiles, event data, midnight energy data and Date & time of collection of data
20. DCU/Gateway should be capable to transfer the complete meter data to central data centre using MPLS/OFC/VSAT and 2G/3G/4G communication media.
21. DCU/Gateway should support multithreading acquisition on ethernet port as well as simultaneous acquisition on each serial port.
22. DCU/Gateway should be capable to have dual SIM option for redundancy and auto switching from one SIM to another SIM shall be available.
23. DCU/Gateway should have non-volatile memory for storing meter data for 30 days for FIFO buffer mode.
24. DCU/Gateway shall be able to communicate to the local server for substation local monitoring as well to the DAS server at CDC. DCU shall have the capability to transfer the meter data from local substation to CDC as per defined schedule and automatic retries for unsuccessful file transfer cases.
25. DCU/Gateway should have
    a. Number of meter connected per TCP/IP port over modbus channel at 9600 baud rate –

    - 30 (max) in case of 5min. polling for 5 parameters

    - 50 (max) in case of 15min polling and >10 parameters.

26. The DCU/gateway shall support on demand meter reading function also. On demand meter reading can be executed either locally through local application or remotely through CDC end application whenever required. On demand reading can be executed for meter reading from any meter connected to the DCU/gateway irrespective of meter protocol and communication port.
27. **DCU/Gateway data transfer:** The DCU/gateway should be able to communicate through the 3G/4G communication, specifications defined below:
    a. Supported GSM/GPRS/EDGE : Quad Band 850/900/1800/1900 MHz
    b. SIM Lock Function – Yes
28. **Remote configuration:** DCU/gateway should have the facility to upgrade the firmware version over WAN communication network using proper authentication through DOTA (download over the air) process. It should also be possible to configure DCU/gateway in single or batch mode.

4. DCU/gateway hardware specification

DCU/gateway package should have two separate module i.e. power supply module and Gateway/DCU module.

Power supply for DCU/Gateway	
Input Voltage Range	Input: 100 - 270 V AC (± 10%), 0.2A max 110 – 240 V DC (± 10%), 0.2A max Output: 5.2V @ 1A (Input 48V DC to 5V DC output compatible)
Mounting	Wall / DIN
Ingress protection	IP 54
Certification	**EMC:** *Draft EN 301-489-1, Draft EN 301-489-17, Draft EN 301-489-52, EN 55032 (Class B), EN 61000-3-2, EN 61000-3-3* **Immunity:** *Draft EN 301-489-1, Draft EN 301-489-17, Draft EN 301-489-52, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5*

		EN 61000-4-6, EN 61000-4-11 **Safety:** *EN 62368-1: 2014 (Second edition)*
Gateway/DCU		
Mechanical	Mounting	Wall / DIN
	Ingress Protection	IP 54
	Power connection	Input: 5.2V at 1A max. over Modular DC Jack
	Enclosure material	PC-FR (Ploy-carbonate flame retardant grade)
Communication	Ethernet	1 x RJ45, 10/100 Mbps / 6kV isolation from AC mains, IPV4/IPV6
	RS 485	2 x RS 485 half duplex / 6kV isolation from AC mains
	4G / 3G / 2G	Dual Nano SIM – with auto SIM switching, 4G fallback to 3G / 2G / Operating voltage 1.65 to 3.3V DC GSM/GPRS/EDGE: Quad Band 850/900/1800/1900 MHz
General features	Processor	528 MHz, Single core ARM Cortex A7
	Storage	NAND Flash - 512 MB / SDRAM - 256 MB
	User Interface	2 x Push buttons
	LED	2 x Bi Color LED (for device health and network health)
	RTC	Internal Digital temperature compensated Real time clock (battery back)
Environmental	Operating Temperature range	-10 to 55^{0}C
	Extended Temperature range	-20 to 70^{0}C
	Storage Temperature	-20 to 80^{0}C
	Relative Humidity	95%, non-condensing
	Vibration	up to 2g
Operating system	Linux	Linux OS
	Protection features	Temperature protection: Over two trip points, Trip0 @ 85 Deg. And Trip1 @ 105 Deg. / Inbuilt Watch dog timer
Certification	EMC / Immunity	**EMC:** *Draft EN 301-489-1, Draft EN 301-489-17, Draft EN 301-489-52* *EN 55032 (Class B), EN 61000-3-2, EN 61000-3-3* **Immunity:** *Draft EN 301-489-1, Draft EN 301-489-17, Draft EN 301-489-52* *EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5* *EN 61000-4-6, EN 61000-4-11* **Radiated Spurious emission :** *ETSI EN 301-908-1, 3GPP TS 51.010-1*
	Safety	**Safety:** *EN 62368-1: 2014 (Second edition)*
Accessories	Antenna	2 nos. Whip Antenna

Annexure III: Specification for Metering Panels

10.1 [Suitable for internal wirings to accommodate eight or more sets of metering equipment]

"SIMPLEX" metering panel having size approximately 2200 mm(height),800 mm(depth),800 mm(width) fabricated from 2(two) mm thick steel sheet(CRCA) totally enclosed , dust tight, weather proof and vermin proof, floor-mounted &self -vertical front , Indoor type cubicle provided with an access door in two halves at the back side with latch and locking arrangement .

The bottom of the panel frame shall be about 100 mm high tie space all around , shall be erected by means of evenly spaced grout bolts projecting through base channel (MS) members of the frame, the panel shall be provided with suitable cable entry arrangement through bottom plates. Panel inside shall be powder coated with same colour inside as well as outside of light grey shade-631 of IS: 5 or equivalent international standards.

Panel wiring shall be standard switch board type, single core (stranded, minimum 7 conductor) annealed copper wires, PVC insulated suitable for tropical climate as specified below, FRLS type 1100 V grade. Wiring of CT circuit/ PT circuit shall be with 2.5 mm2 respectively with standard ferrules and ring type lugs/ Ross Courtney.

Panel shall be provided with common earthing rail that shall be connected with flexible GI strips with Substation earthing. Ground bus of galvanized iron bar not less than 5 mm by 25 mm shall be provided along the back of panels, the ground buses shall be bolted to the frame of the panel in such a way as to make good electrical contact with the panel. Hinged doors and all equipment on the metering cubicle shall be connected to the frame with braided copper strip.

Panels shall be completely enclosed and shall be dust, moisture and vermin proof to meet the requirements of IP: 54. The panels shall be free standing, floor mounting type and shall be of rigid, structural frames, enclosed completely, made with specially selected, smooth finished, CRCA sheet of thickness not less than 2.0 mm for front, sides, top & bottom portions and the doors. There shall be sufficient reinforcement to ensure level surfaces, resistance to vibration, and rigidity during transportation, installation and operation.

All doors and removable covers shall be gasketed all around with neoprene gaskets. Ventilating louvers shall have screens and filters. Design, material selection and workmanship shall be such as to result in neat appearance both inside and outside, with no weld, rivets or bolt heads apparent from outside and with all exterior surfaces true and smooth.

All the Metering panels shall be suitable for accommodating eight sets of self contained metering sets with wiring provisions of current, potential and Aux. AC/DC circuits and communication accessories.

	Each metering panel shall contain the following items and accessories.	
	METERING EQUIPMENT PANEL: Requirement: as per price schedule	
S.No	Descriptions of materials in short	Quantity
1. .	Microprocessor based CT/PT operated, self-contained (rack mounted meter module, calculating unit & display controller unit along with front & rear ports all complete as considered to be one set) 3 phase 3 wire/4 wire 1A/5A site selectable / programmable suitable for unbalanced load, HT Energy meters, class 0.2S Wit associated test terminal blocks installed in the front side and mounting of the meters and TTB shall be panel flush type to comply with Indian Companion Standard (ICS) of Category B for DLMS specification as detailed in this section and other section of tender Documents	As per requirement
2. .	Terminal Boards, CATD M4 (disconnecting type) or equivalent for CT/PT circuit.	As per requirement plus 20% Extra
3.	Terminal Boards stud type CATM6 or equivalent for other circuits except CT/PT.	As per requirement plus 20% Extra
4.	Potential supply complete fuse assembly, 4 nos (3 fuses + 1 link) for each meter. HRC 2A rating.	24 nos.
5.	Complete fuse assembly :	
I.	i)Panel LTAC incoming single phase 240 V, 50 HZ supply complete fuse assembly, 2 nos (1 fuses + 1 link). HRC 16A rating.	02 (two) nos.
II.	ii)Panel Space Heater supply single phase 240 V, 50 HZ supply complete fuse assembly, 2 nos (1 fuses + 1 link). HRC 2A rating.	02 (two) nos.
III.	Panel illumination single phase 240 V, 50 HZ supply complete fuse assembly, 2 nos (1 fuses + 1 link). HRC 2A rating.	02 (two) nos.
IV.	Panel socket single phase 240 V, 50 HZ supply complete fuse assembly, 2 nos (1 fuses + 1 link). HRC 6A rating.	02 (two) nos.
V.	Panel incoming DC fuses & outgoing DC fuses	14(fourteen) nos.

.   .

6.	Panel space Heater: 240V, 50 Hz, 100 W, from any reputed make.	01 no.
7.	Thermostat (30 – 110 0C), from any reputed make.	01 no.
8.	Piano type switches , 240 V, 50 Hz , 6A	03 nos.
9.	Power supply socket(3 pin type) , 240 V , 50 Hz, 6A	01 nos.
10	Panel florescent / LED type illumination fittings, 240 V, 50 Hz, 20 W.	01 set.
11	Door limit switch. 240 V, 50 Hz, from make.	01 no.
12	FRLS, PVC insulated, annealed Cu flexible panel wires, minimum 7strands (2.5 mm2 for CT and 2.5 mm2 for PT or pressure circuit) as per requirement.	1(one) lot
13	Lugs, Ross Courtney, nuts, bolts, washers, spring washers, channels, rails, and PVC type perforated Cable dressing enclosures, etc. as per requirement.	1(one) lot
14	Panel Earthling Rail and flexible GI strips for substation earthling connection.	1(one) set.

Annexure IV : Specification for LT (FRLS) Cables

1. SCOPE

1.1. This specification covers Design, Engineering, Manufacture, Type Testing and Testing including special testing at the manufacturer's works and Delivery at sites as per General Technical Specification as per following:-

1.2. LT CONTROL CABLE (FRLS TYPE) - CU. CONDUCTOR:
1.1 KV (E) stranded plain (untinned) annealed high conductivity copper conductor. Type A PVC insulated, extruded type ST-1 PVC inner sheathed Single layer GI round/ flat armoured, overall served with Type ST-1 PVC suitably compounded to ensure specified fire retardant low smoke properties, heavy duty control cable to IS : 1554 (Pt. I) (latest) and also meeting type and special test requirements as detailed herein.

10.1.1 NOTE:
1. Conductors shall conform to flexibility class 2, of IS: 8130.
2. PVC type shall conform to IS: 5831

2. TECHNICAL QUALIFYING REQUIREMENTS FOR BIDDERS

2.1. As per NIT

3. MATERIALS REQUIRED

3.1. As per Price Schedule

4. TECHNICAL REQUIREMENTS
4.1. General :
   4.1.1. The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation and uncontrolled back fill and chances of flooding by water.
   4.1.2. They shall be designed to withstand all mechanical, electrical and thermal stress under steady state and transient operating conditions.
   4.1.3. The XLPE insulated cables shall be capable of withstanding a conductor temperature of 250°C during a short circuit without any damage. The PVC insulated cables shall be capable of withstanding a conductor temperature of 160°C during short circuit.
   4.1.4. The Copper wires used for manufacturing the cables shall be true circular in shape before stranding and shall be uniformly good quality, free from defects.
   4.1.5. The fillers and inner sheath shall be of non-hygroscopic, fire retardant material, shall be softer than insulation and outer sheath shall be suitable for the operating temperature of the cable.
   4.1.6. Progressive sequential marking of the length of cable in meters at every one meter shall be provided on the outer sheath of all cables.
   4.1.7. All the cables shall pass fire resistance test as per IS: 1554 (Part-I).

4.1.8. The normal current rating of all PVC insulated cables shall be as per IS: 3961.

4.2. PVC Control Cables

4.2.1. The PVC (70ºC) insulated control cables shall be of FRLS type, C1 category, conforming to IS: 1554 (Part-I) and its amendments, read along with this specification. The conductor shall be stranded copper. The insulation shall be extruded PVC type-A of IS: 5831. A distinct inner sheath shall be provided in all cables whether armoured or not. The over sheath shall be extruded PVC type ST-1 of IS: 5831.

4.2.2. Cores shall be identified as per IS: 1554 (Part-I) for the cables up to four
(4) cores as per clause 10.1 of IS 1554 (Part-1) and for cables with more than four (4) cores the identification of cores shall be done as per clause
10.1 or 10.3 of IS 1554 (Part-1) [to be decided during drawing approval stage].

5. STANDARDS

5.1. Cables specified in this specification shall conform to the standards mentioned against each and/or as applicable Indian Standards or equivalent with materials of components like conductor, insulation, sheathing, armouring etc. conforming to relevant IS/International /established Foreign Standards/practices. For cables covered under this specification the following standards/practices latest issues)besides any other standards practices separately mentioned, will apply:-

I.	IS 1885	Electro-technical Vocabulary part XXII Cables, Conductors and accessories for electricity supply.
II.	IS 3961	Recommended current ratings for cables.
III.	IS 1554 (Pt. I)	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100 V.
IV.	IS 9968 (Pt. I)	Elastomer insulated cables for working voltage up to and including 1100 V.
V.	IS 5831	PVC insulation and Sheath of electric cables.
VI.	IS 8130	Conductors for insulated electric cables and flexible cords.
VII.	IS 6380	Elastomeric insulation & sheath of electric Cables.
VIII.	IS 3975	Mild steel wires, strips and tapes for armouring of cables.
IX.	ASTM-D2843	Standards test method for density of smoke from the burning or decomposition of plastics.
X.	ASTM-D2863	Method of measuring minimum oxygen concentration to support like combustion of plastics.
XI.	IEEE 383	Standard for type test of electric cables.
XII.	IEC 332 (Pt. I)	Tests on electric cables under fire conditions.
XIII.	IEC 331	Fire resisting characteristics of Electric cables.

XIV.	IEC 754	Test on gasses evolved during Combustion of electric cables.
XV.	SS 424 1475(SVENSKASTANDARDS)	Flammability test for cables.
XVI.	IS-694 (1990)	PVC insulated cables for working voltages up to and including1100 V
VII.	IEC 60811	Common test methods for insulating and sheathing materials of electric cables and optical cables
VIII.	IEC 60332	Tests on electric and optical fiber cables under fire conditions(all relevant parts)
XIX.	IEC 60331	Tests for electric cables under fire conditions (all relevant parts)
XX.	IEC 60754	Test on gases evolved during combustion of materials from cables-
		Part 1: Determination of the amount of halogen acid gas
		Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity.
XXI.	IS:10418	Wooden drums for electric cables

5.2. Notwithstanding the publication year, if mentioned here, the latest issues including the new ones superseding those mentioned in this specification if any, shall apply.

6. **OPERATING CONDITIONS**
   6.1. Control Cables shall be used for CT secondary circuit, PT secondary circuit and for 220V/250V DC Control & Indication circuit.
   6.2. Voltage variation shall be +/- 20%
   6.3. Frequency variation shall be +/-5%
   6.4. For purpose of this specification ambient temperature shall be 50 deg C peaks and 45 deg C average.
   6.5. The cables will be laid in air, in concrete/brick trenches on rocks, shafts, risers, trays, etc. made from MS channels, angles, flats, MS round etc. Cables may be laid in ducts and buried direct in the ground also.

TECHNICAL SPECIFICATION FOR LT CONTROL CABLES (FRLS TYPE)

1.	Designation	:	1100 V (E) grade, multi-core copper conductor, flat/round armoured, PVC insulated GI overall served with PVC suitably compounded to ensure specified fire retardant low smoke properties heavy duty control cable.
2.	Reference	:	IS 1554 (Pt. I); IS 8130; IS 5831; IS 3975, other applicable Standard & test requirement as subsequently specified.
3.	Conductor	:	Standard plain(un-tinned)annealed high conductivity copper conductor Class 2 table 2 of

		IS 8130.
4.	Insulation :	PVC Type- A to IS 5831.
5.	Inner sheath & filler:	PVC Type ST-1 to IS 5831. Inner sheath shall be extruded.
6.	Armouring :	GI Wire/strips to IS 3975 and IS 1554 (Pt. I)
7.	Outer sheath :	PVC Type ST-1 to IS 5831 suitably compounded for FRLS properties and with suitable additives to prevent attack by rodents and passing test requirements specified hereinafter.
8.	Factory test :	As specified hereinafter.
9.	Colour code (4 core) : Colour code (above 4 core) :	Red-yellow-blue-black As per IS 1554 (Pt. I)

7. IDENTIFICATION:

7.1. Throughout the length cables served with FRLS PVC outer sheath shall be identified by surface marking by embossing/machine printing giving:

7.1.1. Name of manufacturing and year of manufacture:

7.1.2. Cable description e.g. 1100 V 4C x 10.0 Sq. mm Cu PVC FRLS Type cable etc.

7.1.3. Name of customer e.g. CUSTOMER: BSPTCL

7.1.4. Embossed length measure in Meters at every meter interval.

7.1.5. Core identification shall be done as per clause 10.1 & 10.3 of IS 1554 (Pt. I)

8. DRUMMING, REELING AND MARKING :

8.1. Cables shall be supplied in non-returnable wooden or steel drums of heavy construction. Wooden drum shall be properly seasoned sound and free from defects. Wooden preservatives shall be applied to the entire drum.

8.2. Standard lengths of each size of cables shall be 500M 5% reel lengths for power cables and 1000M 5% for control cables unless otherwise specified. The cable length per drum shall be subject to tolerance of plus or minus 5 % of the standard drum length. Non-standard lengths are not acceptable.

8.3. A layer of water proof paper shall be applied to the surface of the drums and over the outer most cable layer.

8.4. A clear space of at least 40 mm shall be left between the cables and the lagging. 8.5.Each drum shall carry the manufacturer's name, the purchaser's name, address
and contract number and type, size and length of the cable, net and gross weight stenciled on both side of the drum. A tag containing the same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

8.6. Packing shall be sturdy and adequate to protect the cables, from any injury due to mishandling or other conditions encountered during transportation, handling and

storage. Both cable ends shall be sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation and erection.

9. TESTS

9.1. Following type tests including special tests, acceptance and routine tests as per requirements of relevant standards mentioned shall be carried out on conductors, cores and finished cables at the premises of NABL accredited Laboratory and/or at the premises of the manufacturer.

9.2. TYPE AND SPECIAL TESTS FOR FRLS CABLES

TYPE TESTS :

A)   Test on Conductor

1.	Tensile test (for Aluminium)	: As per IS 8130.
2.	Annealing test (for Copper)	: As per IS 8130.
3.	Wrapping test (for Aluminium)	: As per IS 8130.
4.	Conductor resistant test (for Aluminium and Copper) : As per IS 8130.	
B)	Test for armouring wires	: As per IS 3975.
C)	Test for thickness of insulation and sheath	:As per IS 5831.Appendix A of IEC 502
D)	Physical test for insulation and outer sheath	: As per IS 5831
	a) Tensile strength and elongation at break	
	b) Ageing in air oven	
	c) Shrinkage Test	
	d) Hot deformation	
	e) Loss of mass in air oven	
	f) Heat Shock test	
	g) Thermal Stability	
	h) Cold Bend Test (for diameter <= 12.5 mm)	
	i)Cold Impact Test (for diameter > 12.5 mm)	
E)	Insulation resistance test	As per IS 1554 (Pt. I)
F)	High voltage test (water immersion test)	As per IS 1554 (Pt.I)
G)	High voltage test at room temperature	As per IS 1554 (Pt.I)
H)	Flammability Test	As per IS 1554 (Pt.I)
I)	Tests for bleeding and blooming of pigments	As per IS 5831
J)	Fire resistance Test	As per relevant IS

9.3. SPECIAL TESTS:

9.3.1.   Oxygen Index test as per ASTM-D2863.
9.3.2.   Temperature Index test to ASTM-D2863.
9.3.3.   Acid gas generation test as per IEC-754-1.
9.3.4.   Smoke density test as per ASTM-D2843-77.
9.3.5.   Flammability test viz. chimney test class F3 to Swedish Standard SS 424- 1475 and Bunched Cable Tray test to IEEE 383 shall be carried out and

tests shall conform to the requirements of the respective standards specified.

9.4. ACCEPTANCE TESTS FOR FRLS CABLES (Shall be conducted as per standard)

a)	Tensile test (for Aluminium)	:	IS 8130.
b)	Annealing test (for copper)	:	IS 8130.
c)	Wrapping test (for Aluminium)	:	IS 8130.
d)	Conductor resistant test	:	IS 8130.
e)	Test for thickness of insulation and sheath:		IS 5831 (all tests)
			Appendix A of IEC 502.
f)	Insulation resistance test	:	IS 5831
g)	High voltage test	:	IS 1554 (Pt. I)
h)	Dimensional check	:	

9.5. ROUTINE TESTS FOR FRLS CABLES (Shall be conducted on each drum of Cable):
   9.5.1. Conductor resistance test : IS 8130
   9.5.2. High voltage test: IS 1554(Pt. I).
9.6. Existence of facilities for carrying out all the above tests in manufacturer's works shall be specifically confirmed. Dates of installation and commissioning and details of make, year of manufacture etc. for machines/test apparatus for carrying out 'special tests' shall be furnished.

9.7. Cost of all test pieces and tests shall be to the bidder's account.
9.8. The purchaser at his discretion may call for additional tests not included here, as may be required to ensure that all materials are satisfactory and in accordance with the specifications. All tests shall be carried out by the manufacturer expeditiously free of cost.
9.9. Routine TCs for all drums shall be furnished. .
9.10.   All TCs shall be submitted to the purchaser for approval before despatch.
9.11.   All TCs shall be furnished in quadruplicate, the first three copies having original signature of the appropriate testing authority with designation and also name in block letter while the fourth copy may be Xerox one.

9.12.   The "LOT" size shall be decided by the purchaser representative at the time of inspection and testing at the manufacturer works based on QAP of the Bidder.
9.13.   Under armour and overall diameters of cables (average values) shall be recorded on each Routine test certificates.

9.14.   DRAWING AND DOCUMENTS
As part of the offer, the tender shall furnish relevant descriptive and illustrative literatures on cable and also the drawings and technical data for the following besides other :

   9.14.1. Descriptive literature/manufacturer's leaflets giving construction details cross-section dimensions and characteristics of different type of cables offered.
   9.14.2. Current rating of cable including derating factors due to grouping, ambient temperature and type of various installations.

9.14.3. Table for short circuit withstand capacity of cable and armour material indicating time duration.

9.14.4. Write-up, sketches, other details illustrating manufacturer's recommendation for splicing jointing and termination.

9.14.5. Table of voltage drop per ampere meter duty considering impedance at 50 Hz at maximum conductor operating temperature.

9.14.6. Tables giving mechanical constructional details including weight, diameter etc.

Annexure V: Specification for Server and Client Computers

1. **Client Computers (PC)**

S.No.	Particulars	Specifications
1	Make	IBM/DELL/HP
2	Processor	Intel i7, 3.4 Ghz, 04 Core OR better
3	Memory type & size	16 GB RAM
4	Hard Disk Capacity (In- built)	500 GB
5	Display Screen size & type	23" or higher wide range TFT/LCD , Flat Monitor
6	No. of USB Port	Min 4 USB
7	Other ports/connectors provided	(i) 2 10/100 LAN ports for receiving signal from Ethernet Switch (ii) One additional LAN port for receiving time synchronization signal from GPS receivers.
8	Operating system offered	WINDOWS 10 OEM
9	Warranty	3Years

2. **Server**

S.No.	Particulars	Specifications
3	Processor	Intel Xeon 3.0 Ghz or higher, 1x8 Core
4	Memory type & size	16 GB RAM
5	Hard Disk Capacity (In-built)	2 X 500 GB (Usable)
7	Network Interface Card	02 nos.
8	Server Version	Windows Server 2019 Standard OEM
9	Warranty	3Years