

BIDDING DOCUMENT FOR

**“Construction of one 33kV feeder at Kamakhya GIS, AEGCL for power supply to
MAP Buildcon”**

FUND: “Deposit Scheme”



(E-Tender)

(VOL – II)

**BID IDENTIFICATION NO:
AEGCL/MD/Tech-406/O&M(LAR)/MAP Buildcon/33kV Bay/BID (R)**

**ASSAM ELECTRICITY GRID
CORPORATION LIMITED**

Rs.1000

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Section - 4

Technical Specification

(This Section contains the Technical Requirements and supplementary information that describe the Goods and Related Services)

4.1.0 SCOPE AND GENERAL TECHNICAL CONDITIONS

4.1.1 INTENT OF THE SPECIFICATION

This volume of the specification deals with the general technical information & criteria for design, manufacture and delivery of equipment/material.

The provisions of this section shall supplement all the detailed Technical Specifications and requirements brought out herein. The Supplier's proposal shall be based on the use of materials complying fully with the requirements specified herein.

4.1.1.1 SCOPE

The work involves design, engineering, manufacture, assembly, inspection, testing at manufacturer's works before dispatch, packing, supply, including insurance during transit, delivery at site of various equipment and materials including substation steel structures as specified in subsequent Clauses and Sections.

It is not the intent to specify completely herein all details of design and construction of the equipment and accessories. However, the equipment and accessories shall conform in all respects to high standards of engineering, design and workmanship and be capable of performing in continuous operation up to the bidder's guarantees in a manner acceptable to the Purchaser. The Purchaser will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance therewith.

The brief description of the scope covered under this bidding document is furnished below:

The major items of works included in the scope of this specification are listed below: -

- Construction of 33KV feeder Bay and all associated civil works as per BoQ and bid specification on turnkey basis.

The brief description of the scope covered under this bidding document is furnished below:

- Survey, Design, engineering, manufacture, assembly and testing at manufacturer's works of 33kV terminal equipment and different substation materials.
- Construction of outdoor cable trenches to link the existing cable trenches, kiosk etc. as per drawings and specification.
- Construction of 33KV feeder Bay and all associated civil works as per BoQ and bid specification on turnkey basis.
- The price quoted shall include cost of all materials and labour to complete the job in all respect as per drawings and this Section.
- Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- Erection, Testing and commissioning of the supplied equipment and structures including construction of foundation and associated civil and electrical works needed for completion of the project and subsequent commissioning of the bay and integration to existing Substation Automation System (SAS).

- Any upgradation of hardware and software for above integration shall be in the scope of contractor including license upgradation (if any). The validity of the license upgraded should be minimum for 10years.

The various items of supply are described very briefly in the schedule of Bid Form, Prices & Other Schedules and annexure. The various items as defined in these schedules shall be read in conjunction with the corresponding section in the technical specifications including amendments and, additions if any.

The tentative Bill of Quantities is furnished in Section 3: Price Schedules. The BOQ is for indicative purpose only and the bidder is required to fill up the BOQ/price schedule as given in the e-tendering portal.

4.1.2 SUPPLIER TO INFORM HIMSELF FULLY

4.1.2.1 The Supplier should ensure that he has examined the General Conditions, qualifying criteria, Specifications and Schedules as brought out in Volume-1 and this Volume and has satisfied himself as to all the conditions and circumstances affecting the contract price and fixed his price according to his own views on these matters and acknowledge that no additional allowances except as otherwise provided therein will be levied.

4.1.2.2 The Purchaser shall not be responsible for any misunderstanding or incorrect information obtained by the Supplier other than information given to the Supplier in writing by the Purchaser

4.1.3 SERVICE CONDITIONS

4.1.3.1 The plant and materials supplied shall be suitable for operation under the following climatic and other conditions:

A)	Peak ambient day temperature in still air	: 45° C
B)	Minimum night temperatures	: 0° C
C)	Reference ambient day temperature	: 45° C
D)	Relative Humidity	
	a) Maximum	: 100%
	b) Minimum	: 10%
E)	Altitude	Below 1000M above MSL
F)	Maximum wind Pressure	As per IS: 802 latest codes
G)	Other data	Refer meteorological data pertaining to the locations.
H)	Seismic intensity	Zone V as per IS 1893

4.1.4 CONFORMITY WITH INDIAN ELECTRICITY RULES & OTHER LOCAL REGULATIONS:

4.1.4.1 The Supplier shall note that all substation works shall comply with the latest provisions of Indian Electricity Rules and with any other regulations. Local authorities concerned in the administration of the rules and regulation relating to such works shall be consulted, if necessary, in regard to the rules and regulations that may be applicable.

4.1.5 STANDARDS

4.1.5.1.1 The equipment covered by this specification shall, unless otherwise stated be designed, constructed and tested in accordance with the latest revisions of relevant Indian Standards and shall conform to the regulations of local statutory authorities.

4.1.5.1.2 In case of any conflict between the standards and this specification, this specification shall govern.

4.1.5.1.3 Equipment conforming to other international or authoritative Standards which ensure equivalent or better performance than that specified under Clause 1.6.1 above shall also be accepted. In that case relevant extracts of the same shall be forwarded with the bid.

4.1.6 ENGINEERING DATA

4.1.6.1 The furnishing of engineering data by the Supplier shall be in accordance with the Bidding Document. The review of these data by the Purchaser will cover only general conformance of the data to the specifications and not a thorough review of all dimensions, quantities and details of the materials, or items indicated or the accuracy of the information submitted. This review by the Purchaser shall not be considered by the Supplier, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications.

4.1.6.2 All engineering data submitted by the Supplier after review by the Purchaser shall or part of the contract document.

4.1.7 DRAWINGS AND DOCUMENTS FOR APPROVAL

4.1.7.1 The supplier shall submit all drawings and documents of all equipment to be supplied, including drawings of foundation, steel structure and any other drawings that may be required for successful completion of the project and get it approved by the Purchaser (AEGCL).

4.1.7.2 In addition, the following sub clauses shall also apply in respect of Contract Drawings.

4.1.7.3 All drawings submitted by the Supplier including those submitted at the time of Bid shall be with sufficient detail to indicate the type, size, arrangement, dimensions, material description, Bill of Materials, weight of each component break-up for packing and shipment, fixing arrangement required, the dimensions required for installation and any other information specifically requested in these specifications.

4.1.7.4 Each drawing submitted by the Supplier shall be clearly marked with the name of the Purchaser, the specification title, the specification number and the name of the Project. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be to the scale and in S.I. units.

4.1.7.5 The drawings submitted for approval to the Purchaser shall be in quadruplicate. One print of such drawings shall be returned to the Supplier by the Purchaser marked "approved/approved with corrections". The Supplier shall there upon furnish the Purchaser additional prints as may be required along with one reproducible in original of the drawings after incorporating all corrections.

4.1.8 INSPECTION & INSPECTION CERTIFICATE

4.1.8.1 The Purchaser, his duly authorized representative and/or outside inspection agency acting on behalf of the Purchaser shall have, at all reasonable times, access to the premises and works of the Supplier and their sub-Supplier(s)/sub-vendors and shall have the right, at the reasonable times, to inspect and examine the materials and workmanship of the product during its manufacture.

4.1.8.2 All routine and acceptance tests whether at the premises or work of, the Supplier or of any Sub-Supplier, the Supplier except where otherwise specified shall carry out such tests free of charge. Items such as labour, materials, electricity, fuel, water, stores apparatus and instruments as may be reasonably demanded by the Purchaser/inspector or his authorized representative to carry out effectively such tests in accordance with the Contract shall be provided by the Supplier free of charge.

4.1.8.3 If desired by the Purchaser, the Supplier shall also carry out type tests as per applicable Standards for which Purchaser shall bear the expenses except in cases where such tests have to be carried out in pursuance to **Clause 1.18.3**. The Supplier is required to quote unit rates of type test charges in a separate Schedule (if such schedule is provided in the Bidding Document) in pursuance to this Clause. However, these type test charges shall not be taken into account in comparing Price Bid.

4.1.8.4 The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Supplier in respect of the agreed Quality Assurance Programme forming a part of the Contract.

4.1.8.5 Tests

The type, acceptance and routine tests and tests during manufacture to be carried-out on the material and equipment shall mean as follows:

- i) Type Tests shall mean those tests, which are to be carried out to prove the process of manufacture and general conformity of the material to this Specification. These tests shall be carried out on samples prior to Commencement of commercial production against the order. The Bidder shall indicate his schedule for carrying out these tests.
- ii) Acceptance Tests shall mean those tests, which are to be carried out on samples taken from each lot offered for pre-dispatch inspection, for the purposes of acceptance of that lot.
- iii) Routine Tests shall mean those tests, which are to be carried out on the material to check requirements, which are likely to vary during production.
- iv) Tests during Manufacture shall mean those tests, which are to be carried out during the process of manufacture and end inspection by the Supplier to ensure the desired quality of the end product to be supplied by him.
- v) The norms and procedure of sampling for these tests will be as per the Quality Assurance Programme to be mutually agreed to by the Supplier and the Purchaser.

4.1.8.6 The standards and norms to which these tests will be carried out are specified in subsequent Sections of this Specification. Where a particular test is a specific requirement of this Specification, the norms and procedure of the test shall be as specified or as mutually agreed to between the Supplier and the Purchaser in the Quality Assurance Programme.

4.1.8.7 For all type and acceptance tests, the acceptance values shall be the values specified in this Specification or guaranteed by the Bidder or applicable Standards, as applicable.

4.1.9 EMPLOYER'S SUPERVISION

4.1.9.1 To eliminate delays and avoid disputes and litigation it is agreed between the parties to the Contract that all matters and questions shall be resolved in accordance with the provisions of this document.

4.1.9.2 The manufacturing of the product shall be carried out in accordance with the specifications. The scope of the duties of the Employer, pursuant to the contract, will include but not be limited to the following.

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- (a) Interpretation of all the terms and conditions of these Documents and Specifications.
 - (b) Review and interpretation of all the Contractors drawings, engineering data etc.
 - (c) Witness or authorize his representative to witness tests at the manufacturer's works or at site, or at any place where work is performed under the contract.
 - (d) Inspect, accept or reject any equipment, material and work under the Contract, in accordance with the Specifications.
 - (e) Issue certificate of acceptance and/or progressive payment and final payment certificate.

4.1.10 GUARANTEED TECHNICAL PARTICULARS

4.1.10.1 The Guaranteed Technical Particulars of the various items shall be furnished by the Bidders. The Bidder shall also furnish any other information's as in their opinion is needed to give full description and details to judge the item(s) offered by them.

4.1.10.2 The data furnished in Guaranteed Technical Particulars should be the minimum or maximum value (as per the requirement of the specification) required. A Bidder may guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered performed successfully if it achieves the minimum/maximum value required as per the technical specification. No preference what so ever shall be given to the bidder offering better/more stringent values than those required as per specification except were stated otherwise.

4.1.11 PACKING

4.1.11.1 All the materials shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. The Supplier shall be responsible for any loss or damage during transportation, handling and storage due to improper packing.

4.1.11.2 The Supplier shall include and provide for securely protecting and packing the materials so as to avoid loss or damage during transport by air, sea, rail and road.

4.1.11.3 All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'up' and 'down' on the sides of boxes, and handling and unpacking instructions as considered necessary. Special precaution shall be taken to prevent rusting of steel and iron parts during transit by sea.

4.1.11.4 The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols, i.e., fragile, handle with care, use no hook etc. wherever applicable.

4.1.11.5 Each package shall be legibly marked by the-Supplier at his expenses showing the details such as description and quantity of contents, the name of the consignee and address, the gross and net weights of the package, the name of the Supplier etc.

4.1.12 CONSTRUCTION TOOLS, EQUIPMENTS ETC.

4.1.12.1 The Contractor shall provide all the construction equipment, tools, tackle and scaffoldings required for construction, erection, testing and commissioning of the works covered under the Contract including construction power water supply etc. He shall submit a list of all such materials to the Employer before the commencement of work at site. These tools and tackle shall not be removed from the site without the written permission of the Employer.

4.1.13 MATERIALS HANDLING AND STORAGE

- 4.1.13.1 All the supplies under the Contract as well as Employer supplied items (if any) arriving at site shall be promptly received, unloaded and transported and stored in the stores by the Contractor.
- 4.1.13.2 Contractor shall be responsible for examining all the shipment and notify the Employer immediately of any damage, shortage, discrepancy etc. for the purpose of Employer's information only. The Contractor shall submit to the Employer every week a report detailing all the receipts during the week. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection at site. Any demurrage, and other such charges claimed by the transporters, railways etc., shall be to the account of the Contractor.
- 4.1.13.3 The Contractor shall maintain an accurate and exhaustive record-detailing out the list of all items received by him for the purpose of erection and keep such record open for the inspection of the Employer.
- 4.1.13.4 All items shall be handled very carefully to prevent any damage or loss. The materials stored shall be properly protected to prevent damage. The materials from the store shall be moved to the actual location at the appropriate time to avoid damage of such materials at Site.
- 4.1.13.5 All the materials stored in the open or dusty location must be covered with suitable weatherproof and flameproof covering material wherever applicable.
- 4.1.13.6 The Contractor shall be responsible for making suitable indoor storage facilities, to store all items/materials, which require indoor storage.
- 4.1.13.7 The Contractor shall have total responsibility for all equipment and materials in his custody, stored, loose, semi-assembled and/or erected by him at site. The contractor shall make suitable security arrangements including employment of security personnel to ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss.
- 4.1.13.8 The Employer will verify the storage facilities arranged by the contractor and dispatch clearance will be provided only after Employer is satisfied.

4.1.14 CONTRACTOR'S MATERIALS BROUGHT ON TO SITE

- 4.1.14.1 The Contractor shall bring to Site all equipment, components, parts, materials, including construction equipment, tools and tackles for the purpose of the work under intimation to the Engineer. All such goods shall, from the time of their being brought vest in the Employer, but may be used for the purpose of the Works only and shall not on any account be removed or taken away by the Contractor without the written permission of the Engineer. The Contractor shall nevertheless be solely liable and responsible for any loss or destruction thereof and damage there to
- 4.1.14.2 The Employers shall have a lien on such goods for any sum or sums, which may at any time, be due or owing to him by the Contractor, under in respect of or by reasons of the Contract. After giving a fifteen (15) days' notice in writing of his intention to do so, the Employer shall be at liberty to sell and dispose of any such goods, in such manner, as he shall think fit including public auction or private treaty.
- 4.1.14.3 After the completion of the Works, the Contractor shall remove from the Site under the direction of the Engineer the materials such as construction equipment, erection tools and tackles, scaffolding etc. with the written permission of the Engineer. If the Contractor fails to remove such materials within fifteen (15) days of issue of a notice by the Engineer, the Engineer shall have the liberty to dispose of such materials as detailed under clause 1.24.2 above and credit the proceeds thereto to the account of the Contractor.

4.1.15 COMMISSIONING SPARES

4.1.15.1 It will be the responsibility of the Contractor to provide all commissioning spares required for initial operation till the Employer declares the equipment as ready for commissioning. All commissioning spares shall be deemed to be included in the scope of the Contract at no extra cost to the Employer.

4.1.15.2 These spares shall be received and stored by the Contractor at least 3 months prior to the schedule date of commencement of commissioning of the respective equipment and utilized as and when required. The unutilized spares and replaced parts, if any, at the end of successful completion of performance and guarantee test shall be the property of the Contractor and he will be allowed to take these parts back at his own cost with the permission of Employer's Representative.

4.1.16 Consignee Details

The Contractor shall supply the equipment and execute the works at 132/33KV Kamakhya GIS, AEGCL, Dist- Kamrup (M), Assam

4.4.0 TECHNICAL SPECIFICATION FOR SURGE ARRESTORS

4.4.1 SCOPE

- 4.4.1.1 This Section covers the specifications for design, manufacture, shop & factory testing before dispatch of 33 kV 10 kA, Station class heavy duty, gapless metal (zinc) oxide Surge Arrestors complete with fittings & accessories.

4.4.2 STANDARDS

- 4.4.2.1 The design, manufacture and performance of Surge Arrestors shall comply with IS: 3070 Part-3 unless otherwise specifically specified in this Specification

4.4.3 GENERAL REQUIREMENT

- 4.4.3.1 The surge arrestor shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current.
- 4.4.3.2 The surge arrestor shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing/silicon polymeric of specified creepage distance.
- 4.4.3.3 The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.
- 4.4.3.4 The surge arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrestor shall be connected with 25x6 mm galvanized strip, one end connected to the surge arrestor and second end to a separate ground electrode. The bidder shall also recommend the procedure which shall be followed in providing the earthing/system to the Surge Arrestor.
- 4.4.3.5 The surge arrestor shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrestor shall change over to the conducting mode.
- 4.4.3.6 The surge arrestor shall be suitable for circuit breaker performing 0-0.3sec.-CO-3min-CO- duty in the system.
- 4.4.3.7 Surge arrestors shall have a suitable pressure relief system to avoid damage to the porcelain/ silicon polymeric housing and providing path for flow of rated fault currents in the event of arrestor failure.
- 4.4.3.8 The reference current of the arrestor shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- 4.4.3.9 The Surge Arrestor shall be thermally stable and the bidder shall furnish a copy of thermal stability test with the bid.
- 4.4.3.10 The arrestor shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.

4.4.4 ARRESTOR HOUSING

- 4.4.4.1 The arrestor housing shall be made up of porcelain/**silicon polymeric** housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform brown colour, free from blisters, burrs and other similar defects.

4.4.4.2 Arrestors shall be complete with insulating bases, fasteners for stacking units together, surge counters with leakage current meters and terminal connectors.

4.4.4.3 The **housing shall be so coordinated that external flashover shall not occur due to application of** any impulse or switching surge voltage up to the maximum design value for arrestor. The arrestors shall not fail due to contamination. The arrester housings shall be designed for pressure relief class as given in Technical Parameters of the specification.

4.4.4.4 Sealed housings shall exhibit no measurable leakage.

4.4.5 FITTINGS & ACCESSORIES

4.4.5.1 The surge arrestor shall be complete with insulating bases, fasteners for stacking units together, surge counters with leakage current meters and terminal connectors.

4.4.5.2 The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of surge arrestor shall be galvanized. The line terminal shall have a built-in clamping device which can be adjusted for both horizontal and vertical takeoff.

4.4.5.3 Grading corona control rings, if necessary, shall be provided on each complete arrestor pole for proper stress distribution.

4.4.6 SURGE MONITOR

4.4.6.1 A self-contained discharge counter suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit. Leakage current meter with suitable scale range to measure leakage current of surge arrestor shall also be supplied within the same enclosure. The number of operations performed by the arrestor shall be recorded by a suitable cyclometric counter and surge monitor shall be provided with an inspection window. There shall be a provision for putting ammeter to record the current/alarm contacts in the control room if the leakage current exceeds the permitted value. Similar provision shall be considered for surge counter also.

4.4.6.2 Surge monitor shall be mounted on the support structure at a suitable height so that the reading can be taken from ground level through the inspection window and length of connecting leads up to grounding point and bends are minimum.

4.4.7 TESTS

4.4.7.1 Test on Surge Arrestors

The Surge Arrestors offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 3070 (Part-3). In addition, the suitability of the Surge Arrestors shall also be established for the following:

Residual voltage test

Reference voltage test

Leakage current at M.C.O.V

P.D. test

Sealing test

Thermal stability test

Aging and Energy capability test

Watt loss test

Each metal oxide block shall be tested for guaranteed specific energy capability in addition to routine/acceptance test as per IEC/IS.

4.4.7.2 The surge arrester housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 2071.

4.4.7.3 Galvanization Test

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS: 2633 & IS 6745.

4.4.8 NAME PLATE

4.4.8.1 The name plate attached to the arrester shall carry the following information:

Rated Voltage

Continuous Operation Voltage

Normal discharge current

Pressure relief rated current

Manufacturers Trade Mark

Name of Sub-station

Year of Manufacturer

Name of the manufacture

Purchase Order Number along with date

4.4.9 TECHNICAL DATA SHEET FOR SURGE ARRESTOR

	Particulars	Voltage class
		33 kV
1	Rated voltage of arrester, kV	30
2	Rated frequency, Hz	50 Hz
3	Nominal discharge current of arrester, kA	10
4	Maximum residual voltage at nominal discharge current, kV (peak)	108
5	Maximum steep current impulse residual voltage at kV (kVP)	120
6	One minute power frequency withstand voltage of arrester insulation, kV (rms)	70
7	1.2 / 50 μ second impulse withstand voltage of arrester insulation, kV (peak)	170
9	Line discharge class	2
10	Insulator Housing	
	Power frequency withstand test voltage(wet) (kV rms)	70
	Lightning impulse withstand tests voltage (KVp)	170
	Pressure Relief Class	40
	Creepage distance not less than (mm)	31mm/kV

4.7.0 Technical Specification for Control and Relay Panels (With Automation)

SCOPE

This Section is intended to cover the design, manufacture, assembly, testing at manufacturer's works of Indoor Relay and Control Panels.

The Control and Relay Panels required are for control and protection of the Power Transformers, Feeders and for others according to requirements. The supply shall include all accessories, special tools, relevant software, supporting steels, spare parts, drawings, instruction manuals etc. The panels shall be supplied complete with all accessories as specified and completely assembled and all internal wiring completed.

The sub-stations will have automation as per guidelines of IEC 61850. The contractor has to supply the C&R panels to match the requirement of Sub-station Automation System (SAS) as specified in the subsequent chapter.

STANDARDS

All equipment and all component parts supplied under this specification shall conform in all respects to the latest issue of relevant Indian Standard Specifications except where specified otherwise in this specification. Equipment meeting any other authoritative standards which ensure an equal or better quality may also be acceptable.

TYPE OF PANEL

All panels shall be simplex type. One simplex panel shall be used for each feeder and bus coupler / by pass breaker. For transformer bays two simplex panels (one each for HV and LV sides) may be used if required.

Simplex Control and Relay Panels shall consist of vertical swing front panels with equipment mounted thereon and having front glass door. Each cubicle assembly shall be provided with doors on the rear having handles with built in locking facility. It shall have double leaf doors with lift off hinges at the back for panels of width more than 800 mm.

These panels shall be of the following approximate dimensions: Height: 2250mm + 15mm anti-vibration pad + 50 mm (base) Depth: 800mm (MAX)

Width: 800 mm to 1000 mm

CONSTRUCTIONAL FEATURES

The panels shall be completely metal enclosed to ensure a dust, moisture and vermin proof atmosphere. The enclosure shall provide a degree of protection not less than IP 31 in accordance with IS-2147

Panels shall be rigid free standing and floor mounting type and comprise of structural frames enclosed completely with specially selected texture finished, cold rolled sheet steel of thickness not less than 3mm for weight bearing members of the panels such as base frame, front sheet and door frames and not less than 2.0 mm for sides, door top and bottom portions. There shall be sufficient reinforcement to provide level surfaces, resistance to vibration and rigidity during transportation and installation.

All joints shall be made flush and all edges shall be bent at right angles and rounded. All structural members shall be bolted or welded together. Necessary arrangement shall be provided for bolting together the adjacent panels as well as for fastening them to the floor. The opening required for mounting the equipment shall be punched or cut and filed smooth.

All doors, removable covers and panels shall be sealed all around with synthetic rubber gaskets Neoprene/EPDM generally conforming to provision of IS 11149. However, XLPE gaskets can also be used for fixing protective toughened glass doors. Ventilating louvers, if provided shall have screens and filters. The screens shall be made of either brass or GI wire mesh.

Panels shall have additional rolled channel plinth at the bottom with smooth bearing surface. The panels shall be fixed on the embedded foundation channels with intervening layers of anti-vibration strips made of shock absorbing materials which shall be supplied by the contractor.

MOUNTING OF EQUIPMENTS

All equipment on and in the panels shall be mounted and completely wired to the terminal blocks ready for external connection. All equipment on the front panels shall be mounted flush. Terminal markings shall be clearly visible.

INTERNAL WIRING

Panels shall be supplied completely with interconnecting wiring provided between all electrical devices mounted and wired in the panels and between the devices and terminal blocks for the devices to be connected to equipment outside the panels. When panels are located adjacent to each other all inter panel wiring and connections between the panels shall be furnished and wiring shall be carried out internally. These adjacent inter panel wiring shall be clearly indicated in the drawing furnished by the CONTRACTOR.

Wiring shall be carried out with 1100-Volt grade, single core, stranded copper conductor wires with PVC insulation. The minimum size of stranded copper conductor used for internal wiring shall be as follows:

(a) All circuits except instrument transformers circuits:

(b) Instrument transformers circuit:

1.5 sq. mm. per lead.

2.5 sq. mm. per lead.

Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided near the top of the panel running throughout the entire length of the panels.

Wire terminals shall be made with solder less clamping type of tinned copper lugs, which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires and shall not fall off when the wire is disconnected from blocks.

Interconnections to adjacent panels shall be brought out to a separate set of terminals blocks located near the slots or holes meant for taking the interconnecting wires. Arrangement shall permit easy inter connection to adjacent panels at site and wires for this purpose shall be provided by the CONTRACTOR looped and bunched properly inside the panel.

A laminated copy of total schematics is to be fixed on the inside of door.

TERMINAL BLOCKS

All internal wiring to be connected to the external equipment shall terminate on terminal blocks, preferably vertically mounted on the side of each panel. Terminal blocks shall be of 650 volts grade and have 10 amps

continuous rating, moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Terminal block designs include a white fibre-marking strip with clear plastic/silicon chip on terminal covers. Marking on the terminal strips shall correspond to block and terminal number on the wiring diagram.

Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. Current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

At least 20% spare terminals shall be provided on each panel and these terminals shall be uniformly distributed on all terminal blocks.

There shall be a minimum clearance of 250 mm between first row of terminal blocks and associated cable gland plates. Also, the clearance between two rows of terminal blocks shall be a minimum of 150mm. A steel strip shall be connected between adjacent terminal block rows at 450-mm intervals for support of incoming cables.

PAINTING

All Sheet steelwork shall be phosphated in accordance with IS 6005.

Oil grease, dirt and warp shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of 2(two) coats of ready mixed, stoving type zinc chromate primer. The first coat may be 'flash dried' while the second shall be stoved.

After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after completion of tests. Exterior Paint shall be texture finishing with RAL 7032 paint shade.

Each coat of primer and finishing paint shall be of a slightly different shade to enable inspection of the painting.

The inside of the panels shall be glossy white.

A small quantity of finishing shall be supplied minor touching up required at site after installation.

NAME PLATES AND MARKINGS

All equipment mounted on front and rear side as well as equipment mounted inside the panel shall be provided with individual nameplates with equipment designation engraved. Also, on the top of the each panel on front as well as rear side large and bold name plates shall be provided for circuit /feeder designation.

All front mounted equipment shall be also provided at the rear with individual name plates engraved with Tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring. The nameplates shall be mounted directly by the side of the respective equipment and shall not be hidden by the equipment wiring.

Nameplates shall be made of non-rusting metal or 3 ply lamicord. Nameplates shall be black with white engraved lettering.

MISCELLANEOUS ACCESSORIES

A 240 Volts, single-phase plug points shall be provided in the interior of each cubicle with ON-OFF switch for connection of headlamp.

Each panel shall be provided with a LED lighting fixtures for the interior illumination of the panel complete with all fittings, i.e. lamp, switch (controlled by panel door)

Each control panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of D.C. and A.C. supplies of various control, AC-DC super vision, signaling, lighting and space heater circuits. MCBs of requisite capacity with fail indicators shall be used, HRC fuse is not acceptable. The main input A.C. and D.C. circuits will be protected with miniature circuit breakers.

EARTHING

All panels shall be equipped with an earth bus securely fixed along with inside base of the panels. The materials and the sizes of the bus bar shall be at least 25X4 mm copper. When several panels are mounted joining each other, the earth bus shall be made continuous and necessary connectors and clamps for this purpose shall be included in the scope of supply. Provisions shall be made for extending the earth bus bar to future adjoining panels on either side.

All metallic cases of equipment shall be connected to the earth bus by independent copper wires of size not less than 2.5 sq. mm. Earthing wire shall be connected on terminals with suitable clamp connectors and soldering shall not be permitted.

PT and CT secondary neutrals or common lead shall be earthed at one place only at the terminal blocks, where they enter the panels.

Technical Specification for SAMAST Compliant Interface Energy Meter (IEM)

1. Interface Energy Meters Technical Specification

The specification covers the design, engineering, manufacturing, assembly and testing of static/electronic Interface Energy Meters) compliant Tri-vector type, Four Quadrant, Bi-Directional Energy Meter, suitable for 3-ph 4wire connections solidly earthed system with balanced and un-balanced loads for a power factor range from zero to unity (lagging & leading), with initial and sustained accuracy of class 0.2s. The energy metering system specified herein shall be used for tariff metering for bulk, inter-utility power flows. Projection mounted type, static composite meter shall be installed for EHV/HV circuit, as a self-contained device for measurement of active energy transmittals in each successive 15 minute or 5-minute block etc. meeting the ABT requirements. These meters shall be integrated in SAMAST framework as an when it goes live so the meter shall comply to SAMAST guidelines. The meter shall also be compatible for integration with SAS system. Necessary isolation and /or suppression shall also be built-in for protecting the meter from surges, voltage spikes, fault-current etc. that occurs in VT and CT circuits of extra high voltage switchyards.

2. Basic Features of Interface Energy Meters

- a) The energy metering system specified herein shall be used for tariff metering for bulk, inter-utility power flows, in different States of India. Static composite meter shall be installed at interface points as a self-contained device for measurement of Voltage (V), Frequency (f), Active (Wh) and Reactive (VARh) energy exchanged in each successive 5 min time block. All meters shall be compliant to IS 15959 and its latest amendments.
- b) Each meter shall have a unique identification code, which shall be marked permanently on its front, as well as in its memory. All meters supplied to as per this specification shall have their identification code starting with "IEM", which shall not be used for any other supplies. "IEM" shall be an eight-digit running serial number, further followed by "A" and "B" for the use with CT secondary of 1A and 5A respectively. This shall be mutually agreed between the buyer and the vendor.
- c) The meters shall be suitable for communication with external device like modem, DCU, etc. which shall be able to communicate with CDCS for local/remote data transfer. The meter shall compulsorily have at least 1 optical port for taking reading through Hand Held Unit (HHU).
- d) Auxiliary Supply to IEM- The meters shall normally operate with the power drawn from DC auxiliary power supply (Range 110V to 220V DC) to reduce the Voltage Transformer (VT) burden. In addition, there shall be provision to operate the meter from the Voltage Transformer (VT) secondary circuit having a rated secondary line-to-line voltage of 110V, and current transformers (CTs) having a rated secondary current of 1 A or 5A. Any further transformers/ transactions/ 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. The reference frequency shall be 50Hz. Also, the meter shall have suitable tolerance (up to 15% either side) for DC supply.
- e) The meters shall safely withstand the usual fluctuations arising during faults etc. In particular, VT secondary voltages 115% of V_{ref} applied continuously and 190% of V_{ref} for 3.0 seconds, and CT secondary current 150% of I_{ref} applied continuously and 30 times of I_{ref} applied for 0.5 seconds shall not cause any damage to or maloperation of the meters.

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- f) The meters shall continue to function for the remaining healthy phase(s), in case one or two phases of VT supply fails. In case of a complete VT supply failure, the computation of average frequency shall be done only for the period during which the VT supply was available in the 5-minute block. Any time block contraction or elongation for clock correction shall also be duly accounted for.
 - g) The total burden imposed by a meter for measurement and operation shall be defined as per IS 14697. An automatic backup for continued operation of the meter's calendar-clock, and for retaining all data stored in its memory, shall be provided through a long-life battery, which shall be capable of supplying the required power for at least 2 years. The meters shall be supplied duly fitted with the batteries, which shall not require to be changed for at least 10 years, as long as total VT supply interruption does not exceed two years. The battery mounting shall be designed to facilitate easy battery replacement without affecting PCB of the meter.
 - h) The meters shall fully comply with all stipulations in IS 14697 except those specifically modified by this specification. The reference ambient temperature shall be 27 °C.
 - i) Each meter shall have a test output device (visual), as per clause 6.11 of IS 14697:1999, for checking the accuracy of active energy (Wh) measurement. The preferred pulsing rate is twenty (20) per Wh for CT sec-1A and four (4) per Wh for CT sec -5A. It shall be possible to couple this device to suitable testing equipment also.
 - j) Exception Management- The three line-to-neutral voltage shall be continuously monitored and in case any of these falls below defined threshold (70% of Vref), meter shall have suitable indication on LED/ LCD. The meter shall also have provision for low voltage event logging in meter memory in case of any phase voltage going below a defined threshold. The time blocks in which such a voltage failure occurs/persists shall also be recorded in the meter's memory with a symbol "*" if 3 Phase RMS voltage applied to the IEM is in between 5% to 70% of Vref and if Voltage is less than 5% of Vref, meter should record Zero voltage symbol "Z".
 - k) Time Accuracy - Each meter shall have a built-in calendar and clock, having an accuracy of 10 seconds per month or better. The calendar and clock shall be correctly set at the manufacturer's works. The date (year-month-day) and time (hour-min.-sec.) shall be displayed on the meter front on demand. Meter shall have the intelligence to synchronize the time with GPS (Local GPS/CDCS GPS/ NAVIC) signal and from PC using software. Limited time synchronization through meter communication port shall be possible at site. When an advance or retard command is given, twelve subsequent time blocks shall be contracted or elongated by five seconds each. All clock corrections shall be registered in the meter's memory and suitably shown on print out of collected data.
 - l) A touch key or push button shall be provided on the meter front for switching on the display and for changing from one indication to the next. The display shall switch off automatically about one minute after the last operation of touch key/push button. When the display is switched on, the parameter last displayed shall be displayed again, duly updated.
 - m) The whole system shall be such as to provide a print out (both from the local PC, and from remote central computer) of the following format:

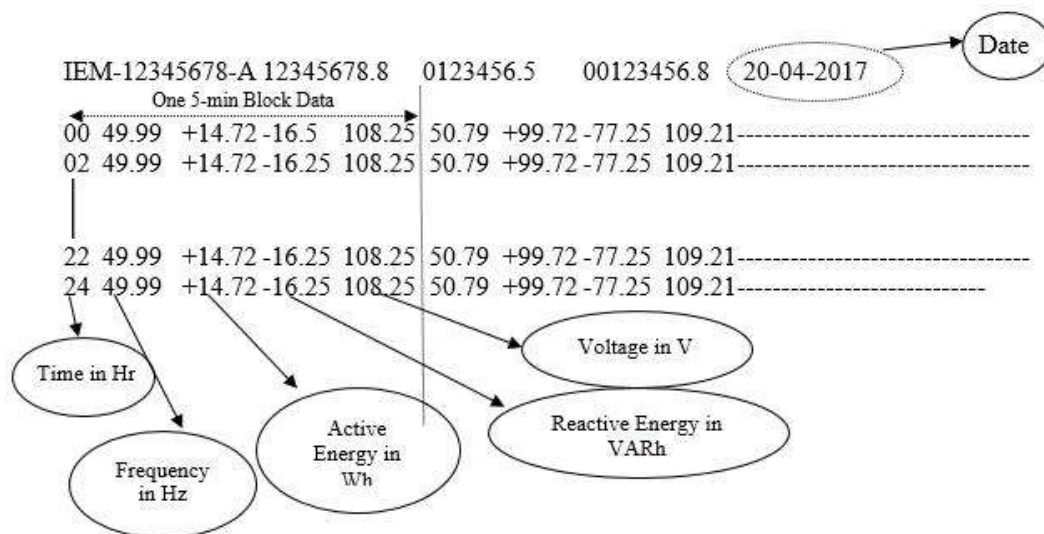


Figure 1: Standard Raw Data Format for IEM

There are 4 values in one 5 min time block. The first row shall contain the meter data for 2 hours, i.e., 24-time blocks, 00 hrs to 02:00 hrs. Similarly, the 2nd row shall contain the data for the next 2 hours and henceforth.

The above data shall be available in text file format (file extension as per IEEE standard/.txt) exportable to Excel. Indication of time retard or advance to be provided without disturbing the proposed format. Each 5-min block data consists of Frequency (in HZ), Active energy (in Wh), Reactive energy (in VARh) and Voltage (in V). All 5-minute Wh and VARh figures in. NPC/output report shall be rounded off upto third decimal.

- n) The portable Hand-Held unit (HHU)/ Common meter reading instrument (CMRI)/ Data Collecting Device (DCD) shall be having IS-15959:2011 compatibility for standardized parameters. The optical coupler for tapping data stored in the SEMs memory shall be compatible universally across different make of SEMs.

o) Constructional Features

- The meters shall be supplied housed in compact and sturdy, metallic or moulded cases of non-rusting construction and/or finish. The cases shall be designed for simple mounting on a plane, vertical surface such as a control/relay panel front. All terminals for CT and VT connections shall be arranged in a row along the meter's lower side. Terminals shall have a suitable construction with barriers and cover, to provide a secure and safe connection of CTs and VTs leads through stranded copper conductors of 2.5 sq. mm. size.
- All meters of the same model shall be totally identical in all respects except for their unique identification codes. They shall also be properly sealed and tamper evident, with no possibility of any adjustment at site, except for transactions allowed in IS 15959.
- The meters shall safely withstand, without any damage or mal operation, reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. in accordance with IS-14697. They shall have an IP-51 category dust-tight construction, and shall be capable of satisfactory operation in an indoor, non-air-conditioned installation.
- Either the meters shall have built-in facility (e.g., test links in their terminals) for in-situ testing, or a separate test block shall be provided for each meter.

3. Measurement

- a) The active energy (Wh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy as per class **0.2S** (IS 14697).
- b) The meter shall compute the net active energy (Wh) sent out from the substation bus bars during each successive 5 min block, and store it in its memory up to fourth decimal with plus sign if there is net Wh export and with a minus sign if there is net Wh import. Further Wh data in NPC/output report shall be rounded upto third decimal.
- c) The meter shall count the number of cycles in VT output during each successive 5 min block, and divide the same by 300 (60 sec/min x 5min) to arrive at the average frequency. The frequency data shall be stored in the meter's memory in Hertz up to third decimal. Further Frequency data in NPC/output report shall be rounded off upto second decimal.
- d) The meter shall continuously compute the average of the RMS values of the three line-to-neutral VT secondary voltages as a percentage of 63.51 V, and display the same on demand. The accuracy of the voltage measurement/computation shall be at least 0.5%, a better accuracy such as 0.2% in the 95-105% range being desirable. The voltage data shall be stored in the meter's memory in volts up to third decimal. Further voltage data in NPC/output report shall be rounded off upto second decimal.
- e) The Reactive energy (VARh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy of 0.5S as specified in IS 14697. The meter shall compute the net Reactive energy (VARh) sent out from the substation bus bars during each successive 5 min block, and store it in its memory up to fourth decimal with plus sign if there is net VARh export and with a minus sign if there is net VARh import. It shall also display on demand the net VARh sent out during the previous 5 min block. Further VARh data in NPC/output report shall be rounded off upto third decimal.
- f) The meter shall also integrate the reactive energy (VARh) algebraically into two separate registers, one for the period for which the average RMS voltage is above 103.0%, and the other for the period for which the average RMS voltage is below 97.0 %. The current reactive power (VAR), with a minus sign if negative, and cumulative reactive energy (VARh) readings of the two registers (>103% and <97%) shall be displayed on demand. The readings of the two registers at each midnight shall also be stored in the meter's memory. When reactive power is being sent out from substation bus bars, VAR display shall have a plus sign or no sign and VARh registers shall move forward. When reactive power flow is in the reverse direction, VAR display shall have negative sign and VARh registers shall move backwards. Generally, the standard PT ratios are 220 kV /110 V, 400 kV /110 V and 765 kV / 110 V. However, at the time of commissioning the vendor may confirm the same from site and configure the meter accordingly to ensure correct recording of reactive energy.
- g) For CT secondary rating of 5A, all computations, displays and memory storage shall be similar except that all figures shall be one fifth of the actual, worked out from CT and VT secondary quantities.
- h) Further, the meter shall continuously integrate and display on demand the net cumulative active energy sent out from the substation bus bars up to that time. The cumulative Wh reading at each midnight shall be stored in the meter's memory. The register shall move backwards when active power flows back to substation bus bars.
- i) Errors for different power factors shall be as defined in IS14697.

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- j) For reactive power (VAR) and reactive energy (VARh) measurements, IS14697 shall be complied with. The accuracy of measurement of reactive energy shall be as per class 0.5S.
 - k) The harmonics shall be filtered out while measuring Wh, V and VARh, and only fundamental frequency quantities shall be measured/computed.
 - l) Data security shall be ensured as per IS 15959 (three layers of security).

4. Memory/ Storage

Each meter shall have a non-volatile memory in which the following shall be automatically stored:

- i. Average frequency for each successive 5 min block, in Hertz up to third decimals.
- ii. Net Wh transmittal during each successive 5 min block, up to fourth decimal, with plus sign if there is net Wh export and with a minus sign if there is net Wh import.
- iii. Net VARh transmittal during each successive 5 min block, up to fourth decimal, with plus sign if there is net VARh export and with a minus sign if there is net MVARh import.
- iv. Cumulative Wh transmittal at each midnight, in eight digits including one decimal.
- v. Cumulative VARh transmittal for voltage high condition, at each midnight in eight digits including one decimal.
- vi. Cumulative VARh transmittal for voltage low condition, at each midnight, in eight digits including one decimal.
- vii. Average RMS voltage for each successive 5min block.
- viii. Date and time blocks of failure of VT supply on any phase, as a star (*)/ (Z) mark.
- ix. The meters shall store all the above listed data in their memories for a period of fifteen (15) days. The data older than fifteen (15) days shall be erased automatically
- x. The software provided at CDCS, i.e., SLDC, will manage all functionalities of collection of data through DCUs, validate the data, store the data in a database, and manage the complete system. Software will also have a scheduler for scheduling the task of collection of data periodically. The periodicity of data collection shall be user defined.

5. Display

Each meter shall have digital display for indication of the following (one at a time), on demand:

- i. Meter serial no. and model: IEM12345678A or IEM12345678B
- ii. Date (year month day /yyyy mm dd): 20160311 d
- iii. Time (hour min sec /hh mm ss): 195527 t
- iv. Cumulative Wh reading: 1234567.8 C
- v. Average frequency of the previous block: 49.89 F
- vi. Net Wh transmittal during the previous block: - 28.75 E

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- vii. Net VARh transmittal during the previous block: - 18.75 R
 - viii. Average % Voltage: 99.2 U
 - ix. Reactive power (VAR): 106.5 r
 - x. Voltage - high VARh register reading: 1234567.5 H
 - xi. Voltage - low VARh register reading: 1234567.4 L
 - xii. Low battery indication
 - xiii. The three line-to-neutral voltages shall be continuously monitored and in case any of these falls below 70 %, a preferably flashing three LEDs (one LED/phase) provided on meter's front shall become steady. They shall go off if all three voltages fall below 70 %. The LED shall automatically resume flashing when all VT secondary voltages are healthy again.
 - xiv. The two VARh registers (xv and xvi) shall remain stay-put while VT supply is unhealthy.

Any other better or more informative mechanism to display the above shall be preferred. The above shall be mutually agreed between the meter buyer and vendor.

Navigation keys to be provided at the meter front plate to navigate the display menu.

6. Communication

- a) Each meter must have an optical port on its front for tapping all data stored in its memory through HHU. In addition to the above each meter shall also be provided with a RS-485, Ethernet and USB port on one of its sides, from where all the data stored in the meter's memory can also be transferred to CDCS (through DCU), local computer and external storage. The overall intention is to tap the data stored in the meter's memories at a scheduled time from any of the above-mentioned ports or any other means and transmit the same to a remote central computer using suitable means of communication. It shall be possible to securely download the IEM data through an USB port via external storage thereby removing the requirement of an MRI (Meter Reading Instrument). It shall be ensured that data transfer through USB shall be unidirectional only i.e., from Meter to external storage device in an authentication process. Meter data shall be tamper-proof.
- b) All meters shall be compatible with Optical port, RS-485 port, Ethernet port and USB / RS-232 port all together at a time and communicate independently. It shall also be possible to obtain a print out (hard copy) of all data collected from the meters, using the local PC. Data collection from any local laptop/PC shall be possible by installing data collection software. Entire project has to be based on Optic Fibre/GSM/4G/3G. Bidder should quote considering availability of Optic Fibre at 80% of locations and availability of PLCC/4G at 20 % of locations. This is for bringing all the bids on common platform. However, the selected agency will have to conduct detailed survey regarding availability of the particular service for all locations. The bidder may conduct Field Survey before submission of bid.
- c) The bidder shall adhere to the appropriate security algorithm for encryption and decryption

Entire project has to be based on Optic Fibre/GSM/4G/3G. Bidder should quote considering availability of Optic Fibre/PLCC/4G/3G/2G for all the locations. However, the selected agency will have to conduct detailed survey regarding availability of the particular service for all locations. Bidders may do Site Survey for availability of communication media prior to submission of bids.

The bidder may design appropriate architecture for providing end to end metering solution. He is free to decide upon the best solution out of all the available options to ensure that data from all IEMs in ASSAM are available at State Load Despatch Centre by the scheduled time. However, the entire responsibility of fully functional end to end metering system shall rest with the bidder in order to meet the performance levels as given in this document. The communication provider may adopt Optical Fibre/GSM/3G/4G communication technology or a combination of these technologies as per the site requirement adopting best available technology in the proposed area of implementation. The successful bidder shall be responsible for proper data exchange among IEM, DCU, CDCS, MDP and other operational/requisite software as part of fully functional metering system.

The bidder shall design a reliable, interference free & robust communication network keeping in view the site conditions. It shall be flexible in terms of providing communication in variable terrain & urban density. The bidder shall design the network architecture keeping in view the existing and planned infrastructure of the utility. During designing, suitable consideration shall be kept for future expansion as per requirement of Utility. Before designing the communication network, the bidder shall do the site survey and would provide the most efficient communication infrastructure. The entire infrastructure & associated civil works required for installation & commissioning of equipment/devices like DCUs, repeaters, routers & access points etc. shall be in the scope of bidder. The operational testing of all the network elements has to be demonstrated by the bidder to the satisfaction of the utility.

- d) The Bidder shall provide the necessary software which would enable a local PC/ CDCS to:
- i. Accept the data from the Optical/Ethernet/WAN and store it in its memory in user defined formats (text, csv, xls, etc.) in a user-defined file name (file name format must be ddmmyy substation name-utility name).
 - ii. Polling feature along with a task scheduler to run the data downloading software at a pre-designated date and time repeatedly or by manually selecting a meter. File naming for such downloaded data should also be in user-defined format. A detailed activity log shall also be available for each downloading operation.
 - iii. Upload/Import meter data (binary files) in the software for further processing. While uploading, there shall be provision to upload all selected files with single key-stroke.
 - iv. Convert the binary file(s) to text file(s). There should be provision to select multiple files based on filename, convert all selected files with single key-stroke and store the text files in the same location where binary files are stored.
 - v. Display the collected data on PC's screen in text format, with forward/backward rolling
 - vi. Print out in text format the data collected from one or more meters, starting from a certain date and time, as per operator's instructions
 - vii. Transmit the collected data, in binary format, through an appropriate communication link to the central computer, starting from a certain date and time, as per operator's instructions.
 - viii. Store the collected data in binary format, on a CD/Pen Drive. In addition to above, in general the software shall be able to convert IEMs data to existing format as well as in tabular (.csv) format as applicable.
- e) The above software shall further ensure that absolutely no tampering (except erasing of complete data with password protection) of the collected metering data is possible during its handling by the PC. The software shall be suitable for the commonly available PCs, (Windows) and shall be supplied to Owner in

a compatible form to enable its easy loading into the PCs available (or to be installed by the Owner/others) at the various substations.

- f) The bidder shall ensure data integrity checks on all metered data received from data collection systems.
- g) The quality of installation of the various equipment & power supply wiring to all field equipment shall be as per standards/ regulations/prevaling practices of the utility. The supply of electricity needed for operation and maintenance of entire Metering system shall be provided free of cost by the respective owners of the premises.

7. Quality Assurance

The quality control procedure to be adopted during manufacturing of the specified equipment shall be mutually discussed and finalized in due course, generally based on the established and proven practices of the manufacturer. The software shall be user friendly which can be easily installed in any PC/Laptop irrespective of operating system of the PC/Laptop, and shall be certified for ensuring data handling capabilities. The same shall be demonstrated by the party during technical evaluation. During demonstration party shall bring standard meter. Thereafter software shall be offered for technical compatibility before taking up further necessary action in the procurement process.

8. Testing

- a) All equipment, after final assembly and before dispatch from manufacturer's works, shall be duly tested to verify that is suitable for supply to the Owner. Routine and acceptance tests shall be carried out on the meters in line with IS 14697.
- b) Any meter which fails to fully comply with the specification requirements shall be liable to be rejected by the Owner. However, the Owner may purchase such meters at a reduced price in case of marginal non-compliance, at his sole discretion.
- c) Acceptance Tests for PC Software and data down loading using meter communication ports- All IEMs after final assembly and before dspatch from Bidder's/Manufacturer's works shall be duly tested to verify that they are suitable for downloading data using meter communication ports shall be subjected to the following acceptance test.
 - i. Downloading Meter Data from the Meter(s) to PC via optical port.
 - ii. Downloading meter data through USB port and RS 232.
 - iii. Downloading meter data to DCU/CDCS through Ethernet as well as RS 485 port.
 - iv. Compatibility with PC Software.
 - v. Functioning of Time synchronization, advance and retard time commands.
 - vi. Per meter downloading time verification.
- d) Copy of Certificate shall be submitted to SLDC

Type Tests

- a) One (1) meter in a batch shall be subjected to the complete range of type tests as per IS14697 and IS15959, after final assembly. In case of any failure to pass all specified tests, the bidder shall arrange

to carry out the requisite modifications/replacements in the entire lot of meters at his own cost. After any such modifications and final assembly, two (2) meters selected out of the lot by the Owner's representative shall be subjected to the full range of type tests. The lot shall be accepted by the Owner only after successful type testing.

- b) The meters used for type testing shall be separately identified, duly marked, and supplied to the Owner in case they are fully functional and as good as other (new) meters, after necessary touching up/refurbishing. In case this is not possible, the bidder shall provide their replacements at no extra cost to Owner.
- c) The Bidder shall arrange all type testing specified above, and bear all expenses for the same.
- d) Copy of Test certificate shall be submitted to SLDC.
- e) Type test certificates completed in all respect from NABL approved test house shall be submitted along with the offer

9. ANOMALY DETECTION FEATURES

The meter shall have features to detect and log the occurrence and restoration of following anomalies, along with date and time of event: 6.1.1. 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.

- 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.
- Voltage Unbalance – The meter shall detect voltage unbalance if there is unbalance in voltages.
- Current Unbalance – The meter shall detect current unbalance if there is unbalance in load conditions. Meter should ensure true system conditions before going for current unbalance checks.
- 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:
 - 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.
 - Feeder Supply Fail -This event shall be logged when feeder supply, i.e., all the voltages go below certain threshold. No snapshot shall be logged with this event.
- Last three hundred & fifty (350) events (occurrence + restoration), in total, shall be stored in the meter memory on first in first out basis.
- 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 of 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.

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

SECTION – 5

TECHNICAL SPECIFICATION OF 33 KV INDOOR VACCUM CIRCUIT BREAKERS

5.1.0 SCOPE

This section of the specification covers the manufacture, testing at manufactures works, erection and commissioning of indoor 33 KV which includes 33 KV circuit breakers with current transformers, voltage transformers, local controls and instruments & meters etc. and wired complete with all accessories as specified.

5.2.0 STANDARDS

The switchgear panels shall comply in all respects the requirement laid down in the latest editions of IEC: 62271-200/100 unless otherwise specified in this specification.

5.3.0 TYPE & RATING

5.3.1 The panels 33 kV switchgear panels shall comprise of 33 kV Vacuum Type circuit breakers, instrument panels and instrument transformers etc. suitable for indoor use. The equipment shall be totally enclosed in a metal clad cubicle, dust and vermin proof with necessary isolation arrangement. Each panel shall be easily extensible on either side and should be complete with necessary internal copper connections, small wiring, L.T. fuses and supporting frame work with bolts to secure it to the floor. The Circuit Breakers shall be draw out type in horizontal position.

5.3.2 Principal parameters

The breakers shall have the following ratings:

- | | |
|---|---|
| a. Type: | Vacuum |
| b. No of poles: | 3 |
| c. Nominal system voltage: | 33 kV |
| d. Highest system voltage: | 36 kV |
| e. Rated frequency: | 50 +/- 1.5 Hz |
| f. Rated continuous current: | 2500 Amp for incoming, 1600 Amp rating at an ambient for outgoing feeders & 1600Amp for Bus Coupler (Bus Bar Rating=2500Amp). |
| g. Symmetrical breaking: | 31.5 kA for 3 Sec. |
| h. Impulse withstand test voltage: | 170 kV (Peak) |
| i. One-minute power frequency withstand test voltage: | 70 kV (rms) |
| j. Short time current: | Not less than 31.5 kA for 3 sec. |
| k. System neutral: | Solidly earthed. |

5.4.0 CONSTRUCTIONAL FEATURES

5.4.1 The switchgear boards shall have a single front, single tier, fully compartmentalized, metal enclosed construction, comprising of a row of freestanding floor mounted panels. Each circuit shall have a separate vertical panel with distinct compartments for circuit breaker truck, cable termination, Main busbars and auxiliary control devices. The adjacent panels shall be completely separated by steel sheets except in busbar compartments where insulated barriers shall be provided to segregate adjacent panels. However, manufacturer's standard switchgear designs without internal barriers in busbar compartment may also be considered.

5.4.2 The circuit breakers and bus PTs shall be mounted on withdrawable trucks, which shall rollout horizontally from service position to isolated position. The breaker truck shall be floormounted so that it can be easily pulled out on the control room floor and the help of trolley etc. are not to be utilized.

5.4.3 The switchgear assembly shall be dust, moisture, rodent and vermin proof, with the truck in any position SERVICE, ISOLATED, TEST or removed, and all doors and covers closed. All doors, removable covers and glass windows shall be gasketed all round with synthetic rubber or neoprene gaskets.

Note: Complied for TEST & SERVICE Position.
Not applicable for Isolated/disconnected Position where an isolating distance or segregation is established in the circuits (Main & Auxiliary) of the withdrawable part as per Clause no 3.129 of IEC 62271-200. The CB door need to be opened to establish isolation in the auxiliary circuit of the withdrawable part.

5.4.4 The bus VT/instrument compartments shall have degree of protection not less than IP: 52 in accordance with IS:2147. However, remaining compartments can have a degree of protection of IP: 42. All louvers if provided shall have very fine brass or GI mesh screen. IPH-2 degree of protection as per IS: 3427 to all live parts shall (whether isolated or removed from panel) even when the breaker compartment door is open. Tight fitting gaskets are to be provided at all openings in relay compartment.

Note: Requirement for IP 52 is generally applicable for application which has exposure to dust and water (Protection against falling water drops when panel is tilted 15Deg on either side of the vertical). Also, the standard IS: 2147 referred in clause no 5.4.4 under this section is applicable for Low Voltage Switchgear only. It is not applicable for HV metal enclosed switchgear. Also, IP42 degree of protection is applicable for installations which have exposure to water ((Protection against falling water drops when panel is tilted 15Deg on either side of the vertical). But as per IEC 62271-200:2011 (applicable standard for indoor metal enclosed switchgear which is installed inside control rooms) the minimum degree of protection required for a metal enclosed switchgear is IP2X (i.e. prevent access to hazardous parts with fingers and protects the equipment inside the enclosure against ingress of solid foreign objects having a diameter of 12.5 mm and greater). Offered panels are tested for IP4X degree of protection (Any object probes greater than 1.0 mm Ø shall not penetrate). Therefore, we request you to accept the ingress protection as IP 4X for the enclosure

5.4.5 Circuit breaker shall be vacuum; draw out type housed in a separate cubicle of the switchboard and shall be enclosed from all sides. A sheet steel hinged lockable door shall be at the front. It shall be possible to withdraw the circuit breaker to 'Test' and 'Isolated' positions with the cubicle door closed. Door interlock shall be provided such that the door can only be open after withdrawing the breaker to 'Isolated' position and the breaker cannot be racked into the 'Service' position unless the door is closed. A visual indication as to show when the breaker is in 'Service', 'Test' or 'Isolated' position shall be provided in front of the door.

5.4.6 The construction of switchgear panel shall ensure following features:

- i) Enclosure shall be constructed with rolled steel sections and cold rolled steel sheets of at least 2.0 mm thickness, Gland plates shall be 2.5 mm thick made out of hot rolled or cold rolled steel sheets and for non-magnetic material it shall be 3.0 mm.
- ii) The switchgear shall be cooled by natural airflow and cooling by any other method shall not be accepted.
- iii) Total height of the switchgear panels may not exceed 2600 mm. The height of switches, push buttons and other hand-operated devices shall not exceed 1800 mm and shall not be less than 700 mm.
- iv) Safety shutters complying with IEC-60298 shall be provided to cover up the fixed high voltage contacts on busbar and cable sides when the truck is moved to ISOLATED position. The shutters shall move automatically, through a linkage with the movement of the truck. Preferably it shall however, be possible to open the shutters of busbar side and cable side individually against spring pressure for testing purpose after defeating the interlock with truck movement deliberately. It shall also be possible to padlock shutters individually. Clearly visible warning label "Isolate elsewhere

before earthing" shall be provided on the shutters of incoming and the connections, which could be energized from other end.

- v) Switchgear construction shall have a bushing or other sealing arrangement between the circuit breaker compartment and the busbar/cable compartments, so that there is no air communication around the isolating contacts in the shutter area with the truck in service position.
- vi) The breaker and the auxiliary compartments provided on the front side shall have strong hinged doors, busbar and cabling compartments provided on the rear side shall have bolted compartment covers with self retaining bolts. Breaker compartment doors shall have locked facility.
- vii) In the service position, the truck shall be so secured that it is not displaced by short circuit forces. Busbars, jumpers and other components of the switchgear shall also be properly supported to withstand all possible short circuit forces corresponding to the short circuit rating specified.
- viii) Suitable base frames made out of steel channels shall be supplied along with necessary anchor bolts and other hardware, for mounting of the switchgear panels. These shall be dispatched in advance so that they may be installed and leveled when the flooring is being done, welding of base frame to the insert plates as per approval installation drawings.
- ix) The switchboard shall have the facility of extension on both sides. Adopter panels and dummy panels required to meet the various busbar arrangement, cable/bus duct termination and layouts are included in Contractor's scope of work.

5.4.7 Plug and socket isolating Contacts for main power circuit shall be silver plated, of selfaligning type, of robust design and capable of withstanding the specified short circuit currents. They shall preferably be shrouded with an insulating material Plug and socket contacts for auxiliary circuits shall also be silver plated, sturdy and of self-aligning type having a high degree of reliability. Thickness of silver plating shall not be less than 10 microns.

5.5.0 INSTRUMENT PANELS

5.5.1 Each unit shall have its own instrument panel provided at the top & complete with small wiring connections from relays, instrument transformers, metering instruments, indicating instruments, selector switches & circuit breaker control switch. All wiring shall be carried out by using stranded single annealed copper conductor insulated with poly vinyl chloride insulation suitable for 110 V service and in accordance with IS:732. CT/PT circuit shall use wire of not less than 2.5 mm² cross-sectional area whereas control/alarm/supervision circuit shall use wire of not less than 1.5 mm² cross-sectional area.

5.5.2 All wires will be continuous from one terminal to the other and, also will have no Tee junction enroute. The connections shall be securely made with the help of connecting lugs duly crimped on to the copper conductor. The meters and relays shall be mounted in a convenient position so as to be readily accessible for inspection or repair. The terminal board provided in the instrument panel of VCBs will be made of moulded dielectric having brass studs, washers, holding nuts & locking nuts. All holding nuts shall be secured by locking nuts. The connection studs shall project 6 mm from the lock nut surface. NO OTHER TYPE OF TERMINAL BOARD IS ACCEPTABLE. The panels shall have a degree of protection of IP-52. The leads from metering CTs shall be directly terminated at TTB & there from at the KWH meter with a provision to seal TTB and KWH meter. The said CT leads will be concealed to prevent their tempering enroute. Similarly, PT leads from secondary box of the PT to TTB & there from to energy meter including inter panel PT leads will also be concealed to prevent their tempering. The mode & extent of concealing the metering leads of CTs & PTs to prevent their tempering (by unscrupulous operating personnel) will be discussed & mutually agreed upon with the successful bidder(s). TTB used on the instrument panel should be suitable for front connections.

5.5.3 Earthing of current free metallic parts or metallic bodies of the meters/switches mounted on the instrument panel and metal enclosed switchgear shall be done by a suitably sized copper conductor. Earth bus made of 25x8 mm bare copper flat will be extended through entire length of 33 kV switch board with suitable provision to connect it to the sub-station earth at the extremities. The earthing arrangement will meet with the requirements laid down in IS:3427 read with its latest amendment.

5.6.0 BUS – BARS

- 5.6.1** All the panels shall be provided with one set of 3 phase 2500 Amps. Heat shrunk PVC Sleeves insulated Main electrolytic copper bus bars for all switchboards and shall be connected in a separate moisture and vermin proof sheet metal chamber. The bus-bar connections & insulator supports shall be mechanically strung & rigidly supported so as to withstand the stresses generated by vibrations, variations in temperature and due to severe short circuits.
- 5.6.2** The bus bars shall be Heat shrunk PVC Sleeves insulated type and supported on insulators at short intervals keeping adequate clearance as per IE rules between bus bars and earth. The bus bar chamber shall be provided with inspection covers with gaskets & bus bar shutters. Provision shall be made for future extension of bus bar & switch board.
- 5.7.0 CIRCUIT BREAKERS**
- 5.7.1** The Circuit Breakers shall be with Vacuum Interrupters, with motor operated spring charging operating mechanism. The breaker manufacturer should also be a manufacturer of vacuum interrupter. The Vacuum Interrupter should be the VCB manufacturer's own make. VI manufacturing facilities should be available in India and proper documentation (i.e., ISO, factory registration, etc.) in support of that should be submitted.
- 5.7.2** The circuit breaker shall be trip free and shall be provided with anti-pumping device.
- 5.7.3** The vacuum type circuit breaker shall be draw out type & trip free. The VCBs shall be suitable for operation from 110 VDC auxiliary supply. The operating mechanism shall be motor operated spring charged type. There shall be provision(s) for manual charging of closing spring and emergency hand trip. The motor used for the purpose will be suitable for 240 V AC as well as for 110 VDC. The operating mechanism shall work satisfactorily at 85% - 110 % of rated supply voltage. The VCB shall have 4 normally open & 4 normally-closed auxiliary contacts over & above the ones required for various control & supervision circuits.
- 5.7.4** The circuit breakers shall have following ratings and characteristics:
- | | | |
|--------|---|---|
| (i) | Rated voltage: | 36 KV |
| (ii) | No. of poles: | 3 |
| (iii) | Rated current: | a) 2500 Amps for transformers.
b) 1600 Amps for outgoing
c) 1600 Amps for Bus Coupler
d) Bus Bar Rating: 2500 Amps |
| (iv) | Rated frequency: | 50 Hz |
| (v) | Rated breaking capacity: | (a) Symmetrical: 25 KA
(b) Asymmetrical: As per IS: 13118 |
| (vi) | Rated breaking capacity: | 2.5 times the rated symmetrical breaking capacity |
| (vii) | Short time current rating: | 31.5 KA for three second |
| (viii) | Rated voltage of operating device: | 110 volts D.C |
| (ix) | Operating mechanism: | Motor operated spring charged independent spring closing mechanism |
| (x) | Impulse withstand voltage: | 170 KV (Peak) |
| (xi) | One-minute power frequency withstand voltage: | 70 KV (rms) |
- 5.8.0 CURRENT TRANSFORMERS**
- 5.8.1** The tenderer shall quote for cast-resin type, single-phase current transformers.
The CT ratio & cores shall be decided during detailed engineering.
- 5.9.0 POTENTIAL TRANSFORMERS**

5.9.1 The tenderer shall quote for oil immersed or cast-resin type having the following particulars for the purpose of metering:

- i) Rated voltage ratio: 33000/110
- ii) No. of phases: 3 phases/star-star connected
- iii) Rated Burden: 50 or 100 VA for each phase
- iv) Class of accuracy: 0.2/3P/3P

5.9.2 Primary wiring of the PTs shall be protected by suitable H.R.C. fuses.

5.10.0 PROTECTIVE RELAYS

5.10.1 Protective relays for protection of transformers, 33 kV feeders and bus section shall be provided in separate panels housed in a separate room. The protection scheme shall be as per **Volume-II**.

5.11.0 CABLE BOXES AND CABLE GLANDS

5.11.1 Cable boxes with cable glands shall be supplied with each of the panel. It should be of adequate dimension for terminals of 33 KV, single core XLPE cables of sizes 800 sq. mm (two numbers per phase for transformer panel and one number per phase for each 33 kV outgoing feeders).

5.11.2 The 33 KV cable boxes shall be located at the back of the switchboards and shall be suitably mounted for cables rising from cable trenches running at floor of the control room. The cable glands provided at the entrance shall have facility for earthing of metal screening of cables.

5.11.3 All control/wire entries should be by means of suitable cable glands such glands should be of brass and tinned.

5.12.0 LOCAL SUPERVISION SCHEME

5.12.1 Instrument panels on each of the 33 kV VCB covered by this specification shall be provided with the following indicating lamps/relay:

- (i) Circuit breaker 'open' Green
- (ii) Circuit breaker 'close' Red
- (iii) Circuit breaker spring charged Blue
- (iv) Circuit breaker 'close' & 'open' lamps will be wired so as to be on 240 V AC under 'normal' condition. These lamps will be switched over to 110 VDC automatically in the event of failure of 240 V AC supply. Each of 33 kV (incoming) instrument panel will be equipped with a suitable relay for this purpose.

5.13.0 METERING SCHEME

5.13.1 Each of the 33 kV VCB will be provided with a suitably scaled ammeter with a selector switch facilitating measurement of phase currents as well as unbalance current. The instrument shall be of moving iron spring-controlled type of industrial grade 'A' classification having accuracy class 1.0 & shall conform to IS:1248.

5.13.2 Each of the 33 kV (incoming) VCB will be provided with a suitably scaled voltmeter with a selector switch. The selector switch shall facilitate the measurement of phase to phase & phase to neutral voltage of all the three phases one by one. The coil of the voltmeter shall be rated for 110 V (phase to phase). The instrument shall be of moving iron spring-controlled type of industrial grade 'A' classification with accuracy class 1.0 & shall conform to IS:1248.

5.13.3 Each of the 33 kV VCB panel (incoming & outgoing) will be equipped with a MW Meter

5.14.0 LOCAL CONTROL SCHEME

5.14.1 The instrument panel of each of the 33 kV VCB will be equipped with a circuitbreaker control handle of pistol grip type with spring return to neutral position and having bell alarm cancellation contacts. The control handle shall be so designed that after being operated to 'close' a VCB the operation cannot be repeated until the control handle has been turned to 'trip' position making it impossible to perform two closing operation consecutively.

5.14.2 The rating of the control handle shall be suitable for the duty imposed by the closing and opening mechanism of VCB. The moving and fixed contacts shall be of such a shape & material to ensure good contact and long life under service operating duty. All contacts shall be readily renewable.

5.14.3 The number of contacts in the control handle will be decided by the bidder keeping in view the requirements of this specification. Two pairs of contacts shall be kept spare. The total number of contacts proposed to be provided shall be stated in the bid.

5.14.4 Safety against inadvertent operation due to light touch on the control handle shall be ensured.

5.15.0 REMOTE OPERATION AND SUPERVISION

5.15.1 The entire 33 kV switchgear panel shall be wired for remote operation and supervision through BCU/RTU. Remote operation shall be either from substation HMI in control room or through SCADA as per Section-8 of this Volume.

5.15.2 A lockable Local/Remote switch shall be provided on the 33 kV switchgear. At remote position the Local Control Scheme (clause 5.14.0) shall be in disabled mode.

5.16.0 PROTECTION SCHEME

5.16.1 Protective relays for protection of transformers, 33 kV feeders and bus section shall be provided in separate panels housed in a separate room. The protection scheme for incomer (transformer) and outgoing feeders (33 kV feeders) shall be generally as per Volume-II. The Bus Section shall have only over current & earth fault relays

5.16.0 PRE-COMMISSIONING CHECKS / TESTS

5.16.1 After installation of panels, power and control wiring and connect contractor shall perform commissioning checks as listed below to proper operation of switchgear/panels and correctness of all respects.

5.16.2 General

- a) Check nameplate details according to specification.
- b) Check for physical damage.
- c) Check tightness of all bolts, clamps and connecting terminal.
- d) Check earth connections.
- e) Check cleanliness of insulators and bushings.
- f) Check heaters are provided.
- g) H.V. test on complete switchboard with CT & breaker / contractor lubricated in position.
- h) Check all moving parts are properly lubricated.
- i) Check for alignment of bus bars with the insulators to ensure alignment and fitness of insulators.
- j) Check for interchangeability of breakers.
- k) Check continuity and IR value of space heater.
- l) Check earth continuity of the complete switchgear board.
- m) The VCB panel should be type tested for withstanding internal arc of 1 sec of maximum fault current for AFLR.

5.16.3 Circuit Breaker

- a) Check alignment of trucks for free movement.
- b) Check correct operation of shutters.
- c) Check slow closing operation (if provided).

- d) Check control wiring for correctness of connections, continuity and IR values.
- e) Manual operation of breakers completely assembled.
- f) Power closing / opening operation, manually and electrically at extreme condition of control supply voltage.
- g) Closing and tripping time.
- h) Trip free and anti-pumping operation.
- i) IR values, resistance and minimum pick up voltage of coils.
- j) Simultaneous closing of all the three phases.
- k) Check electrical and mechanical inter locks provided.
- l) Checks on spring charging motor, correct operation of limit switches and time of charging.
- m) Check vacuum (as applicable).
- n) Mechanical Endurance test as per M2 class of IEC.
- o) The VCB should be type tested for E2 and C2 duty.
- p) All functional checks.

5.18.0 TEST

5.18.1 All routine tests shall be carried out in accordance with IS: 13118-1991(latest edition thereof). VCB and panel should be type tested within 5 years of opening of tender from any of the following testing laboratory: CPRI/ ERDA/ KEEMA/ KERI/ PHELA/ CESI/NABL accredited laboratory.

Note: AEGCL will also accept the type test validity as per the latest CEA guidelines i.e., validity of the type test shall be within 10 years of opening of the tender

5.16.0 TECHNICAL PARAMETERS

Sl. No	DESCRIPTION	PARTICULARS
	BASIC PARAMETERS	
1	Type	Vacuum
2	No of Poles	3
3	Nominal system voltage	33 kV
4	Highest system voltage	36 kV
5	Rated Frequency	50 Hz
6	Rated continuous current	2500 Amp for incoming & 1250 Amp rating at an ambient for outgoing feeders
7	Symmetrical breaking	25 kA
8	Impulse withstands test voltage	170 kV (Peak)
9	One-minute power frequency withstand test Voltage	70 kV (rms)
10	Short time current	Not less than 31.5 kA for 3 sec
11	11 System neutral	Solidly earthed
	CIRCUIT BREAKERS	
1	Rated Voltage	33 kV
2	No of Poles	3
3	Rated current	(a) 2000 Amps for transformers (b) 1250 Amps for outgoing (c) 2500 Amps for bus section
4	Rated Frequency	50 Hz
5	Rated breaking capacity	a. Symmetrical 25 KA b. Asymmetrical As per IS: 13118

6	Rated breaking capacity	2.5 times the rated symmetrical breaking capacity
7	Short time current rating	25 KA for three second
8	Rated voltage of operating device	110 VDC
9	Operating mechanism	Motor operated spring charged independent spring closing mechanism
10	Impulse withstand voltage	170 KV (Peak)
11	One-minute power frequency withstand Voltage	70 KV (rms)
	CURRENT TRANSFORMERS	
	Current transformers for incoming (transformer) panel	
1	Ratio	
2	Accuracy class	
3	Rated Burden	
4	Knee point voltage	
5	Max. Secondary Resistance	
	Current Transformers for outgoing (feeders)	
6	Ratio -400-600A/1-1	
7	Accuracy class - 0.2S	
8	Rated Burden-30VA	
	Current transformers for Bus Section	
9	Ratio	
10	Accuracy class	
11	Rated Burden	
	POTENTIAL TRANSFORMERS	
	Rated voltage ratio	33000/110V
	No. of phases	3 phases/star-star connected
	Rated Burden	100/100/100 VA per phase
	Class of accuracy	0.2/3P/3P