



CORRIGENDUM-I
BID DOCUMENT VOLUME-II

BID IDENTIFICATION NO: AEGCL/MD/CGM(O&M)/CAR/Srikona/Aug/33 KV/EQP. /2023/BID

For the above referred bid, the Volume-II of the bid document is hereby uploaded for reference of the interested bidders.

Interested parties may visit www.aegcl.co.in and <https://assamtenders.gov.in> for bid document.

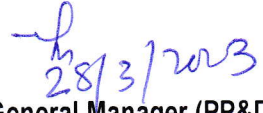
Sd/-

Chief General Manager (PP&D)
Assam Electricity Grid Corporation Limited

Memo No: AEGCL/MD/ CGM(O&M)/CAR/Srikona/Aug/33 KV/EQP./2023/BID/9(a) Date: 28.03.2023

Copy to:

1. IT Cell, O/o the MD, AEGCL, for publication of the corrigendum in AEGCL's Website (Soft copy enclosed)


Chief General Manager (PP&D)
Assam Electricity Grid Corporation Limited

BIDDING DOCUMENT
FOR

**“Supply of 33 kV equipment for augmentation works at 132 kV Srikona
GSS”**



(E-Tender)

(VOL – II: Technical Specifications)

BID IDENTIFICATION NO:
AEGCL/MD/ CGM(O&M)/CAR/Srikona/Aug/33kV/EQP. /2023/BID

**ASSAM ELECTRICITY GRID
CORPORATION LIMITED**

Section	<u>MAIN CONTENTS</u>	Page No.
Section - 4	Technical Specification	3

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

- Design, engineering, manufacture, assembly and testing at manufacturer's works of 33kV terminal equipments and different substation materials, as specified in the BoQ.
- Loading at manufacturer's works, transportation and delivery at respective sites, including unloading at destination sites.

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 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 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.

- (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 where 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.

**4.2.0 SPECIFICATION FOR DESIGN AND FABRICATION
OF SUBSTATION STEEL STRUCTURES**
(Not in scope of this Bid)

4.2.1 SCOPE

4.2.1.1 This section covers the design parameters and specification for fabrication and galvanising, of steel structures, bolts & nuts, tower accessories etc for Substations covered under this Bid Document.

4.2.2 MATERIALS

4.2.2.1 Structural Steel

The structures shall be of structural steel conforming to any of the grade, as appropriate, of IS 2062 (latest edition) Steel conforming IS 8500 may also be used.

Medium and high strength structural steels with known properties conforming to any other national or international standards may also be used.

4.2.2.2 Bolts

Bolts used shall conform to IS12427 or bolts of property class 4.6 conforming to IS 6639 may also be used.

High strength bolts, if used (only with steel conforming to IS 8500) shall conform to property class 8.8 of IS 3757.

Foundation Bolts shall conform to IS 5624.

Step bolts shall conform to IS 10238

4.2.2.3 Nuts

Nuts shall conform to IS 1363 (Part 3). The mechanical properties shall conform to property class 4 or 5 as the case may be as specified in IS 1367 (Part 6) except that the proof stress for nuts of property class 5 shall be as given in IS 12427.

Nuts to be used with high strength bolts shall conform to IS 6623.

4.2.2.4 Washers

Washers shall conform to IS 2016. Heavy washers shall conform to IS 6610. Spring washers shall conform to type B of IS 3663

Washers to be used with high strength bolts and nuts shall conform to IS 6649.

4.2.2.5 Galvanization

Structural members, plain and heavy washers shall be galvanized in accordance with the provisions of IS 4759.

Spring washers shall be hot dip galvanized as per service grade 4 of IS 4759 or IS 1537.

4.2.2.6 Other Materials

Other materials used in the construction of the supporting structures shall conform to appropriate Indian Standards wherever available.

4.2.3 DESIGN PARAMETERS

4.2.3.1 Switchyard structures such as columns, beams and equipment mounting structures shall be designed as per actual site requirement. The drawings are to be submitted for approval prior to supply/execution.

Note: Structures with earth peak shall assume to have four earth wires for design purpose in normal condition.

4.2.3.2 Spans

Following Spans shall be considered in design of all structures as applicable: -

- a). Line gantries (structures to terminate lines):
 - (i) For 33 KV Switchyard: 50 Meter, wind & weight span.
- b). All other Structures
 - (i) For 33 KV Switchyard: 20 Meter, wind & weight span.

4.2.4 Deviation Angle

The design of line gantries shall only be checked for a maximum deviation angle of 300 from normal at center of gantries to Dead End Tower.

4.2.5 Conductors and Shield Wires

- a) The Conductor shall conform to IS: 398 (latest edition) except where otherwise specified herein.

The details of the ACSR Moose, ACSR Zebra and ACSR Panther conductors are tabulated below:

	DESCRIPTION	ACSR 'MOOSE'	ACSR 'ZEBRA'	ACSR 'PANTHER'
1	Code name	MOOSE	ZEBRA	PANTHER
2	Number of strands & size	Al: 54/ 3.53 mm	Al: 54/ 3.18 mm	Al: 30/ 3.00 mm
		St: 7/ 3.53 mm	St: 7/ 3.18 mm	St: 7/ 3.00 mm
3	Overall diameter	35.05 MM	28.62 mm	21.00 mm
4	Breaking load	136.38 KN	130.32 kN	130.32 kN
5	Weight of conductor	2004 Kg/KM	1621 kg / km	974 kg / km
6	Co-efficient Of Linear Expansion	23x10-6 /0C	19.35x10-6 /0C	19.35x10-6 /0C
7	Number of strands			
	Steel centre	1	1	1
	1st Steel Layer	6	6	6
	1st Aluminium Layer	12	12	12
	2nd Aluminium Layer	18	18	18
	3rd Aluminium Layer	24	24	-
8	Sectional area of Aluminium	528.50 mm ²	428.90 mm ²	212.10 mm ²
9	Total sectional area	597.00 mm ²	484.50 mm ²	261.50 mm ²
10	Calculated d.c. resistance at 20 C	0.05552 ohm/km	0.06869 ohm/km	0.1400 ohm/km
11	Ultimate tensile strength	161.2 kN	130.32 kN	89.67 kN

- b) For protection against direct lightning G.I. wires of size 7/3.66 mm conforming to IS 2241 shall be considered for all switch yards.

4.2.6 DESIGN DRAWINGS

4.2.6.1 The relevant drawings for all the towers, beams and equipment mounting structures shall be furnished by the Supplier to the Purchaser which shall include structural/fabrication drawings, Bill of Materials including nuts and bolts.

4.2.6.2 The structural drawings, Bill of materials and shop fabrication drawings for all the structures shall be submitted in four copies and will be finally approved by the Purchaser.

The fabrication shall be taken up from the approved shop drawings.

The overall responsibility of fabricating structure members correctly lies with the Supplier only and the Supplier shall ensure that all the members can be fitted while erecting without any undue strain on them.

4.2.7 ACCESSORIES

4.2.7.1 Step Bolts

Each column/tower shall be provided with step bolts conforming to IS: 10238 of not less than 16mm diameter and 175mm long spaced not more than 450mm apart and extending from 2.5 meters above the ground level to the top. Each step bolt shall be provided with two nuts on one end to fasten the bolt securely to the tower and button head at the other end to prevent the feet from slipping away. The step bolts shall be capable of withstanding a vertical load not less than 1.5 KN.

4.2.7.2 Insulator Strings and Conductor Clamps Attachments

a) Single suspension and tension insulator string assemblies shall be used for stringing busbars. For the attachment of Suspension Insulator string, a suitable strain plate of sufficient thickness for transferring the load to the tower body shall be provided. To achieve requisite clearances, if the design calls for providing extra D-shackles, link plate etc. before connecting the insulator string the same shall be supplied by the Supplier.

b) At tension points strain plates of suitable dimensions placed on the beams, shall be provided for taking the hooks or D-shackles of the tension insulator strings. To achieve requisite clearances, if the design calls for providing extra D-shackles, link plate etc. before connecting the insulator string the same shall be supplied by the Supplier.

4.2.7.3 Earth wire Clamps Attachment

i. Suspension Clamp

The detailed drawing shall be submitted by the Supplier for Purchaser's approval. The Supplier shall also supply U- bolts, D-shackles wherever required.

a) Tension Clamps

Earth-wire peaks of tension towers shall be provided with suitable plates to accommodate the shackle of tension clamps. The Supplier shall also supply the U-bolts wherever required and take Purchaser's approval for details of the attachments before the mass fabrication.

4.2.8 FABRICATION

4.2.8.1 The fabrication of substation steel structures shall be in conformity with the following:

a. Except where hereinafter modified, details of fabrication shall conform to IS: 802 (Part-II) or the relevant international standards.

- b. The tower structures shall be accurately fabricated to connect together easily at site without any undue strain on the bolts.
- c. No angle member shall have the two leg flanges brought together by closing the angle.
- d. The diameter of the hole shall be equal to the diameter of bolt plus 1.5mm.
- e. The structure shall be designed so that all parts shall be accessible for inspection and cleaning. Drain holes shall be provided at all points where pockets of depression are likely to hold water.
- f. All identical parts shall be made strictly inter-changeable. All steel sections before any work are done on them shall be carefully levelled, straightened and made true to detailed drawings by methods which will not injure the materials so that when assembled, the adjacent matching surfaces are in close contact throughout. No rough edges shall be permitted in the entire structure.
- g. Minimum Thickness of Tower Members shall be as follows: -

ITEM	Minimum thickness (in mm)
Leg members & main chords of beams in compression	5
Other members	4

4.2.9 Drilling and Punching

4.2.9.1 Before any cutting work is started, all steel sections shall be carefully strengthened and trued by pressure and not by hammering. They shall again be trued after being punched and drilled.

4.2.9.2 Holes for bolts shall be drilled or punched with a jig but drilled holes shall be preferred. The punching may be adopted for thickness up to 16mm. Tolerances regarding punch holes are as follows:

- a) Holes must be perfectly circular and no tolerances in this respect are permissible.
- b) The maximum allowable difference in diameter of the holes on the two sides of plates or angle is 0.8mm. i.e., the allowable taper in a punched holes should not exceed 0.8 mm on diameter.
- c) Holes must be square with the plates or angles and have their walls parallel.

4.2.9.3 All burrs left by drills or punch shall be removed completely. When the tower members are in position the holes shall be truly opposite to each other. Drilling or reaming to enlarge holes shall not be permitted.

4.2.10 Erection mark

4.2.10.1 Each individual member shall have erection mark conforming to the component number given to it in the fabrication drawings. The mark shall be marked with marking dies of 16mm size before galvanizing and shall be legible after galvanizing.

4.2.11 GALVANIZING AND PAINTING

4.2.11.1 Galvanising of the various members of the structures shall be done only after all works of sawing, shearing, drilling, filling, bending and matching are completed. Galvanising shall be done by the hot dip process as recommended in IIS: 2629 or other such authoritative international standards and shall produce a smooth, clean and uniform coating of not less than 610 gm per square meter. The preparation for galvanising and the galvanising process itself must not affect adversely the mechanical properties of the treated materials. No manual Galvanization process will be accepted.

4.2.11.2 All assembly bolts shall be thoroughly hot dip galvanised after threading. Threads shall be of a depth sufficient to allow for the galvanized coating, which must not be excessive at the root of the threads, so that the nut shall turn easily on the completed bolts without excessive looseness. The nut threads shall not be galvanised, but oiled only.

4.2.11.3 The outside surface shall be galvanised. Sample of galvanised materials shall be supplied to the galvanised test set out in I S 729 or other such authoritative international standards.

4.2.12 EARTHING

4.2.12.1 To keep provision in the structures for earthing, holes shall be drilled on two diagonals opposite legs of the towers/columns/mounting structures. The holes shall be suitable for bolting 65 mm X 12 mm GI strips and shall be such that the lower hole is about 350 mm above the ground level, clear of the concrete muffing, for connecting the earthing strip.

4.2.13 TEST AND TEST CERTIFICATE

4.2.13.1 Each consignment ready for transportation shall be offered to ASEB for inspection before dispatch giving a minimum time of not less than 30 days. Samples of fabricated structure materials shall be subjected to following tests: -

- a) Steel: The structural steel shall conform to IS 226 and IS 8500, BS 4360-1068 or ISO / R 630 other such authoritative international standards. Manufacturer's test certificate shall be submitted for all used steel.
- b) Galvanising: The galvanising shall be as per IS 2633 or BS 729 other such authoritative international standards. Zinc coating over the galvanised surfaces shall not be less than 610 gm per square meter.
- c) Bolts and nuts: Manufacturer's test certificate as per standard practice shall be submitted.

4.2.14 TEST AT SUPPLIER'S PREMISES

4.2.14.1 The Supplier shall fabricate one specimen structure of each type as soon as possible after placement of order and before starting the bulk fabrication of the structures ordered. It shall be assembled on a foundation as nearly similar as practicable to site and tested with suitable test loads as per specified broken wire condition, multiplied by the corresponding factor of safety to ensure that the design and fabrication complies with the requirements. Each structure shall be capable of withstanding the above-mentioned tests without any injury or any permanent deflection at any part. If any member is found to be weak or damaged the design should be suitably modified and the tower re-tested.

4.2.14.2 After the first lot of the structures manufactured, the members forming one structure of each type shall be selected at random from the lots of similar members and assembled in exactly the same manner as to be done at site. The structure then shall be set on foundation as nearly similar as practicable to site and tested with equivalent test load for which the structure has been designed.

4.2.14.3 No structure or any member thereof, which failed the test shall be supplied.

4.3.0 TECHNICAL SPECIFICATION OF 132 KV and 33 KV OUTDOOR SF6 CIRCUIT BREAKERS

4.3.1. SCOPE

4.3.1.1 The intention of this Section of the Specification is to cover design, manufacture, testing at manufacturer's works and of 132KV and 33 KV Circuit Breakers with all fittings and accessories including mounting structures as specified hereunder.

4.3.2. GENERAL REQUIREMENTS

4.3.2.1. The circuit breaker shall be of three phase unit (gang operated) (or) three identical single-phase units (as said in data sheet), outdoor, single pressure puffer type. The operating mechanism shall be electrically and mechanically trip/free with anti-pumping facility suitable for remote electrical closing, tripping as well as local Operation facility as specified. The CBs are meant for installation with Transformers & Lines.

4.3.2.2. The circuit breaker shall be so designed to withstand the effects of temperature, wind load, short circuit conditions and other adverse conditions.

4.3.2.3. The circuit breaker shall be capable of switching transformer-magnetizing currents and shall be restrike - free.

4.3.2.4. All similar parts, particularly removable ones, shall be interchangeable with one another.

4.3.2.5. All cable ferrules, lugs, tags, etc. required for cabling from equipment control cabinet/operating mechanism to the central control cabinet of the breaker shall be supplied loose as per approved schematics.

4.3.2.6. The SF6 breaker shall be designed to ensure that condensation of moisture is controlled by proper selection of organic insulating materials having low moisture absorbing characteristics.

4.3.2.7. The support structure of circuit breaker shall be hot dip galvanized. Sufficient galvanizing thickness shall be achieved with 615 gm/m². All other parts shall be painted as per painting specification enclosed separately.

4.3.3. OPERATING MECHANISM

4.3.3.1. A power spring operated mechanism for closing and tripping shall be provided in the breaker control cabinet. This device shall be so interlocked that while it is under maintenance, the breaker cannot be operated from remote. A slow acting, manually operated device shall be provided for inspection and maintenance purposes.

4.3.3.2. Circuit breaker operating mechanism shall be capable of storing energy for atleast two complete closing and tripping operations.

4.3.3.3. Each mechanism shall have an operation counter.

- 4.3.3.4. The operating mechanism shall be mounted and enclosed in a weather proof, vermin-proof, sheet steel cabinet conforming to IP: 55 degrees of protection. Sheet steel thickness shall be as specified in data sheet. The cabinet shall also house relays, control and auxiliary equipment of each breaker and provision for terminating all control, alarm and auxiliary circuits. It shall be provided with hinged doors with provision for locking and removable gland plates to be drilled at site. Inspection window shall be provided for observation of the instruments without opening the cabinet. It shall be mounted so as to provide convenient access from ground level.
- 4.3.3.5. The cabinet shall be fitted with a thermostatically controlled anti-condensation heater, a 15A, 1 phase, 5 pin socket outlet with switch and a cubicle illuminating lamp suitable for operation on 240 V AC 50Hz supply.
- 4.3.3.6. Provision shall be made for two sources of DC. The change over from one source to other shall be performed through relay only.
- 4.3.3.7. Circuit breakers shall feature high repeatability of absolute closing time over a wide range of parameters (ambient temperature, pneumatic pressure, control voltages, etc.)
- 4.3.3.8. Main poles shall operate simultaneously. There shall be no objectionable rebound and the mechanism shall not require any critical adjustment. It shall be strong, rigid, positive and fast in operation.
- 4.3.3.9. Disagreement circuit shall be provided which shall detect pole position discrepancy.
- 4.3.3.10. The design of the circuit breaker shall be such that contacts will not close automatically upon loss of gas/ air pressure.
- 4.3.3.11. Closing release shall be capable of operating within the range of the rated voltage as specified in the data sheet. Shunt trip shall operate satisfactorily under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker within the range of the rated voltages specified in the Data sheet.
- 4.3.3.12. Working parts of the mechanism shall be of corrosion resisting material. Bearings which require grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the breaker.
- 4.3.3.13. All controls, gauges, relays, valves, hard drawn copper piping and all other accessories as necessary shall be provided including the following:
- 4.3.3.14. Low pressure alarm and lock out relay with adjustable pressure setting suitable for operation on DC system
- 4.3.3.15. A no-volt relay for remote indication of power failure for compressor motor/ Spring Charge motor.
- 4.3.3.16. As long as power is available to the motor, continuous sequence of closing and opening operations shall be possible.

- 4.3.3.17. After failure of power supply to the motor, at least one open-close-open operation of the circuit breaker shall be possible.
- 4.3.3.18. Motor rating shall be such that it requires only about 30 seconds for full charging of the closing spring.
- 4.3.3.19. Closing action of the circuit breaker shall compress the opening spring ready for tripping.
- 4.3.3.20. During closing, springs are discharged and after closing of breaker, springs shall automatically be charged for the next operation. Facility for manual charging of closing springs shall be provided. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is already in the closed position.

4.3.4. OPERATING MECHANISM CONTROL

- 4.3.4.1. The breaker shall normally be operated by remote electrical control. Two electrically independent trip circuit including two trip coils per pole shall be provided. However, provision shall be made for local electrical control. For this purpose, a local/remote selector switch, close and trip control switch/push button shall be provided in the breaker central control cabinet.
- 4.3.4.2. The two way Local/Remote switch shall have minimum 4 (four) pair of contacts and wiring shall be made available to monitor local/remote status from local SCADA.
- 4.3.4.3. The trip coils shall be suitable for trip circuit supervision during both open and close position of the breaker. Necessary terminals shall be provided in the central control cabinet of the circuit breaker by the Supplier.
- 4.3.4.4. The auxiliary switch of the breaker shall be positively driven by the breaker operating rod.
- 4.3.4.5. A conveniently located manual tripping lever or button shall also be provided for local tripping of the breaker and simultaneously opening the reclosing circuit. A local manual closing device which can be easily operated by one man standing on the ground shall also be provided for maintenance purpose. Direction of motion of handle shall be clearly marked.
- 4.3.4.6. Necessary platform with Ladder shall be provided for local operation/maintenance to ease out accessible reach.
- 4.3.4.7. **When the spring get fully charged either through motor or hand cranking, the spring charging motor and the hand cranking device should get disengaged mechanically from the charged spring and this should not be depended upon only the limit switch.**

4.3.5.0. SF6 GAS SYSTEM

- 4.3.5.1. SF6 gas shall serve as an arc-quenching medium during opening/closing operation and as an insulating medium between open contacts of the circuit breaker.
- 4.3.5.2. The circuit breaker shall be single pressure type. The design and construction of the circuit breaker shall be such that there is a minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF6 gas on the internal insulating surfaces of the circuit breaker.
- 4.3.5.3. All gasketed surfaces shall be smooth, straight and reinforced, if necessary, to minimize distortion and to make a tight seal, the operating rod connecting the operating mechanism to the arc chamber (SF6 media) shall have adequate seals. The SF6 gas leakage should not exceed 1% per year
- 4.3.5.4. In the interrupter assembly there shall be an absorbing product box to minimize the effect of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be such as fully compatible with SF6 gas decomposition products.
- 4.3.5.5. Each pole shall form an enclosure filled with SF6 gas independent of two other poles (for 245 & 145 kV CBs) and the SF6 density of each pole shall be monitored. For CBs of voltage class of 36 kV, a common SF6 scheme/density monitor shall be acceptable.
- 4.3.5.6. The dial type SF6 density monitor shall be adequately temperature compensated to model the pressure changes due to variations in ambient temperature within the body of circuit breaker as a whole. The density monitor shall have graduated scale and shall meet the following requirements:
 - It shall be possible to dismantle the density monitor for checking/replacement without draining the SF6 gas by providing suitable interlocked non return valve coupling.

4.3.6.0. BUSHINGS AND INSULATORS

- 4.3.6.1. Bushings and Insulators shall be of Porcelain, Solid core type. Porcelain used for the manufacture of bushings and insulators shall be homogeneous, free from defects, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.
- 4.3.6.2. Glazing of the porcelain shall be of uniform brown colour, free from blisters, burns and other similar defects. Bushings shall be designed to have sufficient mechanical strength and rigidity for the conditions under which they will be used. All bushings of identical ratings shall be interchangeable.

4.3.6.3. Puncture strength of bushings shall be greater than the dry flashover value. When operating at normal voltage, there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the bushings when operating at the normal rated voltage.

4.3.6.4. Bushings shall satisfactorily withstand the insulation level specified in data sheet.

4.3.7. FIXED AND MOVING CONTACTS

4.3.7.1. Main contacts shall have ample area and contact pressure for carrying the rated current and the short time rated current of the breaker without excessive temperature rise which may cause pitting or welding. Contacts shall be adjustable to allow for wear, easily replaceable and shall have minimum moving parts and adjustments to accomplish these results. Main contacts shall be the first to open and the last to close so that there will be little contact burning and wear out.

4.3.7.2. Arcing contacts, if provided, shall be the first to close and the last to open and shall be easily accessible for inspection and replacement. Tips of arcing and main contacts shall be silver faced.

4.3.7.3. If multi-break interrupters are used, they shall be so designed and augmented that a fairly uniform voltage distribution is developed across them.

4.3.8. INTERLOCKS

5.3.8.1. Key release mechanical interlocks shall be incorporated in the operating mechanism for interlocking with the associated isolators, so that operation of the circuit breaker is dependent on a "key-trapped" situation. In addition, electrical interlocks with associated isolators shall be provided.

4.3.9. ADDITIONAL DUTY REQUIREMENTS

4.3.9.1. Circuit breakers shall be capable of clearing short line faults with the same impedance behind the bus corresponding to the rated fault current.

4.3.9.2. Circuit breakers shall be capable of breaking 25% of rated fault current at twice rated voltage under out of phase conditions.

4.3.9.3. The Bid shall highlight the design features provided to effectively deal with:

- a) Breaking of inductive currents and capacitive currents.
- b) Charging of long lines and cables.
- c) Clearing developing faults within the full rating of the breaker.
- d) Opening on phase opposition.

4.3.10.0. ACCESSORIES

4.3.10.1. Gas Pressure Detector

The circuit breaker shall be provided with gas pressure monitor with temperature compensation for initiating alarm and locking the operating mechanism in the event of abnormality. **Gas pressure monitor shall be provided for each pole individually for 132 kV Circuit Breakers.**

4.3.10.2. Position Indicator

Each pole of the circuit breaker shall be provided with a position indicator.

4.3.10.3

Terminals

Each circuit breaker shall be provided with suitable terminal pads of high conductivity aluminium alloy for connecting to the line.

4.3.10.4

Auxiliary Switches

Each circuit breaker shall be equipped with auxiliary switches with sufficient number of contacts for control, indication and interlocking purposes. Ten normally open and ten normally closed contacts shall be provided as spares. All contacts shall be rated for the DC voltage specified in data sheet.

4.3.10.5

Terminal Blocks

All accessories and control devices shall be completely wired. All wirings which are connected to external circuit shall be terminated on terminal blocks installed in the control cabinet. The terminal blocks provided shall have twenty (20) percent spares.

4.3.10.6. Operating mechanism housing shall be supplied with all required accessories including the following:

- a) Padlocks and duplicate keys.
- b) Space heaters equipped with automatic thermostatic control.
- c) Local/remote changeover switch.
- d) Manually operated tripping push button/lever (mechanical) conveniently located to trip all three phases simultaneously.
- e) Control switches to cut off control power supplies.
- f) Fuses as required.
- g) Two earthing terminals.
- h) Auxiliary relays required for satisfactory operation.
- i) Motor contactor with thermal release
- j) Provision for mechanical interlock with isolator.
- k) Readable wiring diagram shall be pasted inside the front cover of the operating mechanism box with indelible ink.

4.3.11. SUPPORT STRUCTURES

4.3.11.1. The Circuit Breakers shall be suitable for mounting on steel structures.

4.3.11.2. The support structure shall be of steel hot dip galvanised type. The height of support structure shall be designed to keep the bottom most live part and bottom of insulators of circuit breakers at minimum clearance from the plinth as specified in data sheet.

4.3.11.3. All necessary galvanised bolts, nuts and washers to complete the erection shall be furnished including the embedded anchor bolts for securing the supporting structure to the concrete foundations.

4.3.12. NAME PLATES

4.3.12.1. All equipment shall have non-corrosive name plates fix at a suitable position indelibly mark with full particular there on in accordance with the standard adapted. In addition to above, the location shall be engraved along with P.O. nos, date and year.

4.3.13. EARTHING

4.3.13.1. Two earthing pads shall be provided on each supporting structure. Each control cabinet or terminal box mounted on the supporting structure shall also be connected to an earthing pad. Separately mounted control cabinets shall be provided with two earthing pads adjacent to the base of the cabinet. The earthing connection shall be bolted type and suitable for receiving 65mm x 12mm MS strip.

4.3.14. TERMINAL CONNECTORS

4.3.14.1. The equipment shall be supplied with required number of terminal connectors of approved type suitable for ACSR conductors. The type of terminal connector, size of connector, material, and type of installation shall be approved by the Employer, as per installation requirement while approving the equipment drawings.

4.3.15. TESTS

4.3.15.1. All routine tests shall be carried out in accordance with relevant IS. All routine/acceptance tests shall be witnessed by the Employer/his authorised representative. The tests shall include the following:

- a) **Routine/Acceptance Tests (all units)**
 - i) Mechanical Operation tests
 - ii) Power frequency voltage withstand test (dry)
 - ii) Tests on auxiliary & control circuits
 - iii) Measurement of resistance of the main circuit.
- b) **Type Tests:**

The bidder shall furnish type test certificates and results for the following tests along with the bid for breaker of identical design.

- i) Breaking and making capacity test
- ii) Short-time current test
- iii) Temperature rise tests
- iv) Lightning Impulse voltage test

- c) **Special Tests:**

The operating mechanism box shall be tested for paint film thickness and the galvanisation test for structure shall be conducted in one of the unit of each type.

d) **Test Certificates**

Copies of routine/acceptance test certificates shall be produced with the endorsement of the inspecting authority to the Employer before effecting despatch. The test report shall contain the following information.

- i) Complete identification data, including serial No. of the breaker.
- ii) Method of application, where applied, duration and interpretation of results in each test.

4.3.16. PRE-COMMISSIONING TESTS

4.3.16.1. Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialties of the items as per the field instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall

arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Employer for approval.

- (a) Insulation resistance of each pole.
- (b) Check adjustments, if any suggested by manufacturer.
- (c) Breaker closing and opening time.
- (d) Slow and Power closing operation and opening.
- (e) Trip free and anti-pumping operation.
- (f) Minimum pick-up voltage of coils.
- (g) Dynamic Contact resistance measurement.
- (h) Functional checking of control circuits interlocks, tripping through protective relays and auto reclose operation.
- (i) Insulation resistance of control circuits, motor etc.
- (j) Resistance of closing and tripping coils.
- (k) SF6 gas leakage check.
- (l) Dew Point Measurement
- (m) Verification of pressure switches and gas density monitor.
- (n) Checking of mechanical 'CLOSE' interlock, wherever applicable.

- (o) Testing of grading capacitor.
- (p) Resistance measurement of main circuit.
- (q) Checking of operating mechanisms
- (r) Check for annunciations in control room.

4.3.17. SPECIAL TOOLS AND TACKLES

4.3.17.1. The Bidder shall furnish a list of any special tools and tackles required for maintenance and operation purposes with recommended quantities for each substation.

4.3.18. TECHNICAL DATA SHEET FOR CIRCUIT BREAKER

Sl. No.	Particulars	Unit	Data for 132kV CB	Data for 33 kV CB
1	Type		SF ₆	SF ₆
2	No of poles		3	3
			(3 Phase Ganged Unit)	(3 Phase Ganged Unit)
3	Service		Outdoor	Outdoor
4	Rated System Voltage	kV	132	33
5	Highest System Voltage	kV	145	36
6	System earthing		Solidly earthed system	Solidly earthed system

7	Rated Voltage of Breaker	kV	145	36
8	Rated Continuous Current	Amps	3150	1250
9	Rated Frequency	Hz	50	50
10	Rated Short Circuit breaking current (I)	kA RMS	40	31.5
	- 3secs - symmetrical			
11	Rated Short Circuit making current	kA PEAK	2.5*I	2.5*I
12	Duty cycle		0-0.3 Sec - CO -3 Min -CO	0-0.3 Sec - CO -3 Min -CO
13	First pole to clear factor		1.3	1.3
14	Opening time			
	i) Opening Time	ms	Not exceeding	Not exceeding
			50 ms	≤35 ms
	ii) Closing Time	ms	Not exceeding	Not exceeding
			120 ms	≤75 ms
15	Insulation level			
	i) Power Frequency with Stand Voltage	kV RMS	275	70
	ii) Impulse withstand Voltage	kV Peak	650	170
16	Minimum clearance between phases	mm	1300	320
17	Minimum clearance between phase to earth	mm	1300	320
18	Minimum Ground clearance (from bottommost live part to plinth level)	mm	5000	4000

19	Minimum clearance from bottom of support insulator to plinth level	mm	2500	2500
20	Minimum Creepage Distance (Total) (31mm/kV)	mm	4495	1116
21	Arcing horn		No	No
22	Operating mechanism:			
	a) Type		Spring Charged	Spring Charged
	b) Rated 3 Phase, 50Hz Voltage for Drive Motor	V	415	415
	c) Rated voltage of Shunt trip coil & operating range	V. DC	220 or 110 [50% - 110%]	220 or 110 [50% - 110%]
	d) Rated voltage of Closing coil & operating range	V. DC	220 or 132 [80% - 110%]	220 or 132 [80% - 110%]
	e) No. of trip coils	No	2 per CB	2 per CB
	f) No. of closing coils	No	1 per CB	1 per CB
	g) No of spare auxiliary contacts & contact rating	Nos	10 N/O+10 N/C	10 N/O+10 N/C (per CB)
		AMPS	(per CB)	10 A at 240V AC
			10 A at 240V AC	& 2A at 220V/ 110V DC
			& 2A at 220V/ 110V DC	
	h) Minimum thickness of sheet steel for control cabinet	mm	3	3
	i) Enclosure Protection		IP55	IP55
23	Reclosing		Three Phase	Three Phase

			auto reclosing	auto reclosing
24	Support structure		Galvanised	Galvanised
	(Painted / Galvanised)			
25	All other parts (Painted / Galvanised)		Synthetic enamel shade	Synthetic enamel shade
			631 of IS5	631 of IS5
			(125 microns)	(125 microns)
26	Minimum size of control wiring (Copper)	Sq. mm	2.5	2.5

4.4.0 TECHNICAL SPECIFICATION OF OUTDOOR CURRENT AND POTENTIAL TRANSFORMERS

4.4.1 SCOPE OF CONTRACT

4.4.1.1 This Section of the Specification covers general requirements for design, engineering, manufacture, assembly and testing at manufacturer's works of 33 kV outdoor Current and Potential Transformers.

4.4.2 STANDARDS

4.4.2.1 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.

4.4.2.2 In case of any conflict between the Standards and this specification, this specification shall govern.

4.4.2.3 The current transformer shall comply also with the latest issue of the following Indian standard.

- (i) IS: 2705(Part-I) Current transformers: General requirement.
- (ii) IS: 2705(Part-II) Current transformers: Measuring Current transformers
- (iii) IS: 2705(Part-III) Current transformers: Protective Current transformers
- (iv) IS: 2705(Part-IV) Current transformers: Protective Current transformers for special purpose application.
- (v) IS: 3156(Part-I) Potential transformers: General requirement.
- (vi) IS: 3156 (Part-II) Potential transformers: Measuring Potential transformers
- (vii) IS: 3156 (Part-III) Potential transformers: Protective Potential transformers

4.4.3 GENERAL REQUIREMENTS

4.4.3.1 The cores of the instrument transformers shall be of high grade, non-aging CRC steel of low hysteresis loss and high permeability.

4.4.3.2 Instrument transformers shall be of Dead Tank design or Live Tank design.

4.4.3.3 The instrument transformers shall be truly hermetically sealed to completely prevent the oil inside the tank coming into contact with the outside temperature. To take care of oil volume variation the tenderer are requested to quote the current transformers with stainless steel diaphragm (bellow).

4.4.3.4 The instrument transformers shall be completely filled with oil.

4.4.3.5 A complete leak proof secondary terminal arrangement shall be provided with each instrument transformers, secondary terminal shall be brought into weather, dust and vermin proof terminal box. Secondary terminal boxes shall be provided with facilities for easy earthing, shorting, insulating and testing of secondary circuits. The terminal boxes shall be suitable for connection of control cable gland.

4.4.3.6 All instrument transformers shall be of single-phase unit.

4.4.3.7 The instrument transformers shall be so designed to withstand the effects of temperature, wind load, short circuit conditions and other adverse conditions.

4.4.3.8 All similar parts, particularly removable ones, shall be interchangeable with one another.

- 4.4.3.9 All cable ferrules, lugs, tags, etc. required for identification and cabling shall be supplied complete for speedy erection and commissioning as per approved schematics.
- 4.4.3.10 The instrument transformers shall be designed to ensure that condensation of moisture is controlled by proper selection of organic insulating materials having low moisture absorbing characteristics.
- 4.4.3.11 All steel work shall be degreased, pickled and phosphated and then applied with two coats of Zinc Chromate primer and two coats of finishing synthetic enamel paint.

4.4.4 INSULATING OIL

- 4.4.4.1 The quantity of insulating oil for instrument transformers and complete specification of oil shall be stated in the tender. The insulating oil shall conform to the requirement of latest edition of IS: 335

4.4.5 COMMON MARSHALLING BOXES

- 4.4.5.1 The outdoor type common marshalling boxes shall conform to the latest edition of IS 5039 and other general requirements specified hereunder.
- 4.4.5.2 The common marshalling boxes shall be suitable for mounting on the steel mounting structures of the instrument transformers.
- 4.4.5.3 One common marshalling box shall be supplied with each set of instrument transformers. The marshalling box shall be made of sheet steel and weather proof. The thickness of sheet steel used shall be not less than 3.0 mm. It is intended to bring all the secondary terminals to the common marshalling.
- 4.4.5.4 The enclosures of the common marshalling boxes shall provide a degree of protection of not less than IP 55 (As per IS 2147).
- 4.4.5.5 The common marshalling boxes shall be provided with double hinged front doors with pad locking arrangement. All doors and removable covers and plates shall be sealed all around with neoprene gaskets or similar arrangement.
- 4.4.5.6 Each marshalling box shall be fitted with terminal blocks made out of moulded non-inflammable plastic materials and having adequate number of terminals with binding screws washers etc. Secondary terminals of the instrument transformers shall be connected to the respective common marshalling boxes. All outgoing terminals of each instrument transformer shall terminate on the terminal blocks of the common marshalling boxes. The terminal blocks shall be arranged to provide maximum accessibility to all conductor terminals.
- 4.4.5.7 Each terminal shall be suitably marked with identification numbers. Not more than two wires shall be connected to any one terminal. **At least 20 % spare terminals shall be provided over and above the required number.**
- 4.4.5.8 All terminal strips shall be of isolating type terminals and they will be of minimum 10 A continuous current rating.
- 4.4.5.9 All cable entries shall be from bottom. Suitable removable gland plate shall be provided on the box for this purpose. Necessary number of cable glands shall be supplied fitted on to this gland plate. Cable glands shall be screw on type and made of brass.
- 4.4.5.10 Each common marshalling box shall be provided with two numbers of earthing terminals of galvanised bolt and nut type.
- 4.4.5.11 All steel, inside and outside work shall be degreased, pickled and phosphate and then applied with two coats of Zinc Chromate primer and two coats of finishing synthetic enamel paint. The colour of finishing paint shall be as follows: -

- i) Inside: Glossy White
- ii) Outside: Light Grey (Shade No. 697 of IS: 5)

4.4.6 BUSHINGS AND INSULATORS

- 4.4.6.1 Bushings and Insulators shall be of Porcelain, Solid core type. Porcelain used for the manufacture of bushings and insulators shall be homogeneous, free from defects, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.
- 4.4.6.2 Glazing of the porcelain shall be of uniform brown colour, free from blisters, burns and other similar defects. Bushings shall be designed to have sufficient mechanical strength and rigidity for the conditions under which they will be used. All bushings of identical ratings shall be interchangeable.
- 4.4.6.3 Puncture strength of bushings shall be greater than the dry flashover value. When operating at normal voltage, there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the bushings when operating at the normal rated voltage.
- 4.4.6.4 The design of bushing shall be such that the complete bushing is a self-contained unit and no audible discharge shall be detected at a voltage up to a working voltage (Phase Voltage) plus 10%. The minimum creepage distance for severely polluted atmosphere shall be 25 mm/KV.
- 4.4.6.5 Sharp contours in conducting parts should be avoided for breakdown of insulation. The insulators shall be capable to withstand the seismic acceleration of 0.5 g in horizontal direction and 0.6g in vertical direction.
- 4.4.6.6 Bushings shall satisfactorily withstand the insulation level specified in data sheet.

4.4.7 TESTS

2.4.1.1 Routine/Acceptance Tests (all units)

- 2.4.1.2 All routine tests shall be carried out in accordance with relevant Standards. All routine/acceptance tests shall be witnessed by the Purchaser/his authorised representative.
- 2.4.1.3 **Type Tests:** The bidder shall furnish type test certificates and results for the all tests as per relevant Standards along with the bid for current and potential transformers of identical design.
- 2.4.1.4 Type test certificates so furnished shall not be older than 7 (seven) years as on date of Bid opening.

4.4.8 NAME PLATES

- 4.4.8.1 All equipment shall have non-corrosive name plates fix at a suitable position indelibly mark with full particular there on in accordance with the standard adapted.

4.4.9 MOUNTING STRUCTURES

- 4.4.9.1 All the equipment covered under this specification shall be suitable for mounting on steel structures.
- 4.4.9.2 Supply of mounting structures is also in the scope of this tender.
- 4.4.9.3 Each equipment shall be furnished complete with base plates, clamps, and washers etc. and other hardware ready for mounting on existing steel structures.

4.4.10 SAFETY EARTHING

- 2.4.10.1. The non-current carrying metallic parts and equipment shall be connected to station earthing grid.

For these two terminals suitable for 40mm X 10mm GI strip shall be provided on each equipment.

4.4.11 TERMINAL CONNECTORS

4.4.11.1 The equipment shall be supplied with required number of terminal connectors of approved type suitable for ACSR. The type of terminal connector, size of connector, material, and type of installation shall be approved by the Purchaser, as per installation requirement while approving the equipment drawings.

4.4.12 TECHNICAL DATA SHEET FOR CURRENT AND POTENTIAL TRANSFORMERS

4.4.12.1 For 132 & 33 kV CTs the instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CTs/reactor are used in the current transformers then all parameters specified shall have to be met treating auxiliary CTs as an integral part of the current transformer. The auxiliary CTs/reactor shall preferably be inbuilt construction of the CTs. In case these are to be mounted separately these shall be mounted in the central marshalling box suitably wired up to the terminal blocks.

4.4.12.2 TYPE AND RATING:

All instrument transformer shall be outdoor type, single phase, oil immersed, self-cooled suitable for mounting on steel structure. The instrument transformer shall have the following ratings and particulars.

<i>Item</i>		Ratings and Particulars	
(A)	Nominal system voltage	132kV	33 kV
(B)	Highest system voltage, kV	145	36
(C)	Rated frequency, HZ	50	50
(D)	System earthing	Solidly earth	Solidly earth
(E)	Insulation level		
(a)	Impulse withstand voltage: kVp	550	170
(b)	One-minute p.f. Withstand voltage, kV (r.m.s.)	230	70
(F)	Short time current for one second, kA	31.5	20
(G)	Minimum creepage distance, mm	As per ISS	As per ISS
(H)	Temperature rise		
(I)	Feeder/ BYPASS/ Bus Coupler CT		
(i)	No. of Cores	3	3
(ii)	Transformation Ratio	As per schedule of requirement	
(iii)	Rated Output		
(a)	Core-1	30 VA	30 VA
(b)	Core-2	15 VA	15 VA
(c)	Core-3		-
(iv)	Accuracy Class		
(a)	Core-1	0.2	0.2
(b)	Core-2	5P	5P
(c)	Core-3	PS	-
(v)	Accuracy Limit Factor		
(a)	Core-1	--	-
(b)	Core-2	10	10
(c)	Core-3	-	-
(vi)	Instrument security factor		
(a)	Core-1	<5	<5
(b)	Core-2	-	-
(c)	Core-3	-	-
(vii)	Minimum Knee point voltage, Volts		
(a)	Core-1	-	-
(b)	Core-2	-	-

(c) Core-3	1200	-
(viii) Maximum secondary resistance, ohm		
(a) Core-1	-	-
(b) Core-2	-	-
(c) Core-3	3	-
(ix) Maximum exciting current, at $V_k/4$ mA		
(a) Core-1	-	-
(b) Core-2	-	-
(c) Core-3 (at $V_k/4$)	30	-
(J) Transformer CT		
(i) No. of Cores	3	3
(ii) Transformation Ratio	As per schedule of requirement	
(iii) Rated Output	3	3
(b) Core-1	30 VA	30 VA
(b) Core-2	15 VA	15 VA
(c) Core-3	-	-
(iv) Accuracy Class		
(a) Core-1	0.2	0.2
(b) Core-2	5P	5P
(c) Core-3	PS	PS
(v) Accuracy Limit Factor		
(a) Core-1	--	-
(b) Core-2	10	10
(c) Core-3	-	-
(vi) Instrument security factor		
(a) Core-1	<5	<5
(b) Core-2	-	-
(c) Core-3	-	-
(vii) Minimum Knee point voltage, Volts		
(a) Core-1	-	-
(b) Core-2	-	-
(c) Core-3	1200	600
(viii) Maximum secondary resistance, ohm		
(a) Core-1	-	-
(b) Core-2	-	-
(c) Core-3	3	3
(ix) Maximum exciting current, at $V_k/4$ mA		
(a) Core-1	-	-
(b) Core-2	-	-
(c) Core-3 (at $V_k/4$)	30	15
POTENTIAL TRANSFORMER		
(i) No. of secondary windings		2
(ii) Transformation ratio		
(a) Winding I	$132kV/\sqrt{3}$	$33kV/\sqrt{3}$
(b) Winding II	$/ 110V/\sqrt{3}$	$/ 110V/\sqrt{3}$

(iii) Rated out put		
(a) Winding I	500	200
(b) Winding II	200	100
(vi) Accuracy class		
(a) Winding I	0.2	0.2
(b) Winding II	3P	3P
(v) Rated voltage factor	1.2	1.2

Note: It is intended to use different ratios of the same CT at the same time for various protections and metering cores. The CTS should therefore be suitable for the above purpose by secondary tapings only. The ratio change by secondary taps is acceptable as long as the required CT specifications are achieved at all ratios.

- (i) The knee point voltage specified above shall be at higher ratio/ taps.

4.5.0 TECHNICAL SPECIFICATION OF ISOLATORS

4.5.1 SCOPE

- 4.5.1.1 This section of the specification is intended to cover design specifications for manufacture and testing of 132kV and 33 KV gang operated Isolators with all fittings and accessories.
- 4.5.1.2 The Isolators are for outdoor installation suitable for horizontally mounting on mounting structures and for use at sub-stations.
- 4.5.1.3 Isolators shall be supplied with Earth Switch as and where specified.
- 4.5.1.4 The bidder shall offer ac motor operated Isolators and earth switches.

4.5.2 GENERAL

- 4.5.2.1 The Isolators and accessories shall conform in general to IS 9921 (or IEC: 62271-102) except to the extent explicitly modified in specification.
- 4.5.2.2 All isolating switches and earthing switches shall have rotating blades and pressure releasing contacts. All isolating and earth switches shall operate through 90° angle from closed position to fully open position.
- 4.5.2.3 Complete isolator with all the necessary items for successful operation shall be supplied including but not limited to the following:
- (i). Isolator assembled with complete base frame, linkages, operating mechanism, control cabinet, interlocks etc.
 - (ii). All necessary parts to provide a complete and operable isolator installation, control parts and other devices whether specifically called for herein or not.
 - (iii) The isolator shall be designed for use in the geographic and meteorological conditions as given in Section 1.

4.5.3 DUTY REQUIREMENTS

- 4.5.3.1 Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the systems in their closed position. They shall be constructed such that they do not open under influence of short circuit current.
- 4.5.3.2 The earth switches, wherever provided, shall be constructionally interlocked so that the earth switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator and shall be in addition to the electrical and mechanical interlocks provided in the operating mechanism.
- 4.5.3.3 In addition to the constructional interlock, isolator and earth switches shall have provision to prevent their electrical and manual operation unless the associated and other interlocking conditions are met. All these interlocks shall be of failsafe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range as stipulated elsewhere in this specification.
- 4.5.3.4 The earthing switches shall be capable of discharging trapped charges of the associated lines.
- 4.5.3.5 The isolator shall be capable of making/breaking normal currents when no significant change in voltage occurs across the terminals of each pole of isolator on account of make/break operation.

4.5.3.6 The isolator shall be capable of making/breaking magnetising current of 0.7A at 0.15 power factor and capacitive current of 0.7A at 0.15 power factor at rated voltage.

4.5.4 CONSTRUCTIONAL DETAILS

4.5.4.1 All isolating switches and earthing switches shall have rotating blades and pressure releasing contacts. All isolating and earth switches shall operate through 90° angle from closed position to fully open position.

4.5.4.2 **Contacts:**

4.5.4.3 The contacts shall be self-aligning and self-cleaning and so designed that binding cannot occur after remaining closed for prolonged periods of time in a heavily polluted atmosphere.

4.5.4.4 No undue wear or scuffing shall be evident during the mechanical endurance tests. Contacts and spring shall be designed so that readjustments in contact pressure shall not be necessary throughout the life of the isolator or earthing switch. Each contact or pair of contacts shall be independently sprung so that full pressure is maintained on all contacts at all time.

4.5.4.5 Contact springs shall not carry any current and shall not lose their characteristics due to heating effects.

4.5.4.6 The moving contact of double break isolator shall have turn-and -twist type or other suitable type of locking arrangement to ensure adequate contact pressure.

4.5.4.7 **Blades:**

4.5.4.8 All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic copper/aluminium. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper silicon alloy or stainless steel or equivalent. The bolts or pins used in current carrying parts shall be made of non-corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast-steel. No grey iron shall be used in the manufacture of any part of the isolator.

4.5.4.9 The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Corona shields/rings etc., shall be made up of aluminium/aluminium alloy.

4.5.4.10 Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism.

4.5.4.11 The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

4.5.4.12 **Insulators:**

4.5.4.13 The insulator shall conform to IS: 2544 and/or IEC-60168. The insulators shall have a minimum cantilever strength of 600/400 Kg. for 145/33 kV insulators respectively.

4.5.4.14 Pressure due to the contact shall not be transferred to the insulators after the main blades are fully closed.

4.5.4.15 **Base:**

Each isolator shall be provided with a complete galvanised steel base provided with holes and designed for mounting on a supporting structure.

4.5.5 EARTHING SWITCHES

- 4.5.5.1 Where earthing switches are specified these shall include the complete operating mechanism and auxiliary contacts.
- 4.5.5.2 The earthing switches shall form an integral part of the isolator and shall be mounted on the base frame of the isolator.
- 4.5.5.3 The earthing switches shall be constructionally interlocked with the isolator so that the earthing switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator and shall be in addition to the electrical interlocks.
- 4.5.5.4 Suitable mechanical arrangement shall be provided for de-linking electrical drive for mechanical operation.
- 4.5.5.5 Each earth switch shall be provided with flexible copper/aluminium braids for connection to earth terminal. These braids shall have the same short time current carrying capacity as the earth blade. The transfer of fault current through swivel connection will not be accepted.
- 4.5.5.6 The frame of each isolator and earthing switches shall be provided with two reliable earth terminals for connection to the earth mat.
- 4.5.5.7 Isolator design shall be such as to permit addition of earth switches at a future date. It should be possible to interchange position of earth switch to either side.
- 4.5.5.8 The earth switch should be able to carry the same fault current as the main blades of the Isolators and shall withstand dynamic stresses.

4.5.6 OPERATING MECHANISM

- 4.5.6.1 The bidder shall offer motor operated Isolators and earth switches. Earth Switches of 36 kV shall only be manual operated.
- 4.5.6.2 Control cabinet/operating mechanism box shall be made of aluminium sheet of adequate thickness (minimum 3 mm).
- 4.5.6.3 A “Local/Remote” selector switch and a set of open/ close push buttons shall be provided on the control cabinet of the isolator to permit its operation through local or remote push buttons.
- 4.5.6.4 Provision shall be made in the control cabinet to disconnect power supply to prevent local/remote power operation.
- 4.5.6.5 Suitable reduction gearing shall be provided between the motor and the drive shaft of the isolator. The mechanism shall stop immediately when motor supply is switched off. If necessary a quick electromechanical brake shall be fitted on the higher speed shaft to effect rapid braking.
- 4.5.6.6 Manual operation facility (with handle) should be provided with necessary interlock to disconnect motor.

4.5.6.7 Gear should be of forged material suitably chosen to avoid bending/jamming on operation after a prolonged period of non-operation. Also all gear and connected material should be so chosen/surface treated to avoid rusting.

4.5.7 OPERATION

4.5.7.1 The main Isolator and earth switches shall be gang operated.

4.5.7.2 The design shall be such as to provide maximum reliability under all service conditions. All operating linkages carrying mechanical loads shall be designed for negligible deflection. The length of inter insulator and interpole operating rods shall be capable of adjustments, by means of screw thread which can be locked with a lock nut after an adjustment has been made. The isolator and earth switches shall be provided with “over center” device in the operating mechanism to prevent accidental opening by wind, vibration, short circuit forces or movement of the support structures.

4.5.7.3 Each isolator and earth switch shall be provided with a manual operating handle enabling one man to open or close the isolator with ease in one movement while standing at ground level. Detachable type manual operating handle shall be provided. Suitable provision shall be made inside the operating mechanism box for parking the detached handles. The provision of manual operation shall be located at a height of 1000 mm from the base of isolator support structure.

4.5.7.4 The isolator shall be provided with positive continuous control throughout the entire cycle of operation. The operating pipes and rods shall be sufficiently rigid to maintain positive control under the most adverse conditions and when operated in tension or compression for isolator closing. They shall also be capable of withstanding all torsion and bending stresses due to operation of the isolator. Wherever supported the operating rods shall be provided with bearings on either ends. The operating rods/ pipes shall be provided with suitable universal couplings to account for any angular misalignment.

4.5.7.5 All rotating parts shall be provided with grease packed roller or ball bearings in sealed housings designed to prevent the ingress of moisture, dirt or other foreign matter. Bearings pressure shall be kept low to ensure long life and ease of operation. Locking pins wherever used shall be rustproof.

4.5.7.6 Signalling of closed position shall not take place unless it is certain that the movable contacts, have reached a position in which rated normal current, peak withstand current and short time withstand current can be carried safely. Signalling of open position shall not take place unless movable contacts have reached a position such that clearance between contacts is at least 80% of the isolating distance.

4.5.7.7 The position of movable contact system (main blades) of each of the Isolators and earthing switches shall be indicated by a mechanical indicator at the lower end of the vertical rod of shaft for the Isolators and earthing switch. The indicator shall be of metal and shall be visible from operating level.

4.5.7.8 The Supplier shall furnish the following details along with quality norms, during detailed engineering stage.

- (i) Current transfer arrangement from main blades of isolator along with millivolt drop immediately across transfer point.
- (ii) Details to demonstrate smooth transfer of rotary motion from motor shaft to the insulator along with stoppers to prevent over travel.

4.5.8 TEST AND INSPECTION

4.5.8.1 The switches shall be subjected to the following type test in accordance to with IS: 9920.
i. Dielectric test (impulse and one minute) power frequency withstands voltage.

- ii. Temperature rise test
- iii. Rated off load breaking current capacity
- iv. Rated active load breaking capacity
- v. Rated line charging breaking capacity
- vi. Rated short time current
- vii. Rated peak withstand current
- viii. Mechanical and Electrical Endurance

4.5.8.2 The equipment shall be subjected to the following routine test.

- (i) Power frequency voltage dry test
- (ii) Measurement of resistance of the main circuit
- (iii) Operating test.

4.5.8.3 The porcelain will have pull out test for embedded component and beam strength of porcelain base.

4.5.9 AUXILIARY SWITCHES

4.5.9.1 All isolators and earth switches shall be provided with 220/110 volts, 6 Ampere auxiliary switches for their remote position indication on the control board and for electrical interlocking with other equipment. In addition to the auxiliary switches required for remote position indications and for their operation. There shall be six pairs of NO and six pairs of NC contacts for each isolating switch and three pairs of NO and three pairs of NC contacts for each earthing switch. All contacts shall be brought out to terminal blocks

4.5.10 CONNECTORS

4.5.10.1 Each isolator shall be provided with appropriate number of bimetallic clamping type connectors as detailed in the schedule of requirement. The maximum length of jumper that may be safely connected or any special instruction considered necessary to avoid under loads on the post isolators should be stated by the bidder.

4.5.11 MOUNTING STRUCTURES

4.5.11.1 All isolators and earthing switches shall be rigidly mounted in an upright position on their own supporting structures. Details of the supporting structures shall be furnished by the successful tenderer. The isolators should have requisite fixing details ready for mounting them on structures.

4.5.12 TECHNICAL DATA SHEET FOR ISOLATORS

No.	Technical Particulars	Isolators class
		33 kV
1	Nominal system voltage, kV	33
2	Highest system voltage, kV	36

3	Rated frequency, Hz.	50
4.	Type of Isolator	Double Break, centre pole rotating
5	Rated continuous current, A	1250
6	Rated short time current, kA	25
7	Rated duration of short time current, (second)	1
8	Rated lightning impulse withstand voltage, kV (peak)	
	i) To earth & between poles	170
	ii) Across isolating distance	180
9	Rated 1 minute power frequency withstand voltage, kV (rms)	
	i) To earth & between poles	70
	ii) Across isolating distance	80
10	Minimum Creepage distance of insulators, mm	31mm/kV
11	Temperature rise	As per relevant IS

4.6.0 TECHNICAL SPECIFICATION FOR SURGE ARRESTORS

4.6.1 SCOPE

4.6.1.1 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.

4.6.2 STANDARDS

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

4.6.3 GENERAL REQUIREMENT

4.6.3.1 The surge arrester shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current.

4.6.3.2 The surge arrester shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing/silicon polymeric of specified creepage distance.

4.6.3.3 The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.

4.6.3.4 The surge arrester shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrester shall be connected with 25x6 mm galvanized strip, one end connected to the surge arrester 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 Arrester.

4.6.3.5 The surge arrester shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrester shall change over to the conducting mode.

4.6.3.6 The surge arrester shall be suitable for circuit breaker performing 0-0.3sec.-CO-3min-CO- duty in the system.

4.6.3.7 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 arrester failure.

4.6.3.8 The reference current of the arrester shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

4.6.3.9 The Surge Arrester shall be thermally stable and the bidder shall furnish a copy of thermal stability test with the bid.

4.6.3.10 The arrester shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.

4.6.4 ARRESTOR HOUSING

4.6.4.1 The arrester 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.

- 4.6.4.2 Arrestors shall be complete with insulating bases, fasteners for stacking units together, surge counters with leakage current meters and terminal connectors.
- 4.6.4.3 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 arrester. 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.
- 4.6.4.4 Sealed housings shall exhibit no measurable leakage.

4.6.5 FITTINGS & ACCESSORIES

- 4.6.5.1 The surge arrester shall be complete with insulating bases, fasteners for stacking units together, surge counters with leakage current meters and terminal connectors.
- 4.6.5.2 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 arrester shall be galvanized. The line terminal shall have a built-in clamping device which can be adjusted for both horizontal and vertical takeoff.
- 4.6.5.3 Grading corona control rings, if necessary, shall be provided on each complete arrester pole for proper stress distribution.

4.6.6 SURGE MONITOR

- 4.6.6.1 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 arrester shall also be supplied within the same enclosure. The number of operations performed by the arrester 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.
- 4.6.6.2 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.

4.6.7 TESTS

4.6.7.1 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.

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

4.6.7.3 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.

4.6.8 NAME PLATE

4.6.8.1 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

4.6.9 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