

SECTION – IV
TECHNICAL SPECIFICATION
FOR
400KV/220KV/132KV/33KV POLYMER HOUSING
SURGE ARRESTERS
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SECTION – IV
TECHNICAL SPECIFICATION FOR SURGE ARRESTERS FOR 420/245/145/36KV
SYSTEMS

1. SCOPE :

1.1 This Specification provides for the design, manufacture, inspection and testing before dispatch, packing and delivery F.O.R. (destinations) of metal oxide (gapless) Surge Arresters with discharge counters, insulating base, terminal connectors and other accessories as specified here in.

Following is the list of documents constituting this Specification. :

(i)	Technical Specification (TS)	
(ii)	Technical Requirements	Appendix-I
(iii)	Quantity and delivery schedule	Appendix-II
(iv)	Guaranteed Technical Particulars	Annexure-A
(v)	Check-List.	Annexure-B
(vi)	Calibration Status of testing equipments and meters/Instruments.	Annexure-C
(vii)	Check-list towards Type Test Reports.	Annexure-D
Note: Annexure-A, B, C & D are to be filled up by the Bidder.		

1.2 All the above along with amendments thereof shall be read and interpreted together. However, in case of a contradiction between the Technical Specification and any other volume, the provisions of this volume will prevail.

1.3 The Surge Arrester shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of offer and purchaser shall have the power to reject any work or materials, which in his judgment is not in full accordance therewith.

2. STANDARDS:-

2.1 Except to the extent modified in the Specification, the Surge Arrester shall conform to the latest editions and amendments of the standards listed hereunder.

	Standard Ref. No.	Title.
1	IEC-60099-4	Metal Oxide Surge Arrester without gaps for A.C system.
2	IS:2147	Degree of protection, provided by enclosures for low voltage switchgear and control.
3	IS:2629	Recommended practice for hot dip galvanization of iron and steel.
4	IS:2633	Method for testing uniformity of coating on zinc coated articles.
5	IS:15086-4	Metal Oxide Surge Arrester without gaps for A.C system.
6	IS:5621 &IEC-621155	Specification for large hollow porcelain for use in electrical installation.
7	IEC-60060-1	High-Voltage Test technique.
8	IEC-60270	Partial discharge measurements.

9	IEC-60099-1	Non-linear resistor type gapped arresters for A.C systems.
10	IEC-60099-2	Measuring Systems
11		Indian Electricity Rules, 1956.
12	IEC-60815	Shed profile of hollow porcelain Insulator.

- 2.2 Surge Arresters with the requirement of other authoritative standards, which ensure equal or better quality than the standards, mentioned above shall also be acceptable. Where the **equipment offered by the supplier conforms to other standards, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the offer. 4 (Four) copies of the reference standards in English language shall be furnished along with the offer.**

3. GENERAL TECHNICAL AND DUTY REQUIREMENTS :

- 3.1 The Surge Arrester shall confirm to the technical requirements as per Appendix-I and this TS.
- 3.2 The energy handling capability of each rating of Arrester offered, supported by calculations, shall be furnished with the offer.
- 3.3 The V-I characteristic of designed arrester of each rating on offer shall be furnished along with necessary supporting documents.
- 3.4 The Surge Arresters shall be fitted with pressure relief devices and arc diverting paths and shall be tested as per the requirements of IEC for minimum prospective symmetrical fault current as specified in Appendix-I.
- 3.5 A grading ring shall be provided if required, (for attaining all the relevant technical parameters) on each complete Surge Arrester.

3.6 PROTECTIVE LEVELS :

Surge Arresters shall be capable of providing protection to sub-station equipments, designed for the withstand levels, given in the following table.

Sl. No.	Equipment to be protected	Lightning impulse 420KV Systems (KVP)	Switching surge 420KV Systems (KVP)	Lightning impulse 245KV Systems (KVP)	Lightning impulse 145KV Systems (KVP)	Lightning impulse 36KV Systems (KVP)
1	Auto Transformers/ Power Transformers.	± 1300	± 1050	± 950	± 550	± 170
2	Instrument Transformers.	± 1425	± 1050	± 1050	± 650	± 170
3	Reactors	± 1300	± 1050	± 900	± 550	± 170
4	Circuit Breakers/Isolators.					
(i)	Phase to ground.	± 1425	± 1050	± 1050	± 650	± 170
(ii)	Across open contacts.	± 1425(+ 240) = 1650	± 900 (+ 345) = 1245	± 1050 for CB ±1200 for ISOLATORS	± 650 for CB ±750 for ISOLATORS	± 195

3.7 Surge arresters shall be suitable for the duty cycles of circuit breakers for all system voltages:

Circuit Breaker Duty Cycle	O-0.3 sec-CO-3 min-CO
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3.8 **DUTY REQUIREMENT :**

- 3.8.1 Surge Arresters shall be gapless type with nonlinear MO resistors without any series or shunt gaps with Arrester Class as mentioned below for different voltage levels:
420 KV CLASS = Station High Duty (SH)
245 KV CLASS = Station Medium Duty (SM)
145 KV CLASS = Station Medium Duty (SM)
33 KV CLASS = Station Low Duty (SL)
- 3.8.2 Surge Arresters shall be capable of discharging over voltages occurring during switching of Un-loaded transformers, lines, capacitors and reactors. It shall be capable of discharging lightning and switching surges and temporary power frequency Over-voltages.
- 3.8.3 A 420 KV class Surge Arrester shall be capable of discharging severe re-energisation Switching surges on long 400 KV lines (Typically of 211 km distance with approx. Surge Impedance of 309 Ohms with capacitance of 11.986nF/Km & over voltage factor of 2.3p.u.).
- 3.8.4 A 420 KV class Surge Arrester shall be capable of discharging energy equivalent to Thermal Energy (W_{th}) of 12 kJ/kV followed by immediate energisation of 50 HZ sequential voltage profile as specified below:
650 kVp for 3 peaks
650 kVp for 0.1 second
650 kVp for 1 second
650 kVp for 10 seconds
- 3.8.5 A 245/145 kV class arrester shall be capable of discharging energy equivalent to Thermal Energy (W_{th}) of minimum 7 kJ/kV followed by procedures as per IEC.
- 3.8.6 A 36 kV class arrester shall be capable of discharging energy equivalent to Thermal Energy (W_{th}) of minimum 4 kJ/kV followed by procedures as per IEC.
- 3.8.7 The reference current of the arrester shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage. The supplier shall submit values and the supporting evidence along with calculations on above.
- 3.8.8 Surge Arresters shall be fully stabilized thermally to give a life expectancy of 100 years under site conditions.
- 3.8.9 Surge Arresters shall be able to withstand maximum wind load of 260 Kg./sq.m.
- 3.8.10 Surge Arresters shall be capable of withstanding effects of direct solar radiation.
- 3.8.11 Unless otherwise brought out separately by the Bidder in the schedule of deviations, the Surge Arresters, offered shall conform to the specification scrupulously. All deviations from the specification shall be brought out in the schedule of deviations. The discrepancies between the specification and the catalogues or literature, submitted as part of the offer shall not be considered as valid deviations unless specifically brought out in the schedule of deviations.

4. **CONSTRUCTION :**

4.1 All the units of arresters of same rating shall be inter-changeable without adversely affecting

the performance.

4.2 The Surge Arresters shall be suitable for pedestal type mounting.

4.3 The Surge Arresters offered for all voltage class shall be of DESIGN-A type i.e. Surge Arresters shall be designed to incorporate pressure relief devices and arc diverting paths to prevent shattering of the blocks or the porcelain housing, following prolonged current flow or internal flash over and providing path for flow of rated fault currents in the event of arrester failure.

4.4 All the necessary flanges, bolts, nuts, clamps etc. required for assembly of complete arrester with accessories and mounting on support structure to be supplied by the purchaser, shall be included in supplier's scope of supply.

4.5 The drilling details for mounting the Arrester on owner's support shall be supplied by the supplier.

4.6 The minimum permissible separation between the Surge Arrester and any earthed object shall be indicated by the Bidder in his offer.

4.7 Sealing Arrangement:

4.7.1. Sealing (for Design-A Arresters) shall be provided in such a way that these are always effectively maintained even when discharging rated lightning current.

4.7.2 The end fittings shall be made of corrosion proof material and preferably be nonmagnetic.

4.7.3 The sealing arrangement (For DESIGN-A arrester) of the surge arrester stacks shall be done incorporating grooved flanges with O-rings /elliptical cross section gaskets of Neoprene or Butyl rubber

4.7.4 Arresters shall be hermitically sealed and shall not lead to "seal pumping" or "wicking" throughout its service life due to pressure differentials or aging of gaskets/sealing compounds used. The supplier shall furnish sectional view of the arrester showing details of sealing employed.

4.7.5 Any compromise in sealing materials, deviation or process lapses in sealing of the surge arrester shall lead to complete rejection of the lot.

4.8 Metal Oxide Block:

4.8.1 Nonlinear blocks shall be sintered metal oxide material. These shall be provided in such a way as to obtain robust construction with excellent electrical and mechanical properties even after repeated operations.

4.8.2 The Material used to coat or collar MO blocks shall be strictly non hygroscopic such as glass material.

4.8.3 The Manufacturer shall submit data for rejection rate of ZnO blocks during manufacturing/ operation for the past three years.

4.8.4 The following details shall be furnished for quality checks:

- A) The heat treatment cycle details along with necessary quality checks used for individual blocks and insulation layer formed across each block.
- B) Metallizing coating thickness for reduced resistance between adjacent discs.

4.9 The Surge Arresters shall be suitable for hot line washing.

4.10 POLYMER HOUSING :

4.10.1 Polymer housing material shall be made of high quality hydrophobic silicon rubber. Polymer Rubber housing shall be free from lamination cavities, surface tack, roughness or other flaws affecting the maximum level of mechanical and electrical strengths. Properties of the polymeric materials shall be specified in the offer and test reports for the same from a NABL accredited laboratory shall be submitted for approval of the purchaser. The polymer material which is used for arrester housing must be resistant to tracking & erosion, stabilized against UV radiation and shall not exhibit any fatigue to temperature and load.

4.10.2 Arresters must have directly moulded housings. Arresters manufactured by slip-on, pre moulded housing will not be accepted in view of the weak interface between the housing and the assembled disc.

4.10.3 The Surge Arrester shall confirm to **IEC 61462** & not fail due to housing contamination. Housing shall be so coordinated that external flashover will not occur due to application of any impulse or switching surge voltage up to maximum design value of Surge Arrester.

4.10.4 Polymer bounding to the core shall be effectively maintained even when surge arrester discharges rated surge current.

4.10.5 The adhesion between the polymeric housing and the metal oxide resistors or any other metallic or non-metallic parts inside the housing must be strong enough, homogeneous, robust and resistant to thermal cycles, and environmental stresses. Tests shall be carried out on each batch during manufacturing and records maintained and provided as & when required during inspection.

4.10.6 The rain sheds / petticoats shall be of polymeric material and shall confirm to the properties and type test reports shall be submitted.

4.10.7 The Polymer weather shed design shall be preferably of self-cleaning type (Aero foil design.) The details of the Polymer housing shed profile such as distance, angle of inclination, gap between the shed, diameter (ID and OD) etc. shall be as per relevant standard and shall be indicated by the Bidder in his offer in the form, during detailed drawing evaluation.

4.10.8 The unified specific creepage distance of the arrester housing shall be as per IEC 60099-4 mentioned in Appendix-I (Technical Requirements).

4.11 **GALVANISATION, NICKEL PLATING ETC. :**

4.11.1 All ferrous parts exposed to atmosphere shall be hot dip galvanized as per IS: 2629, as amended from time to time. Tinned copper/brass lugs shall be used for internal wiring of discharge counter. Screws used for electrical connections shall be either made of brass or shall be nickel-plated.

4.11.2 Ground terminal pads and nameplate brackets shall be hot dip galvanized.

4.11.3 The material shall be galvanized only after completing all shop operations.

4.12 Arresters shall be complete with insulating base having provisions for bolting to flat surface of the structure.

4.13 **ACCESSORIES AND FITTINGS :**

14.13.1 Surge Monitor consisting of surge counter and leakage current meters should be suitable to be mounted on support structure of the arrester and should be tested for IP 66 degree of protection.

4.13.2 **Surge Counters:**

4.13.2.1 A self- contained Surge counter, suitably enclosed for outdoor use and requiring no auxiliary of battery supply for operation shall be provided for each unit. The surge counter shall be operated by the discharge current, passed by the surge arrester and shall be suitable for mounting on the support structure of the Arrester.

4.13.2.2 The cyclometer counter shall be visible through an inspection window from ground level. The counter terminals shall be robust and adequate size and shall be so located that the incoming and outgoing connections are made with minimum possible bends.

4.13.2.3 The Surge Counter shall be connected in the main earth lead from the arrester in such a manner that the direction of the earth lead is not changed or its surge impedance materially altered. A bolted link shall be provided so that the surge counter may be short circuited and removed without taking the arrester out of service.

4.13.2.4 All necessary accessories and earthing connection leads between the bottom of the Arrester and discharge counter shall be in the supplier's scope of supply.

4.13.2.5 For 420 kV and 245 kV class arrester, the surge counter shall be provided with a potential free contact rated for 220 volt (DC) which shall close whenever a surge is recorded by the surge monitor .Necessary arrangement shall be provided for extending the contact information to Substation Automation System.

4.13.3 **LEAKAGE CURRENT METERS :**

4.13.3.1 Leakage current meters (suitable mili-ammeter) shall be connected in the earthing path of the surge arresters to measure the resistor grading leakage current. Meters shall be designed for continuous service.

4.13.3.2 The ammeter shall be suitable for mounting on the support structure of the arrester. The push buttons shall be mounted such that it can be operated from the ground level.

4.13.3.3 Arresters shall be complete with insulating base having provision for bolting to flat surface of the structure. The arrangement of surge monitor enclosure fixing to the structure shall be at its rear/bottom.

4.13.3.4 Grading /corona rings shall be provided on each complete Arrester unit, as required, for proper voltage stress distribution.

4.13.3.5 The grounding terminals shall be suitable for accommodating purchaser's grounding connection to steel earth mat.

4.13.4. The Bidder has to quote unit rates of the **insulating** base and the surge monitor separately. The purchaser reserves its option to procure **insulating** base and surge counter.

4.13.5 Clamp type terminal connector, suitable for 400/220KV-ACSR MOOSE Conductor 132KV & 33KV-ACSR Zebra Conductor shall be provided having both horizontal and vertical take-off.

4.13.6 Two clamp type ground terminal connectors, suitable for G. I. Strip (50 x 6) or (50 x 8) should be provided.

4.13.7 All interconnecting hard wares such as nuts, bolts, spring washers etc. shall be GI instead of MS type with 5% spares to be supplied for different units.

4.13.8. Pollution Shunt (Copper braid) shall be supplied along with each surge Arrester for by-passing the surface current.

4.13.8 Other standard accessories, which are specifically not mentioned, but are usually, provided with Surge Arrester of such type and rating for efficient and trouble free operation should be supplied.

4.13.9 Connection between the surge arrester base and surge monitor shall be through a 2.0 meter (minimum) long insulated copper strip of at least 75 Sqmm cross sectional area or PVC insulated flexible copper cable of at least 70 Sqmm.

4.14. **NAME PLATE:**

Each single pole Arrester shall be provided with non-corrosive legible name plate, at the base bearing thereon, voltage rating of the complete pole and the number of demountable sections with the following data, indelibly marked

- (a) ORISSA POWER TRANSMISSION CORPORATION LIMITED.
- (b) Purchase order No. & Date.
- (c) Name of device.
- (d) Manufacturer's name and trademark and identification no. Of the arrester being supplied.
- (e) Year of manufacture
- (f) Rated system voltage
- (g) Rated Frequency
- (h) continuous operating voltage.(Uc)
- (i) Residual Arrester Voltage(Ures)
- (j) Arrester Class(SH/SM/SL)
- (k) Nominal discharge current.
- (l) Repetitive Charge Transfer rating(Qrs)
- (m) Short Circuit current in KA(rms)
- (n) Energy discharge capability (KJ/KV rating).

4.14 The metallic base of the surge arrester shall have the provision of a separate conducting pad with minimum 10mm thickness for connecting PVC cable/Copper strip (with tinned copper connector/lugs with sufficient surface area) from the base of surge arrester to the input of surge monitor for better surface contact while discharging surges to ground. (The prevalent practice is to connect the PVC cable/Copper strip from the **upper bolt** of insulating base to surge monitor input.)

5. **TEST:**

5.1 **Type Tests:**

The surge Arrester offered should have been subjected to the following type tests in an independent Government approved test laboratory. The bidder shall furnish two sets of type test reports along with the offer. These tests must not have been conducted earlier than five years from the date of opening of technical bid. For any change in the design, type already type tested and the design type offered against this specification, the purchaser reserves the right to demand repetition of some or all type tests without any extra cost to OPTCL in the presence of Purchaser's representative at the cost of the supplier.

- 1 Insulation withstands tests on Arrestor Housing :

- (a) Lightning Impulse Test.(For 390kV/216kV/120kV/30kV)
- (b) Wet switching impulse test. (For 390KV only).
- (c) Wet Power-Frequency test. (For 216kV/120kV/30kV)
- 2 Residual voltage tests.
 - (a) Steep Current
 - (b) Lightning Impulse
 - (c) Switching Impulse
- 3 Test to verify long term stability under continuous operating voltage
- 4 Repetitive charge transfer withstand
- 5 Heat dissipation behavior of test samples
- 6 Operating Duty test.
- 7 Short circuit tests.
 - (a) High current test.
 - (b) Low current test.
- 8 Power frequency voltage vs. time curve.
 - (Temporary over voltage test)
- 9 Bending moment test
- 10 Seismic withstand Test
- 11 Radio Interference voltage test
- 12 Corona Extinction voltage test(For 420/245 KV arresters)
- 13 Seal Leak rate Test
- 14 Test to verify dielectric withstand of the internal components of an arrester.
- 15 Test of internal grading components
- 16 Weather aging test
- 17 Cantilever test on complete arrester as per TEST REQUIREMENT-APENDIX-1.
- 18 IP-66 test on surge monitor.
- 19 Minimum current operation tests of the surge counter.
- 20 Maximum current withstand test of the surge counter.

N.B. :- 1) The conditions as specified in clause No.8.2.6,8.2.7,8.2.8 of IS 15086-4 for not conducting Insulation withstand test on housing based on dry arcing distance or the sum of the partial dry arcing distances is larger than the distance calculated from respective guiding equations, the lightning impulse, Switching impulse, Power frequency voltage test must have been conducted or is to be conducted without any financial liability to OPTCL.

Even if the type test reports are found to be valid as per this specification, the purchaser reserves the right to demand the repetition of some or all the type tests in the presence of purchaser's representative. For this purpose, the bidder shall quote unit rates for carrying out each type test. These prices, if necessary, will be taken into consideration for bid evaluation.

2) Type Test No. 11 & 12 shall be carried out as per the requirements of International Special-Committee on Radio Interference (CISPR) Publication 16-1(1993) Part -1 / NEMA standard Publication No. 107-1964 or in accordance with relevant IEC.

5.2 **ROUTINE TESTS:**

The following routine tests shall be conducted at the supplier's cost on each surge arrester and shall be submitted along with or before offering for inspection for purchaser's approval.

- (a) Sealing test for units with sealed housings.
- (b) Measurement of reference voltage.
- (c) Residual voltage tests.
- (d) Measurement for partial discharge and contact noise.

Note: The above mentioned tests shall be carried out scrupulously as per the sequence i.e. sequentially from (a) to (d).

5.3 **ACCEPTANCE TESTS:**

The following tests, considered as acceptance tests, shall be conducted in the presence of purchasers representative for which no charges will be payable by OPTCL. The acceptance tests, whenever possible shall be conducted on the complete arrester unit. The number of samples to be subjected to acceptance test shall be decided by the purchaser at the time of actual testing.

- I. Temperature Cycle Test on Housing.
- II. Measurement of Power Frequency Voltage at the reference current.
- III. Measurement of leakage current and capacitive current at M.C.O.V.
- IV. Lightning Impulse Residual Voltage Test at N.D.C., 50% of N.D.C. & 200% of N.D.C.
- V. Partial Discharge Tests on complete arresters/units at 1.05 times M.C.O.V.
- VI. Watt loss test.
- VI. Special Thermal stability test AS PER IS 15086-4 CLAUSE 9.2.2.
- VI. Aging test for Zinc Oxide blocks is to be carried out on 3 samples for 72 hours at continuous over voltage (Uc) and at a temperature of 115 degree °C. Acceptance norm being Ir(resistive current wattloss) shall remain remain or decrease at the end of 72 Hrs from the value taken after 1 hour of start of test.
- VII. Porosity test on porcelain components.
- VIII. Galvanization test on metal parts.
- IX. The functional (operational) test on the Surge Counter by way of checking its operation at following nominal discharge currents:
 - (i) 100 Amps with 8/20 micro second wave shape.
 - (ii) 10 KA with 8/20 micro second wave shape.
- X. Check of calibration of leakage current meters.

6 **INSPECTION:-**

- I The purchaser shall have access at all time to the works and all other places of manufacture, where the Surge Arresters are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier's works, raw materials, manufacture of all the accessories and for conducting the necessary tests.

- II The supplier shall keep the purchaser informed in advance of the time of starting and the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.
- III No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected, tested and dispatch schedule attached to this specification.
- IV The acceptance of any quantity of equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection, if such equipments are later found to be defective.

7 QUALITY ASSURANCE PLAN:-

7.1 The Bidder shall invariably furnish following information along with his offer, failing which the offer shall be liable for rejection.

- (i) Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested, list of tests, normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.
- (ii) Information and copies of test certificates as in (i) above in respect of bought-out items.
- (iii) List of manufacturing facilities available.
- (iv) Level of automation, achieved and list of areas where manual processing exists.
- (v) List of Manufacturing process and quality assurance plan for evaluation.
- (vi) List of areas in manufacturing process where stage inspections are normally carried out for quality control and details of such tests and inspections.
- (vii) Special features provided in the equipment to make it maintenance free
- (viii) List of testing equipments, meters available with Bidder for final testing of equipment, specified and test plant limitation, if any, vis-à-vis the type, acceptance and routine tests, specified in the relevant standards and this specification. These limitations shall be very clearly brought out in the offer.
- (ix) All the testing equipments, meters etc. should have been calibrated in a Government approved laboratory. The Bidder must submit the list of testing equipments and meters test-wise as per Annexure-C of this Technical Specification.

7.2 The suppliers, within 30 days of placement of order submit the following information to the purchaser.

- (i) List of raw materials as well as bought out accessories and the names of the materials as well as bought-out accessories and the names of sub-suppliers, selected from those, furnished along with the offer.
- (ii) Type test certificates of the raw material and bought out accessories.
- (iii) Manufacturing process and Quality Assurance Plan (QAP) with hold points for the purchaser's inspection. The QAP and hold points shall be discussed between the purchaser and the supplier before the QAP is finalized.

- 7.3 The supplier shall submit the routine test certificates of bought out item and raw material at the time of acceptance testing of the fully assembled equipment.

8. DOCUMENTATION :

- 8.1 All drawings shall conform to relevant Indian Standard as per relevant IS. All drawings shall be in ink and suitable for microfilming.
All dimensions and data shall be in S.I. Units.
- 8.2 The supplier shall furnish four sets of following drawings/documents along with his offer.
- (i) General outline drawings of the complete Arrester with technical parameters.
 - (ii) Drawings showing clearance from grounded and other line objects and between adjacent poles of Surge Arresters, required at various heights of Surge Arresters.
 - (iii) Drawings showing details of pressure relief devices.
 - (iv) Detailed drawing of discharge counters along with the wiring and schematic drawing of discharge counter and meter.
 - (v) Outline drawing of insulating base.
 - (vi) Details of grading rings, if used.
 - (vii) Mounting details of Surge Arresters.
 - (viii) Details of line terminal and ground terminals.
 - (ix) Volt-time characteristics of Surge Arresters.
 - (x) Details of galvanization being provided on different ferrous parts.
 - (xi) The detailed dimensional drawing of porcelain Housing such as ID, OD, thickness and insulator details such as height, profile of petticoats, angle of inclination and gap between successive petticoats, total creepage distance etc.
 - (xii) Cross-sectional view of the Surge Arrester Units showing all components.

8.3 TEST REPORTS :

- (i) Four copies of type test reports shall be furnished to the purchaser with the tender specification. Copies of acceptance test reports and routine test reports shall be furnished to the purchaser. One copy will be returned duly certified by the purchaser and only thereafter shall the materials be dispatched.
- (ii) All records of routine test reports shall be maintained by the supplier at his works for periodic inspection by the purchaser.
- (iii) All test reports of tests, conducted during manufacture shall be maintained by the supplier. These shall be produced for verification as and when requested for by the purchaser.

9. PACKING AND FORWARDING:

- 9.1 The equipment shall be first packed in **durable sealed polythene** and then in suitable crates with required packing for support so as to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement of lifting such as lifting hooks etc. shall be

provided. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.

- 9.2 Each consignment shall be accompanied by a detailed packing list containing the following information :
- (a) Name of the consignee :
 - (b) Details of consignment :
 - (c) Destination :
 - (d) Total weight of consignment :
 - (e) Sign showing upper/lower side of the crate :
 - (f) Handling and unpacking instructions :
 - (g) Bill of materials indicating contents of each package :
- 9.3 The supplier shall ensure that the bill of materials is approved by the purchaser before dispatch.

10. QUANTITY AND DELIVERY REQUIREMENT:

- (i) **This is set out in Appendix – II of this specification.**
- (ii) The scope of supply shall include a supply of 2.5% extra quantity of bolts, nuts, washers, split pins, cotter pins and such other small loose items free of cost.

APPENDIX – I.

(TECHNICAL REQUIREMENTS)

TECHNICAL REQUIREMENTS FOR METAL OXIDE (GAPLESS) SURGE ARRESTERS

The Surge Arrester under this Specification shall conform to the parameters given below :-

Sl. No.	Particulars.	Technical Parameters	Technical Parameters.	Technical Parameters	Technical Parameters
1	Nominal system voltage (phase to phase) (KV rms).	400	220	132	33
2	Highest system voltage (phase to phase) (KV rms).	420	245	145	36
3	System Frequency (HZ).	50 ± 5 %	50 ± 5 %	50 ±5%	50 ±5%
4	System Neutral earthing.	Effectively earthed.	Effectively earthed.	Effectively earthed	Effectively earthed
5	Installation.	Outdoor.	Outdoor.	Outdoor	Outdoor
6	Class.	Station class, 20 KA, heavy duty type.	Station class, 10 KA, Medium duty type.	Station class, 10 KA, Medium duty type.	Station class, 10 KA, Light duty type.
7	Type of construction of arrester.	Single column, single phase.	Single column, single phase.	Single column, single phase.	Single column, single phase
8	No. of phases.	Three	Three	Three	Three
9	Maximum duration of earth fault (Sec.)	3	3	3	3
10	Rated arrester voltage (KV rms)	390	216	120	30
11	Nominal discharge current (KAP) Disscharge current at which insulation co ordination will be done	20 KA of 8/20 microsec wave	10 KA of 8/20 microsecond Wave.	10 KA of 8/20 microsecon d Wave.	10 KA of 8/20 microsecond Wave.
12	Rated Thermal Energy Rating (KJ/KV)(Wth)	12kJ/kV	7kJ/kV	7kJ/kV	4kJ/kV
13	Repititive charge transfer rating(C) Qth	2.4 C	1.6 C	1.6 C	1 C
14	Continuous operating voltage at 50° C(KV rms)	303	175	102	25
15	Maximum switching surge residual voltage (KVP)	670 (at 2KA)	500 at 1KA	280 at 1KA	72 at 500 A
16	Maximum residual voltage at 8/20 micro second(KVP)				

	(i) 5 KA.	---	560	310	85
	(ii) 10 KA Nominal discharge current.	800	600	330	90
	(iii) 20 KA.	850	---	---	---
17	Steep fronted Wave residual Voltage at 20kA(KVp)	925	---	---	---
18	High current short duration test value (KAP)(4/10 Micro-second wave).	100	100	100	100
19	Low current long duration test value	As per latest IS and IEC			
20	Current for pressure relief test (KA-rms)	63	50	40	25
21	Minimum accepted creepage distance(mm/KV)	31	31	31	31
22	One minute wet power frequency withstand voltage of Arrester housing (KV-rms).	N/A	As Per latest IS and IEC	As Per latest IS and IEC	As Per latest IS and IEC
23(a)	Impulse withstand voltage of arrester housing with 1.2/50 micro-second wave (KVP).	As Per latest IS and IEC	As Per latest IS and IEC	As Per latest IS and IEC	As Per latest IS and IEC
23(b)	Switching Impulse Voltage (Wet) with 250/2500 micro-second (KVP)	As Per latest IS and IEC	N/A	N/A	N/A
24	Pressure relief class.	Design -A	Design -A	Design -A	Design -A
25	Corona extinction voltage (KV-rms).	320	216	-	-
26	RIV for frequency between 0.5 MHz and 2 MHz in all positions	Less than 500 micro volts at 266KV	Less than 500 micro volts for 156 KV	Less than 500 micro volts for 92 KV	--
27	Partial discharge at 1.05 times continuous over-voltage.	Nor more than 10 PC.	Nor more than 10 PC.	Nor more than 10 PC	Nor more than 10 PC
28	Seismic acceleration.	0.3g horizontal 0.15g vertical	0.3g horizontal 0.15g vertical.	0.3g horizontal 0.15g vertical.	0.3g horizontal 0.15g vertical
29	Reference ambient temperature.	50°C	50°C	50°C	50°C
30	(a) IR at MCOV.	Less than 500 micro amperes.	Less than 500 micro amperes.	Less than 500 micro amperes.	Less than 400 micro amperes
	(b) IC at MCOV.	Less than 1500 micro amperes.	Less than 1500 micro amperes.	Less than 1500 micro amperes.	Less than 1200 micro amperes
31	a) Reference Current (mA)	1 to 5 mA	1 to 5 mA	1 to 5 mA	1 to 5 mA

	b) Reference voltage at reference current.	Greater than rated voltage.	Greater than rated voltage.	Greater than rated voltage.	Greater than rated voltage.
32	Maximum cantilever strength of the arresters (KG) for 1 minute withstand.	350	150	150	150
33	Maximum deflection at above cantilever in mm.	200	125	50	20
34	TOV (KVP).				
	(i) 0.1 sec.	575	382	170	53
	(ii) 1.0 sec.	550	366	163	51
	(iii) 10.0 sec.	475	351	156	49
	(iv) 100.0 sec.		336	149	47

ANNEXURE-A.

GUARANTEED TECHNICAL PARTICULARS FOR 420/245/145/36 KV SURGE ARRESTER

(To be filled in by the Bidder)

1	Bidder's Name and Address.	
2	Manufacturer's Name.	
3	Manufacturer's type designation.	
4	Applicable standards.	
5	Arrester class and type.	
6	Rated Arrester Voltage (KV rms).	
7	Maximum continuous operating voltages (MCOV) at design ambient temperature (KV-rms).	
8	Nominal discharge current (8/20 micro second wave) (KA).	
9	Thermal Energy rating (KJ/KV).	
10	Repetitive charge transfer rating(C)	
11	Maximum switching surge residual voltage	
12	Maximum residual voltage for 8/20 micro-second current wave.	
	(a) At 50 % nominal discharge current.	
	(b) At 100 % nominal discharge current.	
	(c) At 200 % nominal discharge current.	
13	Maximum residual voltage with 1 micro-second current wave at 20 KAP (KVP).	
14	One minute power frequency (dry) & (wet) withstand voltage of arrester (KV-rms).	
15	Impulse withstand test voltage of arrester housing with 1.2/50 micro-second wave (KVP).	
16	High current short duration (4/10 micro-second impulse wave) (KAP).	
17	Low current long duration (KAP).	
18	Reference voltage and corresponding reference current of arrester (KV)(mA).	
19	Maximum internal leakage current by its rms or peak value and both resistive and capacitive component separately at	
	(a)Nominal System voltage ($\pm 5\%$) (resistive/capacitive) (mA).	
	(a) COV (resistive/capacitive) (mA).	
	(b) 1.1 COV (resistive/capacitive) (mA).	
	(c) COV at 150°C (resistive/capacitive) (mA).	

	(d) Reference voltage (resistive/capacitive) (mA).	
20	Pressure relief class.	
21	Are the protection levels affected by pollution of external insulation.	
22	Energy absorption capability per operation of the arrester, during a switching surge discharge (KJ).	
23	Maximum amount of energy that may be despatched into the arrester during discharge assuming that discharge takes place within 1 minute period and state the switching surge current (KJ/KA).	
24	Internal pressure required to operate pressure relief device as a percentage of burst pressure of porcelain (KJ) & %.	
25	Dynamic 50 Hz over-voltage with stand capability (KV-rms).	
	(a) For 0.1 Second.	
	(b) For 1 Second.	
	(c) For 10 Seconds.	
	(d) For 100 Seconds.	
26	Minimum prospective symmetrical fault current (KA).	
27	Declared Bending load i) SSL ii) SLL	
28	Connecting cable from insulating base to surge monitor(copper/aluminium with size)	
29	Whether potential free contact provided in surge counter for 420/245 KV arrester	
30	Rejection rate of ZnO blocks during manufacturing and operation for the past three years (%) separately.	
	(a) 2017-2018.	
	(b) 2018-2019.	
	(c) 2019-2020.	
31	ZnO DISC DATA.	
	(a) Rated voltage of ZnO disc. (KV-rms).	
	(b) No. of ZnO discs in a unit (Nos.)	
	(c) No. of units of arrester (Nos.)	
	(d) Height/thickness of ZnO discs (mm).	
	(e) Diameter of ZnO disc (mm).	
32	EXTERNAL INSULATION.	
	(a) Type.	
	(b) Applicable standard.	
	(c)(i) Lightning Impulse withstand test voltage of housing with 1.2/50 micro sec. Wave (KVP).	
	(ii) Wet switching impulse test voltage with 250/2500 micro second(KVP)	
	(d) One minute power frequency withstand voltage of arrester housing KV rms.	
	[i] Dry.	
	[ii] Wet.	
	(e) Total creepage distance of arrester housing (mm).	
	(f) Cantilever strength of complete arrester (Kg-m).	
33	OVER ALL DIMENSIONS.	
	(a) Overall Height (mm).	
	(b) Height up to top of terminal pad from mounting plane (mm).	
	(c) Material of terminal pad.	

	(d) Size of terminal pad (mm).	
	(e) Mounting dimensions and diameter of mounting holes (mm).	
	(f) Diameter of insulator (mm).	
	(g) Total weight of complete arrester (Kg.)	
34	TERMINAL CONNECTOR.	
	(a) Manufacturer's Name.	
	(b) Applicable standards.	
	(c) Type.	
	(d) Material of connector.	
	[i] Clamp body.	
	[ii] Bolts and Nuts.	
	[iii] Spring washers.	
	(e) Rated current (Amps.)	
	(f) Rated terminal load (kg.)	
	(g) Factor of safety.	
	(h) Minimum thickness of any part (mm).	
	(i) Weight of clamp complete with hard ware (kg.)	
	(j) Type test report as per IS enclosed.	
	(k) OGA Drawing enclosed.	
35	INSULATORS.	
	(a) Manufacturers Name.	
	(b) Type.	
	(c) Applicable standards.	
	(d) Height (mm).	
	(e) Diameter (top) mm	
	(f) Diameter (bottom) mm	
	(g) Total creepage distance (mm).	
	(h) Rated voltage (KV-rms)	
	(i) Power frequency with stand voltage for 1 min. dry and wet (KV-rms)	
	(j) 1.2/50 micro - second impulse withstand voltage (KVP)	
	(k) Corona Extinction voltage (KV-rms)	
	(l) Weight (kg.)	
	(m) Maximum allowable span (mm).	
	(n) Cantilever strength (Kg-m).	

APPENDIX – II

QUANTITY AND DELIVERY SCHEDULE

Lot	Description.	Quantity required in No.s	Desired delivery.	Destination.
1	2	3	4	5
1	400KV SA	40	Within 4 (Four) months from the date of placement Purchase Order	Any store/site within Orissa State, same will be mentioned in the purchase order/release

				order.
2	220KV SA	25	-do-	-do-
3	132KV SA	40	-do-	-do-
4	33KV SA	150	-do-	-do-

The detail delivery programme and quantity to be delivered will be intimated at the time of placement of the purchase order/issue of release order.

ANNEXURE – B

CHECK – LIST

- 1 Whether calculation towards energy handling capability of the Surge Arrester furnished as per Clause No.3.2 of TS?
2. Whether there is provision of Corona Grading Ring in the SA as per Clause No.3.4 and 4.15.4 of TS? If not, whether justification for non-provision of the same furnished?
3. Whether calculations and supporting evidence furnished to satisfy Clause No.3.7 of TS?
4. Whether the heat treatment cycle details along with necessary quality checks used for individual blocks furnished as per Clause 4.10 of TS?
5. Whether sectional view of arrester showing details of sealing provided as per Clause No.4.11 of TS furnished?
6. Whether S.A. is suitable for hot line washing as per Clause No.4.12 of TS?
7. Whether porcelain petticoat is of aero foil design? Whether drawing of porcelain Housing as per Clause No.4.13.4 of TS furnished?
8. Whether information as per Clause No.7.1 (i) to (viii) of TS furnished?
9. Whether drawings and documents as per Clause No.8.2 (i) to (xii) of TS furnished?
10. Whether special measures in the manufacture of Surge Arrester for operating at ambient temperature of 50°C (against 40°C as per IEC-99-4, Clause No.4.4.1) are to be taken? State the special measures in details

Signature of the Bidder with Seal & Date

ANNEXURE –C.

CALIBRATION STATUS OF TESTING EQUIPMENTS AND INSTRUMENTS/METERS

Sl no	CALIBRATION OF EQUIPMENTS	Furnished or not
1	Name of the Test.	
2	Meters and equipments required for the corresponding test with range accuracy make and Sl. No.	
3	Date of Calibration.	
4	Due date of Calibration.	
5	Name of the Calibrating Agency	
6	Whether Calibrating Agency is Govt. Approved.	
7	Whether documents relating to Govt. Approval of the calibrating Agency furnished?	
8	Whether the meters/ equipment fulfill the accuracy class as per calibration report	
9	Whether the calibrating agency has put any limitation towards the use of the particular meter/equipment. If yes, state the limitations.	
10	Whether green sticker or blue sticker or yellow sticker has been affixed on the body of the particular equipment/meter. State the colour of the affixed sticker.	
11	In spite of imposed limitations, whether the particular meter/ equipment can still be used? Justify its use for corresponding test(s).	
12	Remarks if any.	

Signature of the Bidder with seal and date

TS for 33KV SA

ANNEXURE-D

CHECK LIST TOWARDS TYPE TEST REPORTS

Sl no	<u>TYPE TEST REPORTS</u>	Furnished or not
1	Name of the Type Test.	
2	Date of Test.	
3	Name of the Laboratory where the Test has been conducted.	
4	Whether the Laboratory is Government Approved.	
5	Test reports are valid as per Clause No.5.1 of T.S.	
6	Whether the copy of Test Report in complete shape along with drawings etc. furnished or not?	
7	Whether the Type Tested Surge Arrester fulfills the technical requirements as per TS.	
8	If the type tested Surge Arrester does not fulfill the technical requirements as per this specification, whether the bidder agrees to conduct the particular type test again at their own cost without any financial liability to OPTCL in the presence of OPTCL's representative within the specified delivery period.	
9	Remarks if any.	

Signature of the Bidder with seal and date