



## **ODISHA POWER TRANSMISSION CORPORATION LIMITED**

### **TECHNICAL SPECIFICATION FOR**

### **400KV/220KV/132KV/33KV PORCELAIN/COMPOSITE HOUSING SURGE ARRESTERS**

## **1. IMPORTANT INSTRUCTION:**

**Please read the following instructions carefully before submitting your bid:**

- 1.1** All the drawings, i.e. dimension, elevation, side view, front view, plan, cross sectional view, isometric view, important component drawing etc., in PDF along with AutoCAD format and manuals (Technical/Installation/Operation) in PDF format, for offered item shall be submitted. The hard copies as per specification also shall be submitted.
- 1.2** The acceptability of Type Test reports submitted by any bidder/EPC shall be strictly in adherence to the broad guidelines mentioned in clause no. 2 of “CEA guidelines for the validity period of Type Tests conducted on major electrical equipment of power transmission system” published in May 2020.
- 1.3** The Bidder/EPC shall have to submit all the required type test reports for the offered item along with the accessories. In case of submission of soft copy of type test report, high resolution colour scan of the original test report must be submitted. Scanned copy of Xerox of type test reports shall not be entertained. If required, the firm has to show the original type test report for the purpose of verification. In absence of this, the evaluation shall be carried out accordingly as non-submission of type test reports. The type test report of Surge Arrester submitted by the manufacturer shall be considered valid if the date of type test does not exceed 10 years as on the last date of submission of bid; provided:-  
There is no major changes introduced in the basic design / technology /material /mechanical /construction /functionalities /performance characteristics/ manufacturing process of the equipment.

**OR**

Until the relevant IS/IEC / statutory guidelines is revised which warrants fresh type tests because of introduction of new type tests even though there is no change in material/basic design of the equipment.

- 1.4** The Bidder/EPC must fill up all the point of GTP for offered item/s. Instead of indicating “refer drawing, or as per IS/IEC”, the exact value/s must be filled in. All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.
- 1.5** The Bidder/EPC is required to impart training in view of manufacture, assembly, erection, operation and maintenance for offered item, at his works, to the person/s identified by OPTCL, in the event of an order, free of cost. The cost of logistics will be borne as per the clauses of respective purchase orders/work orders.
- 1.6** The discrepancies between the specification and the catalogues or literature, submitted as part of the offer OR with prevalent standards/Govt. guidelines shall not be considered as valid deviations unless otherwise the same deviations related to TS is brought out separately by the Bidder/EPC in the pre-bid queries or in form of clarification. If any modification felt necessary to improve performance, efficiency and utility of equipment, the same must be submitted along with Pre-Bid Queries with reasons duly supported by documentary evidences and such modifications, not mentioned in Pre-bid queries, will not be considered.
- 1.7** For purpose of Agreement, the firm shall provide warranty as specified in the purchase order / tender document. Notwithstanding the foregoing, Supplier agrees to waive the expiration of the Warranty Period in the event where in a pattern of defect/trend of failure is observed after the Warranty Period in a significant portion of the supplied quantity, or any critical defect discovered which, in Purchaser's opinion, constitutes a threat of damage to property or to the health and safety of any person.
- 1.8** Warranty certificate for purchase of any material, whether directly procured by OPTCL or EPC agency, shall be issued directly in favour of OPTCL.

## 2. SCOPE:

- 2.1 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 equipment and meters/Instruments.	Annexure-C
(vii)	Check-list towards Type Test Reports.	Annexure-D
(viii)	Standard Manufacturing Quality Plan of Surge Arrester	Appendix -III
<b>Note: Annexure-A, B, C &amp; D are to be filled up by the Bidder/EPC.</b>		

- 2.2 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.
- 2.3 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.

## 3. STANDARDS:

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

	<b>Standard Ref. No.</b>	<b>Title.</b>
1	IEC-60099-4	Metal Oxide Surge Arrester without gaps for A.C system.
2	IEC-60099-5	Surge Arrester selection and application recommendation
3	IS:15086-4	Metal Oxide Surge Arrester without gaps for A.C system.
4	IEC-60529	Degree of protection provided by Enclosures(IP Code)
5	IS:2147	Degree of protection, provided by enclosures for low voltage switchgear and control.
6	IS:2629	Recommended practice for hot dip galvanization of iron and steel.
7	IS:2633	Method for testing uniformity of coating on zinc coated articles.
8	IS:5621 & IEC-62155	Specification for large hollow porcelain for use in electrical installation.

9	IEC-61462	Composite Insulators-Hollow insulator for use in indoor and outdoor installations
10	IEC-62217	Polymeric HV insulators for indoor and outdoor use
10	IEC/TS-60815	Selection and dimensioning of HV insulators intended for use in polluted condition.
11	IEC-60060-1	High-Voltage Test technique.
12	IEC-60270	Partial discharge measurements.
13		Indian Electricity Rules, 1956.

### **Note:**

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 confirms 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.

## **4. GENERAL AND TECHNICAL REQUIREMENTS:**

- 4.1 The Surge Arrester shall confirm to the technical requirements as per Appendix-I and this Technical Specification.
- 4.2 The energy handling capability of each rating of Arrester offered, supported by calculations, shall be furnished with the offer.
- 4.3 The V-I characteristic of designed arrester of each rating on offer shall be furnished along with necessary supporting documents.
- 4.4 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.
- 4.5 Surge Arresters shall be fully stabilized thermally to give desired performance throughout its life expectancy under Site conditions.
- 4.6 Surge Arresters shall be able to withstand the following forces:
  - a. Maximum wind speed of 55 m/sec.
  - b. Forces in event of Short circuit
  - c. Self-weight along with conductor and clamp.
- 4.7 Surge Arresters shall be capable of withstanding effects of direct solar radiation.
- 4.8 A grading ring shall be provided if required, (for attaining all the relevant technical parameters) on each complete Surge Arrester.

### **4.9 CLIMATIC CONDITION:**

The Surge Arrester shall be designed for use in geographical and meteorological conditions as given below:

1	Max. Ambient Air Temperature(°C)	50°C
2	Min. Ambient Air Temperature(°C)	0°C
3	Avg. Daily Ambient Air Temperature(°C)	32°C

4	Avg. Annual Rainfall(cm)	150
5	No. of Rainy Days in an Year	250
6	Max. Relative Humidity (%)	99
7	Max. Wind Speed (m/sec)	55
8	Max. Altitude above Mean Sea level(m)	1000
9	Isoceraunic level(days/year)i.e. Avg. no. of Thunderstorm days	70
10	Seismic level(horizontal Acceleration)	0.3g
11	Pollution Level	Heavy/Very Heavy
12	Air Borne Contamination	Highly polluted
13	Special Environmental Conditions	Presence of Salinity in air in coastal areas and excessive dust deposition in industrial areas

#### 4.10 PROTECTIVE LEVEL:

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

Sl. No.	Equipment to be protected	420KV			245KV		145KV	36KV
		PF(KV RMS)	LI(KVP)	SI(KVP)	LI(KVP) /PF(KV RMS)	SI(KVP)	LI(KVP)/ PF(KV RMS)	LI(KVP)/ PF(KV RMS)
1	Auto Transformers/ Power Transformers/ Reactor	630	1425	1050	1050/ 460	850	650/275	170/ 70
2	Instrument Transformers.	630	1425	1050	1050/ 460	-----	650/275	170/ 70
4	Circuit Breakers/Isolators.							
	Phase to Phase	520	1425	1575	1050/ 460	-----	650/275	170/ 70
(i)	Phase to ground.	520	1425	1050	1050/ 460	-----	650/275	170/ 70
	Across Isolating Distance	610	1425 (+240)	900 (+345)	1200/ 530	-----	750/315	195/80
(ii)	Across open switching device	610	1425 (+240)	1050	1050/ 460	-----	650/275	170/ 70
5	Circuit Breaker Duty Cycle	O - 0.3 sec - CO - 3 min - CO						

#### 4.11 DUTY REQUIREMENT:

The offered surge arresters shall have the following capabilities as indicated below:

ARRESTER ATTRIBUTE	420 KV	245 KV	145 KV	36 KV
CLASSIFICATION	SH	SM	SM	SL

NOMINAL DISCHARGE CURRENT	20 kA	10 kA	10 kA	10 kA
SW. IMPULSE DISCHARGE CURRENT	2 kA	1 kA	1 kA	0.5 kA
REPITITIVE CHARGE TRANSFER RATING( $Q_{rs}$ )	$\geq 2.4$	$\geq 1.6$	$\geq 1.6$	$\geq 1$
ENERGY HANDLING CAPABILITY( $W_{th}$ )	$\geq 10$	$\geq 7$	$\geq 7$	$\geq 4$

- 4.11.1** 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.
- 4.11.2** 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.).

## **5. DESIGN AND CONSTRUCTION DETAILS:**

- 5.1** All the units of arresters of same rating shall be inter-changeable without adversely affecting the performance.
- 5.2** The Surge Arresters shall be suitable for pedestal type mounting.
- 5.3** **The 420 KV Surge Arrester (both Porcelain and Polymer housing) 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 housing, following prolonged current flow or internal flash over and providing path for flow of rated fault currents in the event of arrester failure. **Surge arresters of 245 KV class and below shall be of Design-A/Design-B type.** i.e. **Design-B (only applicable for composite housing) arresters** shall be embedded, all the components free from bubbles and gaps thus preventing partial discharge and moisture ingress. This type of design does not require pressure relief device and must have the ability to cracking and tearing open of housing due to arc action thereby avoiding violent shattering.
- 5.4** 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.
- 5.5** The drilling details for mounting the Arrester on owner's support shall be supplied by the supplier complying with clause No.5.14.10 of this specification.
- 5.6** The minimum permissible separation between the Surge Arrester and any earthed object shall be indicated by the Bidder/EPC in his offer.
- 5.7** **SEALING ARRANGEMENT:**
- 5.7.1** Sealing (for Design-A Arresters) shall be provided in such a way that these are always effectively maintained even when discharging rated lightning current.
- 5.7.2** The end fittings shall be made of corrosion proof material and preferably be nonmagnetic.

- 5.7.3** 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.
- 5.7.4** 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.
- 5.7.5** Any compromise in sealing materials, deviation or process lapses in sealing of the surge arrester shall lead to complete rejection of the lot.
- 5.8** **METAL OXIDE BLOCK:**
- 5.8.1** Non-linear 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.
- 5.8.2** The Material used to coat or collar MO blocks shall be strictly non-hygroscopic such as glass material.
- 5.8.3** The Manufacturer shall submit data for rejection rate of ZnO blocks during manufacturing/ operation for the past three years.
- 5.8.4** 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.
- 5.9** The Surge Arresters shall be suitable for hot line washing.
- 5.10** **PORCELAIN HOUSING (where ever applicable):**
- 5.10.1** All porcelain Housings shall be free from lamination cavities or other flaws, affecting the maximum level of mechanical and electrical strengths.
- 5.10.2** The porcelain shall be well vitrified and non-porous.
- 5.10.3** The minimum creepage distance of the arrester housing shall be as per Appendix-I (Sl.No. 21) based on the pollution level of areas of operation.
- 5.10.4** The porcelain petticoat shall be preferably of self-cleaning type (Aerofoil design). The details of the porcelain housing such as height, angle of inclination, shape of petticoats, gap between the petticoats, diameter (ID and OD) etc. shall be indicated by the Bidder/EPC in his offer in the form of detailed drawing.
- 5.10.5** Porcelain housings shall be so coordinated that external flash over will not occur due to application of impulse or switching Surge voltages up to the maximum design value for arrester.
- 5.10.6** Surge Arresters shall incorporate anti-contamination feature to prevent arrester failure, caused by uneven voltage gradient across the stack, resulting from contamination of the arrester porcelain.
- 5.10.7** All portions of the assembled porcelain enclosures and supports other than gaskets, which may in anyway be exposed to the atmosphere shall be composed of completely non-hygroscopic material or glazed porcelain.

**5.11 POLYMER HOUSING(where ever applicable) :**

- 5.11.1 Polymer housing material shall be made of high quality hydrophobic silicone 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.
- 5.11.2 For Design – B, Arresters must have directly moulded housings. Arresters manufactured by slip-on, premoulded housing will not be accepted in view of the weak interface between the housing and the assembled disc.
- 5.11.3 **The Surge Arrester in general shall confirm to IEC 61462 and IEC 62217 as applicable.** It shall 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.
- 5.11.4 Polymer bounding to the core shall be effectively maintained even when surge arrestor discharges rated surge current.
- 5.11.5 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 carry out on each batch during manufacturing and records maintained and provided as & when required during inspection.
- 5.11.6 The rain sheds / petticoats shall be of polymeric material and shall confirm to the properties and type test reports shall be submitted.
- 5.11.7 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/EPC in his offer in the form, during detailed Drawing evaluation.

- 5.11.8 The minimum creepage distance of the Composite housing surge arrester shall be as per Appendix-I (Sl.No. 21) based on the pollution level of areas of operation.

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

- 5.12.1 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.
- 5.12.2 Ground terminal pads and nameplate brackets shall be hot dip galvanized.
- 5.12.3 The material shall be galvanized only after completing all shop operations.



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

**5.14 ACCESSORIES AND FITTINGS:**

**5.14.1** 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 67 degree of protection.

**5.14.2 SURGE COUNTERS:**

5.14.2.1 A self- contained Surge counter, suitably enclosed for outdoor use and requiring no auxiliary 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.

5.14.2.2 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.

5.14.2.3 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.

5.14.2.4 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.

5.14.2.5 **For all classes of surge arresters, 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.**

**5.14.3 LEAKAGE CURRENT METERS:**

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

5.14.3.2 The ammeter shall be suitable for mounting on the support structure of the arrester.

5.14.3.3 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.

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

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

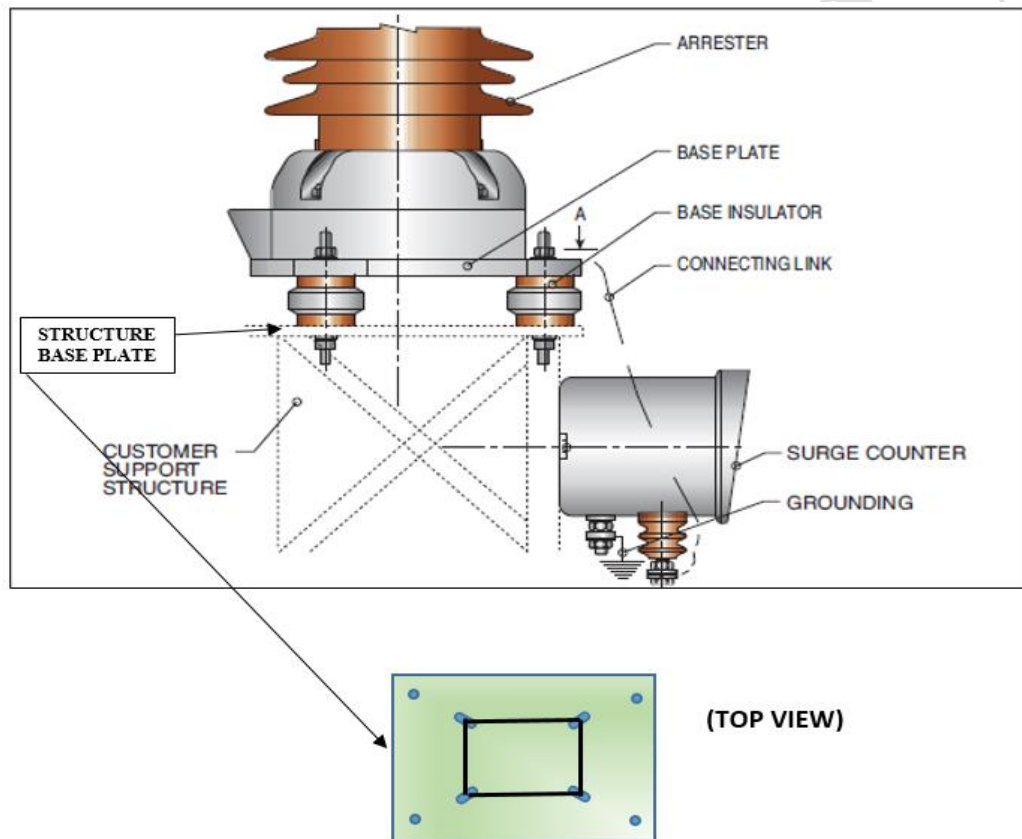
**5.14.4** The Bidder/EPC has to quote unit rates of the **insulating** base and the surge monitor

Separately. The purchaser reserves its option to procure **insulating** base and surge counter.

- 5.14.5 In General, Clamp type Aluminium alloy terminal connector, suitable for 400 KV (ACSR MOOSE Conductor) /220 KV (ACSR ZEBRA Conductor) /132KV (ACSR PANTHER Conductor) /33KV (suitable for conductors with overall Dia Ø14 to Ø 18 mm) shall be provided having both horizontal and vertical take-off. However, this may vary depending on site requirement and suitability of terminal connectors shall be decided on case to case basis during approval of drawings.**
- 5.14.6** Two clamp type ground terminal connectors, suitable for G. I. Strip (50 x 6) or (50 x 8) should be provided.
- 5.14.7** 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.
- 5.14.8** 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.
- 5.14.9 Connection between the surge arrester base and surge monitor shall be through a 2.0 meter long PVC insulated flexible copper cable of at least 25 Sq mm. The metallic base of the surge arrester shall have the provision to accommodate connecting PVC cable with tinned copper connector/lugs with sufficient surface area for discharging surges to ground (without allowing the surge to pass through the structure) only through the surge counter.**
- 5.14.10 In line with the standardization plan of OPTCL, the fixing dimension of the surge arrester base upon the base plate of the equipment structure is standardized as below:**

VOLTAGE LEVEL	CENTER TO CENTER HOLE DISTANCE OF THE SA BASE PLATE OR ADAPTER CHANNEL(IF USED) IN MM	HOLE DISTANCE OF THE DIAGONAL SLOTTED HOLES OF THE STRUCTURE BASE PLATE	HOLE DIA	NO. OF HOLES
390 KV	380	360-400	Ø18	4
216 KV	280	260-300	Ø16	4
120 KV	280	260-300	Ø16	4
30 KV	180	160-200	Ø14	4

The base plate mounted on top of the surge arrester structure, which is in scope of the purchaser, shall be having 4 slotted holes with distances as mentioned above in the 3<sup>rd</sup> column of the table for each voltage level. To match with the same, the offered surge arresters must have the uniform base plate fixing dimensions as per the requirement mentioned in 2<sup>nd</sup> column of the table. If SA base plate dimensions cannot be met, in such a condition, adapter C-Channel (of MS HDG material) may be used to achieve uniform dimensions as mentioned above which ultimately shall be mounted above base insulators and bolted to the base plate of the equipment structure. A typical diagram is shown below for better visualization:



**(TYPICAL ARRANGEMENT OF STRUCTURE BASE PLATE WITH SLOTTED HOLES FOR SA MOUNTING)**

#### **5.15 NAME PLATE:**

Each single pole Arrester shall be provided with non-corrosive legible name plate, at the base bearing the following data, indelibly marked:

- (a) ODISHA POWER TRANSMISSION CORPORATION LIMITED.
- (b) Purchase order No. & Date.
- (c) Other information as detailed in clause No. 4 of IEC 60099 – 4 or in subsequent revisions.

## **6. TEST**

### **6.1 TYPE TESTS:**

The surge Arrester offered should have been subjected to the following type tests in an independent NABL accredited test laboratory.

1. All Type Tests as mentioned in the latest revision of relevant IEC / IS.
2. Seismic withstand Test
3. Corona Extinction voltage test(For 420/245 KV arresters)
4. IP-67 test on surge monitor.

### **6.2 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: Water dip test at 1.5m depth from top of Surge Arrestor for 30 minutes shall be performed during assembly of Surge Arrester stacks.
- (b) Measurement of reference voltage.
- (c) Residual voltage tests.
- (d) Measurement for partial discharge.

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

### **6.3 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.

- I. Sealing test:** Water dip test at 1.5m depth from top of Surge Arrestor for 30 minutes shall be performed on the fully assembled Surge Arrester. This test shall be carried out first followed by all other tests as stipulated from II – VII mentioned below.
- II.** All Acceptance Tests including **Special Thermal Stability Test** as mentioned in the latest revision of relevant IEC / IS.
- III.** Measurement of leakage current and capacitive current at M.C.O.V.
- IV.** Galvanization test on metal parts.
- V.** 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.
- VI.** Check of calibration of leakage current meters.
- VII.** Wattloss measurement at 10 KV and  $U_c$  at ambient temperature.

**Note: The sampling of specimens for acceptance test shall be as per clause no.9.2.1 of IEC 60099-4.**

## **7. 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 equipment are later found to be defective.

## **8. QUALITY ASSURANCE PLAN:-**

- 8.1** The suppliers, within 30 days of placement of order shall submit the following information to the purchaser.
- (i) List of raw materials as well as bought out accessories and the names of the materials selected from those, furnished along with the offer.
  - (ii) Type test certificates of the raw material and bought out accessories.
  - (iii) Finalization of MQP and FQP (which were submitted during technical bid) with hold points for purchaser's inspection. **The purchaser reserves the right to share its Standard Manufacturing Quality Plan (SMQP) and Field Quality Plan (FQP) to the manufacturer which shall be mutually agreed upon in such a case.**
- 8.2** The supplier shall submit the routine test certificates of bought out item, raw material and finished products at the time of offering for acceptance tests of the fully assembled equipment.
- 8.3** All the testing equipment, meters etc. should have been calibrated in a Government approved laboratory. The Bidder/EPC must submit the list of testing equipment and meters test-wise as per Annexure-C of this Technical Specification.

## **9. DOCUMENTATION:**

**9.1** 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 connectors and ground terminals.
- (ix) Volt-time characteristics of Surge Arresters.
- (x) V-I characteristic of Zinc Oxide Disc.
- (xi) Details of galvanization being provided on different ferrous parts.
- (xii) The detailed dimensional drawing of porcelain Housing/Polymer 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.
- (xiii) Cross-sectional view of the Surge Arrester Units showing all components including sealing.

### **9.2 TEST REPORTS :**

- (i) Both hardcopies and soft 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.

## **10. PACKING AND FORWARDING:**

The equipment shall be first packed in durable sealed polythene and then in suitable wooden crates (for porcelain housing surge arresters) and sealed hard plastic crates with caps (for composite housing surge arrester) with required packing for support so as to withstand handling during transport and outdoor storage in the field units. **The packaging of Composite housing arresters (generally prone to damage) shall be robust enough to avoid intrusion of rats and rodents and suitable for outdoor storage in both horizontal and vertical position.** 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.

**10.1** 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 :

**10.2** The supplier shall ensure that the bill of materials is approved by the purchaser before dispatch.

## **11. 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 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:-

<b>Sl. No.</b>	<b>Particulars.</b>	<b>Technical Parameters</b>	<b>Technical Parameters.</b>	<b>Technical Parameters</b>	<b>Technical Parameters</b>
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	Arrester 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)	<b>336</b>	216	120	30
11	Nominal discharge current (KAP) $\mu$	20 KA of 8/20 $\mu$ sec wave	10 KA of 8/20 $\mu$ sec wave	10 KA of 8/20 $\mu$ sec wave	10 KA of 8/20 $\mu$ sec wave
12	Rated min. Thermal Energy Rating (KJ/KV)(Wth)	10kJ/kV	7kJ/kV	7kJ/kV	4kJ/kV
13	Repetitive charge transfer rating© Qth	2.4 C	1.6 C	1.6 C	1 C
14	Continuous operating voltage at 50° C(KV rms)	<b>280</b>	172	102	24
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	Prospective Symmetrical SC current (KA-rms)	63	50	40	31.5
21	Minimum accepted creepage distance(mm/KV) unless otherwise categorically specified				
i)	Polymer Housing	31	31	31	31
ii)	Porcelain Housing	25	25	25	25
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
(b)	Switching Impulse Voltage (Wet) with 250/2500 micro-second (KVP)	As Per latest IS and IEC	N/A	N/A	N/A
24	SC Design Classification	Design -A	Design -A/B	Design-A/B	Design -A/B
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	Cantilever strength withstand in KG for 1 minute	350	300	300	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

## **APPENDIX – II**

### **QUANTITY AND DELIVERY SCHEDULE**

Lot	Description.	Quantity required in No.s	Desired delivery.	Destination.
1	2	3	4	5
1	400KV SA		Within xxxxx 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		-do-	-do-
3	132KV SA		-do-	-do-
4	33KV SA		-do-	-do-

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

## **ANNEXURE-A.**

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

**(To be filled in by the Bidder/EPC)**

1	Bidder/EPC'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	Short Circuit Design Class (Design-A / Design-B)	
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 dispatched 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 /weak spot of housing (in case of composite housing)	
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 for Composite Housing Surge Arrester i) Specified Short Term Load ii) Specified Long term Load iii) Maximum deflection during application of load iv) Permanent deflection measured from 1min to 10 min	
28	Declared Bending load for Porcelain/Cast resin Housing Surge Arrester i) Specified Short Term Load ii) Mean Breaking Load iii) Maximum deflection during application of load iv) Permanent deflection measured from 1min to 10 min	
29	Connecting cable from insulating base to surge monitor(material, size and length to be specified )	
30	Whether potential free contact provided in surge counter for 420/245/145 KV arrester	
31	Rejection rate of ZnO blocks during manufacturing and operation for the past three years (%) separately.	
	(a) 2017-2018.	
	(b) 2018-2019.	
	(c) 2019-2020.	
32	<b>ZnO DISC DATA.</b>	
	(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).	
33	<b>OVER ALL DIMENSIONS.</b>	
	(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	<b>TERMINAL CONNECTOR.</b>	
	(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	<b>INSULATOR HOUSING.</b>	
	(a) Manufacturers Name.	
	(b) Type.(Porcelain/Composite)	
	(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 in KV-rms	
	I) Dry	
	II) Wet	
	(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).	

Signature of the Bidder/EPC with Seal & Date

## **ANNEXURE – B**

### **CHECK – LIST**

2. Whether there is provision of Corona Grading Ring in the SA? ..... If not, whether justification for non-provision of the same furnished?
3. Whether calculations and supporting evidence for reference current furnished to satisfy Clause No.4.4 of TS?
4. Whether the heat treatment cycle details along with necessary quality checks used for individual blocks furnished?
5. Whether sectional view of arrester showing details of sealing provided furnished?
6. Whether S.A. is suitable for hot line washing?
7. Whether porcelain petticoat is of aero foil design? Whether drawing of porcelain Housing furnished?                   **OR**  
Whether Composite Housing drawings, Cross-sectional views furnished in the Drawing?
8. Whether information as per Clause No.8 of TS furnished?
9. Whether drawings and documents as per Clause No.9 of TS furnished?
10. Whether the Surge Arrester base design confirms to Clause No.5.14.11?
11. Whether the surge Arrester design confirms to Clause No.4.6? If yes, justify with necessary calculation.
12. 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/EPC 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 equipment 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	<b>Whether the meters/ equipment fulfill the accuracy class as per calibration report</b>	
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/EPC with seal and date

**ANNEXURE-D**  
**CHECK LIST TOWARDS TYPE TEST REPORTS**

SL no	<b><u>TYPE TEST REPORTS</u></b>	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 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	<b>If the type tested Surge Arrester does not fulfill the technical requirements as per this specification, whether the Bidder/EPC 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.</b>	
9	Remarks if any.	

Signature of the Bidder/EPC with seal and date



# APPENDIX -III

	<u>SUPPLIER DETAILS:</u>	<b>STANDARD MANUFACTURING QUALITY PLAN</b>			<u>CUSTOMER ADDRESS:</u> OPTCL CORPORATE OFFICE,JANPATH, BHOINAGAR,BHUBANESWAR, ODISHA, PIN-751022	
		<b>EHV SURGE ARRESTER(UP TO 400 KV )</b>				
		DATE OF ISSUE :- 23.12.2022	REV. :- 00	QAP NO. :- OPTCL/EQ/MQP/EHVSA		


## Abbreviation used in this booklet -

PH -- PHYSICAL  
EL -- ELECTRICAL  
VI -- VISUAL  
MM – MEASUREMENT  
CH -- CHEMICAL  
ME – MECHANICAL


SS – SAMPLE SELECTION  
AD – APPROVED DRAWING/GTP  
AS – APPLICABLE STANDARD  
AL – ACCREDITED LAB  
RR—RECORD REVIEW  
DD—DESIGN DATASHEET

S -- SUB-VENDOR  
M -- MANUFACTURER  
C -- CUSTOMER  
P -- PERFORM  
V -- VERIFICATION  
W -- WITNESS


T.C. --TEST CERTIFICATE  
E.M.--EQUIPMENT MANUFACTURER  
C.M.--COMPONENT MANUFACTURER  
CHP -CUSTOMER HOLD POINT

	<u>SUPPLIER DETAILS:</u>	<b>STANDARD MANUFACTURING QUALITY PLAN</b>					<b>CUSTOMER ADDRESS:</b> OPTCL CORPORATE OFFICE,JANPATH, BHOINAGAR,BHUBAN ESWAR, ODISHA, PIN-751022				
		<b>EHV SURGE ARRESTER (UP TO 400 KV )</b>									
		DATE OF ISSUE :- 23.12.2022		REV. :- 00	QAP NO. :- OPTCL/EQ/MQP/EHVSA						
SL. NO.	ITEM / TEST / OPERATION	TYPE OF CHECK	SAMPLING RATE	REFERENCE DOCUMENT	ACCEPTANCE NORMS			RECORD FORMATS	RESPONSIBILITY		
								S	M	C	

<b>1</b>	<b>RAW MATERIAL INSPECTION</b>										
<b>1.1</b>	<b>POLYMER INSULATOR</b>										
<b>1.1.1</b>	Visual Examination	Visual	3% EM / 100% at supplier	Approved Drawing & OPTCL Specification / IEC 61462	Approved Drawing & OPTCL Specification / IEC 61462	CMTC/EMTC	P	P/W	V		
<b>1.1.2</b>	Overall Height	Measurement	-do-	-do-	-do-	CMTC/EMTC	P	P/W	V		
<b>1.1.3</b>	Inner Diameter (if applicable)	Measurement	-do-	-do-	-do-	CMTC/EMTC	P	P/W	V		
<b>1.1.4</b>	Parallelism of flanges (If applicable)	Physical	-do-	-do-	-do-	CMTC/EMTC	P	P/W	V		
<b>1.1.5</b>	Creepage distance	Physical	-do-	-do-	-do-	CMTC/EMTC	P	P/W	V		
<b>1.1.6</b>	Inner Pressure (If applicable)	Mechanical	-do-	-do-	-do-	CMTC/EMTC	P	P/W	V		
<b>1.1.7</b>	Routine Bending load	Mechanical	-do-	-do-	-do-	CMTC/EMTC	P	P/W	V		
<b>1.1.8</b>	Hardness shore-A (If applicable)	Mechanical	-do-	ASTM D 2240/ DIN 53505 / IEC61462	ASTM D 2240/ DIN 53505 / IEC61462	CMTC/EMTC	P	P/W	V		
<b>1.1.9</b>	Elongation	Mechanical	-do-	ASTM D 412/ DIN 53504	ASTM D 412/ DIN 53504	CMTC/EMTC	P	P/W	V		
<b>1.1.10</b>	Tensile Strength	Mechanical	-do-	ASTM D 412/ DIN 53504 / ISO 37 TY 1	ASTM D 412/ DIN 53504	CMTC/EMTC	P	P/W	V		
<b>1.1.11</b>	Tear strength	Mechanical	-do-	ASTM D 624B	ASTM D 624B	CMTC/EMTC	P	P/W	V		


	<u>SUPPLIER DETAILS:</u>	STANDARD MANUFACTURING QUALITY PLAN					CUSTOMER ADDRESS: OPTCL CORPORATE OFFICE,JANPATH, BHOINAGAR,BHUBANESWAR, ODISHA, PIN-751022				
		EHV SURGE ARRESTER (UP TO 400 KV )									
		DATE OF ISSUE :- 23.12.2022		REV. :- 00	QAP NO. :- OPTCL/EQ/MQP/EHVSA						
SL. NO.	ITEM / TEST / OPERATION	TYPE OF CHECK	SAMPLING RATE	REFERENCE DOCUMENT	ACCEPTANCE NORMS			RECORD FORMATS	RESPONSIBILITY		
								S	M	C	

1.2	PORCELAIN INSULATOR (UPTO 336 KV CLASS) (If applicable)									
1.2.1	Visual Examination	Visual	100%	IS 5621/OPTCL Specification	IS 5621/OPTCL Specification	CM-TC	P	P/W	V	
1.2.2	Porosity test	Physical	1 sample per lot	-do-	-do-	CM-TC	P	P/W	V	
1.2.3	Temperature cycle test	Physical	2 sample per lot	-do-	-do-	CM-TC	P	P/W	V	
1.2.4	Ultrasonic test	Electrical	100%	-do-	-do-	CM-TC	P	P/W	V	
1.3	ALUMINIUM FLANGE/CASTING (if applicable)									
1.3.1	Chemical Composition	Chemical	1sample/batch every six months EM & 1sample/every batch supplier	IS 617 /OPTCL Specification	IS 617 /OPTCL Specification	CM-TC	P	P/W	V	
1.3.2	Tensile Strength	Mechanical		-do-	-do-	CM-TC	P	P/W	V	
1.3.3	Hardness	Physical		-do-	-do-	CM-TC	P	P/W	V	
1.3.4	Visual/finish	Visual		-do-	-do-	CMTC/EMTC	P	P/W	V	
1.3.5	Dimension	Measurement		-do-	-do-	CMTC/EMTC	P	W	V	
1.4	FRP TUBE (if applicable)									
1.4.1	Specific Gravity	Physical	One sample/lot	OPTCL Specification / IEC 62217	OPTCL Specification / IEC 62217	CM-TC	P	P/W	V	
1.4.2	Water Absorption	Physical	One sample/lot	-do-	-do-	CM-TC	P	P/W	V	


	<u>SUPPLIER DETAILS:</u>	<b>STANDARD MANUFACTURING QUALITY PLAN</b>					<b>CUSTOMER ADDRESS:</b> OPTCL CORPORATE OFFICE,JANPATH, BHOINAGAR,BHUBANESWAR, ODISHA, PIN-751022			
		<b>EHV SURGE ARRESTER (UP TO 400 KV )</b>								
		DATE OF ISSUE :- 23.12.2022		REV. :- 00		QAP NO. :- OPTCL/EQ/MQP/EHVSA				
SL. NO.	ITEM / TEST / OPERATION	TYPE OF CHECK	SAMPLING RATE	REFERENCE DOCUMENT	ACCEPTANCE NORMS		RECORD FORMATS	RESPONSIBILITY		
								S	M	C

<b>1.4.3</b>	Glass Content	Physical	One sample/lot	-do-	-do-	CM-TC	P	W	V	
<b>1.4.4</b>	Visual	Visual	5 sample/lot	-do-	-do-	CM-TC	P	W	V	
<b>1.4.5</b>	Dielectric Strength	Electrical	EM/100% supplier	-do-	-do-	CM-TC	P	W	V	
<b>1.4.6</b>	Dimension	Measurement	5 sample per lot	-do-	-do-	CM-TC	P	W	V	

<b>1.5</b>	<b>FRP ROD</b>									
<b>1.5.1</b>	Specific Gravity	Physical	One sample/lot	OPTCL Specification/ ASTM D 792 // IEC 62217	OPTCL Specification/ ASTM D 792 // IEC 62217	CM-TC	P	P / W	V	
<b>1.5.2</b>	Water Absorption	Physical	One sample/lot	OPTCL Specification / ASTM D 570	OPTCL Specification / ASTM D 570	CM-TC	P	P / W	V	
<b>1.5.3</b>	Glass Content	Physical	One sample/lot	OPTCL Specification / ASTM D 2584	OPTCL Specification / ASTM D 2584	CM-TC	P	W	V	
<b>1.5.4</b>	Visual	Visual	5 sample/lot EM/100% supplier	OPTCL Specification	OPTCL Specification	CM-TC	P	W	V	
<b>1.5.5</b>	Dielectric Strength	Electrical	Once in six month	IEC 62217/ OPTCL Specification	IEC 62217/ OPTCL Specification	CM-TC	P	W	V	
<b>1.5.6</b>	Dimension	Measurement	5 sample per lot EM & supplier	OPTCL Specification/ Approved Drawing	OPTCL Specification/ Approved Drawing	CM-TC	P	W	V	


	<u>SUPPLIER DETAILS:</u>	<b>STANDARD MANUFACTURING QUALITY PLAN</b>					<b>CUSTOMER ADDRESS:</b> OPTCL CORPORATE OFFICE,JANPATH, BHOINAGAR,BHUBANESWAR, ODISHA, PIN-751022				
		<b>EHV SURGE ARRESTER (UP TO 400 KV )</b>									
		DATE OF ISSUE :- 23.12.2022		REV. :- 00		QAP NO. :- OPTCL/EQ/MQP/EHVSA					
SL. NO.	ITEM / TEST / OPERATION	TYPE OF CHECK	SAMPLING RATE	REFERENCE DOCUMENT	ACCEPTANCE NORMS		RECORD FORMATS	RESPONSIBILITY			
							S	M	C		

<b>1.6</b>	<b>SPRING (if applicable)</b>									
<b>1.6.1</b>	Chemical Composition	Chemical	One sample/lot	OPTCL Specification/ IS 4454	OPTCL Specification / IS 4454	CM-TC	P	P/W	V	
<b>1.6.2</b>	Diameter	Measurement	One sample/lot	-do-	-do-	CMTC/EMTC	P	P/W	V	
<b>1.6.3</b>	Height	Measurement	One sample/lot	-do-	-do-	CMTC/EMTC	P	W	V	
<b>1.6.4</b>	Load	Electrical	One sample/lot	-do-	-do-	CM-TC	P	W	V	
<b>1.6.5</b>	Permanent Set	Physical	One sample/lot	-do-	-do-	CM-TC	P	W	V	
<b>1.7</b>	<b>GASKET (if applicable)</b>									
<b>1.7.1</b>	Shore Hardness	Mechanical	One sample/lot	OPTCL Specification/Manufacturer standard	OPTCL Specification / Manufacturer standard	CM-TC	P	W	V	
<b>1.7.2</b>	Tensile Strength	Mechanical	One sample/lot	-do-	-do-	CM-TC	P	W	V	
<b>1.7.3</b>	Elongation	Mechanical	One sample/lot	-do-	-do-	CM-TC	P	W	V	
<b>1.7.4</b>	Compression Permanent test	Mechanical	One sample/lot	-do-	-do-	CM-TC	P	W	V	
<b>1.7.5</b>	Ozone resistance test	Mechanical	One sample/lot	-do-	-do-	CM-TC	P	W	V	


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		<b>EHV SURGE ARRESTER (UP TO 400 KV )</b>									
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<b>1.8</b>	<b>PRESSURE RELIEF PLATE (if applicable)</b>										
<b>1.8.1</b>	Visual	Visual	5 sample per lot, EM/100%	OPTCL Specification/Manufacturer standard	OPTCL Specification/Manufacturer standard	CMTC/EM TC	P	P/W	V		
<b>1.8.2</b>	Dimension	Measurement	-do-	-do-	-do-	CMTC/EM TC	P	P/W	V		
<b>1.8.3</b>	Thickness	Measurement	-do-	-do-	-do-	CMTC/EM TC	P	W	V		
<b>1.8.4</b>	Pressure test	Mechanical	One sample/lot	-do-	-do-	CM-TC	P	W	V		

<b>1.9</b>	<b>INSULATING BASE</b>										
<b>1.9.1</b>	Electrical Test	Electrical	One sample/lot	OPTCL Specification / Manufacturer standard	OPTCL Specification / Manufacturer standard	CM-TC	P	W	V		
<b>1.9.2</b>	Compression test (if applicable)	Mechanical	One sample/lot	-do-	-do-	CM-TC	P	W	V		
<b>1.9.3</b>	Dimension	Measurement	5 sample per lot EM and supplier	-do-	-do-	CM-TC	P	W	V		


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<b>1.10</b>	<b>TERMINAL ASSEMBLY</b>											
<b>1.10.1</b>	Coating thickness in HDG item	Measurement	1 sample per lot EM /supplier 5 sample	OPTCL Specification/ Approved Drawing	OPTCL Specification / Approved Drawing	CM-TC	P	P/W	V			
<b>1.10.2</b>	Visual	Visual	100%	-do-	-do-	CM-TC	P	P/W	V			
<b>1.10.3</b>	Dimension	Measurement	1 sample per lot EM & SUPPLIER	-do-	-do-	CM-TC	P	P/W	V			
<b>1.10.4</b>	Tensile strength	Mechanical	1 sample per lot EM & SUPPLIER	IS 733	IS 733	CM-TC	P	P/W	V			
<b>1.11</b>	<b>SURGE COUNTER</b>											
<b>1.11.1</b>	Calibration setting at 1mA	Electrical	100 %	OPTCL Specification, IEC 60099-5 / Manufacturer Plant standard	OPTCL Specification, IEC 60099-5/ Manufacturer Plant standard	CMTC/ EMTC	P	P/V	V			
<b>1.11.2</b>	Counter operation test	Electrical	100 %	-do-	-do-	CMTC/ EMTC	P	P/V	V			
<b>1.11.3</b>	Water dip test	Physical	100 %	-do-	-do-	CMTC/ EMTC	P	P/V	V			
<b>1.11.4</b>	Visual	Visual	100 %	-do-	-do-	CMTC/ EMTC	P	P/V	V			
<b>1.11.5</b>	Dimension	Measurement	One sample/lot	-do-	-do-	CMTC/ EMTC	P	P/V	V			

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<b>1.12</b>	<b>HARDWARE</b>										
<b>1.12.1</b>	Coating thickness	Measurement	5 sample per lot	OPTCL Specification/ Relevant Standard	OPTCL Specification/ Relevant Standard	CMTC/EM TC	P	P/W	V		
<b>1.12.2</b>	Dimension	Physical	5 sample per lot	-do-	-do-	CMTC/EM TC	P	P/W	V		
<b>1.12.3</b>	Thread check	Physical	5 sample per lot	-do-	-do-	CMTC/EM TC	P	P/W	V		
<b>1.12.4</b>	Visual Inspection	Visual	5 sample per lot	-do-	-do-	CMTC/EM TC	P	P/W	V		
<b>1.13</b>	<b>BASE PLATE</b>										
<b>1.13.1</b>	Coating thickness in HDG item	Measurement	1 sample per lot EM/supplier 5 sample	OPTCL Specification/ IS 2629/IS 2633/ IS 4759	OPTCL Specification / OPTCL Specification/ IS 2629/IS 2633/ IS 4759	CM-TC	P	P/W	V		
<b>1.13.2</b>	Visual	Visual	100%	OPTCL approved drawings	OPTCL approved drawings	CM-TC	P	P/W	V		
<b>1.13.3</b>	Dimension	Measurement	1 sample per lot EM & supplier	OPTCL approved drawings	OPTCL approved drawings	CM-TC	P	P/W	V		
<b>1.14</b>	<b>GRADING RING</b>										
<b>1.14.1</b>	Chemical Composition	Chemical	one sample/lot	OPTCL Specification/ IS 733	OPTCL Specification/IS 733	CM-TC	P	P/W	V		




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1.14.2	Dimension	Measurement	1 sample per lot EM/supplier 5 sample	-do-	-do-	CMTC/EM TC	P	P/W	V
1.14.3	Visual	Visual	1 sample per lot EM/supplier 100%	-do-	-do-	CMTC/EM TC	P	P/W	V

<b>1.15</b>	<b>ZNO BLOCKS</b>
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1.15.1	Aging Test for 72 hrs & Watt loss & Thermal Stability	Electrical	3Sample/lot	OPTCL Specification/ Relevant standard	OPTCL Specification/ Relevant standard	CM-TC	P	P/W	W/V
1.15.2	Energy Capability Test	Electrical	100%	-do-	-do-	CM-TC	P	P/W	W/V
1.15.3	Residual voltage	Electrical	100%	-do-	-do-	CM-TC	P	P/W	W/V
1.15.4	Reference Voltage	Electrical	5 Samples per lot	-do-	-do-	CM-TC	P	P/W	W/V
1.15.5	Visual	Visual	100%	-do-	-do-	CM-TC	P	P/W	W/V
1.15.6	Dimension	Measurement	5 Sample/lot	-do-	-do-	CM-TC	P	P/W	W/V


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<b>B</b>	<b>IN PROCESS INSPECTION</b> (OPTCL may carry out inspection as and when required)										
<b>2.1</b>	<b>POWDER PROCESSING</b>										
<b>2.1.1</b>	Powder Processing	Physical	OPTCL Specification & EM Drawing	OPTCL Specification/ Manufacturer's standard	OPTCL Specification/ Manufacturer's standard	EM-TC	---	P	V		
<b>2.2</b>	<b>FURNACE AREA</b>										
<b>2.2.1</b>	Furnace area	Physical	OPTCL Specification & EM Drawing	OPTCL Specification / Manufacturer's standard	OPTCL Specification / Manufacturer's standard	EM-TC	---	P	V		
<b>2.3</b>	<b>ZNO BLOCK INSPECTION</b>										
<b>2.3.1</b>	Visual Examination	Visual	100%	OPTCL Specification	OPTCL Specification	EMTC	--	P	V		
<b>2.3.2</b>	Physical	Visual	3 sample/batch	OPTCL Specification & EM Approved Drawing	OPTCL Specification & EM Approved Drawing	EMTC	--	P	V		
<b>2.3.3</b>	Dimension	Visual	3 sample/batch	-do-	OPTCL Specification & EM Approved Drawing	EMTC	---	---	V		
<b>2.3.4</b>	Parallality	Visual	3 sample/batch	-do-	OPTCL Specification & EM Approved Drawing	EMTC	---	P	V		
<b>2.3.5</b>	Residual Voltage Test	Electrical	3 sample/batch	OPTCL Specification & IEC 60099-4	OPTCL Specification & IEC 60099-4	EMTC	--	P	V		
<b>2.3.6</b>	Thermal stability test & energy capability test on ZnO Blocks	Electrical	3 sample/batch	OPTCL Specification / IEC 60099-4 ( 2 L.D. impulses of 2 msec Duration )	OPTCL Specification / IEC 60099-4	EMTC	--	P	V		

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2.3.7	Watt loss test on ZnO Blocks	Electrical	3 sample/batch	OPTCL Specification/ IEC 60099	OPTCL Specification/ IEC 60099	EMTC	--	P	V	
2.3.8	Repetitive charge transfer rating(Qrs)	Electrical	3 sample/batch	OPTCL Specification/ IEC 60099	OPTCL Specification/ IEC 60099	EMTC	--	P	V	

<b>C</b>	<b>FINAL INSPECTION AND TESTING</b>									
	<b>NOTE:</b> ALONG WITH FINAL INSPECTION OFFER, THE OEM HAS TO SUBMIT THE FOLLOWING (IN BOTH SOFT AND HARD COPIES): <ol style="list-style-type: none"> <li>INTERNAL TEST REPORT (ROUTINE TEST REPORT)</li> <li>INSTRUMENT CALIBRATION CERTIFICATES</li> <li>TEST PROCEDURES AND CONNECTION DIAGRAM</li> <li>IN CASE OF INSPECTION IS CONDUCTED THROUGH VIDEO CONFERENCING, THE FIRM HAS TO DECLARE IN WRITTEN THAT ATLEAST 4 HIGH RESOLUTION CAMERAS SHALL FOCUS TOWARDS THE TEST OBJECT FROM DIFFERENT ANGLES GIVING THE INSPECTOR MULTIDIRECTIONAL VIEW AND ONE PORTABLE CAMERA WHICH SHALL GIVE CLOSE IN VIEW OF THE TEST RUSLTS OF TESTING INSTRUMENTS.THE VC APPLICATION REQUIRED FOR CONDUCTING THE INSPECTION SHALL ALSO BE MENTIONED.</li> </ol>									
	OPTCL WILL DEPUTE /NOMINATE ITS INSPECTOR FOR INSPECTION ONLY AFTER VERIFICATION AND CONFIRMATION OF THE ABOVE.									
3.1	<b>ROUTINE TEST</b>									
3.1.1	Sealing test for units with sealed housings.	Physical	100%	OPTCL Specification	Water dip test at 1.5m depth from top of Surge Arrestor for 30 minutes shall be performed.	EM-TC	---	P	V	
3.1.2	Reference Voltage Measurement	Electrical	100%	IEC 60099-4 / OPTCL Datasheet	IEC 60099-4 / OPTCL datasheet. After water Dip at 1.5 meter depth for 30 min	EM-TC	---	P	V	


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3.1.3	Lightening impulse Residual Voltage Test	Electrical	100%	IEC 60099-4 / OPTCL Datasheet	IEC 60099-4 / OPTCL datasheet. After water Dip at 1.5 meter depth for 30 min	EM-TC	--	P	V	
3.1.4	Measurement of Internal Partial Discharge and contact noise	Electrical	100%	IEC 60099-4 / OPTCL Datasheet	IEC 60099-4 / OPTCL datasheet. After water Dip at 1.5 meter depth for 30 min	EM-TC	--	P	V	
3.1.5	Current distribution test ( for multi column arrester)	Electrical	100%	IEC 60099-4	IEC 60099-4	EM-TC	--	P	V	


3.2	<b>FINAL ACCEPTANCE TEST ON ARRESTER</b>									
3.2.1	Sealing test for units with sealed housings.	Physical	Cube root of quantity	OPTCL Specification	Water dip test at 1.5m depth from top of Surge Arrestor for 30 minutes shall be performed.(Test 3.2.2 to 3.2.4 shall be conducted after water dip test)	EMTC	-	P	W/V	
3.2.2	Power frequency Reference Voltage Test	Electrical	Cube root of quantity	IEC 60099-4 / OPTCL Specification	IEC 60099-4 / OPTCL Specification. Post water dip at 1.5 meter depth, 30 Mins	EMTC	-	P	W/V	
3.2.3	Lightening Residual Voltage Test(at N.D.C., 50% of N.D.C. & 200% of N.D.C)	Electrical	Cube root of quantity	IEC 60099-4 / OPTCL Specification	IEC 60099-4 / OPTCL Specification. Post water dip at 1.5 meter depth, 30 Mins	EMTC	-	P	W/V	
3.2.4	Partial Discharge Test (at 1.05 times M.C.O.V)	Electrical	Cube root of quantity	IEC 60099-4 / OPTCL Specification	IEC 60099-4 / OPTCL Specification. Post water dip at 1.5 meter depth, 30 Mins	EMTC	-	P	W/V	

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<b>3.2.5</b>	Measurement of leakage current and capacitive current at M.C.O.V	Electrical	Cube root of quantity	IEC 60099-4 / OPTCL Specification	IEC 60099-4 / OPTCL Specification	EMTC	-	P	W/V
<b>3.2.6</b>	Watt loss test (at U <sub>c</sub> and 10K.V)	Electrical	Cube root of quantity	IEC 60099-4 / OPTCL Specification	IEC 60099-4 / OPTCL Specification	EMTC	-	P	W/V
<b>3.2.7</b>	Special Thermal stability test	Electrical	Cube root of quantity	IEC 60099-4 / OPTCL Specification	IEC 60099-4 / OPTCL Specification	EMTC	-	P	W/V
<b>3.2.8</b>	Galvanization test on metal parts	Electrical	Cube root of quantity	IEC 60099-4 / IS 2633/ IS 2629 OPTCL Specification	IEC 60099-4 / IS 2633/ IS 2629 OPTCL Specification	EMTC	-	P	W/V
<b>3.2.9</b>	Counter Operation Test a) 100 Amps with 8/20 micro second wave shape. (b) 10 KA with 8/20 micro second wave shape	Electrical	Cube root of quantity	IEC 60099-4 / OPTCL Specification	IEC 60099-4 / OPTCL Specification	EMTC	-	P	W/V
<b>3.2.10</b>	Meter Operation and calibration Test	Electrical	Cube root of quantity	IEC 60099-4 / OPTCL Specification	IEC 60099-4 / OPTCL Specification	EMTC	-	P	W/V

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<b>3.3</b>	<b>TYPE TEST</b>										
<b>3.3.1</b>	Insulation withstand tests on the arrester housing	Electrical	As per Purchase Order /Agreed term	IEC 60099-4 & OPTCL Specification	IEC 60099-4 & OPTCL Specification	EMTC	-	P/W	W/V		
<b>3.3.2</b>	Residual voltage test a) Steep current impulse residual voltage test. b) Lightning impulse residual voltage test c) Switching impulse residual voltage test.	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V		
<b>3.3.3</b>	Test to verify long term stability under continuous operating voltage	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V		
<b>3.3.4</b>	Repetitive charge transfer withstand	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V		
<b>3.3.5</b>	Heat dissipation behavior of test samples	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V		
<b>3.3.6</b>	Operating duty test	Electrical	3 samples as per IEC 60099	-do-	-do-	EMTC	-	P/W	W/V		

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<b>3.3.7</b>	Short circuit test  (a) High current test. (b) Low current test.	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V
<b>3.3.8</b>	Power frequency voltage vs. time curve. (Temporary over voltage test)	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V
<b>3.3.9</b>	Bending moment test	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V
<b>3.3.10</b>	Seismic withstand test	Electrical	-do-	CISPR Publication 16-1(2019) Part -1 / Relevant IEC	CISPR Publication 16-1(2019) Part -1/ Relevant IEC	EMTC	-	P/W	W/V
<b>3.3.11</b>	Radio interference voltage test	Electrical	-do-	IEC 60099-4 & OPTCL Specification	IEC 60099-4 & OPTCL Specification	EMTC	-	P/W	W/V
<b>3.3.12</b>	Corona Extinction voltage test(For 420/245 KV arresters)	Electrical	-do-	IEC 60099-4 & OPTCL Specification	IEC 60099-4 & OPTCL Specification	EMTC	-	P/W	W/V
<b>3.3.13</b>	Seal leak rate test	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V
<b>3.3.14</b>	Test to verify dielectric withstand of the internal components of an arrester (if applicable)	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V

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<b>3.3.15</b>	Test of internal grading components(if applicable)	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V
<b>3.3.16</b>	Weather ageing test( for polymer housing arrester)	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V
<b>3.3.17</b>	IP-67 test on surge counter	Electrical	-do-	-do-	-do-	EMTC	-	P/W	W/V
<b>3.3.18</b>	Environmental test (not for polymer)	Physical	-do-	-do-	-do-	EMTC	-	P/W	W/V
<b>3.3.19</b>	Polluted housing test (not for polymer)	Physical	-do-	-do-	-do-	EMTC	-	P	W/V

<b>D</b>	<b>PACKING AND DESPATCH</b>								
<b>4.1</b>	Checking for completeness of the equipment and accessories including spares as per order.	Visual	100%	As per EM Process Specification	As per EM Process Specification		-	P	W/V
<b>4.2</b>	Check for proper packing (for polymer/porcelain housing arrester)	Visual	100%	As per EM Process Specification	As per EM Process Specification and cl no 10 of OPTCL specification		-	P	W/V
<b>4.3</b>	Ensure supply of O&M manual and Test reports						-	P	W/V