

## **TECHNICAL SPECIFICATION FOR 9 KV, 5 KA DISTRIBUTION TYPE METAL OXIDE LIGHTNING ARRESTERS POLYMERIC HOUSED WITHOUT GAPS FOR AC SYSTEMS:**

**1. SCOPE:** This specification covers the design, manufacture, testing, supply and performance requirements for gapless metal oxide, Polymeric housed distribution type surge arresters for outdoor use.

**2. PURPOSE:** The polymeric housing Lightning Arresters (Distribution type) are required to be used to protect the 11 KV Distribution Transformers from high transient voltage (surge) in a three phase solidly earth neutral system. These Lightning Arresters will be connected between phase and earth just before the transformers H.V. Bushings.

The 9 KV, 5 KA Lightning Arresters shall possess the following electrical and physical characteristics.

### **ELECTRICAL:**

- (i) Voltage : 9 KV
- (ii) Frequency : 50 HZ
- (iii) Nominal Discharge Current : 5 KA

**3. SERVICE CONDITIONS:** The Surge arresters with Disconnecter and accessories shall be suitable for continuous, satisfactory operation under climatic conditions listed below: -

- 1. Maximum ambient air temp. (°C) : 50
- 2. Minimum ambient air temp. (°C) : 3.5 in shade
- 3. Humidity (%) : 10 to 100
- 4. Maximum altitude above mean sea level : 1000 (Meter)
- 5. Maximum annual rainfall (mm) : 1450
- 6. Maximum wind pressure (kg/Sq.Mtr.) : 150
- 7. Isoceraunic level : 50
- 8. Seismic level (Horizontal accln.). : 0.3 g
- 9. Moderately hot and humid tropical Climate, conducive to rust and fungus growth.

### **4. DEFINITIONS:**

**4.1. LIGHTNING ARRESTER:** A device designed to protect electrical apparatus from high transient over voltages.

**4.2. GAPLESS METAL-OXIDE LIGHTNING ARRESTER:** A Lightning arrester having one or several non-linear metal-oxide resistors with highly non-linear voltage-current characteristics, connected in series, but having no integrated series or parallel spark gaps.

**4.3. POLYMERIC HOUSED LIGHTNING ARRESTER:** A lightning arrester with a housing made of polymeric material without air Voids neither between the housing and the metal-oxide resistors nor the housing itself. Arresters must have directly moulded housings. Arresters manufactured by slipon, pre moulded housing will not be accepted in view of the weak interface between the housing and the assembled disc. The arrester Design shall be of Cage design.

**4.4. SHORT CIRCUIT TEST / MODE OF FAILURE PERFORMANCE:** Behavior of the arrester during and after a simulated internal failure with different power frequency short circuit currents.

**4.5. BONDING BETWEEN HOUSING AND METAL-OXIDE RESISTORS/ INTERFACIAL SEALING:** The Polymeric Housing shall be moulded directly on the assembled stacked zinc oxide Disc mechanically held together to ensure perfect bonding and also ensure void free assembly. Arrester manufactured by Slipping on, Pre moulded Housing will not be accepted in view of the weak interface between the housing and the assembled disc. The arrester Design shall be of Cage design.

**5. PHYSICAL:** The 9KV polymeric housing Lightning Arresters should be of Single Pole, Outdoor type suitable for use in A.C. three phase 11 KV, 50 Hz & effectively earthed neutral system respectively and for application at altitudes upto 1000 metres. They should be suitable for operation in tropical and humid climates for a temperature variation from 5 Degree Celsius to 65 Degree Celsius and for relative humidity as high as 100%.

## 6. LIST OF STANDARDS:

Unless otherwise modified in this specification, the Lightning Arresters shall conform in all respects to IS 3070/1985 part-I, IEC-99-4/1991 (Latest version). The tenderers shall go through the above IS/IEC thoroughly before making their offers.

1. IEC-99-4/1991 Specification for Surge arresters without gap of A.C.system.
2. IS-3070 Specification for Lightning Arresters (Part-1)/1985 for Alternating Current Systems &(Part-3)/1993.
3. IS-4759/1996 Hot dip zinc-coating on structural steel and other allied products.
4. ISS-2633/1986 Method for testing uniformity of coating on zinc coated articles.
5. ISS-13947/1993 Degree of protection provided by (Part-I) enclosures for low voltage switch gear and control.
6. Indian Electricity Rules 1956.
7. IEC 60099 – Part 4 & Part 5: Metal-oxide surge arresters without gaps for a.c. systems. The housing shall conform to the degree of protection as per IP53 (IS 1394 part-I, 1993).

**7. SYSTEM PARAMETERS:** The Lightning arrester must be able to operate under the system parameters mentioned in this specification.

Nominal System Voltage	: 11 KV
Frequency	: 50 Hz
Grounding of Neutral	: Solidly
Temporary Overvoltage (Earth Fault Factor):	10.4KV for 10 sec.
Highest System Voltage	:12KV
Short Circuit Levels	:20KA
Insulation Withstand Level (BIL)	: 75KV

## 8. PRODUCT REQUIREMENTS:

**8.1. POLYMERIC HOUSING MATERIAL:** The polymer material which is used for the arrester housing must be tracking and erosion resistant, stabilized against UV radiation in similar applications (like MV/HV cable terminations, insulators and arresters) in country.

**8.2. HOUSING AND MECHANICAL REQUIREMENTS:** The Lightning arrester shall meet the following specifications:

Creepage Length	: 300 mm (min.)
Pull Strength	: 1000 N (min)
Cantilever Load	: 75 Nm (min)
Torsion	: 30 Nm (min)

**8.3. ELECTRICAL REQUIREMENTS:** The Lightning arrester shall meet the following specifications based on IEC 60099-4 :

Arrester Max. Cont. Operating Voltage $U_c$	: 7.65 KV rms
Arrester Rated Voltage $U_r$	: 9 KV rms
Nominal Discharge Current $I_n$	: 5 kA p
Long Duration Discharge Class	: 75A, 1000 $\mu$ s Max.
Residual Voltage @ $I_n$	: 30.0 kVp
Lightning Impulse 1.2/50 $\mu$ s Withstand Voltage	: 75 KVp
Wet Power Frequency Withstand Voltage	: 28 KV rms.

**8.4. ACCESSORIES & MOUNTING:** The mounting accessories shall be designed arresters shall be suitable for vertical and horizontal mounting fixed in Channel of size 75 x 40, 100 x 50 & 125 x 65 mm and hence they should be suitable for bracket mounting.

The Lightning Arresters should be designed so that in case of its total failure, it should not shatter and damage the nearby equipments. They may be provided with the following:

a) Adjustable mounting bracket so as to enable it to be fixed in any of the channels with bolts & nuts with spring washer and ordinary washers. The bolts, nuts and clamps etc. shall be suitably galvanized as per IS 2629.

b) The line and earth terminals should be designed to accommodate 7/2.59mm ACSR Conductor / 7/3.15 mm AAAC Conductor and there should not occur any bimetallic action. The fasteners used should be "Self Locking " type.

**8.5. DISCONNECTORS:** The earth end shall get connected to the earth terminal of the arrester through disconnector. The function of the disconnector is that in the event of, operation of surge arrester, the current shall pass to earth and the disconnector shall disconnect (isolate) the earth terminal and it shall remain suspended on the mounting of the arrester. There by it will be disconnected from the earth and shall provide visual indication to the patrolling personnel. The line can be recharged without isolating the damaged arrester. The arrangements of disconnector is to be submitted along with tender document.

The arrester for 11KV System be provided with a suitable disconnecting device. This shall be connected in series with the ground lead and should not affect the sealing system of the arrester. The disconnecting device shall conform to the requirement specified in IS:3070 (Part-II) 1993 & IEC 60099-4 (1991-II) clause 5.12, 7.6.3.

1. Each and every individual unit of surge arrester shall be hermetically sealed and fully protected against ingress of moisture suitable rubber gaskets with effective sealing system should be used. The hermetic seal shall be effective for entire life time of arresters and under the service conditions specified. The supplier shall furnish sectional view showing details of sealing employed. Manufacturers should device a suitable routine production testing to verify the efficiency of sealing.
2. All the units of arresters of same rating shall be interchangeable type without adversely affecting the performance.
3. The lightning (surge) arrester shall be suitable for pedestal type mounting which will be arranged by the purchaser.
4. All necessary bolts, nuts, clamps etc., required for mounting on support structure shall be included in the scope of supply.
5. All polymer housing shall be free from flaws affecting mechanical and electrical strengths.
6. All exposed ferrous parts shall be hot dip galvanized as per IS:2633
7. Line terminal pads and ground terminal pads should be hot dip galvanized.
8. The polymer material which is used for arrester housing must be tracking and erosion resistant, stabilized against UV radiation and have proven records in similar applications (like MV/HV cable terminations, insulators and arresters) in country.

#### **8.6. TERMINAL CONNECTORS:**

Surge arrester should be provided with terminal connection suitable for single dog for 30kV & Single Weasel for 10kV.

Terminal connector shall be manufactured and tested as per IS:5361 and should be type tested. The terminal connector drawings should be submitted separately with the tender documents.

1. All casting shall be free from blow holes, surface blisters, cracks and cavities. All Sharp edges and corners shall be blurred and rounded off.
2. All current carrying parts shall be designed and manufactured to have minimum contact resistance.
3. The contact surface must be machined smooth to obviate excessive current density.
4. The terminal connector for connection of conductor should be suitable for ACSR Squirrel Raccoon conductor with Universal take off arrangement (can be adjusted for both horizontal & vertical takeoff) and should have adequate current carrying capacity.
5. The terminal connector shall be manufactured out of Aluminium alloy grade as per IS and by gravity die casting process only.
6. Terminal connector should have six bolts to hold the conductor and conductor hold length shall be 100mm approximately. All nuts, washers, bolts etc, shall be stainless steel/hot dip galvanized.
7. The top metal gap and the base of the lightning arresters shall be galvanized.
8. The base of the lightning arresters shall be provided with two separate terminal distinctly marked for connection to earth.

**8.7. CORROSION PROTECTION:** The arrester and all its accessories shall be adequately protected against corrosion. All exposed ferrous components, unless of stainless steel or other noncorrosive metal, shall be hot-dip galvanized. Hardware shall be of stainless steel.

**8.8. TENDER SAMPLE:** ONE tender sample of offered Polymeric surge arrester with disconnector will have to be submitted along with the offer.

**9. TESTING:** The arresters shall be tested in accordance with the following latest standards IEC 60099-4/ 2004-05 Standard.

**9.1. LOCATION OF TESTS:** Routine tests and acceptance tests shall be carried out at the supplier's factory. Type tests shall be carried out in the laboratories of an NABL accredited independent test institute/ Govt. approved lab. Relevant type test certificates are mandatory and shall be issued by the CPRI/ERDA.

**9.2. TYPE TEST FOR ARRESTERS WITH POLYMERIC HOUSING:** All the tenderers must submit copies of type test certificates along with laboratory approved drawings for the products offered by them. Type tests should be carried out in accordance with the latest version of specified standard at Govt. approved / NABL accredited lab and test reports should enclosed on date of opening the tender. Surge arresters offered shall be manufactured with the same configuration & raw materials as used in the surge arrester for which type test reports are submitted.

- a. Insulation Withstand Test on Arrester Housing
- b. Residual Voltage Tests
- c. Long Duration Current Impulse Withstand Test
- d. Operating Duty Test
- e. Partial Discharge Voltage Test
- f. Accelerated ageing test
- i. Power frequency voltage versus time characteristics
- g. Weather Ageing Test
- h. High Current Short Circuit Test & Low Current Short circuit Test.

The arrester shall prove its withstand capability with respect to internal failures by passing the following type tests:

Short Circuit Test in accordance with IEC 60099-4/2004-05 Standard. procedure shall be used for testing.

The minimum symmetric fault current shall be 20KA rms for a minimum of 0.2s for high current short circuit test.

The fault current shall be initiated preferably by prefailing the arrester within  $5 \pm 3$  minutes with a power frequent AC voltage.

For low current short circuit test, the test shall be performed Specification for Polymeric Surge Arresters by over voltage method.

During the test no parts must be ejected and the arrester has to maintain its integrity. All flames must self extinguish within one minute after the test.

***The type tests as specified in the IS should be carried out not later than 10 years from the date of opening of bid.***

**9.3. ROUTINE TESTS:** The manufacturer shall carry out the following routine tests on each single arrester in accordance with IEC 60099-4/ 2004-05 Standard.

- AC Reference Voltage Test (final arrester)
- Partial Discharge Test (final arrester including hardwares/accessories)
- Residual Voltage Test (final arrester or metal-oxide resistors)

The manufacturer shall provide a routine test report including all relevant details with respect to the test limits. On request, the manufacturer shall also provide a routine test protocol including all measuring results. Sample test are not acceptable.

**9.4. ACCEPTANCE TESTS:** The acceptance tests shall be carried out as per IEC: 60099-4/ 2004-05 standard.

- 1. Power frequency reference voltage test
- 2. Lightning impulse residual voltage test
- 3. Internal partial discharge test
- 4. Visual examination & Dimensional verification

5. Peel Off Test to verify if the design is of Cage design or not.

**9.5. Test Certificate:** Routine Test, acceptance test and optional tests as per IEC: 60099-4/2004-05 standard with its latest amendments shall be conducted using testing kit/ equipment / instruments calibrated in any of the Government Institute / Undertaking / Government Recognized Laboratory.

**10. MARKING:** Each arrester shall be provided with a nameplate, bearing the following information, as a minimum, in English language:

- Arrester Type
- IEC standard
- Continuous Operating Voltage  $U_c$
- Rate Voltage  $U_r$
- Nominal Discharge Current
- Rated Short Circuit Current
- Manufacturers name or trademark
- Month & Year of manufacture
- PROPERTY OF "
- Guarantee Period :
- P.O.No. & Ref.No. :

**11. DRAWINGS:** The tenderer shall furnish catalogues, literature and detailed dimensional drawings of complete arrester with disconnector showing clearances, polymeric housing details & name plate details.

**12. QUALITY ASSURANCE:** The manufacturer shall be certified in accordance with ISO 9001. The supplier has to provide a copy of a valid certificate along with his quote. Relevant manuals shall be presented upon request.

**13. PACKING AND SHIPMENT:** Arresters shall be securely packed, complete with all accessories, in strong nonreturnable boxes, in such a manner as to prevent damage during shipment.

**14. GUARANTEED TECHNICAL PARTICULARS;**

The bidder shall furnish the technical particulars as per the Annexure and submit the same with his tender.

**15. INSPECTION:**

15.1. All routine tests and inspection for acceptance Tests shall be made at the place of manufacturer unless otherwise specially agreed upon by the manufacture and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchase all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with this specification.

15.2. The purchaser has the right to have the type tests carried out at suppliers cost by an independent agency wherever there is a dispute regarding the quality of supply.

**IMPORTANT NOTE:** As per the instructions of the Director, Ministry of Power, New Delhi, Govt Of India vide Lr . No.25-11/6/2018-PG, Dt.02.07.2020

a) All equipment, components, and parts imported for use in the manufacturing of Air break Switches with Insulators shall be tested in the Country to check for any kind of embedded malware/ Trojans/cyber threat and for adherence to Indian standards.

b) All such testings shall be done in certified laboratories that will be designated by the Ministry of Power (MoP).

c) Any import of equipment/components/parts from “prior reference” countries i.e. CHINA, PAKISTAN or by persons owned by, controlled by, or subject to the jurisdiction or the directions of these “prior reference” countries will require prior permission of the Government of India.

d) Where the equipment/components/parts are imported from “prior reference” countries, with special permission, the protocol for testing in certified & designated laboratories shall be approved by the Ministry of Power (MoP).

e) The above shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used or any activity directly or indirectly related to power supply system.

**15. GUARANTEE:**

Supplied equipment should be guaranteed for 12 months from the date of installation or for 18 months from date of receive at destination, whichever is earlier. If the equipment is found defective within the above guarantee period, it should be replaced/repaired by the supplier free of cost within one month of the receipt of intimation.

**16. GENERAL:**

The tenderer shall furnish an undertaking stating that no court cases were filed/pending against terms and conditions of any APSPDCL tender.

**GUARANTEED TECHNICAL PARTICULARS FOR GAPLESS METAL OXIDE DISTRIBUTION TYPE  
ARRESTERS WITH POLYMERIC HOUSING WITH DISCONNECTORS**

Sl. No.	Description		Offered by Bidder
1	Name of Manufacturer		
2	Arrester Type or Designation		Metal oxide Gapless Outdoor Type
3	Arrester Continuous Operating Voltage Uc	KV rms	7.65 kV rms
4	Arrester Rated Voltage Ur	KV rms	9kV rms
5	Nominal Discharge Current In	KA	5kA
6	Line Discharge Class	Class	Distribution
7	High Current Discharge Current 4/10μs	kA	65kA
8	Long Duration Current Amplitude	A	75A
9	Long Duration Current Duration	μs	1000 μs
10	Impulse High Current short during discharge Amps (4/10Microsec wave)KA peak	kA	65kA
11	Nominal discharge current (8/20 microsec wave)KA	kA	5kA
12	Pull Strength	N	1000
13	Cantilever Strength	Nm	75Nm
14	Torque Strength	Nm	30Nm
15	Total Height of Arrester	mm	
16	Creepage Length	mm	Min 300mm
17	IR Value (on 1000 V megger)	Ohm	
18	Lightning Impulse 1.2/50μs withstand level	Kvp	75kVp
19	Wet Power Frequency withstand level	Kv rms	28kV rms
20	Housing Type		Polymeric
21	Housing Material		Silicon Rubber
22	Colour of Housing		Grey
23	Size of the line terminal		M10
24	Min space required for 3 phase installation	mm	240mm
25.a	Leakage current at Maximum operation voltage at 0.8 resistive		Resistive: less than 300 μA
b	Leakage current at Maximum operation voltage at 1.2 capacitive		Capacitive: About 800 μA
26	Max. Partial discharge level arrester will be able to operate under the	Pc	<10pC
27	System parameters mentioned in the specification	Yes/No	Yes
28.a	Maximum residual voltage of arrester for : Lightning Current Impulse 8/20 μs at 2.5KA	kV	29.0 kV
b	5 KA	kV	30.0 kV
c	10 kA	kV	31.0 kV
29	Residual voltage for steep current wave (10KA of one micro second wave)KV peak	kV	32kvp
30	Minimum recommended Center-to-Center Distance between Arresters	mm	240mm
31	Minimum recommended Distance from Center of Arrester to nearest grounded object	mm	180mm
32	Whether earth disconnector, as mentioned in the specification, is provided	Yes/No	YES

<b>Sl. No.</b>	<b>Description</b>		<b>Offered by Bidder</b>
33.a	Temporary over voltage withstand: 0.1 second KV rms		11.0kV rms
b	1.0 second KV rms		10.0kV rms
c	10.0 second KV rms		9.5kV rms