

## **SPECIFICATION FOR 30 KV, 10 KA STATION 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 station type surge arresters for outdoor use

**2. PURPOSE:** The polymeric housing Lightning Arresters (Station type) are required to be used to protect the 33 KV Power Transformers, Sub-station Equipments on 33KV 3Phase, 50 cycle A.C. system for outdoor installation.

The 33 KV Station type Lightning Arresters shall possess the following electrical and physical characteristics.

### **ELECTRICAL:**

- (i) Voltage: 30 KV
- (ii) Frequency: 50 HZ
- (iii) Nominal Discharge Current: 10 KA Class-2

**3. SERVICE CONDITIONS:** The Surge arresters 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 33KV polymeric housing Lightning Arresters should be of Single Pole, Outdoor type suitable for use in A.C. three phase 33 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	: 33 KV
Frequency	: 50 Hz
Grounding of Neutral	: Solidly
Fault Level	: 1500MVA

Highest System Voltage : 36KV  
Short Circuit Levels : 40KA  
Insulation Withstand Level (BIL): 175KV

## **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.

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

Creepage Length : 900 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  $U_c$  : 25.0 KV rms  
Arrester Rated Voltage  $U_r$  : 30 KV rms  
Nominal Discharge Current  $I_n$  : 10 kA p  
Long Duration Discharge Class : 400A, 2000 $\mu$ s  
Max. Residual Voltage @  $I_n$  : 85.0 kVp  
Lightning Impulse 1.2/50 $\mu$ s Withstand Voltage: 175 KVp  
Wet Power Frequency Withstand Voltage : 100 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 or 100 x 50 or 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. Terminal connectors shall be suitable for horizontal/vertical take off.

## **8.5. TERMINAL CONNECTORS:**

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

Terminal connectors 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.

**8.6. 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.

**8.7. TENDER SAMPLE:** ONE tender sample of offered Polymeric surge arrester with terminal connector 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. Repetative charge transfer Test
- g. Heat Dissipation Test
- h. Accelerated ageing test
- i. Power frequency voltage versus time characteristics

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 40KA rms for a minimum of 0.2s for high current short circuit test.

The fault current shall be initiated preferably by pre-failing 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.

**GUARANTEED TECHNICAL PARTICULARS FOR GAPLESS METAL OXIDE STATION CLASS-2 ARRESTERS  
WITH POLYMERIC HOUSING**

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	25.0kV rms
4	Arrester Rated Voltage Ur	KV rms	30kV rms
5	Nominal Discharge Current In	KA	10kA
6	Line Discharge Class	Class	Station
7	High Current Discharge Current 4/10 $\mu$ s	kA	100kA
8	Long Duration Current Amplitude	A	400A
9	Long Duration Current Duration	$\mu$ s	2000 $\mu$ s
10	Impulse High Current short during discharge Amps (4/10Microsec wave)KA peak	kA	100kA
11	Nominal discharge current (8/20 microsec wave)KA	kA	10kA
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 900mm
17	Lightning Impulse 1.2/50 $\mu$ s withstand level	Kvp	175kVp
18	Wet Power Frequency withstand level	Kv rms	100kV rms
19	Housing Type		Polymeric
20	Housing Material		Silicon Rubber
21	Colour of Housing		Grey
22	Size of the line terminal		M10

Sl. No.	Description		Offered by Bidder
23	Min space required for 3 phase installation	mm	240mm
24	Leakage current at Maximum operation voltage at 0.8 resistive		Resistive: less than 300 $\mu$ A
25	Leakage current at Maximum operation voltage at 1.2 capacitive		Capacitive: About 800 $\mu$ A
26	Max. Partial discharge level arrester will be able to operate under the System parameters mentioned in the specification	Pc	<10pC
27		Yes/No	Yes
28.a	Maximum residual voltage of arrester for : Lightning Current Impulse 8/20 $\mu$ s at 2.5KA	kV	80.0 kV
b	10 KA	kV	85.0 kV
c	20 kA	kV	90.0 kV
29	Residual voltage for steep current wave (10KA of one micro second wave)KV peak	kV	92kvp
30	Minimum recommended Center-to-Center Distance between Arresters	mm	325mm
31	Minimum recommended Distance from Center of Arrester to nearest grounded object	mm	275mm
32.a	Temporary over voltage withstand: 0.1 second KV rms		37.5kV rms
b	1.0 second KV rms		36.0kV rms
c	10.0 second KV rms		34.5kV rms