STATION CLASS SURGE ARRESTERS

1. 33kV VOLTAGE CLASS SURGE ARRESTORS

1.1. INTRODUCTION

The section covers the specification of 33kV voltage level, 10 kA, Station class heavy duty, gapless metal (zinc) oxide Surge Arrestors complete with insulating base, terminal clamps, complete fittings & accessories for installation on outdoor type 33kV switchgear/transmission lines/ transformers.

1.2. STANDARDS

The design, manufacture and performance of Surge Arrestors shall comply with IS: 3070 Part-3 and other specific requirements stipulated in the specification. Unless otherwise specified, the equipment, material and processes shall conform to the latest applicable Indian/International Standards as listed hereunder:

IS:2071-1993 (Part-1)	Methods of High Voltage Testing General Definitions & Test Requirements.
IS:2071-1974(Part-2)	Test Procedures
IS:2629-1985	Recommended Practice for hot dip galvanizing on Iron & Steel
IS:2633-1986	Method for Testing uniformity of coating of zinc coated Articles.
IS:3070-1993 (Part – 3)	Specification for surge arrestor for alternating current systems. Metal-Oxide lightening Arrestors without gaps
IS:4759-1996	Specification for hot dip zinc coating on Structural Steel and Other allied products.
IS:5621-1980	Hollow Insulators for use in Electrical Equipment.
IS:6209-1982	Methods of Partial discharge measurement.
IS:6745	Method for determination of mass of zinc coating on zinc coated iron and steel articles
ANSI/IEEE-C.62.11	Metal oxide, Surge Arrestor for AC Power Circuits.
IEC –60099-4	Surge Arrestors

The equipment complying with any other internationally accepted standards shall also be considered if it ensures performance equivalent to or superior to the Indian Standards.

1.3. GENERAL REQUIREMENT

1.3.1. The metal oxide gap less Surge Arrestor without any series or shunt gap shall be suitable for protection of 33kV switchgear, transformers, associated equipment and 33 kV lines from voltage surges resulting from natural disturbance like lightning as well as system disturbances.

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

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

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

1.3.5. The surge arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrestor shall be connected with 25x6 mm galvanized strip, one end connected to the surge arrestor and second end to a separate ground electrode. The bidder shall also recommend the procedure which shall be followed in providing the earthing system to the Surge Arrestor.

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

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

1.3.8. Surge arrestors shall have a suitable pressure relief system to avoid damage to the porcelain/silicon polymeric housing and

providing path for flow of rated fault currents in the event of arrestor failure.

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

1.3.10. The arrestors for 33 kV system shall be suitable for mounting on transformers, Bus, Line & structure as per scheme. The supplier shall furnish the drawing indicating the dimensions, weights etc. of the surge arrestors for the design of mounting Structure.

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

1.4. ARRESTOR HOUSING

1.4.1. The arrestor housing shall be made up of porcelain/**silicon polymeric** housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform brown **(for porcelain**)/Grey **(for silicon polymeric)** colour, free from blisters, burrs and other similar defects.

Arrestors shall be complete with fasteners for stacking units together and terminal connectors.

1.4.2. The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching surge voltage up to the maximum design value for arrestor. The arrestors shall not fail due to contamination. The 33 kV arrestors housing shall be designed for pressure relief class as given in Technical Parameters of the specification.

1.4.3. Sealed housings shall exhibit no measurable leakage.

1.5. FITTINGS & ACCESSORIES

1.5.1. The surge arrestor shall be complete with fasteners for stacking units together and terminal connectors.

1.5.2. The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of surge arrestor shall be galvanized. The line terminal shall have a built in clamping device which can be adjusted for both horizontal and vertical take off.

1.6. TESTS

1.6.1. Test on Surge Arrestors

The Surge Arrestors offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS : 3070 (Part-3)/IEC-60099-4. In addition, the suitability of the surge arresters shall also be established for the followings

i) Acceptance tests

a) Measurement of power frequency reference voltage of arrester units.
b) Lightning impulse residual voltage on arrester units (IEC clause 6.3.2)
c) Internal ionization or partial discharge test

ii) Special Acceptance tests

a) Thermal stability test (IEC **99-4**clause 7.2.2)

b) Watt loss test.

iii) Routine tests

a) Measurement of reference voltage
b) Residual voltage test of arrester unit
c) Internal ionization or partial discharge test
d) Sealing test
e) Verticality check on completely assembled surge arresters as a sample test on each lot **if applicable.**

iv) Type Tests

Following shall be type test as per IS 3070 (Part 3): 1993 or its latest amendment.

1. Insulation Withstand test
   a) Lightning Impulse
   b) Power Frequency (Dry/Wet)
2. Residual Voltage Test
   a) Steep current impulse residual voltage test
   b) Lightning impulse residual voltage test
   c) Switching Impulse Residual voltage test
3. Long duration current impulse withstand test
4. Switching surge operating duty test
5. Power frequency voltage Vs. Time characteristics
6. Accelerated Ageing test
7. Pressure relief test
   a) High Current
   b) Low Current
8. Artificial pollution test (for porcelain housing)
9. Seismic Test
10. Partial Discharge test
11. Bending test
12. a) Temperature cycle test (for porcelain housing)
13. Galvanising test on metal parts
14. Seal Leakage test (for porcelain housing)
15. Seal leak test and operation tests (for surge monitor)
16. Weather ageing test (for polymer housing)

1.6.2. The maximum residual voltages corresponding to nominal discharge current of 10 kA for steep current, impulse residual

voltage test, lightning impulse protection level and switching impulse level shall generally conform to **Annex-K of IEC-99-4.**

1.6.3. The contractor shall furnish the copies of the type tests and the characteristics curves between the residual voltage and nominal discharge current of the offered surge arrestor and power frequency voltage v/s time characteristic of the surge arrestor subsequent to impulse energy consumption as per clause 6.6.**7** of IS:3070 (Part-3) offered along with the GTP/Drawing.

1.6.4. The surge arrestor housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 5621.

1.6.5. Galvanization Test

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS:2633 & IS 6745.

1.7. NAME PLATE

1.7.1. The name plate attached to the arrestor shall carry the following information:

- Rated Voltage
- Continuous Operation Voltage
- Normal discharge current
- Pressure relief rated current
- Manufacturers Trade Mark
- Name of Sub-station
- Year of Manufacturer
- Name of the manufacture
- Name of Client-“ “

- Purchase Order Number along with date

1.8. DRAWINGS AND INSTRUCTION MANUALS

Within 15 days of receipt of the order, the successful tenderer shall furnish to the purchaser the following drawings and literature for approval:

(i) Outline dimensional drawings of Surge Arrestor and all accessories.

(ii) Assembly drawings and weights of main component parts.

(iii) Drawings of terminal clamps.

(iv) Arrangement of earthing lead.

(v) Minimum air clearance to be maintained of line components to ground.

(vi) Name plate

(vii) Instructions manual

(viii) Drawing showing details of pressure relief valve

(ix) Volt-time characteristics of surge arrestors

(x) Detailed dimensional drawing of porcelain housing/Silicon polymeric i.e. internal diameter, external diameter, thickness, height, profile, creepage distance, dry arcing distance etc.

1.9. TECHNICAL PARTICULARS

1.9.1. The surge arrestors shall conform to the following standard technical requirements. The Insulation values shall be enhanced considering the altitude of operation & other atmospheric conditions.

System Parameters:

Nominal system voltage	:	33 kV
Highest system voltage	:	36 kV
System earthing	:	Solidly earthed system
Frequency (Hz)	:	50
Lightning Impulse withstand Voltage (kVP)	:	170
Power frequency withstand Voltage (kV rms)	:	70
Connection to system	:	Phase to earth

1.9.2. Surge Arrestors

Type of Surge Arrestor	:	Gapless Metal oxide outdoor
Arrestor rating (kV rms)	:	30
Continuous Operating voltage (kV rms)	:	25
Standard Nominal Discharge Current Rating (kA) (8x20 micro impulse shape)	:	10
Line discharge class	:	2
Degree of protection	:	IP-**67**
Lightning Impulse at 10 kA	:	85
Partial discharge at 1.05 COV not greater than	:	50 (PC)
Energy capability corresponding to		
a) Arrestor rating (kj/kV)	:	4.5
b) COV (kJ/kV)	:	4.9
Peak current for high current impulse operating duty of arrestor classification 10 kA	:	100

1.9.3. Insulator Housing

Power frequency withstand test voltage (wet) (kV rms)	:	70
Lightning impulse withstand/tests voltage (kVP)	:	170
Pressure Relief Class	:	40
Creepage distance not less than	:	900 mm

1.9.4. Galvanisation

Fabricated Steel Aticles		
-- 5 mm thick cover	:	610 g/m^2
-- Under 5 mm but not less than 2 mm thickness	:	460 g/m^2
-- Under 2 mm but not less than 1.2 mm thickness	:	340 g/m^2
Castings		
-- Grey Iron, malleable iron	:	610 g/m^2
Threaded works other than tubes & tube fittings		
-- Under 10 mm dia		270 g/m^2
-- 10 mm dia & above		300 g/m^2

2. 11kV VOLTAGE CLASS SURGE ARRESTORS

2.1. INTRODUCTION

This section covers the specification of 11kV voltage station Surge Arrestors for installation on outdoor type 11kV switchgear, transmission lines, transformers etc. 11kV side of which is not enclosed in a cable box. Station class surge arrestors shall be complete with fasteners for stacking units.

2.2. STANDARDS

The design, manufacture and performance of Surge Arrestors shall comply with IS: 3070 Part-3 and other specific requirements stipulated in the specification. Unless otherwise specified, the equipment, material & processes shall conform to the latest amendments of the following:

IS:2071-1993 (Part-1)	Methods of High Voltage Testing General Definitions & Test Requirements.
IS:2071-1974 (Part-2)	Test Procedures.
IS: 2629-1985	Recommended Practice for hot dip galvanizing on Iron & Steel.
IS: 2633-1986	Method for Testing uniformity of coating of zinc coated Articles.
IS:3070-1993 (Part	Specification for surge arrestor for

– 3)	alternating current systems. Metal-Oxide lightening Arrestors without gaps.
IS: 4759-1996	Specification for hot dip zinc coating on structural steel and other allied products.
IS: 5621-1980	Hollow Insulators for use in Electrical Equipment.
IS: 6209-1982	Methods of Partial discharge measurement.
IS: 6745	Method for determination of mass of zinc coating on zinc coated iron and steel articles.
ANSI/IEEE-C.62.11	Metal oxide, Surge Arrestor for AC Power Circuits.
IEC –60099-4	Surge Arrestors.

The equipment complying with any other internationally accepted standards shall also be considered if it ensures performance equivalent to or superior to the Indian Standards.

2.3. GENERAL REQUIREMENT

2.3.1. The metal oxide gap less Surge Arrestor without any series or shunt gap shall be suitable for protection of 11 kV side of power transformers, associated equipment and 11kV lines from voltage surges resulting from natural disturbance like lightning as well as system disturbances.

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

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

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

2.3.5. The surge arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrestor shall be connected with 25x6 mm galvanized strip, one end connected

to the surge arrestor and second end to a separate ground electrode. The bidder shall also recommend the procedure which shall be followed in providing the earthing system to the Surge Arrestor.

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

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

2.3.8. Surge arrestors shall have a suitable pressure relief system to avoid damage to the porcelain/ silicon polymeric housing and providing path for flow of rated fault currents in the event of arrestor failure.

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

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

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

2.3.12. The surge arrestor shall be provided with line and earth terminals of suitable size.

2.4. ARRESTOR HOUSING

2.4.1. The arrestor housing shall be made up of porcelain/**silicon polymeric** housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform **brown** (**for porcelain**)/**Grey** (**for silicon polymeric**) colour, free from blisters, burrs and other similar defects.

Arrestors shall be complete with fasteners for stacking units together and terminal connectors.

2.4.2. The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching surge voltage upto the maximum design value for arrestor. The arrestors shall not fail due to contamination. The 11kV arrestors housing shall be designed for pressure relief class as given in Technical Parameters of the specification.

2.4.3. Sealed housings shall exhibit no measurable leakage.

2.5. ARRESTOR MOUNTING

The arrestors shall be suitable for mounting on 4 pole/2 pole structure used for pole/plinth mounted transformer and for incoming and outgoing lines. Arrestor may also be required to be mounted on a bracket provided in the Transformers.

2.6. FITTINGS & ACCESSORIES

2.6.1. The surge arrestor shall be complete with fasteners and terminal connectors.

2.6.2. The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of surge arrestor shall be galvanized. The line terminal shall have a built in clamping device which can be adjusted for both horizontal and vertical take off.

2.7. TESTS

2.7.1. Test on Surge Arrestors

The Surge Arrestors offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS : 3070 (Part-3)-/IEC:600994. In addition, the suitability of the surge arresters shall also be established for the followings.

i) Acceptance tests

a) Measurement of power frequency reference voltage of arrester units.

b) Lightning impulse residual voltage on arrester units (IEC clause 6.3.2)
c) Internal ionization or partial discharge test

ii) **Special Acceptance tests:**

a) Thermal stability test (IEC clause 7.2.2)
b) Watt loss test.

iii) **Routine tests**

a) Measurement of reference voltage
b) Residual voltage test of arrester unit
c) Internal ionization or partial discharge test
d) Sealing test
e) Verticality check on completely assembled surge arresters as a sample test on each lot **if applicable.**

iv) **Type Tests**

Following shall be type test as per IS 3070 (Part 3): 1993 or its latest amendment

1. Insulation Withstand test
   a) Lightning Impulse
   b) Power Frequency (Dry/Wet)
2. Residual Voltage Test
   a) Steep current impulse residual voltage test
   b) Lightning impulse residual voltage test
   c) Switching Impulse Residual voltage test
3. Long duration current impulse withstand test
4. Switching surge operating duty test
5. Power frequency voltage Vs. Time characteristics
6. Accelerated Ageing test

7. Pressure relief test
   c) High Current
   d) Low Current
8. Artificial pollution test (for porcelain housing)
9. Seismic Test
10. Partial Discharge test
11. Bending test
12. a) Temperature cycle test (for porcelain housing)
13. Galvanising test on metal parts
14. Seal Leakage test (for porcelain housing)
15. Seal leak test and operation tests (for surge monitor)
16. Weather ageing test (for polymer housing)

2.7.2. The maximum residual voltages corresponding to nominal discharge current of 10 kA for steep current, impulse residual voltage test, lightning impulse protection level and switching impulse level shall generally conform to Annex-K of IEC-99-4.

2.7.3. The contractor shall furnish the copies of the type tests and the characteristics curves between the residual voltage and nominal discharge current of the offered surge arrestor and power frequency voltage v/s time characteristic of the surge arrestor subsequent to impulse energy consumption as per clause 6.6 of IS:3070 (Part-3) offered alongwith the bid.

2.7.4. The surge arrestor housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS :5621.

2.7.5. **Galvanization Test**

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS:2633 & IS 6745.

2.8. NAME PLATE

2.8.1. The name plate attached to the arrestor shall carry the following information:

- Rated Voltage
- Continuous Operation Voltage
- Normal discharge current
- Pressure relief rated current
- Manufacturers Trade Mark
- Name of Sub-station
- Year of Manufacturer
- Name of the manufacture
- Name of Client-
- Purchase Order Number along with date

2.9. DRAWINGS AND INSTRUCTION MANUALS

Within 15 days of receipt of the order, the successful tenderer shall furnish to the purchaser, the following drawings and literature for approval:

(i) Outline dimensional drawings of Surge Arrestor and all accessories.
(ii) Assembly drawings and weights of main component parts.
(iii) Drawings of terminal clamps.
(iv) Arrangement of earthing lead.
(v) Minimum air clearance to be maintained of line components to ground.

(vi) Name plate
(vii) Surge monitor, if applicable.
(viii) Instructions manual
(ix) Drawing showing details of pressure relief valve
(x) Volt-time characteristics of surge arrestors
(xi) Detailed dimensional drawing of porcelain housing/Silicon polymeric i.e. internal diameter, external diameter, thickness, height, profile, creepage distance, dry arcing distance etc.

2.10. TECHNICAL PARTICULARS

2.10.1. The surge arrestors shall conform to the following standard technical requirements. The Insulation values shall be enhanced considering the altitude of operation & other atmospheric conditions.

System Parameters

i)	Nominal system voltage	11kV
ii)	Highest system voltage	12 kV
iii)	System earthing	Effectively earthed system
iv)	Frequency (Hz)	50
v)	Lightning Impulse withstand Voltage (kVP)	75
vi)	Power frequency withstand Voltage (kV rms)	28
vii)	Arrestor duty	
--	Connection to system	Phase to earth
--	Type of equipment to be protected	transformers & switchgear

2.10.2. **Surge Arrestors**

i)	Type	Gapless Metal oxide outdoor

ii)	Arrestor rating (kV rms)	9
iii)	Continuous Operating voltage (kV rms)	7.65
iv)	Standard Nominal Discharge Current Rating (kA) (8x20 micro impulse shape)	10
v)	Degree of protection	NA
vi)	Line discharge Class	2
vii)	Steep current at 10 kA	45
viii)	Lightning Impulse at 10 kA	40
ix)	Energy capability corresponding to	
	a) Arrestor rating (kj/kV)	4.5
	b) COV (kj/kV)	4.9
x)	Peak current for high current impulse operating duty of Standard TS fo arrestor classification10 kA	100

2.10.3. Insulator Housing

i)	Power frequency withstand test voltage (Wet) (kV rms)	28
ii)	Lightning impulse withstand/tests voltage (kVP)	75

2.10.4. Galvanisation

i)	Fabricated Steel Aticles	
	a) 5 mm thick cover	610 g/m^2
	b) Under 5 mm but not less than 2 mm thickness	460 g/m^2
	c) Under 2 mm but not less than 1.2 mm thickness	340 g/m^2
ii)	Castings	
	Grey Iron, malleable iron	610 g/m^2
iii)	Threaded works other than tubes & tube fittings	

a) Under 10 mm dia	270 g/m^2
b) 10 mm dia & above	300 g/m^2

NOTE- Surge Monitor shall have to be provided if coverded in BPS.

3. DISTRIBUTION CLASS SURGE ARRESTORS

3.1. INTRODUCTION

This section covers the specification of Distribution class Surge Arrestor for 11kV transmission lines, transformers etc.

3.2. STANDARDS

The design, manufacture and performance of Surge Arrestors shall comply with IS: 3070 Part-3 and other specific requirements stipulated in the specification. Unless otherwise specified, the equipment, material and processes shall conform to the latest applicable Indian/International Standards as listed hereunder:

IS:2071-1993 (Part-1)	:	Methods of High Voltage Testing General Definitions & Test
IS:2071-1974 (part-2)	:	Test Procedures
IS:2629-1985	:	Recommended Practice for hot dip galvanizing on Iron & Steel
IS:2633-1986	:	Method for Testing uniformity of coating of zinc coated Articles.
IS3070-1993 (Part–3)	:	Specification for surge arrestor for alternating current systems. Metal-Oxide lightening Arrestors without gaps
IS:4759-1996	:	Specification for hot dip zinc coating on Structural Steel and Other allied products.
IS:5621-1980		Hollow Insulators for use in Electrical Equipment.
IS:6209-1982		Methods of Partial discharge measurement.
IS:6745		Method for determination of mass of zinc coating on zinc coated iron and steel articles
ANSI/IEEE-C.62.11 : (1982)		Metal oxide, Surge Arrestor for AC Power Circuits.
IEC –60099-4		Surge Arrestors

3.2.1. The equipment complying with any other internationally accepted standards shall also be considered if it ensures performance equivalent to or superior to the Indian Standards.

3.3. GENERAL REQUIREMENT

3.3.1. The metal oxide gap less Surge Arrestor without any series or shunt gap shall be suitable for protection of 11 kV side of Distribution Transformers, associated equipment and 11 kV lines from voltage surges resulting from natural disturbance like lightning as well as system disturbances.

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

3.3.3. The surge arrestor shall consist of non-linear metal oxide resistor elements placed in series and housed in electrical grade porcelain housing / silicon polymeric of specified Creepage distance.

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

3.3.5. The surge arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrestor shall be connected with 25x6 mm galvanized strip, one end connected to the surge arrestor and second end to a separate ground electrode. The contractor shall also recommend the procedure which shall be followed in providing the earthing/system to the Surge Arrestor.

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

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

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

3.3.9. The Surge Arrestor shall be thermally stable and the contractor shall furnish a copy of thermal stability test with the bid.

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

3.4. ARRESTOR HOUSING

3.4.1. The arrestor housing shall be made up of porcelain/***silicon polymeric*** housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform **brown (for porcelain)/ Grey (for silicon polymeric)** colour, free from blisters, burrs and other similar defects.

3.4.2. The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching surge voltage upto the maximum design value for arrestor. The arrestors shall not fail due to contamination.

3.4.3. Sealed housings shall exhibit no measurable leakage.

3.5. ARRESTOR MOUNTING

The arrestors shall be suitable for mounting on 4 pole/2 pole structure used for pole mounted transformer and for incoming and outgoing lines.

3.6. FITTINGS & ACCESSORIES

3.6.1. The surge arrestor shall be complete with disconnector and terminal connectors and all other accessories.

3.6.2. The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of surge arrestor shall be galvanized. The line terminal shall have a built in clamping device which can be adjusted for both horizontal and vertical take off.

3.7. TESTS

3.7.1. Test on Surge Arrestors

The Surge Arrestors offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS : 3070

(Part-3)-1993. In addition, the suitability of the surge arresters shall also be established for the followings

a) **Acceptance tests:**
   i) Measurement of power frequency reference voltage of arrester units.
   ii) Lightning impulse residual voltage on arrester units (IEC clause 6.3.2)
   iii) Internal ionization or partial discharge test

b) **Special Acceptance tests:**
   i) Thermal stability test (IEC clause 7.2.2)

c) **Routine tests:**
   Measurement of reference voltage
   i) Residual voltage test of arrester unit
   ii) Internal ionization or partial discharge test
   iii) Sealing test
   iv) Verticality check on completely assembled surge arresters as a sample test on each lot if applicable.

d) **Type tests:** Following shall be type test As per IS 3070 (Part 3)-/IEC;60094 or its latest amendment

1.	Insulation Withstand test a) Lightning Impulse voltage test b) Power Frequency (Dry & Wet)
2.	Residual Voltage Test a) Steep current impulse residual voltage test b) Lightning Impulse Residual Voltage Test
3.	Long duration current impulse withstand test
4.	High current impulse operating duty test
5.	Power frequency voltage Vs. Time characteristics
6.	Accelerated Ageing test
7.	Artificial pollution test (for porcelain housing)
8.	Partial discharge test

9.	Visual Examination (for porcelain housing)
10.	a) Temperature cycle test (for porcelain housing)
11.	Mechanical Failing Load test (Bending Strength test)
12.	Uniformity of Zinc coating, Mass of zinc coating
13.	Time versus current curve (for disconnector)
14.	Weather ageing test (for polymer housing)

3.7.2. The maximum residual voltages corresponding to nominal discharge current of 5 kA for steep current, impulse residual voltage test, lightning impulse protection level and switching impulse level shall generally conform to Annex-K of IEC-99-4.

3.7.3. The contractor shall furnish the copies of the type tests and the characteristics curves between the residual voltage and nominal discharge current of the offered surge arrestor and power frequency voltage v/s time characteristic of the surge arrestor subsequent to impulse energy consumption as per clause 6.6.7 of IS:3070 (Part-3) offered alongwith the GTP.

3.7.4. The surge arrestor housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 5621

3.7.5. GALVANIZATION TEST

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS:2633 & IS 6745.

3.7.6. TEST ON SURGE ARRESTOR DISCONNECTORS

The test shall be performed on surge arrestors which are fitted with arrestor disconnector or on the disconnector assembly alone if its design is such as to be un-affected by the heating of adjacent parts of the arrestor in its normally installed portion in accordance with IS:3070 (Part-3).

3.8. NAME PLATE

3.8.1. The name plate attached to the arrestor shall carry the following information:

- Rated Voltage
- Continuous Operation Voltage
- Normal discharge current
- Manufacturers Trade Mark
- Year of Manufacturer
- Name of the manufacture
- Name of Client-
- Purchase Order Number along with date

3.9. DRAWINGS AND INSTRUCTION MANUALS

The successful bidder shall furnish to the purchaser the following drawings and literature for approval:

(i) Outline dimensional drawings of Surge Arrestor and all accessories.

(ii) Assembly drawings and weights of main component parts.

(iii) Drawings of terminal clamps.

(iv) Arrangement of earthing lead.

(v) Minimum air clearance to be maintained of line components to ground.

(vi) Name plate

(vii) Instructions manual

(viii) Drawing showing details of pressure relief valve

(ix) Volt-time characteristics of surge arrestors

(x) Detailed dimensional drawing of porcelain housing/Silicon polymeric i.e. internal diameter, external diameter, thickness, height, profile, creepage distance, dry arcing distance etc.

3.10. TECHNICAL PARTICULARS

3.10.1. The surge arrestors shall conform to the following standard technical requirements. The Insulation values shall be enhanced considering the altitude of operation & other atmospheric conditions.

System Parameters

i)	Nominal system voltage	11kV
ii)	Highest system voltage	12 kV
iii)	System earthing	Solidly earthed system
iv)	Frequency (Hz)	50
vii)	Lightning Impulse withstand Voltage (kVP)	75
viii)	Power frequency withstand Voltage (kV rms)	28
vii)	Arrestor duty	
--	Connection to system	Phase to earth
--	Type of equipment to be protected	11 kV transformers & switchgear

3.10.2. **Surge Arrestors**

i)	Type	Gapless Metal oxide outdoor
ii)	Arrestor rating (kV rms)	9

iii)	Continuous Operating voltage (kV rms)	7.65
v)	Nominal Discharge Current Rating (kA) (8x20 micro impulse shape)	5
v)	Long Duration discharge class	Distribution class
vi)	Maximum residual voltage (kV peak)	
	a) at 5 kA	27
vii)	Partial discharge at 1.05 COV not greater than	50 (PC)
viii)	High current impulse withstand voltage at 5 kA (kVp)	65

3.11. INSULATOR HOUSING

i)	Power frequency withstand test voltage (Wet) (kV rms)	28
ii)	Lightning impulse withstand/tests voltage (kVP)	75
iii)	Creepage distance not less than (mm)	300

3.12. GALVANISATION

i)	Fabricated Steel Articles	
	a) 5 mm thick cover	610 g/m^2
	b) Under 5 mm but not less than 2 mm thickness	460 g/m^2
	c) Under 2 mm but not less than 1.2 mm thickness	340 g/m^2
ii)	Castings	
	Grey Iron, malleable iron	610 g/m^2
iii)	Threaded works other than tubes & tube fittings	
	a) Under 10 mm dia	270 g/m^2
	b) 10 mm dia & above	300 g/m^2