**Annexure-A**

TECHNICAL SPECIFICATION FOR 30 kV 10 KA Station type lightening arrestor & 9 KV, 10 KA Station type lightening arrestor

1. SCOPE: This specification covers Design, Manufacture, and testing at manufacturer’s works, supply and delivery of 30KV 10 KA Station type Lightening Arrestor.

**Technical Specification of 30kv 10ka Station Type Lightening Arrestor –**

* 1. STANDARDS The design, manufacture and performance of Lightening 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- | Methods of High Voltage Testing General Definitions |
| 1)IS:2071 -1974(Part- | & Test Requirements. Test Procedures |
| 2)IS:2629 -1985 | Recommended Practice for hot dip galvanizing on |
| IS:2633-1986 | Iron & Steel Method for Testing uniformity of coating of  zinc |
| IS:3070-1993 (Part – 3) | coated Articles. Specification for Lightening arrestor for  alternating current  systems. Metal-Oxide lightening Arrestors |
| IS:4759-1996 | Specification for hot dip zinc coating on Structural |
| IS:5621-1980 | Steel and Other allied products.Hollow Insulators for use in Electrical |
| IS:6209-1982 | Methods of Partial discharge measurement. |
| IS:674 5 | Method for determination of mass of zinc coating on |
| ANSI/IEEE-C.62.11 | zinc coated iron and steel articlesMetal oxide, Lightening Arrestor for AC Power |
| IEC –60099-4 | Circuits.Lightening 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. GENERAL REQUIREMENT
     1. The metal oxide gap less Lightening Arrestor without any series or shunt gap shall be suitable for protection of 33kV switchgear, transformers, associated equipment and 33 kV lines from voltage Lightenings resulting from natural disturbance like lightning as well as system disturbances.

* + 1. The lightening arrestor shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of Lightening current.

* + 1. The arrestor shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing of specified creepage distance.

* + 1. The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.
    2. The Lightening arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of Lightening arrestor shall be connected with 25x6 mm galvanized strip, one end connected to the Lightening 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 Lightening Arrestor.

* + 1. The Lightening arrestor shall not operate under power frequency and temporary over voltage conditions but under Lightening conditions, the Lightening arrestor shall change over to the conducting mode.

* + 1. The Lightening arrestor shall be suitable for circuit breaker performing 0-0.3sec.-CO-3 min CO- duty in the system.

* + 1. Lightening arrestors shall have a suitable pressure relief system to avoid damage to the porcelain/silicon porcelain housing and providing path for flow of rated fault currents in the event of arrestor failure.

* + 1. 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. 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 Lightening arrestors for the design of mounting Structure.

* + 1. The arrestor shall be capable of handling terminal energy for high Lightenings, external pollution and transient over voltage and have low losses at operating voltages.

* 1. ARRESTOR HOUSING

* + 1. The arrestor housing shall be made up of porcelain/silicon porcelain 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 (forporcelain housing ) colour, free from blisters, burrs and other similar defects.

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

* + 1. The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching Lightening 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. Sealed housing s shall exhibit no measurable leakage.

* 1. TECHNICAL PARTICULARS For 30 kV, 10 kA

* + 1. The Lightening 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. Lightening Arrestors duty of arrestor classification 10 kA

|  |  |  |
| --- | --- | --- |
| Type of Lightening 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 | : | 100 |

* + 1. 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. Galvanisation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Fabricated Steel Aticles |  |  |  |  |
| -- 5 mm thick cover | : | 610 g/m2 |  |  |
| -- Under 5 mm but not less than 2 | : | 460 g/m2 |  |  |
| -- Under 2 mm but not less than 1.2 mm mm thickness | : | 340 g/m2 |  |  |
| Castings |  |  |  |  |
| -- Grey Iron, malleable iron | : | 610 g/m2 |  |  |
| Threaded works other than tubes & tube fittings |  |  |  |  |
| -- Under 10 mm dia |  | 270 g/m2 |  |  |
| -- 10 mm dia & above |  | 300 |  |  |

3.4.3. Sealed housing s shall exhibit no measurable leakage.

* 1. 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.

* 1. FITTINGS & ACCESSORIES

* + 1. The Lightening arrestor shall be complete with disconnector and terminal connectors and all other accessories.

* + 1. 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 Lightening 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. TYPE TESTS

3.7.1. Test on Lightening Arrestors 30 kV 10 KA Station type lightening arrestor & 9 KV, 10 KA

Type tests: Following shall be type tested as per IS 3070 (Part 3)-/IEC;60094 or its latest amendment ( From NABL LAB)

|  |  |
| --- | --- |
| 1. | Insulation Withstand test    a) Lightning Impulse voltage test  b) Power Frequency (Dry |
| 2. | & Wet)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) |

3.7.2. 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.

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 Lightening arrestor and power frequency voltage v/s time characteristic of the Lightening 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 Lightening 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 LIGHTENING ARRESTOR DISCONNECTORS

The test shall be performed on Lightening 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 Manufacturer

* 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:

1. Outline dimensional drawings of Lightening Arrestor and all accessories.
2. Assembly drawings and weights of main component parts.
3. Drawings of terminal clamps.
4. Arrangement of earthing lead.
5. Minimum air clearance to be maintained of line components to ground.
6. Name plate
7. Instructions manual

1. Drawing showing details of pressure relief valve

1. Volt-time characteristics of Lightening arrestors

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

3.10. TECHNICAL PARTICULARS For 09 kV, 10 KA LA

3.10.1. The Lightening 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

1. Nominal system voltage 11kV

1. Highest system voltage 12 kV

1. System earthing Solidly earthed system

1. Frequency (Hz) 50

1. Lightning Impulse withstand 75 Voltage (kVP)

1. Power frequency withstand 28 Voltage (kV rms)

vii) Arrestor duty

-- Connection to system Phase to earth

-- Type of equipment to be protected 11 kV transformers & switchgear

3.10.2. Lightening Arrestors

i) Type Gapless Metal oxide outdoor

ii) Arrestor rating (kV rms)

iii) Continuous Operating voltage (kV rms)

iv) Nominal Discharge Current10 Rating (kA) (8x20 micro impulse shape)

v) Long Duration discharge class Distribution class

vi) Maximum residual voltage (kV peak)

a) at 10 kA 27

vii) Partial discharge at 1.05 COV not greater than 50 (PC)

viii) High current impulse withstand voltage at 10 kA 65 (kVP)

3.11. INSULATOR HOUSING

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

|  |
| --- |
| iii) Creepage distance not less than (mm) |

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**3.12.** **GALVANISATION**

i) Fabricated Steel Articles

1. 5 mm thick cover 610 g/m2
2. Under 5 mm but not less than 2 mm thickness 460 g/m2
3. Under 2 mm but not less than 1.2 mm thickness 340 g/m2

|  |  |  |  |
| --- | --- | --- | --- |
|  | ii) Castings  Grey Iron, malleable iron - 610 g/m2    ii) Threaded works other than tubes & tube fittings   1. Under 10 mm dia - 270 g/m2 2. 10 mm dia & above - 300 g/m2 |  |  |

TECHNICAL SPECIFICATION FOR **9KV Lightening arrestor 5 KA Line type (for Distribution Line & DT**

* + - 1. SCOPE: This specification covers Design, Manufacture, and testing at manufacturer’s works, supply and delivery of 9KV 5KA Line type Lightening Arrestor.
      2. TECHNICAL SPECIFICATION OF 9KV Lightening arrestor 5 KA Line type (for Distribution Line & DT
  1. INTRODUCTION

This section covers the specification of Distribution class Lightening Arrestor for 9kV transmission lines, transformers etc.

* 1. STANDARDS

The design, manufacture and performance of Lightening 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 (Part1) | : | 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 & |
| IS:2633-1986 | : | Method for Testing uniformity of Steel coating of zinc coated |
| IS3070-1993 (Part–3) | : | Specification Articles.for Lightening arrestor for alternating  current systems. Metal-Oxide lightening  Arrestors without gaps |
| IS:4759-1996 | : | Specification for hot dip zinc coating on Structural Steel and |
| IS:5621-1980 |  | Hollow Insulators for use in Electrical Equipment.Other allied products. |
| IS:6209-1982 |  | Methods of Partial discharge measurement. |
| IS:6745 |  | Method for determination of mass of zinc coating on zinc |
| ANSI/IEEE-C.62.11 : |  | Metal oxide, coated iron and steel articlesLightening Arrestor for AC Power  (1982) Circuits. |
| IEC –60099-4 |  | Lightening 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 Lightening Arrestor without any series or shunt gap shall be suitable for protection of 9 kV side of Distribution Transformers, associated equipment and 9 kV lines from voltage Lightening resulting from natural disturbance like lightning as well as system disturbances.

* + 1. The Lightening arrestor shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of Lightening current.

* + 1. The Lightening arrestor shall consist of non-linear metal oxide resistor elements placed in series and housed in electrical grade porcelain housing of specified Creepage distance.

* + 1. The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.

* + 1. The Lightening arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of Lightening arrestor shall be connected with 25x6 mm galvanized strip, one end connected to the Lightening 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 Lightening Arrestor.

* + 1. The Lightening arrestor shall not operate under power frequency and temporary over voltage conditions but under Lightening conditions, the Lightening arrestor shall change over to the conducting mode.
    2. The Lightening arrestor shall be suitable for circuit breaker performing 0-0.3 min-CO-3 minCO- duty in the system.

* + 1. 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. The Lightening Arrestor shall be thermally stable and the contractor shall furnish a copy of thermal stability test with the bid.

* + 1. The arrestor shall be capable of handling terminal energy for high Lightenings, external pollution and transient over voltage and have low losses at operating voltages.

3.4. ARRESTOR HOUSING

* + 1. The arrestor housing shall be made up of porcelain/silicon porcelain 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 porcelain housing ) colour, free from blisters, burrs and other similar defects.

* + 1. The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching Lightening voltage upto the maximum design value for arrestor. The arrestors shall not fail due to contamination.

* + 1. Sealed housing s shall exhibit no measurable leakage.

* 1. 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.

* 1. FITTINGS & ACCESSORIES

* + 1. The Lightening arrestor shall be complete with disconnector and terminal connectors and all other accessories.

* + 1. 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 Lightening 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 Lightening Arrestors

The Lightening 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 Lightening 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

1. Verticality check on completely assembled Lightening 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 |
| 2. | & Wet)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 ) |

* + 1. 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.

* + 1. 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 Lightening arrestor and power frequency voltage v/s time characteristic of the Lightening arrestor subsequent to impulse energy consumption as per clause 6.6.7 of IS:3070 (Part-3) offered alongwith the GTP.

* + 1. The Lightening arrestor housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 5621

* + 1. 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. TEST ON LIGHTENING ARRESTOR DISCONNECTORS

The test shall be performed on Lightening 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 Manufacturer

- 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:

Outline dimensional drawings of Lightening Arrestor and all accessories.

Assembly drawings and weights of main component parts.

Drawings of terminal clamps.

Arrangement of earthing lead.

Minimum air clearance to be maintained of line components to ground.

Name plate

(vii) Instructions manual

(viii) Drawing showing details of pressure relief valve

1. Volt-time characteristics of Lightening arrestors

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

3.10. TECHNICAL PARTICULARS

3.10.1. The Lightening 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 11kV

Highest system voltage 12 kV

System earthing Solidly earthed system

Frequency (Hz) 50

Lightning Impulse withstand 75 Voltage (kVP)

Power frequency withstand 28 Voltage (kV rms)

vii) Arrestor duty

-- Connection to system Phase to earth

-- Type of equipment to be protected 11 kV transformers & switchgear

3.10.2. Lightening 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 5 Rating (kA) (8x20 micro impulse shape)

Long Duration discharge class Distribution class

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

Power frequency withstand test voltma ge (Wet) (kV r s) 28

Creepage distance not less than 300 mm

Lightning impulse

withstand/tests voltage (kVP) 75

3.12 **GALVANISATION**

i) Fabricated Steel Aticles

a) 5 mm thick cover

Under 5 mm but not less than 2 mm thickness 460 g/m2

Under 2 mm but not less th an 1.2 mm thickness 340 g/m2

|  |  |  |  |
| --- | --- | --- | --- |
| ii) | Castings  Grey Iron, malleable iron    Threaded works other than t ubes & tube fittings   1. Under 10 mm dia 2. 10 mm dia & above |  | 610 g/m2 |
| iii) | 270 g/m2 |
| 300 g/m |