# SUPPLY CHAIN MANAGEMENT

## THIRUVANANTHAPURAM

## SPECIFICATION

**220kV,110kV & 66kV LIGHTNING ARRESTER**

| | | |
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| **APPLICABLE TO KSEBL** | **Rev#0** | DOC. NO.: **SCM-SPEC/XT/ LIGHTNING ARRESTER** |
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**Technical Specification and Evaluation Committee for Transmission Material**

**(i) Document Approval & Control Status**

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**(ii) Amendments and History**

| *Sec. #* | *Rev. #* | *Date* | *History of Change* |
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**1. PURPOSE:**

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **220kV,110kV & 66kV Lightning Arrester** in a professional manner

**2. SCOPE:**

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL. Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **220kV,110kV & 66kV Lightning Arrester** used in field by KSEBL

**3. RESPONSIBILITY :**

**The Executive Engineer (T), Office of Chief Engineer, Supply Chain Management** shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

**4. PROCEDURE FOR REVISION:**

Modifications if any, in the technical specification will be incorporated as **Revisions.** Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev. No.0.1, 0.2 etc.**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev. No.1.0, 2.0 etc.**

All the details of regarding the revisions (both minor and major) will be incorporated in **"(ii)-Amendments and history"** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer (SCM).** Those who notice any discrepancy or have any suggestion regarding revision, may bring the matter to the attention of Chief Engineer (SCM) in writing or through e-mail id:**cescm@kseb.in**

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## TECHNICAL SPECIFICATION FOR 220kV, 110kV & 66kV LIGHTNING ARRESTER

1) **Scope:-**

**1.1)** This specification covers the designing manufacture, assembly and testing at Manufacturer's works and delivery of Metal Oxide (gap less), 220 kV, 110kV & 66kV, 10 kA **Station Medium** - polymer housed Surge Arrestors complete with discharge counter, insulating base and other accessories for all rating Lightning Arresters of various ratings complete in all respects conforming to modern design and practice for protection of sub Station equipments (3 phase 50 cycles solidly earthed neutral A.C systems).

1) 220kV Metal oxide gap less heavy duty polymer housed Surge Arrestors (Discharge class- Station Medium)

2) 110kV Metal oxide gap less heavy duty polymer housed Surge Arrestors (Discharge class- Station Medium)

3) Supporting structure for 110kV Metal oxide gap-less heavy duty polymer housed Surge Arrestors.

4) 66kV Metal oxide gap less heavy duty polymer housed Surge Arrestors (Discharge class- Station Medium)

5) Supporting structure for 66kV Metal oxide gap less heavy duty polymer housed Surge Arrestors

1.2) It is not the intent to specify completely herein all the details of design and construction of Surge Arrestors. However, Surge Arrestors shall conform in all respects to the high Standard of design and workmanship and be capable of performing in continuous commercial operation up to Bidder's guarantee in a manner acceptable to Purchaser. The Arrestors offered shall be complete with all parts, necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of supply, irrespective of whether they are specifically brought out in the commercial order or not.

2) **Standards: -**

2.1. The Surge Arrestors shall conform to the latest editions and amendments available at the time of supply, of the standards listed hereunder.

| Sl.No. | Standard Ref. No.(with latest amendments) | Title |
|---|---|---|
| 1. | IEC:60099-4 **edn 3** | Specification Part-4 for Surge Arrestors without gap for AC system |

| | | |
|---|---|---|
| 2. | IS 15086-PART 4 | Specification for Lightning Arrestors for alternating current system. |
| 3. | IS: 2629 | Recommended practice hot dip galvanizing of iron and steel |
| 4. | IS: 2633 | Method for testing uniformity of Coating on zinc coated articles |
| 5. | IS: 2147 | Degree of protection provided by enclosures for low voltage Switchgear and control |
| 6. | Safety | Indian Electricity Rules, 1956 |
| 7. | IEC 61462 | Composite hollow insulators - Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V - Definitions, test methods, acceptance criteria and design recommendations |
| 8. | IEC-60815 | Selection and dimensioning of high-voltage insulators intended for use in polluted conditions. The rain sheds / petticoats shall be of ***polymeric material and shall confirm to IEC 60815*** |
| 9. | IEC-60270 | Partial discharge measurement |
| 10. | IEC-60-1 | High voltage test techniques |
| 11. | IEC-270-2 | Insulation coordination |

**Note:**

i) For the purpose of this specification all technical terms used hereinafter shall have the meaning as per IEC/ISS specification

ii) For the parameters of the Arrestor which are not specified in IEC specification for Surge Arrestors, the provisions of IS:15086-Part-4 shall be applicable.

2.2. Surge Arrestors meeting with the requirements 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 Bidder conforms to other standards, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the

offer. Four (4) copies of the reference standards in English language shall be furnished along with the offer.

3) **Rated Arrestors voltage:-**

| Rated Arrester Voltage | Normal System Voltage | Maximum System Voltage |
|---|---|---|
| 198kV | 220kV | 245kV |
| 96kV | 110kV | 123kV |
| 60kV | 66kV | 72.5kV |

4) **Nominal discharge current:-** The arrestors shall have a nominal discharge current of 10kA.

5) **System Neutral Connection:-** The system is an effectively earthed neutral system.

6) **Outdoor installation:**-All the lightning arrestors are to be suitable for outdoor installation in E.H.T. Sub stations of the Kerala Power Grid.

7) **CLIMATIC CONDITIONS:-** The equipment is required to operate satisfactorily under the following site condition:

| | | |
|---|---|---|
| i) | Temperature<br>a) Maximum in air under hot sun<br>b) Minimum | <br>50°C<br>-2.5°C |
| ii) | Relative Humidity<br>a) Maximum<br>b) Minimum | <br>100%<br>26% |
| iii) | Isocerounic level | 45 |
| iv) | Approx. no. of rainy days/year | 180 days nearly |
| v) | Average rain fall/year | 3000 mm |
| vi) | Altitude above mean sea level | Below 1000 meters |
| vii) | Max. wind pressure | 130 Kg./m2 |
| viii) | Average number of dust storm days per annum | 50 |
| ix) | Seismic level- Horizontal acceleration | 0.5g |

**The reference ambient temperature may be taken as $50^0$ C.**

8) **Special conditions:** -The arrestors shall be of modern design of Polymer housing type without spark gaps designed to limit voltage surges on a.c. power circuits. The units shall be hermetically sealed and the resisters shall be vertically stacked. The arrestors shall be designed to have

adequate thermal discharge capacity for severe switching surges, long duration surges and multiple strokes.

The atmosphere at place is laden with mild acid and dust in suspension during the dry months and subject to fog in cold months. The temperature variation between the daily minimum and maximum is very large. The area is also subject to heavy monsoon rains and heavy lightning.

9) **Maximum Residual Voltage:-** For lightning arrestors (at nominal discharge current of 10KA) Maximum residual voltage and minimum power frequency withstand voltage and maximum continuous operating voltage (MCOV) shall be as per IS 15086-PART 4 (with latest amendments).

10) **Partial discharges: -**The partial discharges in the arrestors energized at 1.05 times. Its continuous operating voltage shall not exceed 50 PC.

11) **Type:-** The metal oxide type lightning arrestors shall be designed to provide maximum possible protection against lightning and switching surges. Supporting insulators, terminal connectors and other components as specified hereafter, shall be provided with arrestors. The metal oxide type lightning arrestors shall be of class 'A' pressure relief device and long duration Class-II

12) **GENERAL TECHNICAL REQUIREMENTS:**

12.1) **Design & Construction:-** The Surge Arrestors shall conform to the technical requirements and GTP.

1) The energy handling capability of each rating of Arrestor offered, supported by calculations, shall be furnished in the offer.

2) The grading ring on each complete Arrestor for proper stress distribution shall be provided if required for attaining all the relevant technical parameters.

13) **PROTECTIVE LEVELS:-** The basic insulation levels and switching impulse withstand levels of the lines and equipment to be protected, have been specified in clause-26, "Principal Parameters". The protective characteristics of the Arrestors offered shall be clearly specified in the schedule of guaranteed technical particulars.

14) **GENERAL REQUIREMENTS:-**

1) The materials and components not specifically stated in this specification but which are necessary for satisfactory operation of the equipment are deemed to be included in the scope of supply unless specifically excluded.

2) Unless otherwise brought out separately by the Bidder in the schedule of deviations the Surge Arrestors offered shall conform to the specification scrupulously. All deviations from the specification shall be brought out in the schedule of deviations. The discrepancies between the specification and the catalogs or literature submitted as part

of the offer shall not be considered as valid deviations unless specifically brought out in the schedule of deviations.

3) Any deviation which has not been specifically brought out in the schedule of deviations of the Bid Proposal Sheets, shall not be given effect to. The deviations brought out in the schedule shall be supported by authentic documents, standards and other references.

4) The Surge Arrestors shall be suitable for hot line washing.

15) **DUTY REQUIREMENTS:-** The surge arresters shall be capable of discharging over voltages occurring due to switching on unloaded transformer, reactors and long lines. The arrester should have Repetitive Charge transfer withstand (1.1*Qrs) of 2.4 Coulombs and thermal energy rating (With) 7.8 kJ / kV.

16) **CONSTRUCTION:-**

1) All the units of Arrestors of same rating shall be inter-changeable without adversely affecting the performance.

2) The Surge Arrestors shall be suitable for pedestal type mounting.

3) All the necessary flanges, bolts, nuts, clamps etc., required for assembly of complete Arrestor with accessories and mounting on support structure , shall be included in Bidder's scope of supply.

4) The drilling details for mounting the Arrestor on KSEBL's support shall be supplied by the Supplier.

5) The minimum permissible separation between the Surge Arrestor and any earthed object shall be indicated by the Bidder in his offer.

6) Fittings and accessories:- Surge arresters should be supplied with suitable mounting bracket made of SMC. Surge arrester should be provided with terminal connector suitable for through connection / vertical / horizontal take-off.

7) All the necessary flanges, bolts, nuts, clamps etc., required for assembly of complete Arrestor with accessories including line terminals connection (galvanized) and mounting on support structure to be supplied by the Purchaser, shall be included in Bidder's scope of supply. The lightning arrestor shall be suitable for pedestal mounting/mounting with suitable insulating bracket on steel structures. Supporting structure shall be suitable to ensure the minimum working clearance as per IS. The minimum height shall not be less than ……../……/……mm from ground and steel structure should meet the required ASTM standard. (Refer standard tender drawing for structure). The drilling details for mounting the Arrestor on Purchaser's support shall be supplied by the Supplier.

8) The end fittings shall be non-magnetic and of corrosion proof material. The end fittings used in polymer arrester shall be made from aluminum through machining process/ pressure die-casting process. Sand casted and gravity casted end fittings are not acceptable due to poor micro structure and porosity issues.

9) MOV blocks shall have full metalization to have full face contact and to reduce contact resistance between adjacent discs.

17) **Polymer Housing:-**

1) Polymer housing material shall be silicon rubber. Polymer Rubber housing shall be free from lamination cavities 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/ GOI/State Government laboratory/CPRI/ERDA shall be submitted for approval of the purchaser. The polymer material used for arrester housing must have resistant to tracking & erosion, and stabilized against UV radiation.

2) The surge arrester shall not fail due to housing contamination. TERT (Tracking & Erosion resistance test) Test shall be carried out on the material used for housing as per ASTM D 2303 and test report shall be submitted.

3) Polymeric housing shall be made of Silicone:- The rain sheds / petticoats shall be of polymeric material and shall confirm to IEC 60815.

4) The rain sheds / petticoats shall be of polymeric material and shall confirm to the properties and type test reports shall be submitted and shall not be pre- moulded push on type or slip on type. The adhesion between the polymeric housing and the metal oxide resistors or any other metallic or non-metallic parts cycles and environmental stresses.

5) Polymer bounding to the core shall be effectively maintained even when surge arrestor discharges rated surge current.

6) 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 in his offer in the form, during detailed drawing.

18) **GALVANISATION, NICKEL PLATING ETC.:-**

1) All ferrous parts exposed to atmosphere shall be hot dip galvanised 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 nickel plated.

2) Ground terminal pads and name plate brackets shall be hot dip galvanized.

3) The material shall be galvanized only after completing all shop operations.

19) **ACCESSORIES AND FITTINGS:-**

1) Discharge counters shall be provided for the Arrestors except for all the arrestors. The discharge counter shall be provided with milli-ammeter (0-5mA) for measuring the leakage current and shall not require any DC or AC Aux. Supply. It shall be suitable for outdoor use. The installation of discharge counter shall not adversely affect the Arrestor performance.

2) The discharge counter shall register operation whenever lightning or any other type of surge strikes the Surge Arrestor.

3) All necessary accessories and earthing connection leads between the bottom of the Arrestor and the discharge counter shall be in the Bidder's scope of supply. The connecting lead between discharge counter and Surge Arrestor shall be of copper flexible cable of size 50sq.mm and minimum of 1.5 meter length. The discharge counter shall be so designed that the readings of discharges recorded by the counter and the readings of mille-ammeter shall be clearly visible through an inspection window to a person standing on ground. The minimum height of support structure shall be 2.5M. Terminal connector conforming to IS: 5561 for shall be supplied along with the arrestor.

4) Each Surge Counter shall have terminals of robust construction for connection to Earthing lead and these shall be suitably arranged so as to enable the incoming and outgoing connections to be made with minimum bends. Suitable grounding terminal shall be provided for earthing of surge arrestors up to water level. Proper functioning of the Surge counter with Surge Arrestor shall be ensured by the Supplier.

20) **Terminal Connectors:-** Each lightning arrestor shall be supplied with compression type terminal connector suitable for ACSR Double Kundah for 110kV & 66kVLA, ACSR Double Moose with 250 mm spacing for 220kV LA. The bolt and nuts shall be of suitable size & of stainless steel with washer and nuts (including lock nut) for each bolt shall be supplied. Each terminal connector shall be suitable for through connection/ vertical/ horizontal take-off. Conductor size will be given during detailed engineering.

21) **Galvanizing:-** All metal parts exposed to weather and likely to be subjected to corrosion, shall be hot dip galvanized as per IS: 2629 (latest edition). Bolts, Nuts and Washers shall be electro zinc plated. The conducting parts shall have suitable current density to have satisfactory performance during service life.

22) **Name Plate:-** Each arrestor shall have non-corrosive nameplate, legibly and indelibly marked and securely fixed to it. They shall be provided with the information as required by relevant standard. The words 'KSEBL' shall, also, be punched on it after inspection of lightning arrestor is over.

Manufacturer's name or trade mark and identification no. of the Arrestor being supplied.

1) Rated voltage.
2) Purchase Order Number & date.
3) Maximum continuous operating voltage.
4) Type.
5) Rated Frequency.
6) Nominal discharge current.
7) Long duration discharge class.
8) Year of manufacture.

23) **Mounting:-** The lightning arrestors shall be suitable for pedestal mounting on steel structures. The necessary flanges, clamps, nuts etc for the base of the Lightning Arrestors and line terminals connection shall be supplied and these shall be galvanized.

24) **Supporting Structure:-** Supply of galvanized steel supporting structure are also included in the scope of supply 220 kV and 110 kV LAs. The height of the structure shall be suitable to ensure the minimum working clearance prescribed as per CEA (Measures) relating to safety & Electric supply – Regulation 2010. The minimum height including structure shall be 5500mm for 220kV & 4600mm for 110kV LAs. Structures to be manufactured by ensuring the stability of the system and complying ASTM Standard.

25) **AUXILIARY POWER SUPPLY:-** The equipment offered under this specification shall be suitable for the following auxiliary power supplies.

| | | |
|---|---|---|
| a) | Power Devices (like drive motors) | 415V, 3 Phase, 4 wire 50 Hz, neutral grounded AC supply |
| b) | AC Control and protective devices, lighting fixtures, space heaters | 240V, single phase, 2 wire 50 Hz, neutral grounded AC supply |
| c) | DC alarm, control and protective devices | 110V, DC 2-Wire |

Each of the foregoing supplies shall be made available by the Purchaser at the terminal point for each equipment for operation of accessories and auxiliary equipment. Bidder's scope

shall include supply of interconnecting cables, terminal boxes, etc., The above supply voltages may vary as below and all devices shall be suitable for continuous operation over entire range of voltages.

| | | |
|---|---|---|
| i) | AC Supply- | voltage+10%&-15% frequency ± 5% |
| ii) | DC Supply- | 15% to +10% |

26) **SYSTEM PARAMETERS:-** The Surge Arrestors offered under this specification shall conform to the parameters given below:

| SL. No. | Particulars | System Voltage ( kV (rms) | | |
|---|---|---|---|---|
| 1 | Nominal system voltage | 220 | 110 | 66 |
| 2 | Highest system voltage | 245 | 123 | 72.5 |
| 3 | 1.2/50 microsecond impulse voltage withstand level<br>Transformer & reactors (kVp)<br>Other equipment's and Lines (kVp) | <br>900<br>1050 | <br>550<br>650 | <br>325<br>325 |
| 4 | Minimum prospective symmetrical fault current for 1 second at Arrestor location (kA rms) | 40 | 31.5 | 31.5 |
| 5 | Anticipated levels of Temporary over voltage and its duration<br>a) Voltage (p.u.)<br>b) Duration (Seconds) | <br>1.5/1.2<br>1/10 | <br>1.5/1.2<br>1/10 | <br>1.5/1.2<br>1/10 |
| 6 | System frequency(Hz) | 50 ± 2.5 C/S | 50 ± 2.5 C/S | 50 ± 2.5 C/S |
| 7 | Neutral Grounding | Effectively earthed | Effectively earthed | Effectively earthed |
| 8 | No. Phases | 3 | 3 | 3 |

27) **TESTS:-**

27.1) **Type Test:-** All the Lightning Arrester offered shall be fully type tested as per IEC: 60099-4 Edition 2.2 2009-05 at the Government approved / NABL laboratory of the eligible county or independent internationally recognized testing laboratory. The Bidder shall furnish one set of the type test reports for the Lighting Arrester of the type and Design offered by him along with the offer. The Type Test report shall not be older than 10(Ten) years and shall be valid up to the expiry of validity of offer, otherwise the offer will not be considered.

**The following type test reports shall be submitted with the technical bid.**

| Sl.No. | List of Type test reports |
|---|---|
| **I)** | **Tests on metal oxide blocks** |
| i) | Steep Current Impulse Residual Voltage test |
| ii) | Lightning impulse Residual voltage test |
| iii) | Switching impulse Residual voltage test |
| iv) | Long duration current impulse withstand test |
| v) | Operating duty test |
| a) | - High Current Impulse operating duty test |
| b) | - Switching Surge Operating Duty test |
| c) | - Accelerated ageing test |
| d) | P. F. voltage v/s time characteristic |
| **II)** | **Tests on Arrester with Housing** |
| i) | Lightning Impulse voltage withstand test on insulator (cl. No. 8.2.6) |
| ii) | P.F. (Wet) voltage withstand test on insulator (cl. 8.2.8) |
| iii) | Banding test (cl. No. 10.8.9) |
| iv) | All applicable test on silicon rubber as per standard IEC-61462 and TERT (Tracking & Erosion resistance test) as per ASTM D2303 |
| **III)** | **Tests on complete Arrester** |
| i) | Weather aging test (5000 h) (cl. 10.8.14) |
| ii) | Seismic forces withstand test |
| iii) | High current short circuit test |
| iv) | Low current short circuit test |
| v) | Water immersion test (cl.10.8.9.3.2) |
| vi) | leakage check test (cl. 9.1(d ) |
| **IV)** | **General** |
| i) | STC on Terminal connector (31.5 kA for 1 sec) |
| ii) | Degree of Protection test on counter/surge monitor (IP-67) |

| | |
|---|---|
| iii) | Uniformity of Zinc coating for metal parts |
| iv) | Special Thermal stability test as per cl.9.2.2 of IEC 60099-1-2009 |

27.2) **ACCEPTANCE AND ROUTINE TESTS:-** All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in presence of Purchaser's representative.

**The following acceptance tests shall be carried out in presence of KSEBL's representative:-**

**List of Acceptance test reports:**

1) Power frequency voltage withstand test
2) Lightning Impulse residual voltage test on complete arrester / unit of arrester
3) Reference voltage test
4) Leakage check test
5) Partial discharge test
6) Visual / Dimensional check
7) Special Thermal stability test as per cl.9.2.2 of IEC 60099-4-2009
8) Galvanization test on metal parts
9) Functional (operational) tests on surge monitor/counter at nominal is charge currents
   i) 100 Amps with 8/20 microsecond wave shape.
   ii) 10/20 KA with 8/20 microsecond wave shape.
10) Water immersion test for a duration of 24 hrs, to check the water penetration, on any one randomly selected sample from every 50 (Fifty) or below nos. of LA offered for inspection, shall be carried out and report shall be submitted.

27.3) Acceptance tests, whenever possible shall be conducted on the complete arrester unit. The number of samples to be subjected to acceptance tests shall be decided by the purchaser at the time of actual testing

**The following routine test reports shall be submitted.**

**List of Routine test reports:-**

1) Measurement of reference voltage
2) Lightning Impulse Residual voltage test
3) Partial discharge test
4) Tests on discharge counter
5) Visual / Dimensional check

6) Leakage check rate test for a duration of 24 hrs to check the water penetration, on any one randomly selected sample from every 50 (Fifty) or below nos. of LA offered for inspection, shall be carried out and report shall be submitted.

28) **SURGE MONITOR:-**

The following routine test shall be performed in the presence of KSEBL's representative:

1) Tests for satisfactory operation of surge counter while discharging surges.
2) Test for correctness of leakage current meter before and after the passage of surges.
3) Visual examination tests.

29) **INSPECTION:-**

1) The inspection may be carried out by the KSEBL at any stage of manufacture. The successful Bidder shall grant free access to the KSEBL's representative at all times to the works and all other places of manufacture, where equipment are being manufactured and the Contractor shall provide all facilities without extra charges, for unrestricted inspection of the Contractor's works, raw materials, manufacture of the equipment., all the accessories and for conducting necessary test as detailed herein.
2) The Contractor shall keep the KSEBL informed in advance, about the manufacturing program so that arrangement can be made for inspection.
3) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.
4) The KSEBL reserves the right to insist for witnessing the acceptance/routine testing of the bought out items.
5) The Contractor shall submit their internal inspection report containing manufacturer's test certificates before offering the material for inspection.
6) The acceptance of any quantity of equipment shall in no way relieve the Contractor 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.

30) **DOCUMENTATION:-** The successful bidder shall submit four sets of following drawings for approval.

**List of drawings:-**

**1)** General outline drawings of the complete Arrestors with technical parameters.
2) Drawing showing clearance from grounded and other live objects and between adjacent poles of Surge Arrestors, required at various heights of Surge Arrestors.

3) Drawings showing details of pressure relief devices.

4) Detailed drawing of discharge counters along with the wiring and schematic drawing of discharge counter and meter.

5) Outline drawing of insulating base.

6) Details of grading rings, if used.

7) Mounting details of Surge Arrestors.

8) Details of line terminal and ground terminals.

9) Volt-time characteristics of Surge Arrestors.

10) Details of galvanising being provided on different ferrous parts.

11) The detailed dimensional drawing of polymer housing such as ID, OD, thickness and insulator details such height, profile of petticoats, angle of inclination and gap between successive petticoats, total Creepage distance etc.,

Adequate copies of acceptance and routine test certificates, duly approved by the purchaser, shall accompany the despatch consignment.

The manufacturing of the equipments shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the supplier's risk.

Copies of nicely printed and bound volumes of operation, maintenance and erection manuals in English language, for each type and rating of equipment supplied shall be submitted by the supplier for distribution, prior to the despatch of the equipment. The manual shall contain all the drawings and information required for erection, operation and maintenance of the surge Arrester. The manual shall also contain a set of all the approved drawings, type test reports etc.

Complete technical and guaranteed particulars are required in the appendix and as per the ISS/IEC shall be furnished with the bid. Drawing showing dimension, mounting arrangement and clearance required etc. should also be furnished with the bid. Copies of type test certificates shall also be forwarded along with the bids. Complete technical data and drawings of the arresters offered shall be furnished.

31) **Marking:-** Each unit shall legibly and indelibly be marked to show the following:

a) Name or Trade Mark of the manufacture.

b) Month and year of manufacture.

c) Country of manufacture.

d) Marking on the porcelain shall be printed and shall be applied before firing.

32) **Packing And Forwarding:-**The material shall be packed in crates suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the material 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 for lifting, such as lifting hooks etc. shall be provided. Any material found short inside he packing cases shall be supplied by supplier without any extra cost.

Each consignment shall be accompanied by a detailed packing list containing the following information: -

a) Name of the consignee.

b) Details of the 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 material indicating contents of each package

33) **Safety Device:-** Arrester shall be provided with safety device with properly designed blow off hollow device to disconnect arrester from off time in case of spark over resulting in failure of lightning arrester. No nuisance operation should occur in event of lighting arrester effectively discharging HV to earth and returning to normal system level.

All necessary accessories and earthing connection leads between the bottom of the Arrester and the discharge counter shall be in the supplier's scope. The discharge counter shall be so designed that the readings of discharges recorded by the counter and the readings of milliamp meter shall be clearly visible through an inspection window to a person standing on ground. The minimum height of support structure shall be such that the live part to plinth level clearance shall be maintained as per relevant specification. All the Mounting bolt, Nut, washers etc shall be supplied with each LA.

34) **Name plate details:**-Name plate details with warranty period is to be marked with each LA as per approved drawing.

Sd/-
**Chief Engineer (SCM)**

## ANNEXURE - I(b)

## TECHNICAL REQUIREMENTS FOR METAL OXIDE (GAPLESS) SURGE ARRESTORS

| SL.No | Particulars | Required parameters (System of Voltages) | | |
|---|---|---|---|---|
| | | **220kV** | **110kV** | **66kV** |
| 1 | Rated Arrestor Voltage (kV) | 198 | 96 KV | 60 |
| 2 | M.C.O.V. (kV) | 168 kV | 81 kV | 53 kV |
| 3 | Installation | outdoor | Outdoor | Outdoor |
| 4 | Class | Station Medium | Station Medium | Station Medium |
| 5 | Type of construction for 10 kA rated Arrestor. | Single column, Single phase | Single column, Single phase | Single column, Single phase |
| 6 | Nominal discharge current corresponding to 8/20 micro sec wave shape (kA rms) | 10kA | 10kA | 10kA |
| 7 | Minimum discharge capacity (Corresponding to discharge characteristics) | 7.8KJ/kV | 7.8KJ/kV | 7.8KJ/kV |
| 8 | Type of mounting | Pedestal mounting and Suitable insulating bracket | Pedestal mounting and Suitable insulating bracket | Pedestal mounting and Suitable insulating bracket |
| 9 | Connection (Between phase to earth P/E) (Between phase to phase P/P) | P/E | P/E | P/E |
| 10 | Long duration discharge class | 3 | 3 | 3 |
| 11 | Max. Switching Surge kV(P)<br>Protective level voltage at 1.<br>1.500A<br>2.1000 Amp | 460 kV peak as per IEC 99-4 | 230Kv as per IEC- 99-4 | 140kV as per IEC-99-4 |

| | | | | |
|---|---|---|---|---|
| 12 | Max. residual voltage kV(P) for nominal discharge current 10 KA with 8/20 micro second wave<br>1. at >5kA<br>2. at >10kA<br>3. at >20 kA | As per IEC- 99-4<br>576<br>As per IEC-99-4 | As per IEC<br>288<br>as per IEC 99-4 | As per IEC<br>173 kV<br>as per IEC 99-4 |
| 13 | Max. Residual voltage kV (P) steep fronted current impulse of 10 KA. | 600 | 372 | 186 |
| 14 | Minimum pros symmetrical fault current for pressure relief test (kA rms) | 40 | 31.5 | 31.5 |
| 15 | a) Terminal connector suitable for ACSR Conductor size | ACSR Double Moose | ACSR Double Kundah | ACSR Double Kundah |
| | b) Take off | Vertical | Vertical | Vertical |
| 17 | Voltage (KV rms) -corona | 198 | 120 | 60 |
| 18 | Maximum radio interference voltage (Micro volt) when energised at MCOV | 500 | 500 | 500 |
| 19 | Whether insulating base and discharge counter with milli - ammeter are required. | Yes | Yes | Yes |
| 20 | Minimum Creepage distance of Arrestor housing (mm) | 25mm/kV | 25mm/kV | 25mm/kV |

Sd/-

**Chief Engineer (SCM)**

**ANNEXURE II**

**SCHEDULE OF GUARANTEED AND TECHNICAL PARTICULARS OF 220 KV & SUPPORTING STRUCTURE FOR 220KV LIGHTNING ARRESTERS**

| Sl. No. | Description | KSEBLs Requirement | 220kV LA & SS |
|---|---|---|---|
| 1) | Name of Manufacturer | | |
| 2) | (a) Type and designation number | Station Class Metal Oxide Gapless Lightning Arresters | |
| | (b) Whether heavy duty or not | Heavy Duty | |
| 3) | Model | | |
| 4) | Applicable IS/ IEC Reference | IEC:60099-4 edn 3 and IS:15086 PART 4 | |

| | | | |
|---|---|---|---|
| 5) | No. of units per Arrester | 3 | |
| 6) | Rated voltage (kV) | 198 kV | |
| 7) | Continuous operating voltage (kV) | 168 kV | |
| 8) | Installation | Outdoor | |
| 9) | Arrestor construction | Polymeric with FRP rod crimped at end fittings | |
| 10) | Nominal discharge current 8/20 micro second wave)KA | 10kA | |
| 11) | Repetitive Charge transfer | | |
| a) | Charge transfer capability(Qrs) | 2.4C | |

| | | | |
|---|---|---|---|
| b) | Thermal energy (Qth) | 7.8 kJ/kV | |
| 12) | Reference current(mAp) | 5 mAp. | |
| 13) | Reference voltage (min kV rms) | Greater than rated voltage | |
| 14) | Rated frequency(Hz) | 50 | |
| 15) | Maximum residual voltage at (8/20µs impulse wave) | | |
| a) | 5 KAp (kVp) | 520 kVp | |
| b) | 10KAp (kVp) | 550 kVp | |
| c) | 20KAp (kVp) | 610 kVp | |

| | | | |
|---|---|---|---|
| 16) | Maximum steep current impulse residual at 10kAp(kVp) | 600 kVp | |
| 17) | Maximum switching current impulse residual at 500A(kVp) | 455 kVp | |
| 18) | Temporary overvoltage withstand capability(with prior energy) for | | |
| a) | 1 sec (kVrms) | 336 kVrms | |
| b) | 10 sec (kVrms) | 322 kVrms | |
| c) | 100 sec (kVrms) | 308 kV rms | |
| 19) | Lightning impulse voltage withstand capability (Dry) (kVp) | 1050 kVp | |
| 20) | Power frequency voltage withstand capability (Wet) (kVrms) | 460 kVp | |

| | | | |
|---|---|---|---|
| 21) | Maximum partial discharge (pC) | < 10 | |
| 22) | High current impulse withstand capability (4/10µs impulse wave) (kAp) | 100 kAp | |
| 23) | Total creepage distance of polymer housing (mm) | 25 mm /kV | |
| 24) | Cantilever strength | 1000 Nm | |
| 25) | Total weight of complete Arrester Unit | | |
| 26) | Height of complete unit from base to line side | | |
| 27) | Minimum clearance | | |
| | 1) Between arresters centre to centre | | |

| | | | |
|---|---|---|---|
| | 2) Arrester and adjoining earthed objects (mm) | | |
| 28) | Maximum resistive component of current at Maximum continuous operating voltage Micro amps | <1 milli Amps | |
| 29) | Maximum capacitive component of current at MCOV- (Milli amps) | 1.2 | |
| 30) | Mounting flange dimensional detail | 3 holes 12.5mm ϕ 120° apart at 274 mm PCD. | |
| 31) | Earthing arrangement provided for earthing side of arresters | To be Provided. | |
| 32) | Number of sections in complete unit | 3 | |
| 33) | Maximum permissible length of rod between | 1.5 mtr long 50sq.mm CU insulated cable | |

| | | | |
|---|---|---|---|
| | i) Arrester and surge counter | As short as possible | |
| | ii)Surge counter and earth | | |
| 34) | Technical particulars of | | |
| a) | Surge counter | Electromagnet type 6 digit Counter | |
| b) | Surge monitor | | |
| 35) | Particulars of terminal connection | ACSR Double Moose | |
| 36) | Weight of supporting structure | | |
| 37) | Weight of structure before galvanizing | | |

| | | | |
|---|---|---|---|
| 38) | Weight of structure after galvanizing | | |
| 39) | Galvanizing thickness | >87 microns confirming to IS | |

**Name,address,mobile No.& email-id of the Bidder**

**SCHEDULE OF GUARANTEED AND TECHNICAL PARTICULARS OF 110 KV & SUPPORTING STRUCTURE FOR 110KV LIGHTNING ARRESTERS**

| Sl. No. | Description | KSEBLs Requirement | 110kV LA & SS |
|---|---|---|---|
| 1) | Name of Manufacturer | | |
| 2) | (a) Type and designation number | Station Class Metal Oxide Gapless Lightning Arresters | |
| | (b) Whether heavy duty or not | Heavy Duty | |
| 3) | Model | | |
| 4) | Applicable IS/ IEC Reference | IEC:60099-4 edn 3 and IS:15086 PART 4 | |
| 5) | No. of units per Arrester | 2 | |

| | | | |
|---|---|---|---|
| 6) | Rated voltage (kV) | 110 | |
| 7) | Continuous operating voltage (kV) | 81 | |
| 8) | Installation | Outdoor | |
| 9) | Arrestor construction | Polymeric with FRP rod crimped at end fittings | |
| 10) | Nominal discharge current 8/20 micro second wave)KA | 10kA | |
| 11) | Repetitive Charge transfer | | |
| a) | Charge transfer capability(Qrs) | 2.4C | |
| b) | Thermal energy (Qth) | 7.8 kJ/kV | |

| | | | |
|---|---|---|---|
| 12) | Reference current(mAp) | 5 | |
| 13) | Reference voltage (min kV rms) | Greater than rated voltage | |
| 14) | Rated frequency(Hz) | 50 | |
| 15) | Maximum residual voltage at (8/2µs impulse wave) | | |
| a) | 5 KAp (kVp) | | |
| b) | 10KAp (kVp) | 372 | |
| c) | 20KAp (kVp) | | |
| 16) | Maximum steep current impulse residual at 10kAp(kVp) | 372 kVp | |

| | | | |
|---|---|---|---|
| 17) | Maximum switching current impulse residual at 1000A(kVp) | 280 kVp | |
| 18) | Temporary overvoltage withstand capability(with prior energy) for | | |
| a) | 1 sec (kVrms) | 170 kms | |
| b) | 10 sec (kVrms) | 162kV rms | |
| c) | 100 sec (kVrms) | 158 kv rms | |
| 19) | Lightning impulse voltage withstand capability (Dry) (kVp) | 550 kVp | |
| 20) | Power frequency voltage withstand capability (Wet) (kVrms) | 230 kV rms | |
| 21) | Maximum partial discharge (pC) | < 10 | |

| | | | |
|---|---|---|---|
| 22) | High current impulse withstand capability (4/10µs impulse wave) (kAp) | 100 | |
| 23) | Total creepage distance of polymer housing (mm) | 25 mm / kV | |
| 24) | Cantilever strength | 1000 Nm | |
| 25) | Total weight of complete Arrester Unit | | |
| 26) | Height of complete unit from base to line side | | |
| 27) | Minimum clearance | | |
| | 1) Between arresters centre to centre | | |
| | 2) Arrester and adjoining earthed objects (mm) | | |

| | | | |
|---|---|---|---|
| 28) | Maximum resistive component of current at Maximum continuous operating voltage Micro amps | <1 milli Amp | |
| 29) | Maximum capacitive component of current at MCOV- (Milli amps) | 1.2 | |
| 30) | Mounting flange dimensional details | 3 holes 12.5mm ϕ 120° apart at 274 mm PCD. | |
| 31) | Earthing arrangement provided for earthing side of arresters | To be Provided. | |
| 32) | Number of sections in complete unit | 2 | |
| 33) | Maximum permissible length of rod between | 1.5 mtr long 50sq.mm Cu insulated cable | |
| | i) Arrester and surge counter | As short as possible | |

| | | | |
|---|---|---|---|
| | ii)Surge counter and earth | | |
| 34) | Technical particulars of | | |
| a) | Surge counter | Electromagnet type 6 digit Counter | |
| b) | Surge monitor | | |
| 35) | Particulars of terminal connection | ACSR Double Kundah | |
| 36) | Weight of supporting structure | | |
| 37) | Weight of structure before galvanizing | | |
| 38) | Weight of structure after galvanizing | | |

| | | | |
|---|---|---|---|
| 39) | Galvanizing thickness | >87 microns confirming to IS | |

**Name,address,mobile No.& email-id of the Bidder**

## SCHEDULE OF GUARANTEED AND TECHNICAL PARTICULARS OF 66 KV LIGHTNING ARRESTERS

| Sl. No. | Description | KSEBLs Requirement | 66kV LA |
|---|---|---|---|
| 1) | Name of Manufacturer | | |
| 2) | (a) Type and designation number | Station Class Metal Oxide Gapless Lightning Arresters | |
| | (b) Whether heavy duty or not | Heavy Duty | |
| 3) | Model | | |
| 4) | Applicable IS/ IEC Reference | IEC:60099-4 edn 3 and IS:15086 PART 4 | |
| 5) | No. of units per Arrester | One | |

| | | | |
|---|---|---|---|
| 6) | Rated voltage (kV) | 60 kV | |
| 7) | Continuous operating voltage (kV) | 53kV | |
| 8) | Installation | Outdoor | |
| 9) | Arrestor construction | Polymeric with FRP rod crimped at end fittings | |
| 10) | Nominal discharge current 8/20 micro second wave)KA | 10kA | |
| 11) | Repetitive Charge transfer | | |
| a) | Charge transfer capability(Qrs) | 2.4C | |
| b) | Thermal energy (Qth) | 7.8 kJ/kV | |

| | | | |
|---|---|---|---|
| 12) | Reference current(mAp) | 5 mAp | |
| 13) | Reference voltage (min kV rms) | Greater than rated voltage | |
| 14) | Rated frequency(Hz) | 50 | |
| 15) | Maximum residual voltage at (8/2µs impulse wave) | | |
| a) | 5 KAp (kVp) | 157 kVp | |
| b) | 10KAp (kVp) | 170 kVp | |
| c) | 20KAp (kVp) | 185 kVp | |
| 16) | Maximum steep current impulse residual at 10kAp(kVp) | 186 kVp | |

| | | | |
|---|---|---|---|
| 17) | Maximum switching current impulse residual at 500A(kVp) | 140 kVp | |
| 18) | Temporary over voltage withstand capability (with prior energy) for | | |
| a) | 1 sec (kVrms) | 67 kV rms | |
| b) | 10 sec (kVrms) | 62 kV rms | |
| c) | 100 sec (kVrms) | 58 kV rms | |
| 19) | Lightning impulse voltage withstand capability (Dry) (kVp) | 325 kVrms | |
| 20) | Power frequency voltage withstand capability (Wet) (kVrms) | 140 kV rms | |
| 21) | Maximum partial discharge (pC) | < 10 | |

| | | | |
|---|---|---|---|
| 22) | High current impulse withstand capability (4/10µs impulse wave) (kAp) | 100 | |
| 23) | Total creepage distance of polymer housing (mm) | 25mm/kV | |
| 24) | Cantilever strength | 1000 Nm | |
| 25) | Total weight of complete Arrester Unit | | |
| 26) | Height of complete unit from base to line side | | |
| 27) | Minimum clearance | | |
| | 1) Between arresters centre to centre | | |
| | 2) Arrester and adjoining earthed objects (mm) | | |

| | | | |
|---|---|---|---|
| 28) | Maximum resistive component of current at Maximum continuous operating voltage Micro amps | <1 milli Amp | |
| 29) | Maximum capacitive component of current at MCOV- (Milli amps) | 1.2 | |
| 30) | Mounting flange dimensional details | 3 holes 12.5mm ϕ 120° apart at 274 mm PCD. | |
| 31) | Earthing arrangement provided for earthing side of arresters | To be Provided. | |
| 32) | Number of sections in complete unit | One | |
| 33) | Maximum permissible length of rod between | 1.5 mtr long 50sq.mm CU insulated cable | |
| | i) Arrester and surge counter | As short as possible | |

| | | | |
|---|---|---|---|
| | ii)Surge counter and earth | | |
| 34) | Technical particulars of | | |
| a) | Surge counter | Electromagnet type 6 digit Counter | |
| b) | Surge monitor | | |
| 35) | Particulars of terminal connection | ACSR Double Kundah | |
| 36) | Weight of supporting structure | | |
| 37) | Weight of structure before galvanizing | | |
| 38) | Weight of structure after galvanizing | | |

| | | | |
|---|---|---|---|
| 39) | Galvanizing thickness | >87 microns confirming to IS | |

Name,address,mobile No.& email-id of the Bidder