

VOLUME – IIA

TECHNICAL SPECIFICATION

SECTION – 4(B)

CHAPTER: SURGE ARRESTORS

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Clause No.	Particulars
1.0	General
2.0	Duty requirements
3.0	Constructional features
4.0	Fittings and Accessories
5.0	Tests
6.0	Spare parts
7.0	Parameters
8.0	Testing and Commissioning

VOLUME –IIA

Section 4 (B)

CHAPTER- SURGE ARRESTERS

1.0 GENERAL

- 1.1 Qualifying Requirements please refer Bid documents.
- 1.2 The surge arresters shall conform to IEC :60099 except to the extent modified in the specification and shall also be in accordance with requirements under section 1 and 2.
- 1.3 Arresters shall be of hermetically sealed units, self-supporting construction, suitable for mounting on tubular / lattice type support structures to be supplied by the Contractor.

2.0 DUTY REQUIREMENTS:

- a. The surge arresters shall be of heavy - duty station class and gapless type (i.e., metal oxide type) without any series or shunt gaps.
- b. The surge arresters shall be capable of discharging over voltages occurring during switching of unloaded transformers and long lines.
- c. Void.
- d. 96kV, 60kV, 30kV and 9kV class arresters shall be capable of discharging energy equivalent to class 2 of IEC for 123kV, 72.5kV, 36kV and 12kV system for two successive operations.
- e. The surge arresters shall be suitable for withstanding forces as defined section - 2.
- f. The reference current of the arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- g. The surge arresters are being provided to protect the following equipment whose insulation level are indicated in the table give below:

Equipment to be protected	Lightning impulse(KVp) for 123 KV system	Lightning impulse(KVp) for 72.5 KV system	Lightning impulse(KVp) for 36 KV system
1	3	4	5
Power transformer	±550	±325	±170
Instrument Transformer	±550	±325	±170

CB/Isolator phase to ground	±550	±325	±170
Across open contacts	----	-----	----

- h. The duty cycle of CB proposed to be installed in 123KV / 72.5KV / 36KV System is 0-0.3Sec. – CO - 3Min - CO. The surge arrester shall be suitable for such circuit breaker duties in the system.

3.0 CONSTRUCTIONAL FEATURES:

The feature and constructional details of surge arresters shall be in accordance with requirement stipulated hereunder:

- a) The non - linear blocks shall be of sintered metal oxide material. These shall be provided in such a way as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.
- b) The surge arresters shall be fitted with pressure relief devices suitable for preventing shattering of arrester housing and providing path for flow of rated fault currents in the event of an arrester failure. Details shall be furnished in the bids along with quality checks.
- c) The arresters shall not fail due to arrester, porcelain contamination.
- d) Seals shall be provided in such a way that these are always effectively maintained even when discharging graded lightning current.
- e) Outer insulator shall be porcelain /Polymer conforming to requirements stipulated in Section - 2 (GTR). Terminal connectors shall conform to requirements stipulated under section - 2 (GTR).

Outer insulator housing shall be so coordinated that external flashover will not occur due to application of any impulse or switching surge voltage up to the maximum design value for arrester.
- f) The end fittings shall be made of nonmagnetic and corrosion proof material and preferably, be nonmagnetic.
- g) The nameplate shall conform to the requirements of IEC incorporating the year of manufacture.
- h) The heat treatment cycle details along with necessary, quality checks used for individual blocks along with insulation layer formed across each block are to be furnished. Metalizing coating thickness for reduced resistance between adjacent discs is to be furnished with additional information schedule of bid proposal sheets along with

procedure for checking the same. Details of thermal stability test for uniform distribution of current on individual disc is to be furnished.

- i) The manufacturer will submit data for rejection rate of ZnO blocks during manufacturing/ operation for the past three years.

Porcelain Housing:

- i. All Porcelain housing shall be free from lamination cavities or other flaws affecting the maximum level of mechanical and electrical strengths.
- ii. The Porcelain shall be well vitrified and non-porous.
- iii. The Creepage distance of the arrester housing shall be as per Technical Parameters under 6.0
- iv. The Porcelain petticoat shall be preferably of self-cleaning type (Aerofoil design). The details of the porcelain housing such as height, Angle of inclination, shape of petticoats, gap between the petticoats, diameter (ID and OD) etc., shall be indicated by the Bidder in his offer in the form, during detailed drawings.
- v. The Arrester housing shall conform to the requirements of latest IEC 60099-4 specification. Amended up to date.

Polymer Housing:

- i. 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 laboratory shall be submitted for approval of the purchaser. The polymer material which is used for arrester housing must have resistance to tracking & erection, and stabilized against UV radiation.
- ii. 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-molded 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 inside the housing must be strong enough, homogeneous, robust and resistant to thermal cycles and environmental stresses. Tests shall be carried out on each batch during manufacturing and records maintained and provided as & when required during inspection.
- iii. The Creepage distance of the arrester housing shall be as per Technical Parameters under 6.0.

- iv. The Polymer weather shed design shall be preferably of self-cleaning type (Aerofoil 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 drawings.
- v. The Arrester housing shall conform to the requirements of latest IEC 60099-4 specification. Amended up to date.

4.0 FITTINGS AND ACCESSORIES:

- a) 96 KV / 60 KV / 30 KV / 9 kV arresters shall be complete with insulating base having provision for bolting to flat surface of structure.
- b) Self contained discharge counters, suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit along with necessary connection. Suitable leakage current meters should also be supplied within the same enclosure. The reading of milli-ammeter and counters shall be visible through an inspection glass panel. The terminals shall be robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The design of the surge monitor shall be such that it is possible to tilt the surge monitor downwards by an angle of up to 45° from Horizontal plane.
- c) Surge monitor consisting of Discharge counters and milli-ammeters should be suitable to be mounted on support structure of the arrester and should be tested for IP : 55 degree of protection. The standard supporting structure for surge arrester should be provided with a standard mounting pad, for fixing the surge monitor. The surge monitor should be suitable for mounting on this standard mounting pad. Also all nuts, bolts, washers etc., required for fixing the surge monitor shall have to be supplied by the Contractor.
- d) Grading / Corona rings shall be provided on each complete an-ester unit as required. Suitable terminal connectors shall be supplied by the contractor.

5.0 TESTS:

- 5.1 **Type tests :** Type tested surge arresters shall be offered. The type test reports shall not be older than ten (10) years on the day of bid opening. The type tests are to conducted again with out any extra cost to the owner in case the type test reports are older than ten (10) years as on the last date of submission of bid. The type test charges are to be indicated in the schedule. The owner reserves right to insist for conducting all or a few type tests even though the type tests are less than

ten (10) years old as on the day, last date of submission of bid, the payment in such cases will be made as per the rates in the schedule.

a) For Surge Arrestors manufactured in India:

- i. Type tests on indigenous equipment for which an accreditation body of the country like Central Power Research Institute testing facility is available in India, should have been conducted in any independent laboratories approved by Government or accredited by National Testing Agency (NTA), Electrical Research and Development Association (ERDA), etc.
- ii. Type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- iii. The type tests conducted in-house by manufacturers shall also be acceptable where the specific test facilities are not available in independent NABL accredited laboratories provided the lab (manufacturer's) is accredited by National accreditation body of the country and the tests have been witnessed by a representative of NABL accredited Independent laboratory/Power utility.

b) For Surge Arrestors manufactured Abroad:

- i. Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of respective country.
- ii. Type tests conducted in-house by manufacturers shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests have been witnessed by a representative of accreditation body/Power utility.

In accordance with the requirements stipulated under section 1 & 2 the surge arresters shall have been type tested as per IEC / IS . They shall also be subjected to routine and acceptance tests in accordance with IEC document. In the switching surge operating duty test, the samples shall be pre heated to 70° C (instead of 60° C as given in IEC) prior to application of long duration surges for contamination test procedures outlined in ANSI - 062 - 11 - 1987 may be followed until IEC brings out alternate test procedure for the same.

The contractor shall submit type test procedures along with the bid each metal oxide block of surge arresters shall be tested for the guaranteed specific energy capability- in addition to the routine acceptance test as per IEC - 60099.

NOTE:

All type tests on Polymer housing material shall be in accordance with IEC 61462, test reports for the same shall be furnished.

5.2 a) **Acceptance Tests :**

1. Measurement of power frequency reference voltage of the arrester units.
2. Lightning Impulse residual voltage on arrester units (IEC clause 6.3.2).
3. Internal Ionisation or partial Discharge test.

b) **Special Acceptance Test;**

1. Thermal stability test on three sections (IEC 7.2.2)
2. Aging & Energy capability test on blocks (Procedure to be mutually agreed)
3. Wattloss test

c) **Routine tests :**

1. Measurement of Reference voltage
2. Residual voltage test of arrester unit.
3. Internal Ionization test or partial discharge test.
4. Sealing test.
5. Verticality checks on completely assembled surge arresters as a sample test on each lot.

d) **Test on surge monitors ;**

The surge monitors shall also be connected in series with the test specimens during residual voltage and current impulse withstand tests to verify efficacy of the same. Additional routine / functional tests with one 100 A and 10 KA current impulse, (8 / 20 micro sec.) shall also be performed on the surge monitor.

e) **Test on insulators :**

All routine tests shall be conducted on the hollow column insulators as per IEC - 60233.

6.0 **SPARE PARTS:**

Bidder shall include in his proposal spare parts as mentioned in Sections - 1 & 2.

7.0 **PARAMETERS :**

A. **SURGE ARRESTER:**

- | | | | | | |
|----|---|------|------|-------|-------|
| a) | Rated arrester voltage KV | 96 | 60 | 30 | 9 |
| b) | Nominal discharge
Current of 8 / 20 micro sec wave | 10KA | 10KA | 10 KA | 10 KA |

c)	Minimum discharge capacity	5kJ / KV (referred to rated arrester Voltage corresponding to minimum Discharge Characteristics			
d)	Continuous operating voltage at 50 deg C KV	81	50	25	7.5
e)	Max. switching surge residual voltage (1 KA) kVp	272	175	85	---
f)	Max. residual voltage kVp at				
	i) 5 KA	560 kVp			
	ii) 10 KA nominal discharge current (kVp)	600	195		
g)	Max. steep current impulse residual voltage at 10 kA	650 kVp			
h)	Long duration discharge class as applicable	3/2	3/ 2	3/2	3/2
i)	High current short duration test value (4/ 10 micro second wave)	100 kAp	100 kAp	100 kAp	----- ----
j)	Current for pressure relief test KA RMS	40	40	25	-----
k)	Low current long duration test value (2000 micro sec)	----- As per IEC -----			
l)	Pressure relief class	-----A-----			
m)	Installation	Outdoor	Outdoor	Outdoor	Outdoor
n)	Class	Station	Station	Station	Station
o)	Insulation Level				
	i) Full wave impulse withstand voltage (1.2/50 micro sec.)				
	1. Arrester Housing (kV peak)	±550	±325	±170	±75
	ii) Switching impulse withstand voltage (250/2500 micro sec) dry and wet				
	1. Arrester housing (kV peak)	-----NA-----			
	iii) One minute power frequency dry withstand voltage				

1. Arrester housing (kV rms)	230	140	70	28
p) Minimum creepage distance for arrestor housing (mm)	3075	1815	900	300
q) Cantilever strength (for 1 minute withstand test) (kg)	150	150	150	150
r) Maximum deflection at above cantilever load (mm)	200	200	200	200
s) Terminal Connector Suitable for ACSR Conductor Size	Drake	Lynx/ Drake	Coyote /Rabbit	Coyote
t) Take Off	-----Vertical or Horizontal -----			
u) Connection	-----Phase to Earth-----			

Note :- In isolated OR unearthed Neutral system, the voltage rating of the S.A. should be 110% of the nominal voltage in the case of capacitor bank.

8.0 TESTING AND COMMISSIONING:

An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the Field Quality Program / Instruction of the equipment supplier or owner without any extra cost to the owner. The contractor shall arrange all instruments required for conducting these tests along, with calibration certificates and shall furnish the list of instruments to the owner for approval.

- a) Leakage current measurement
- b) Resistance of ground connection.