

METAL OXIDE SURGE ARRESTERS

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PURPOSE AND SCOPE

The National Grid (NG) Technical Specification for metal-oxide surge arresters is primarily by reference to BS EN 60099-4 and defines the required enabling parameters and additional technical requirements for surge arresters connected to and rated for use on the NG UK Electricity Transmission System 132 kV, 275 kV, 400 kV and other lower voltage systems.

This document specifies the requirements for substation surge arresters of the following type: open terminal (AIS) porcelain, polymeric, integrated polymeric housed and gas insulated (GIS) systems connected directly between phase-and-earth of the NG UK Electricity Transmission System. It supports the more general requirements defined in the companion documents TS 1, TS 2.1 and TS 2.2.

Informative: Special applications for surge arresters (series compensation, MSCDN, transmission line arresters etc) will not be covered in this specification. While the general elements of this specification maybe used, the application specification will provide the functional performance requirements.

PART 1 – PROCEDURAL

1 REQUIREMENTS

1.1 General Requirements For All Surge Arresters

- 1.1.1 All surge arresters shall comply with TS 1, TS 2.1, TS 2.2, and BS EN 60099-4.
- 1.1.2 The surge arrester shall be designed to operate under the specified short circuit conditions, without failure of the assembly, without operation of the pressure relief device, or without change (exceeding 5%) to the protective levels declared by the manufacturer (based on routine test results for the specific arrester) for the design life of the surge arrester.
- 1.1.3 Unless otherwise specified, the surge arrester shall be suitable for connection between each phase and earth. It shall be self-supporting and suitable for upright or inverted mounting.

- 1.1.4 All surge arresters with a separate housing, shall be provided with a means for pressure relief to ensure that a surge arrester failure, when the power arc is established inside the housing, cannot rupture or cause explosive shattering of the housing for all conditions within its declared rating.
- 1.1.5 All surge arresters, for use above 132 kV or which have provision for condition monitoring, shall have an insulated base.
- 1.1.6 A surge counter shall be supplied together with a permanent leakage current indicator or provision for external leakage current measurement, all of which shall be readable or accessible at the ground level with the surge arrester in service.
- 1.1.7 The surge counter shall be connected to the base of the surge arrester and the substation earthing in such a manner that the total current through the surge arrester passes through the counter. The supplier shall provide recommendations on surge counter testing and the equipment necessary to perform the duty.
- 1.1.8 The connection and associated terminal between the surge arrester and the surge counter or permanent current indicator, shall be shrouded and insulated to a lightning impulse withstand level of 15 kV peak. The connection will be exposed to high voltage during the passage of arrester conduction current and shall in addition meet the requirements in TS 2.1.
- 1.1.9 The earth connection shall remain electrically continuous after being subject to the short circuit current and duration specified in TS 1.

1.2 Additional Requirements For Air Insulated (AIS) Surge Arresters

- 1.2.1 The surge arrester shall be free standing and the performance shall be maintained with the surge arrester mounted on a structure of minimum height specified in TS 2.1, irrespective of the proximity of other apparatus, (which may or may not be at earth potential), and walls or other structures at minimum distances specified in TS 2.1.
- 1.2.2 The arrester manufacturer shall specify the high voltage connection from the busbar to the arrester. Suitable terminals and fittings as required by TS 2.1 shall be provided at the line end of the surge arrester.
- 1.2.3 The surge arrester terminals shall be designed to:
 - a) Remain intact and serviceable after being subject to the relevant short time current and duration specified in TS 1.
 - b) The radio noise emitted by all connections shall not exceed the values measured in accordance with BS EN 60437 (60099-4).
 - c) If a surge arrester is to be used with a busbar support function it shall satisfy the post insulator mechanical requirements of TS 3.2.9

1.3 Additional Requirements For Gas Insulated (GIS) Metal-Enclosed Surge Arresters

- 1.3.1 Surge arresters shall comply with the relevant elements of TS 3.2.14.
- 1.3.2 The metal-enclosure insulation structure and accessories shall comply with TS 3.2.14. The design shall enable the surge arrester to be mounted on vibration dampers, as required by the specific site location.
- 1.3.3 The supplier shall demonstrate to the satisfaction of the purchaser the reliability of the metal enclosure to prevent SF₆ gas leakage to the atmosphere over the lifetime of the unit. In most cases the unit will be located outdoors, the evidence needs to demonstrate the enclosure

and seals are robust to the weathering effects of the environment for the lifetime of the equipment.

- 1.3.4 Any adapter or fitting plate shall meet the relevant requirements of the clauses in this section.

1.4 Additional Requirements for Special Application Surge Arresters

- 1.4.1 Transformers with delta connected terminals requiring surge arresters may also require them to be installed in a phase to phase configuration in addition to an arrester connecting each corner to earth. This will be dependent on the insulation level margin of the terminal to be protected.

2 FUNCTIONAL AND PERFORMANCE REQUIREMENTS

All surge arresters and their associated equipment shall comply with the general performance requirements in BS EN 60099-4 and the following specific performance requirements.

2.1 Specific Performance Requirements for All Surge Arresters

- 2.1.1 Specific requirements for NG surge arresters used on the transmission system are given in Table 1.

- 2.1.2 Specific requirements for other NG system voltages or application involving surge arresters will be specified in the contract tender document or relevant specifications.

	Performance Characteristics						
	Nominal operational voltage	13kV	33kV	66kV	132kV	275kV	400kV
1	Minimum Surge Arrester Maximum Continuous Operating Voltage MCOV (kV _{rms})	12	24 ⁸	50 ⁹	100	200	285
2	Minimum Surge Arrester Rated Voltage Vr ¹ (kV _{rms})	15	33 ⁸	72 ⁹	132	260	360
3	Minimum Nominal Discharge Current ² (kA _{peak})	10	10	10	10	10	20
4	Minimum Line Discharge Class ²	3	3	3	3	3	4
5	Impulse Current Withstand (kA _{peak})	100	100	100	100	100	100
6	Minimum Lightning Impulse Protective Margin ³	40% @10kA _{pk}	40% @10kA _{pk}	40% @10kA _{pk}	40% @10kA _{pk}	40 % @10kA _{pk}	40 % @20kA _{pk}
7	Minimum Switching Impulse Protective Margin ⁴	n/a	n/a	n/a	n/a	25 % @1 kA _{pk}	25 % @2 kA _{pk}
8	Maximum Steep Current Impulse (20 kA _{peak}) Residual Voltage	1.15 X Max. LIRV	1.15 X Max. LIRV	1.15 X Max. LIRV	1.15 X Max. LIRV	1.15 X Max. LIRV	1.15 X Max. LIRV
9	Short Circuit Class to IEC 60099-4	50kA	31.5kA	31.5kA	40kA	40kA	63kA
10	Minimum Cantilever Strength (SLL) ^{5,7}	2kN	2kN	2kN	2kN	2kN	2kN
11	Maximum Deflection at Dynamic Load (SSL)	100mm	100mm	100mm	100mm	100mm	100mm
12	Maximum Radio Interference ⁶	N/A	N/A	N/A	2500 μV	2500 μV	2500 μV

Table 1 – Surge Arresters Performance Characteristics