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Functional Specification

220kV Surge Arresters

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1 SCOPE

This Functional Specification covers the requirement for supply of surge arresters for onshore compensation compounds for use in offshore wind transmission links delivered by the Customer as Contestable Works, after which EirGrid will own and operate such assets.

The relevant TECHNICAL SCHEDULE OTS-SSS-425 gives further requirements and should be filled for every type of surge arresters.

2 LEGISLATION AND STANDARDS

2.1 LEGISLATION

Equipment offered shall be compliant with the provisions of the latest applicable versions of all relevant Irish legislation and directives of the European Union.

These include the following or latest versions/ amendments as appropriate:

SI No. 132	Safety signs regulations 1995 (implements EEC Directive 92/58)
SI No. 291	Safety, Health and Welfare at Work (Construction) Regulations
SI No. 299	Safety, Health and Welfare at Work (General Application) Regulations 2007
SI No. 445	Safety, Health and Welfare at Work (General Application) (Amendment) Reg. 2012
Reg (EC) No 1907/2006	Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
Reg (EC) No 1272/2008	Classification, Labelling and Packaging of Substances and Mixtures (CLP)
Reg (EU) No 517/2014	Fluorinated greenhouse gases and repealing regulation (EC) No 842/2006
Reg (EU) 2015/2068	Format of labels for products and equipment containing fluorinated greenhouse gases
Reg (EU) 2015/2065	Format for notification of the training and certification programmes of the Member States
Reg EU 2015/2066	Minimum requirements and the conditions for mutual recognition for the certification of natural persons carrying out installation, servicing, maintenance, repair or decommissioning of electrical switchgear containing fluorinated greenhouse gases or recovery of fluorinated greenhouse gases from stationary electrical switchgear
Directive 2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS)
Directive 2012/19/EU	Waste electrical and electronic equipment (WEEE)
Directive 2014/30/EU	Harmonisation of the laws of the Member States relating to electromagnetic compatibility
ECE/TRANS/275	Vol. I and II ("ADR 2019") European Agreement Concerning the International Carriage of Dangerous Goods by Road

Unless the Customer can show to EirGrid's satisfaction that CE marking is not required, equipment shall carry the CE Mark in accordance with Directive 768/2008/EC and the

EU Construction Products Regulation (No. 305/2011 – CPR) and adequate documentation to demonstrate full compliance should be retained.

In order to prove compliance, the equipment shall carry the CE Mark in accordance with Direction 768/2008/EC and the EU Construction Products Regulation (No. 305/2011 – CPR) where required.

2.2 NATIONAL INTERNATIONAL AND OTHER APPLICABLE STANDARDS

Except where otherwise stated in the functional specification, materials shall be designed, manufactured, tested and installed according to relevant IEC and/or EN standards.

Where available, the Irish adaptation of European standards (IS EN version), including any national normative aspects shall be applied.

Where no IEC standard or EN standard has been issued to cover a particular subject then an international or British Standard shall be applied. The latest edition and amendments shall apply in all cases.

The equipment shall comply with the latest editions of the international standards, codes and normative references indicated below, and the latest editions of the standards that they reference.

Table 1 Standards

Standard number	Title
EN 60099-4	Metal oxide surge arresters without gaps for a.c. systems
EN 60507	Artificial Pollution Tests
IEC 62271-301	Dimensional standardisation of terminals for high-voltage switchgear and control gear.
IEC Guide 113	Materials Declaration Questionnaires
EN 60529	Degrees of Protection
EN 62271	HV AC switchgear and controlgear
EN 60815	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions
EN 60099-4	Metal-oxide surge arresters without gaps for a.c. systems

3 RATING

The guaranteed ratings and characteristics shall be as follows.

NOTE: The Customer shall verify surge arrester rating by an Insulation Coordination study.

3.1 VOLTAGE & PROTECTION LEVEL

Table 2 Voltage & Protection Level

Network Max operating Voltage kV	Connected To	Arrester Rated Voltage (Ur) kV
245	Phase	228
	Neutral	133

3.2 ENERGY CAPABILITY AND CLASS

The arresters shall have energy capability and class as follows.

Table 3 Energy Capability & Class

Arrester Rated Voltage (kV)	Protected Equipment Connected to	EN Discharge Class	Min. Energy Absorption Capability (kJ/kV)	Nominal Discharge Current (kA)
228	Lines up to 150km Cables up to 8km	2	1.5	10
228	Cables 8km to 15km	3	3	10

For cables longer than 15 km, Customer shall be guided by relevant EN, IEC standards and submit a proposal to EirGrid for review.

3.3 INSULATION LEVEL OF ARRESTER HOUSING

3.3.1 WITHSTAND VOLTAGES

The insulators used in the arrester housings shall have minimum rated withstand voltages related to the protection levels as follows.

Table 4 Phase Surge Arrestors

Phase Surge Arresters	Withstand
Lightning Impulse 1.2/50µs	750 kV peak (LIPL x 1.3 kV peak)
Switching Impulse, 250/2500 µs	610 kV peak (SIPL x 1.25 kV peak)
Neutral Surge Arrestors	
Lightning Impulse 1.2/50µs	440 kV peak (LIPL x 1.3 kV peak)
Switching withstand voltage	350 kV peak (SIPL x 1.25 kV peak)

3.3.2 CREEPAGE DISTANCE

For phase connected arresters, the creepage distance shall be as indicated for the relevant network voltage under NETWORK PARAMETERS (higher values) and for arresters connected to transformer neutrals shall be as follows.

Table 5 Creepage

Rated Voltage kV	Creepage Distance mm
245	7,595

The Reference Unified Specific Creepage Distance (RUSCD) for the phase to earth insulators shall be in accordance with EN 62271-1 and EN 60815 for rated voltage 245 kV and very heavy pollution level 53.7mm/kV.

3.3.3 PARTIAL DISCHARGE

The maximum partial discharge of a complete arrester shall not exceed 5 pC when energised at 1.05 times its maximum continuous operating voltage.

3.3.4 MECHANICAL TERMINAL LOAD

The rated static withstand loads shall be as specified in the TECHNICAL SCHEDULES.

The surge arresters shall be capable of withstanding the specified static loads which include for the effects of wind and ice. During tests to prove rating, it is intended that the specified load for a particular unit be applied in any direction to the high voltage terminal.

During routine operation, the sum of the loads acting should not exceed 50% of the specified withstand load.

Arrester units shall withstand rarely occurring extreme dynamic loads (e.g. short circuits).

Typical requirements on the networks covered by this specification are as follows.

Table 6 Mechanical Loading

Highest Network Voltage kV	Maximum Permissible Service Load – MPST (Polymer Housing)
245	6kN

4 PRESSURE RELIEF

Surge arresters containing a significant gas volume e.g. “Design A” arresters as described in EN 60099-4 shall be fitted with pressure relief devices to ensure that the housings shall not shatter explosively on surge arrester failure.

The surge arresters shall meet the high and low current requirement of EN 60099-4, clause 6.11.

5 SURGE COUNTERS

Surge arrester units shall be fitted with a surge counter of approved type which is matched to the rating. The counter shall be capable of operating satisfactorily and without deterioration under the service conditions.

Surge Counters and leakage current meters shall be supplied as combined units in single housings capable of being mounted so as to allow observation of the indications from ground level.

The device shall have degree of protection IP65 in accordance with EN 60529.

If the surge counter/leakage current meter is powered by any means, this form of power should be renewable energy, with no external wiring. Alkaline batteries are not acceptable.

It shall be possible to check the operation of the surge counters in a field test. The method of performing such a test for the surge counter offered shall be described by the Customer to EirGrid. The surge counter shall not be resettable.

Leakage current meters shall enable the continuous monitoring of surge arrester leakage current at normal operating voltages. Details of how such meters are bypassed under surge operation shall be included in the Customers submission to EirGrid.

Alternative forms of surge arrester monitoring devices may be offered as an option.

The mounting arrangements for milliammeter/discharge counters are as follows,

- 1 Milliammeter/counters may be mounted on lightning arrester support structures at about 1.6 m above ground level. The housing shall be bolted to the structure
- 2 The connection from the arrester terminal to the counter shall be by insulated cable.
- 3 The connection of this cable to the bushing terminal of the counter shall be insulated to prevent accidental contact.

6 MOUNTING ARRANGEMENT

All surge arresters shall be suitable for mounting on steel support structures, which will be supplied by the Customer.

The support structures shall be dimensioned so that when arresters are mounted, the height above ground of the lowest point of live insulators shall be a minimum of 2300 mm.

7 TERMINALS

7.1 HIGH VOLTAGE

HV terminals shall be rated for the required continuous current and any short time overload conditions

The terminals shall comply with the requirements of EN 62271-301. They shall either be flat with holes of 14 mm diameter at 50 mm centres diameter plain round terminals. All terminals shall be corrosion resistant and compatible for use with aluminium/aluminium alloy connectors.

Earth terminals shall be flat and suitable to accept horizontal connection of two copper conductors of approximately 12.5 mm diameter, terminated with cable lugs drilled to accept M12 fixing stud.

Alternative terminals, such as conductor clamps compatible with either copper or aluminium conductors may be offered.

The Customer shall include full particulars of the proposed terminals in the TECHNICAL SCHEDULES.

8 CORROSION PROTECTION

All exposed ferrous parts, including nuts and bolts, shall be hot-dip galvanised to comply with EirGrid Spec

The Customer shall state clearly in the schedule of Corrosion Protection (part of TECHNICAL SCHEDULES) the corrosion protection applied to any aluminium or aluminium-alloy parts.

The Customer shall draw attention to all exposed points in their equipment at which aluminium or aluminium-alloy parts are in contact with or in close proximity to other metals and shall state clearly the protection employed at each point to exclude air and moisture.

Experience has shown that extreme precautions are necessary, because of the high humidity, to prevent the aggressive ingress of moisture between flange plates, around gaskets and O-rings, at insulator/flange interfaces, etc.

All corrosion protection and painting systems shall be designed to achieve a High Durability (above 15 years) coating to Category C5-M (ISO 12944-2) suited to environments with high condensation, pollution and salinity.

9 MARKINGS

Rating plates, labels and other marking shall be clear, indelible, corrosion proof, and shall be in English. The information on rating plates shall be in accordance with EN 60099-4. In addition, the EN discharge class shall be included. A serial number shall be included on the rating plate. Drawings of all rating plates and labels shall be submitted to EirGrid for review.

In addition, the equipment shall have the CE Mark in accordance with the requirements of the clause on standards.

10 TESTS

10.1 TYPE

All surge arresters offered shall have been fully type tested in accordance with EN 60099-4.

These type tests shall have been carried out at an independent testing station or alternatively have been witnessed by a representative of an independent testing agency or other independent witness.

The type tests shall include the following:

- Salt mist test according to EN 60099-4, clause 8.10.3.2 with a duration of 96 hours.
- Seal leak rate test according to EN 60099-4, clause 10.8.11
- Weather aging test according to EN 60099-4, clause 10.8.14

Certificates/Reports containing full details of type tests shall be submitted.

As specified in EN 60099-4, the pressure relief test shall be in accordance with EN 60099-1, i.e. including high and low current pressure relief tests.

As an artificial pollution test is not yet established in EN 60099-4, an artificial pollution test shall be performed in accordance with EN 60507. The Customer shall include full details of the test method adopted, the effect of pollution on the arresters and hence the validity of the test conditions. Such testing may be witnessed by EirGrid.

10.1 ROUTINE

Routine tests shall be carried out in accordance with EN 60099-4.

In addition, tests shall be performed to verify correct operation of surge counters and leakage current meters.

The manufacture shall measure the actual creepage distances to earth over external insulation on a representative sample of surge arresters prior to dispatch. The resultant values shall be included in the routine test report. EirGrid reserve the right to witness testing.

The Customer shall include details of all quality control checks/ routine tests which will be performed on porcelain housings, individual ZnO blocks (including verification that the

material is homogeneous) and on complete arresters with a minimum requirement being the following.

10.2 ACCEPTANCE

10.2.1 STANDARD

Acceptance tests shall be performed on the nearest whole number to the cube root of the number of arresters to be supplied in accordance with EN 60099-4.

In addition, tests shall be performed on porcelain housings, the Customer shall include details of all such acceptance tests.

EirGrid may witness the acceptance tests and shall be notified in advance of performance of these tests.

10.2.2 SPECIAL THERMAL STABILITY TEST

The Customer shall make provision for the special thermal stability test in accordance with EN 60099-4. If required by EirGrid this test shall be carried out before arrester assembly and may be witnessed by EirGrid.

11 DELIVERY

11.1 TEST RESULTS

At the conclusion of routine tests, results shall be available to EirGrid for review

12 INSTALLATION INSTRUCTIONS

While Installation is the responsibility of the Customer, EirGrid require that a copy of the manufacturer's installation instructions be provided. The instructions shall be in English and shall cover all aspects of installation including putting into service. The Customer shall ensure that the information supplied is clear and specific to the equipment being provided.

13 COMPLIANCE WITH SPECIFICATION

All deviations from the requirements of this Specification shall be listed in the schedule of deviations included in the technical schedule.

14 DOCUMENTATION

All documents shall be in English.

14.1 SUBMISSION FOR DESIGN REVIEW

The following information shall be submitted for review

- 1 Completion of all technical schedules.
- 2 Fully detailed Type test certificates and reports plus full details of the test method adopted for the artificial pollution test.
- 3 Details of routine and acceptance tests, including those on porcelain housings, surge counters and leakage current meters as well as on complete arresters.
- 4 Details of routine testing carried out on equipment at any stage prior to dispatch.
- 5 Full details of voltage grading system employed including a plot or graph of potential distribution along the stack.
- 6 Power frequency voltage versus time characteristic of the arresters.
- 7 Completed list of deviations
- 8 Complete set of technical drawings
- 9 Complete technical documentation, including Diagrams showing arrangement and internal connections of metal-oxide columns.
- 10 Technical details, description of operation and drawings of the surge counter and description of method for surge counter field test.
- 11 Technical details and drawings of the leakage current meter and indication of how it is bypassed under surge conditions.
- 12 Details of quality control checks during manufacture, e.g. checks on individual ZnO blocks to verify that the material is homogeneous.
- 13 Complete list of recommended spare parts
- 14 Complete list of specialist tools
- 15 Complete installation instructions
- 16 Complete operational instructions
- 17 Complete maintenance instructions
- 18 Complete decommissioning and dismantling instructions
- 19 Statement of acceptance of EirGrid warranty
- 20 Reference list of the specific equipment proposed

The above list is not exhaustive and does not preclude the Customer from disclosing any further information pertaining to the Item of plant.

Plant offered without the complete submission of the above requirements cannot be reviewed

EirGrid require that the following information be submitted after the design review:

- complete set of equipment drawings with rating plate diagram, physical dimension drawings including all details necessary for the design of the support steel structures, foundations, high- voltage connections and equipment layout.