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Functional Specification

220kV Disconnectors and Earth Switches for

Air Insulated Stations

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1 SCOPE

This Functional Specification is applicable for use in offshore wind transmission links delivered by the Customer as Contestable Works, to be owned and operated by EirGrid.

The specification relates to the Onshore Compensation Compound and covers the 220kV Disconnectors and Earth 220kV Disconnectors and Earth Switches for Air Insulated Stations.

This specification should be read in association with the project specific contestable works pack and project documentation and all other relevant functional specifications as issued by EirGrid.

For the purpose of this specification the term Customer shall refer to Offshore Wind Power Developers, Independent Power Producers responsible for the design and build of assets to be handed over to EirGrid. This Functional Specification covers supply of 220kV disconnectors and earthing switches of air-insulated stations (AIS).

The relevant TECHNICAL SCHEDULE OTS-SSS-423 shall to be completed for each type of disconnectors and earth switches.

2 LEGISLATION CODES 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

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 Directive 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.

IEC 60815	Guide for the selection of insulators in respect of polluted conditions
IEC 60529	Classification of degrees of protection provided by enclosures.
IEC 62271-1	High-voltage switchgear and controlgear - Part 1: Common specifications
IEC 62271-102	High voltage switchgear and controlgear: Alternating current disconnectors and earthing switches
IEC 62271-301	High voltage switchgear and controlgear: Dimensional standardisation of terminals

3 SERVICE CONDITIONS

The equipment shall be suitable for installation on the Transmission system. The design parameters are specified in EirGrid's functional specification OFS-SSS-400, Onshore Compensation Compound General Requirements.

4 TYPE AND DUTY

All side-by-side disconnectors and earthing switches shall be three phases with common driving mechanism. Independent, single phase type mechanisms shall be required for pantographs type disconnectors and earthing switches.

4.1 APPLICATION

The disconnectors and earthing switches shall be electrically operated. In addition, it is a requirement that they be fitted with a manually operated mechanism for maintenance purposes.

The following types of disconnectors and earthing switches are covered by this specification. Their application on the network is indicated under duty.

Combined busbar sectionaliser / busbar disconnector / Line Disconnect with built-in earthing switch can be either

1. Horizontal side by side centre break rotary or
2. Horizontal side by side double-side-break rotary or
3. Pantograph type with built-in earthing switch

The Busbar earth switch shall be a Pantograph type earth switch.

4.1.1 PANTOGRAPH DISCONNECTORS / EARTH SWITCHES.

If pantograph disconnectors/earth switches are used, they can be of two design types, for twin steel-cored aluminium flexible conductors or aluminium tubular conductors depending on the choice of busbar conductors.

The TECHNICAL SCHEDULES for the particular enquiry gives busbar details in the stations covered. The pantograph fixed contacts shall be complete with the necessary ties and connectors to suspend the contacts from the busbar. The required length of the ties will be determined by the height of the closed disconnector and the sag profile of the busbar at the point of attachment. The support steelwork will be dimensioned in such a way that the bottom of a bushing will be 2300 mm above the base of the steelworks (structure). Drive shafts shall be dimensioned accordingly to allow mechanism boxes to be located at a suitable height (i.e. top of mechanism box at a height of approximately 1250 mm).

EirGrid requires that all HV conductors in an open switchyard shall be located at least 4700 mm above ground level. Insulators shall be dimensioned such that this requirement is met for all conductors connected to the HV terminals. Pantograph disconnectors/earth switches shall meet this requirement when connected to busbars with a minimum height of 8500 mm.

The Customer shall include full details of the contact zone, i.e. (a) the moving contact closing envelope and (b) the limiting positions of the fixed contact within the moving contact.

5 RATINGS

The guaranteed ratings and characteristics shall be as follows.

5.1 VOLTAGE

The rated voltages of the disconnectors and earthing switches shall be the highest network voltages as specified under NETWORK PARAMETERS in OFS-SSS-400 specification.

5.2 INSULATION LEVELS

The insulation withstand levels, normal and higher creepage distances and insulation level of auxiliary circuits shall be as specified under NETWORK PARAMETERS in OFS-SSS-400 specification.

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

5.3 NORMAL CURRENT

The normal current ratings will be stated in the TECHNICAL SCHEDULES and Single Line Diagram.

5.4 SHORT TIME CURRENT WITHSTAND

The short time current withstand of disconnectors and earthing switches shall be such as to withstand the short circuit and dynamic currents specified under NETWORK PARAMETERS in OFS-SSS-400 specification.

5.5 SWITCHING CAPABILITY

5.5.1 DISCONNECTORS

The maximum capability of disconnectors to make and break capacitive charging currents shall be stated in the TECHNICAL SCHEDULES. IEC requirements and project specific requirements shall be met.

5.5.2 LINE EARTHING SWITCHES

The maximum capability of line earthing switches to break capacitive and inductive currents (induced from adjacent circuits of double-circuit lines) shall be stated in the TECHNICAL SCHEDULES. IEC requirements and project specific requirements shall be met.

5.5.3 PARTIAL DISCHARGE

There are no partial discharge requirements of a switch unit as a whole. However, in the case of components for which the relevant IEC Publication includes partial discharge measurement evidence shall be submitted showing that those components have passed the partial discharge tests in accordance with the IEC Publication.

5.6 RADIO INTERFERENCE LEVEL

The radio interference level at $1.1U_r/\sqrt{3}$, when measured in accordance with the relevant IEC publication, shall not exceed 2500 μV .

5.7 MECHANICAL TERMINAL LOAD

Rated static withstand load for straight-load and cross-load conditions are defined in the relevant IEC publication.

The disconnectors/ earthing switches shall be capable of withstanding the specified static loads which include for the effects of wind and ice and shall be able to open and close while subjected to such loads. Under normal conditions, the sum of the loads acting should not exceed 50% of the specified withstand load.

The equipment shall withstand rarely occurring extreme dynamic loads (e.g. short circuits), in addition to the static loads, as per relevant IEC standards. The combined loads shall be minimum 1.4 times the static withstand load.

6 DRIVE MECHANISMS

6.1 TYPE

All disconnectors and earthing switches shall be equipped with DC electric motor drive mechanisms and shall be suitable for operation electrically by remote and local control. In addition, all disconnectors and earthing switches shall be equipped with facilities for local manual operation from ground level which shall not be dependent on the availability of any power supply (see clause on Mounting Arrangements). Electric power drives shall be automatically disabled during local manual operation.

Local electrical operation shall be provided. A local/remote switch shall be provided. The design logic of control circuits shall not require standing supplies at the remote-control points to be obtained from the mechanism box.

Electrical operation shall require a double pole command.

Suitable thermal overload protection shall be provided for the DC motor.

Motor drive mechanisms shall also be suitable for manual operation and each mechanism shall be provided with a separate removable operating handle with a fixed storage position attached to the mechanism box. To prevent the accidental movement of the handle by the motor a mechanical and/or electrical interlock shall inhibit electrical operation (both locally and remotely) if the handle lever is inserted in position for manual operation.

All phases of the disconnectors/Earth switches shall open and close simultaneously. All drives shall include a hold-on arrangement which will extend the electrical command impulses until the operation is complete.

Disconnectors shall have one drive mechanism per triple-pole unit (unless the manufacturer recommends otherwise) and shall be complete with all necessary rods and linkages to couple the three poles mechanically.

Earthing switches shall have one drive mechanism per triple-pole unit (unless the manufacturer recommends otherwise – earthing switches combined with pantograph disconnectors shall have an individual drive mechanism per pole) and shall be complete with all necessary rods and linkages to couple the three poles.

All disconnectors and earthing switches shall be padlockable in the open and closed positions. A hole approximately 7 mm diameter shall be available for accepting padlocks with a 6.3 mm diameter shackle. This is known as the “danger lock”. The lockable arrangement shall not impinge on the drive arms.

Minimum air clearance distances that are in OFS-SSS-400 specification must be complied with in all positions / cases.

All disconnectors and earthing switches must be designed so that upon removing/using/replacing its manual handle from/to its storage position (for manual operation) it is not possible to contravene the 2300 mm to the bottom of its live bushing.

Moving parts which are accessible to operation and maintenance personnel shall be equipped with guards which provide degree of protection IP2X according to IEC 60529.

6.2 AUXILIARY POWER SUPPLIES

Drive motors, contactors, hold-on coils, auxiliary switches and all other auxiliary equipment shall have a rated operating voltage of 220V DC.

Automatically controlled anti condensation heaters shall be provided in the mechanical boxes and marshalling kiosks and have to be rated for operating voltage 230V AC, 50Hz.

6.3 INTERLOCKS

Disconnectors with built-on earthing switches shall be equipped with a mechanical interlock which shall prevent

- Operation of the disconnector when the earthing switch is closed.
- Operation of the earthing switch when the disconnector is closed.

The interlock conditions shall be effective for both electrical and manual operation.

Interlocking for manual operation shall have a bypass facility. This bypass facility must be accepted by EirGrid before installation.

Bypass printed instructions shall be located on the inside of the door of the control box.

6.4 AUXILIARY SWITCHES

Auxiliary switches shall be provided. In addition to the switches required for open and close operation and hold-on circuits, at least eight spare normally-open and eight spare normally-closed contacts shall be provided.

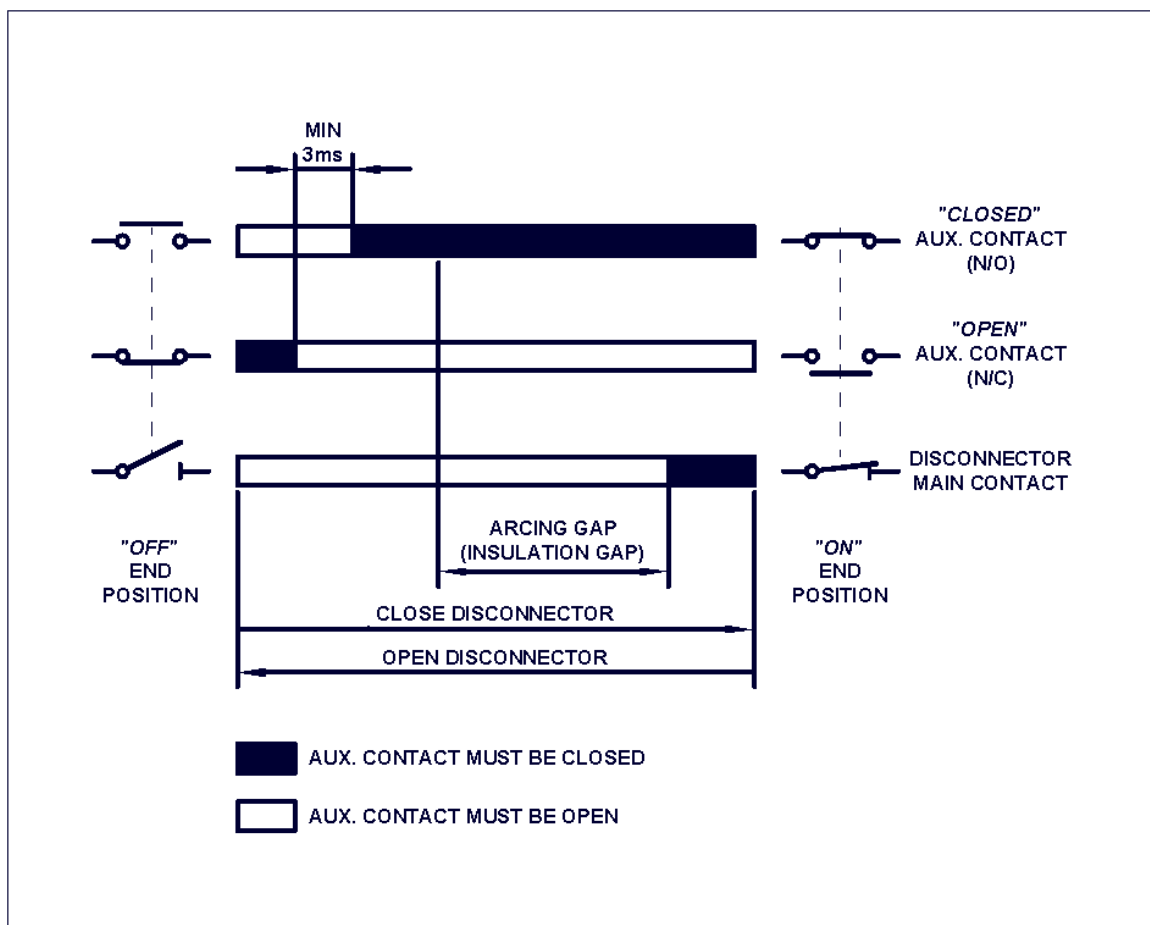
The switches shall be wired to individual terminals in the cabinet box.

The contacts shall be primary contacts only. Contact multipliers are not permitted.

Signalling of the closed position shall not take place until the moving contacts have reached a position in which the rated currents can be carried safely.

Signalling of the open position shall not take place until the moving contacts have reached a position in which the rated insulation test voltage can be withstood.

Each disconnector shall be equipped with one special normally-closed (N/C) and one special normally-open (N/O) contact according to the following sketch.



During the closing operation the N/O contact must close before the main contact reaches the insulation breakdown gap. During the opening operation the N/O contact ("Closed" signal) must not open before the main contact has passed the contact gap at which re-ignition can occur.

The N/C contact must open not less than 3 milliseconds before the closing of the N/O contact. These special contacts are not required on earthing switches.

6.5 MECHANISM BOXES/CONTROL CABINETS

The enclosures of all drive mechanisms/control cabinets shall have a degree of protection to IP54 in accordance with IEC 60529 and shall be equipped with suitable anti-condensation heaters. The live parts of heaters shall be enclosed with degree of protection IP2X.

Where local mechanical position indication is provided it shall have the words “ON” and “OFF” clearly marked as per relevant IEC standards.

6.6 EARTHING

All flexible earths required to earth drive shafts and manual operating handles shall be supplied.

All metallic drive linkages which are accessible from ground level shall be bonded and earthed.

7 MOUNTING ARRANGEMENT

All disconnectors shall be suitable for mounting on steel support structures, which will be supplied by the Customer. The necessary heights of the support structures to achieve all operational and safety clearances specified shall be stated in the TECHNICAL SCHEDULES.

Drive shafts shall be dimensioned accordingly to allow mechanism boxes to be located at a suitable height (i.e. top of mechanism box at a height of approximately 1250 mm).

The minimum height of the support structures will be determined by the requirement, for unscreened installations, that the height above ground of the lowest point of live insulators be a minimum of 2300 mm.

The control boxes and handles shall be at a convenient height for operation from ground level. It shall not be possible to infringe on the 2300 mm clearance when using /removing/replacing the manual handle from/to its storage location.

Mounting requirements for indoor equipment will be specific to individual installations and will be agreed on a project-specific basis.

8 HIGH-VOLTAGE TERMINALS

The terminals shall comply with the requirements of IEC 62271-301.

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

9 CORROSION PROTECTION

All exposed ferrous parts, including nuts and bolts, shall be hot-dip galvanised to comply with EirGrid Specification OFS-SSS-420.

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 what protection is 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.

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

10 MARKINGS

Nameplates, 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 IEC 62271-102 and IEC 62271-1. Serial number and year of manufacture shall be included. Drawings of all rating plates and labels shall be submitted for EirGrid review.

Earth switch blades shall be painted (or permanently taped) yellow and green, the yellow sections being 150mm long and the green sections 150mm, starting with yellow from the contact end. The colours shall be as per applicable IEC standard for earthing equipment. The blades shall be suitably primed before painting.

In addition, the equipment shall have the CE Mark.

11 TESTS

11.1 TYPE

All disconnectors and earthing switches offered shall have been fully type tested in accordance with IEC 62271-102 and the results shall demonstrate, in relevant respects, the capability to meet the requirements of this specification.

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

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

EirGrid reserve the right to request further testing to be carried out at an independent testing station. All proposals are subject to this condition. Such testing may be witnessed by EirGrid.

11.2 ROUTINE

All disconnectors and earthing switches shall be routine tested in accordance with IEC 62271-102. The tests may be witnessed by EirGrid and shall include verification of the IP rating through a weatherproofing test in accordance with IEC 62271-1 and operational tests of a fully assembled disconnector/earth switch of each type ordered.

12 DELIVERY

12.1 TEST RESULTS

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

12.2 PACKAGING

All plant and accessories be suitably packed and in non-returnable crates or cases and all spare parts shall be suitably packed and treated for long term storage. Each packing shall be indelibly marked for identification purposes as to its contents. The information shall correspond with any maintenance or design designation name or numbers.

13 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.

14 MAINTENANCE

14.1 GENERAL

All disconnectors and earthing switches shall as far as possible be maintenance free. However, "Greased for Life" joints are not acceptable. All moving joints shall be fitted with grease nipples.

14.2 SPECIAL TOOLS

The Customer shall list in the attached schedule of Special Tools (part of TECHNICAL SCHEDULES) any special tools required for maintenance of the equipment. All such tools shall be provided with clear instruction in English as to their function and operation.

14.3 SPARE PARTS

The Customer shall advise on the continuing availability of the complete range of spare parts for the equipment offered.

The Customer shall list in the attached schedule of Recommended Spares (part of TECHNICAL SCHEDULES) those spare parts which the manufacture recommends should be held by the EirGrid.

All recommended spare parts, types and quantities plus any additional requirements of EirGrid shall be advised to with EirGrid.

All spare parts shall be provided with a description of their function and a complete installation instruction with associated drawings. All instructions shall be in English.

14.4 MAINTENANCE INSTRUCTIONS

The Customer shall provide a complete set of maintenance instructions. The instructions shall be complete, in English and contain all associated instructions and drawings pertaining to the continuing maintenance of the equipment throughout its lifecycle.

15 COMPLIANCE WITH SPECIFICATION

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

Should EirGrid determine that the proposal does not comply with this specification or any part of it, EirGrid reserves the right to reject the proposal.

16 DOCUMENTATION

All documentation shall be in English.

16.1 SUBMISSION FOR DESIGN REVIEW

The following information shall be submitted for review

1. Complete drawings, detailing physical dimensions, layout of equipment, support structures, fixing details and high voltage connections.
2. Complete set of Electrical drawings detailing in full all electrical circuits and associated accessories.
3. Fully completed copy of the TECHNICAL SCHEDULES attached to this specification
4. Fully detailed Type Test Certificates/Reports.
5. Complete technical documentation.
6. Details of routine testing carried out on equipment at any stage prior to dispatch
7. Completed list of deviations.
8. Full details of any modifications made to the drive mechanism since type testing. This shall require a complete report of testing carried out to prove the modification.
9. Complete set of technical drawings including, outline dimensioned drawings of disconnectors and earthing switches and auxiliary equipment and drawings of drive mechanisms, disconnector/earth switch bearings and timing diagrams of auxiliary switches.
10. Complete list of recommended spare parts
11. Complete list of specialist tools
12. Complete installation instructions
13. Complete operational instructions
14. Complete maintenance instructions
15. Complete decommissioning and dismantling instructions
16. Statement of acceptance of EirGrid warranty
17. 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.