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Functional Specification

Electrical & Mechanical Services for Transmission System Control Buildings and Compounds

Revision	Date	Description	Originator	Reviewer	Checker	Approver
R0	20/04/2022	First Issue	Vitali Garon	Niall McMahon Daniele Giustini	Leon Notkevich, Neil Cowap	Aidan Corcoran, Richard Blanchfield
R1	03/10/2022	Issued for use after industry feedback	Vitali Garon	Daniele Giustini James Staunton	Neil Cowap	Louise O'Flanagan

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.

This functional specification defines requirements for Electrical and Mechanical Services for Transmission System Control Buildings and Compounds.

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.

2 GENERAL

2.1 SAFETY

Electrical wiring shall be in accordance with local regulations for electrical installations and with the requirements of the EirGrid functional specification OFS-SSS-406 (Auxiliary Cables and Wiring System) and the latest edition of the Irish regulations.

Careful consideration shall be given to clear identification of any possible explosive atmospheres, and the competency of all responsible persons, operatives and designers shall be verified in accordance with I.S. EN 60079-14.

2.2 CONSERVATION OF ENERGY

The Customer shall comply with the requirements of Part L of the Building Regulations, Conservation of Fuel and Energy. Alternative proposals will be considered for approval by EirGrid.

Preference shall be given to the use of energy efficient appliances as far as possible.

The use of incandescent luminaires is not acceptable in new installations.

2.3 MISCELLANEOUS

The design of all services shall be such that the associated equipment shall be fully integrated into the overall design of the OCC. All cabinets, panels, racks, boards shall have the same architectural features (height, kicking strip, colour, method of manufacture, labelling, etc.) as other cabinets and equipment within the room.

Small power fittings (sockets, switches, isolators, etc.) shall be surface mounted and all wiring, including that to switch and socket positions, shall be run in surface mounted trunking.

A minimum of 20% spare capacity shall be included in the design of LV distribution system.

Lighting and small power layout drawings shall detail the circuit arrangement and be fully supported with Distribution Board Schedules.

In addition to the drawings specified for particular items of plant, fully dimensioned layout/elevation drawings, showing all cabinets, boards, etc. integral with the main equipment, shall be submitted to EirGrid.

A detailed Spares List shall be formulated and submitted together with a Mechanical & Electrical Maintenance Method Statement for all plant and equipment.

Details of all plant and equipment shall be submitted for review by EirGrid.

All outdoor fittings shall be suitable for the service conditions outlined in EirGrid Functional Specification OFS-SSS-400.

Particular attention shall be given to ensuring prevention of moisture ingress and protection against deterioration due to solar radiation (UV) or thermal cycling.

Suitable cable containment shall be provided and adequate segregation of LV, ELV and fire safety cabling shall be ensured.

3 LEGISLATION CODES AND STANDARDS

3.1 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:

Document Number	Title/Description
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

Document Number	Title/Description
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
	Irish Building Regulations and associated Approved Documents (https://www.housing.gov.ie/housing/building-standards/building-regulations/building-regulations

Unless the Customer can document 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.

3.2 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.

Number	Document Title
I.S. 10101	National Rules for Electrical Installations
I.S. 291	Selection, Commissioning, Installation, Inspection and Maintenance of Portable Fire Extinguishers
I.S. 3217	Emergency Lighting
I.S. 3218	Fire detection and alarm systems for buildings
I.S. EN 1505	Ventilation For Buildings - Sheet Metal Air Ducts and Fittings with Rectangular Cross Section - Dimensions
I.S. EN 1506	Ventilation For Buildings - Sheet Metal Air Ducts and Fittings with Circular Cross-section - Dimensions
I.S. EN 1507	Ventilation For Buildings - Sheet Metal Air Ducts with Rectangular Section - Requirements for Strength and Leakage
I.S. EN 1838	Lighting Applications - Emergency Lighting
I.S. EN 1886	Ventilation For Buildings - Air Handling Units - Mechanical Performance
I.S. EN 12097	Ventilation For Buildings - Ductwork
I.S. EN 12237	Ventilation For Buildings - Ductwork - Strength and Leakage of Circular Sheet Metal Ducts
I.S. EN 13053	Ventilation For Buildings - Air Handling Units - Rating and Performance for Units, Components and Sections
I.S. EN 15251	Indoor Environmental Input Parameters for Design and Assessment of Energy Performance of Buildings Addressing Indoor Air Quality, Thermal Environment, Lighting and Acoustics
I.S. EN 16798-3	Energy Performance of Buildings - Ventilation for Buildings - Part 3: For Non-residential Buildings
I.S. EN ISO 16890	Air Filters for General Ventilation
I.S. EN 50131	Alarm Systems
I.S. EN 60079	Explosive atmospheres
I.S. EN 60081	Double-capped Fluorescent Lamps
I.S. EN 60598	Luminaires
I.S. EN 60309	Plugs, Socket-outlets, and Couplers for Industrial Purposes

Number	Document Title
I.S. EN 60839	Alarm And Electronic Security Systems
I.S. EN 61000	Electromagnetic Compatibility (EMC)
I.S. EN 50172	Emergency Escape Lighting Systems
BS 476	Fire Tests on Building Materials and Structures
BS 1363	13a Plugs, Socket-outlets Adaptors and Connection Units
BS 5266	Emergency Lighting
BS 7671	Requirements For Electrical Installations - IET Wiring Regulations
ISO 6944	Fire Containment - Elements of Building Construction
ISO 9001	Quality Systems
ISO 10294	Fire resistance tests

4 LIGHTING

4.1 GENERAL

The OCC buildings shall be provided with adequate internal and external lighting for the safe execution of normal operations and maintenance during periods of poor light and at night.

It shall be operated at 230 V, 50 Hz. All luminaries shall give good visual performance and shall be free from excessive glare, stroboscopic effects, and flicker from discharge lamps.

Safety and amenity shall be important considerations of the lighting design. The system shall be designed to ensure satisfactory operation and service life under all variations of voltage, frequency, and temperature.

The correlated colour temperature (CCT) shall be standard throughout the installation (4000 K preferred value), or to match the existing where applicable. A minimum colour rendering Index (CRI) of 80 shall apply.

The LED modules shall have a minimum design life of 50,000 hours L80 B10 and a maximum abrupt failure value of 5.

All luminaries shall comply with I.S. EN 60598

Notwithstanding any requirements for battery rooms, all cables shall have an earth conductor to ground all lighting fittings and accessories

4.2 INDOOR LIGHTING

Levels of illumination for particular areas shall be designed to the following values.

Table 1 Lighting Lux Levels

Area	Average illuminance (Lux)	Uniformity factor (min/avg)
Control Room	500	0.2
Battery room	250	0.4
Other plant room	200	0.4
General (cable rooms/pits, corridors, entrances, stairs, toilets, and general circulation areas)	100	0.4

The illumination level of indoor lighting shall be measured horizontally at a height of 1 metre above the floor.

The light sources shall be LED type. These shall be equivalent to single or twin 58W high efficiency fluorescent luminaires, with a minimum lumen output of 3900 lumens and 7000 lumens resp.

A drawing shall be produced detailing the lux levels in each room within the control building.

4.3 OUTDOOR LIGHTING

LED lighting shall be provided. The average illuminance shall be measured at ground level. In general, sufficient illumination shall be provided to allow safe pedestrian travel anywhere in the substation. At no part of the outdoor area shall the horizontal illuminance be less than 2 lux.

A drawing shall be produced detailing the lux levels throughout the compound.

These lights shall be controlled by an automatic thermal photo-controlled device that switches on at 55 lux and re-sets at 110 lux. An override switch for manual operation shall also be provided, with a facility for switching off the automatic operation. The fittings shall be mounted such that maintenance of the lamps does not require the use of ladders more than 2 m high in the vicinity of the HV equipment. Alternatively, tall lighting columns can be installed with a hinge facility to allow maintenance at ground level.

Multi way switches located at the compound entrance and inside the main entrance door of each substation building are required to provide acceptable levels of luminance for vehicle and pedestrian access to and surrounding the substation buildings.

The average level of illuminance of outdoor lighting shall be 0.5 lux unless stated otherwise in the planning permission documents. The outdoor lighting scheme shall be in accordance with the requirements of the local authority.

Outdoor lighting should not infringe on standard clearance requirements; see specification OFS-SSS-400. Hinged lighting posts are acceptable provided clearances are maintained.

Minimum distance from lightning posts to permanent structures shall be 1.5 m.

4.3.1 LIGHTING SWITCHES

Lighting switches shall generally be metal clad, 230-volt, 15 amp, "AC only" type capable of operating at their full rated capacity.

Switches shall be one way, two way or intermediate as required and where mounted together they shall be fitted in a common box. For surface installations they shall be fitted with fixed grids and in flush installations the grids shall be adjustable. Switches mounted externally shall be of weatherproof pattern fitted with machined box and cover joint, brass operating handles, neoprene weather-tight seals and external fixing feet.

For areas such as toilets and corridors, PIR detectors should be employed for light control. PIR indicators to be provided in accordance with the Building Regulations.

Switches shall be mounted 1.4m above finished floor level. Switches controlling battery room lighting shall be mounted outside the room, adjacent to the access door.

Manual switches for the outdoor lighting shall be provided at the gate and main building entrance as outlined in section 4.3.

4.4 EMERGENCY LIGHTING

4.4.1 GENERAL

Emergency lighting and signage shall comply with I.S. 3217, where not in conflict with this specification, and shall be provided by self-contained batteries in the individual light fittings.

On failure of the AC supply the emergency lighting shall be automatically illuminated within 5 seconds after supply failure and remain illuminated for a minimum of 3 hours after the AC supply failure.

The illumination by the emergency escape lighting system of a compartment of the escape route shall be from two or more luminaires so that the failure of one luminaire does not plunge the route into total darkness or make the directional finding effect of the system ineffective. For the same reason, two or more luminaires shall be used in each open area (anti-panic area). Note: The provision of an internally illuminated exit sign may contribute to meeting this requirement for rooms not greater than $6m^2$ floor area.

Test facilities shall be provided for checking that the emergency lighting system is in working order as per requirements of I.S. 3217.

There shall be one emergency test relay (CTU) for all the emergency lighting circuits, with isolating links to enable/disable testing of individual areas.

4.4.2 EMERGENCY ILLUMINANCE LEVELS

Emergency Illuminance levels along defined and undefined escape routes shall meet I.S. 3217.

For defined escape routes up to and including 2 m in width the following lux levels shall be achieved:

- A horizontal illuminance of no less than 1 lux along the centre line

- A horizontal illuminance of no less than 50% of that value in the central band of width no less than half the width of the route.

Defined escape routes exceeding 2 m in width can be considered as a number of adjacent or overlapping 2 m wide strips, in accordance with I.S. 3217. In this case the following lux levels shall be achieved:

- A horizontal illuminance of no less than 1 lux along each strip centre line

- A horizontal illuminance of no less than 50% of that value in each central band of width no less than 1 m.

Defined escape routes exceeding 2 m in width can alternatively be provided with open area lighting. In this case a minimum horizontal illuminance of 0.5 lux shall be achieved for all areas excluding a 0.5 m border.

In addition to the requirements above the following minimum emergency illumination levels shall be achieved:

- 5 lux vertical illuminance at the first aid box & eye wash station
- 5 lux vertical illuminance at all firefighting equipment, fire alarm panel and call points
- 1 lux horizontal illuminance on the floor in front of electrical panels and cabinets*
- 5 lux min vertical illuminance at control equipment, panels, cabinets, and AC/DC boards
- 5 lux horizontal illuminance at battery working height

4.4.3 Emergency Exit Signs

Self-contained illuminated "Exit" signs shall be provided in each room over the doors of emergency escape routes. These units shall provide sustained lighting of the legend and of the door threshold while the room main lights are switched on, and for a minimum of 3 hours after an a.c supply failure.

There are only two types of emergency exit signs that are permitted under I.S. 3217:

- Type 1 (which complies with I.S. EN 1838:2013). Example: 
- Type 2 (which complies with I.S. EN 1838:1999). Example: 

To ensure continuity of signage throughout the building it is recommended that only one type of emergency exit sign shall be used.

For new buildings and significant alterations/extensions to an existing building, Type 1 emergency exit signs shall be used throughout.

Emergency exit signs shall be illuminated at all material times (i.e., when the building is occupied) and in the event of failure of the supply to the normal lighting. Therefore, emergency exit signs need to be the maintained type, as even in daylight hours the sign needs to be illuminated. If the room has no natural light, then switched-maintained type can be used, wired off the same switch as the normal lighting in that room/area.

* This includes AC and DC boards, mimic and all protection and control cabinets

5 POWER FACILITIES

Power facilities shall be in accordance with the latest edition of Irish National Rules for Electrical Installations (ETCI ET-101 or equivalent superseding document).

5.1 INDUSTRIAL POWER

400 V socket centres shall be provided within 20 m of all plant, equipment and work areas and all accessible roof spaces where equipment is located.

Each socket centre shall comprise of 400 V a.c 63 A and 32 A, 3P+N+E switched industrial type round sockets, coloured red, in accordance with IEC 60309. Each 400 V socket shall have integrated MCB overload protection.

5.2 NON-INDUSTRIAL POWER

230 V a.c 13 A, twin switched sockets (3 pin BS 1363) with overload protection and 30 mA RCD protection shall be provided as required for the expected operation and maintenance of the facility including all plant.

The design shall locate sockets such that the requirement for trailing cables is minimised. Power and telecommunication sockets shall be located at floor level where room design layouts indicate that these shall be required.

5.3 DRAWINGS

The following drawings shall be submitted to EirGrid for review.

1. Physical layout of equipment.
2. Equipment schedule to cover all items of equipment and giving complete information on each item including manufacture, type, rating etc.
3. Completed Distribution Board Schedules.

6 HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

6.1 GENERAL

Adequate heating, ventilation and air conditioning systems shall be provided to cater for plant and personnel under the range of Service Conditions described in the General Requirements Specification.

It is not a requirement to install air conditioning anywhere in the building(s) unless Customer design requires it. If it is being installed, the air-conditioning system shall be designed, installed & commissioned in accordance with I.S. EN 16798.

Space heating, ventilation and cooling requirements within all areas shall be designed to minimise the use of energy.

6.1.1 DESIGN PARAMETERS

The design shall consider anticipated maximum levels of occupancy, ambient and solar gains, ambient temperature fluctuations, lighting, electrical equipment, and heat losses from electrical equipment.

6.1.2 DESIGN CALCULATIONS

The Customer shall calculate heat gains and losses under the specified conditions for each part of each building, considering solar radiation, thermal transmittance through roofs, walls, floors and windows, fresh air requirements, heat emission from installed electrical equipment and lighting, personnel, infiltration, and any other sources.

The Customer shall be responsible for determining the heat transfer coefficients for all materials used in building construction. In the event of any change in materials, design, or method of building construction, the Customer shall at all-time be responsible for rechecking the design of all systems to ensure that they are capable of meeting the specified design requirements.

Where internal heat gains rise above 40 W/m², natural ventilation is deemed inadequate and mechanical assistance shall be implemented.

6.2 AIR FLOW

The air flow rate in each building, room shall be adequate for personnel, smoke control in the event of fire, dilution, and removal of dust/fumes, and building pressurisation.

All air intakes to HVAC equipment shall have air filters classed according to EN13779 and EN 779 considering outdoor air quality to be dusty (ODA2).

The percentage of fresh air in the total air supply shall depend on the particular requirements of each room and shall vary from 10% to 100%; however, battery rooms and toilets shall be provided with 100% fresh air at all times.

6.3 HEATING

Areas requiring heating shall be capable of being maintained at a set temperature controllable across the range of 10 - 25ºC.

- The temperature in the control rooms and GIS switchgear rooms shall not be allowed to fall below 10°C.
- The temperature in the battery room shall not be allowed to fall below 15°C (heating will automatically be switched on if the battery room temperature falls below 15°C).
- Two smaller heaters are preferred over a single larger unit, to provide redundancy

These areas shall also be capable of being maintained at a relative humidity no greater than 50%.

Heating in the control building shall generally be provided by electrical storage heaters controlled by thermostats to operate when the temperature falls below the required minimum temperature.

7 FIRE PROTECTION

7.1 GENERAL

The Customer shall design, procure, install, and commission the complete monitoring and detection equipment, audible alarms, and control equipment necessary to detect and annunciate and supress a fire condition.

The fire protection system shall be designed, manufactured and installed to the highest standards of reliability and in accordance with the best modern practice by a specialist manufacturer and installer.

All major specialised firefighting equipment and devices shall be identified as available in the local market, i.e., an established maintenance and spares service shall be available locally.

All the arrangements for protection against fire including zoning of buildings, fire alarm systems, type, size, and location of fire extinguishers shall be subject to the approval of EirGrid.

The fire protection installation shall be ready for operation before commissioning of the substation.

7.2 Fire Detection And Alarm Systems

Fire detection and alarm system shall be installed in accordance with the latest version of EirGrid Functional specification OFS-SSS-409 and I.S. 3218.

7.3 Portable Fire Extinguishers

Firefighting equipment in the form of portable fire extinguishers shall be provided at various locations throughout OCC.

The locations, sizes, and types of extinguishers shall be based on the Customers Design Risk Assessment and existing Irish legislation and will be reviewed by EirGrid. As a minimum, CO_2 and dry powder extinguishers shall be located at each room exit.

All portable fire extinguisher locations shall have suitable secure storage facility, at indoor locations the extinguishers shall be securely wall mounted.

8 Drawings and Information

In addition to the site layout and building drawings, Sufficient drawings should be issued to EirGrid to allow a thorough review. A non-exhaustive typical list is below drawings are below

1) Physical layout of equipment in indoor lighting scheme. Flush mounted fittings shall be shown integral with the ceiling tile arrangement.
2) Physical layout of equipment in outdoor lighting scheme.
3) Physical layout of equipment in emergency lighting scheme.
4) Electrical schematic diagrams of all lighting schemes showing operation and control.
5) Description of the lighting schemes involved and their operation and control.
6) Equipment schedule to cover all items of equipment and giving complete information on each item including manufacture, type rating etc.
7) Completed Distribution Board Schedules
8) Details of the Heating and ventilation system prosed including required calculations
9) Details of the fire protection & alarm system
10) Details of the intruder detection and alarm system

Before handover to EirGrid, detailed instructions on operation and maintenance shall be submitted to EirGrid.

9 MISCELLANEOUS EQUIPMENT

An electrical clock with digital twenty-four-hour reading shall be installed in the control room, on top of the row of control cabinets in a central position facing the operator's desk. This clock shall remain operational in the event of a failure of AC supply to it.

The workshop/store shall be fitted out with the following as a minimum:

- Workbench with vice
- Shelving
- Chairs
- Storage for portable earths and other plant accessories