Document Reference: OFS-SSS-400-R2

Onshore Compensation Compound

General Requirements

Revision	Date	Description	Originator	Reviewer	Checker	Approver
R0	14/04/22	First Issue	Vitali Garon	Daniele Giustini Niall McMahon	Neil Cowap Leon Notkevich	Aidan Corcoran, Richard Blanchfield
R1	07/10/2022	Issued for use after industry feedback	Vitali Garon	Daniele Giustini James Staunton	Neil Cowap Leon Notkevich	Aidan Corcoran, Louise O'Flanagan
R2	21-12-22	Issued for use after industry feedback	Vitali Garon	James Staunton	Neil Cowap Leon Notkevich	Louise O'Flanagan

1 ABBREVIATIONS

AC	Alternating current
AIS	Air Insulated Switchgear
BIL	Basic Impulse Level
BREEAM	Building Research Establishment Environmental Assessment Method
CEMP	Construction Environmental Management Plan
CLP	Classifying, Labelling, Packaging
CPR	(EU) Construction Products Regulation
CT	Current transformers
DC	Direct current
EHV	Extra High Voltage (220kV and above), mainly used for transmission voltages in the context of this document
EMC	Electromagnetic compatibility
EN	European Norm
ESBN	ESB Networks
FEED	Front end engineering and design
GIS	Gas Insulated Switchgear
HV	High voltage (from 33 kV to 132 kV inclusive). Mainly used for wind farm inter-array system voltages, in the context of this document.
HVAC	Heating, Ventilation and Air-Conditioning
IEC	International Electrotechnical Commission
IPP	Independent Power Producer
I.S.	Irish Standard
ISO	International Organization for Standardization
LCC	Local Control Cabinet
LV	Low Voltage (as per IEC)
MV	Medium Voltage mainly used for distribution system voltage levels above 1 kV AC in the context of this document.

OCC	Onshore Compensation Compound (onshore substation for offshore wind assets)
OHL	Overhead Line
OSP	Offshore Substation Platform
PCC	Point of Common Coupling
POC	Point Of Connection
QC	Quality control
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
rms	Root-mean-square
SCADA	Supervisory control and data acquisition
SI	System of units (Système international d'unités)
SLD	Single Line Diagram
STATCOM	Static Synchronous Compensator
SVC	Static Var Compensator
UPS	Uninterruptible Power Supply
VT	Voltage transformers
WEEE	Waste Electrical and Electronic Equipment

2 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 following specification outlines the general requirements for the design and construction of EirGrid's onshore compensation compounds (OCC) for offshore wind power projects.

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.

EirGrid have prepared a set of drawings OFS-SSD-500, OFS-SSD-501 and OFS-SSD-502 for OCC design. The drawings are not for full mandatory compliance as specific project requirements may differ but should be used as a typical guidance.

3 APPLICABLE SPECIFICATIONS AND STANDARDS

3.1 STANDARDS

All installations shall comply with the latest version of the Grid Code. The Irish Grid Code is available on the EirGrid website http://www.eirgridgroup.com

Except where otherwise stated in the functional specification, materials shall be designed, manufactured, tested and installed according to relevant IEC/EN standards. Where applicable the Irish adaptation of the standard (IS EN version), including any national normative aspects, shall apply. Where no IEC Standard has been issued to cover a particular subject then an EN, recognised international or British Standard shall be applied. The latest edition and amendments shall apply in all cases.

Table 1 List of Applicable Standards

Number	Title
IEC 50110	Operation of electrical installations
IEC 60071	Insulation co-ordination
IEC 60529	Degrees of protection provided by enclosures (IP code)
IEC 60617	Graphical symbols for diagrams
IEC 60815	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions
IEC 60865	Short Circuit Currents – Calculation of effects
IEC 61936	Power installations exceeding 1 kV a.c. Common rules
IEC 62474	Material declaration for products of and for the electrotechnical industry
IEC Guide 113 ed1.0	Materials declaration questionnaires - Basic guidelines
ISO 9001:2000 (or later)	Quality Management Systems
	Safety Health & Welfare at Work Act 2005
	Safety Health & Welfare at Work (Construction) Regulations 2013
	EU Directive 2013/35/EU on EMF S.I. No. 337 of 2016

Number	Title
	Safety Signs at places of Work Regulation 1995
SI 176/2010	Safety, Health and Welfare at Work (General Application) (Amendment) Regulations 2010
SI No 299/2007	Safety, Health and Welfare at Work (General Application) Regulations 2007 and its amendment of 2020 S.I. No 2/2020
	Latest EU ROHS (Restriction of Hazardous Substances) and WEEE (Waste Electrical and Electronic Equipment) Directives
	EU Construction Products Regulation (No. 305/2011 – CPR)
	CLP (Classifying, Labelling, Packaging) Regulation (EC) No 1272/2008
EN ISO 3746	Acoustics – determination of sound power levels and sound energy levels of noise sources using sound pressure – survey method using and enveloping measurement surface over a reflecting plane.
EN ISO 9614	Acoustics – determination of sound power levels of noise sources using sound intensity – Series
I.S. 10101	National Rules for Electrical Installations
ET103:2015	National Rules for Electrical Installations Power installations exceeding 1 kV a.c. (1.5 kV d.c.), 1st Edition
IEC 60204-1, IEC 61000-6-2 and IEC 61000-6-4	Standards for EM compatibility.
IEC 60309	Standards for plugs, socket-outlets and couplers for industrial purposes

IEC 60204-1, IEC 61000-6-2 and IEC 61000-6-4 for EM compatibility.

IEC 60309 for plugs, socket-outlets and couplers for industrial purposes

The design of the substation, and the plant and equipment supplied, installed and used shall comply (in order of precedence) with the requirements of:

1. National, European or International legislation
2. EirGrid Grid Code and Functional Specifications
3. IEC/EN standards
4. Other international standards

In case of conflict between this specification and any other IEC or relevant specifications, the requirements of this specification shall take precedence; however, the Customer may seek a clarification from EirGrid to any conflict if necessary.

The Customer shall state in his proposal the standards and codes of practice which he proposes for any items of plant not covered by IEC standards. If required by EirGrid, the Customer shall submit two English language copies of these standards not later than the design submission date.

Where appropriate, the equipment shall carry the CE Mark in accordance with Directive 768/2008/EC and the EU Construction Products Regulation (No. 305/2011 – CPR) and sufficient documentation to demonstrate full compliance shall be retained.

At the end of construction and commissioning all temporary electrical equipment including cabling shall be removed.

3.2 UNITES OF MEASUREMENT

The SI system of units shall be used throughout.

Temperature shall be in degrees Celsius.

Electrical energy shall be in kWh and gas and fluid pressure shall be expressed in MPa.

4 FUNCTIONAL REQUIREMENTS

4.1 SERVICE CONDITIONS

The site climatological conditions shall be taken into consideration when designing the substation. The climate in Ireland is moderate and extreme temperatures are very rare, and the equipment to be provided shall be capable of operating satisfactorily under the conditions likely to be encountered on site.

4.1.1 INDOOR ENVIRONMENTAL CONDITIONS

The following service conditions apply to all indoor equipment:

Table 2 Service Conditions Indoors

Item	Value
Maximum ambient temperature	40°C
Maximum daily average ambient temperature	30°C
Annual average ambient temperature	20°C
Minimum ambient temperature	5 ºC
Humidity	95%

The indoor equipment to be provided shall be capable of operating satisfactorily at these temperatures, and their ratings at these temperatures shall also be stated.

4.1.2 Outdoor Environmental Conditions

The following outdoor air temperatures apply:

Table 3 Service Conditions Outdoors

Item	Value
Maximum ambient temperature	40°C
Maximum daily average ambient temperature	30°C
Annual average ambient temperature	20°C
Minimum ambient temperature	- 25 ºC

Equipment will also be exposed to:

- Average Solar Radiation of 420 – 870 W/m2
- Maximum wind (3 second gust) velocity of 50 metres per second.
- High Humidity of up to 95%, salty, highly corrosive atmosphere which is particularly severe on non-galvanised ferrous parts and aluminium and its alloys.
- A high incidence of wind driven rain, with a rainfall average of 1000 mm per annum.
- Rainfall frequency, typically once every two days on average.

4.1.3 Creepage

The values for the required creepage shall be as identified in the Project Specific Requirements. Outdoor insulators shall be suitable for site pollution severity (SPS) class e – Very Heavy in accordance with IEC 60815-1 (RUSCD 53.7 mm/kV).

The final minimum creepage distance shall be calculated using the method given in IEC 60815-2 or 60815-3 for HV plant.

4.1.4 Network Parameters

The system design information is as per Table 4 below:

Table 4 Network Parameters

Description	220 kV	400 kV	LV aux
Nominal Voltage	220 kV	400 kV	400 / 230 V ± 10%
Highest Network Voltage	245 kV	420 kV	440 V / 253 V
No. of Phases	3	3	3, 4 wire

Description	220 kV	400 kV	LV aux
Frequency	50 Hz	50 Hz	50 Hz ± 2.5 %
Neutral Point	Directly Earthed at selected points	Directly Earthed at selected points	Directly Earthed
3 Phase Short Circuit Level (rms)	40 kA	50 kA	16 kA[1]
Duration of Short Circuit[2]	1 s	1 s	1 s
Peak Short circuit current (peak)	100 kA	125 kA	N/A

For AIS designs the specified minimum 3 Phase Short Circuit level (rms) applies for both electrical and mechanical forces. To comply with the mechanical aspect of this, the Customer must carry out HV conductor loading calculations as per the latest revision of IEC 60865.

A typical system X/R ratio of 14 shall be considered except in the following circumstances:

- Designated substations, where a higher value has been outlined.
- CT suitability calculations where a minimum X/R value of 25, or as outlined in the project protection specification, shall apply.
- Busbar forces calculations, where a minimum X/R value of 25 shall apply.

The Customer shall consider the capacitive and inductive switching requirements in accordance with the project specific requirements and the relevant functional specification for the switching devices. All HV and EHV circuit breakers shall be single pole devices and with the facility to act in conjunction with Point-of-Wave switching relay.

[1] This is the standard value for design of LV equipment in Transmission substations based on a standard rural supply. A higher value may apply due to supply from ESBN Industrial connection (up to 37 kA).

[2] This value is the maximum, to be used for equipment withstand purposes. Alternative clearance times and network parameters shall be considered for various protection and earthing calculations in accordance with the relevant functional specifications.

Table 5 Insulation Levels

Description	220 kV	400 kV
Rated voltage (U_r) kV (rms)	245	550
Rated power frequency withstand voltage		
(U_d) kV (rms) Phase–earth & phase-phase	460	620
(Ud) kV (rms) Across isolating distance	530	800
Rated lightning impulse withstand voltage		
(U_p) kV (peak) Phase–earth & phase-phase	1050	1550
(U_p) kV (peak) Across isolating distance	1200	1550 (+315)[3]
Rated switching impulse withstand voltage		
(U_s) kV (peak) Phase–earth	N/A	1175
(U_s) kV (peak) Phase–phase	N/A	1760
(U_s) kV (peak) Across isolating distance	N/A	900 (+450)[3]

In the case of 220 kV no switching impulse level is assigned, and the clearances are dictated by the BIL.

LV equipment shall have rated power frequency withstand rating of 2 kV (rms) for 1 minute. This has an equivalent rating of 3 kV across the isolating distance.

4.2 PHYSICAL DESIGN REQUIREMENTS

4.2.1 ACCESS REQUIREMENTS

It shall be possible to gain access to the OCC for maintenance and operation purposes. This shall be unrestricted 24/7 access. EirGrid personnel or delegated representative and Customer shall be able to access the EirGrid Onshore Compensation Compound (OCC) with no interaction with any 3rd party.

Access shall be provided by an access road and bridges (where road crosses ditches and streams or creek), suitable for carrying maintenance vehicles, spare parts/equipment to be replaced and trucks from a public roadway to the substation gate.

[3] Note: The values in parentheses are the peak values of the a.c. voltage applied to the opposite terminal.

Access into the OCC shall be provided for by a double gate which opens inwards. Access within the substation shall be provided by means of a 4.5 m wide road entrance.

Access within the OCC around the equipment and buildings shall be provided for by means of suitable access ways and turning circles for largest necessary maintenance vehicles and trucks and doors on the buildings suitable for allowing access to the equipment housed inside.

The site and access route shall be designed to allow suitable access for required cranes and required construction and maintenance vehicles to all pieces of plant within the compound. Hard-standing areas shall also be provided to support heavy equipment installations.

Surface trough ducts shall be arranged to minimise restriction of vehicular access to the HV plant. The electrical design shall be fully co-ordinated with the civil design to ensure that trafficable and non-trafficable areas of trenching are clearly identified.

Confined spaces give rise to significant risk. Where practicable, designs should be such that the need for work in confined spaces is avoided. Where this cannot be achieved, substation physical design requirements shall be such that the guidelines contained in the latest revision of the HSA (Health and Safety Authority) Code of Practice for confined spaces are incorporated into the substation design where applicable.

Where there is equipment on both sides of a passageway the passageway shall have a minimum width of 1.2 m. Other passageways shall have a minimum width of 1 m.

Doors shall be arranged to open in the direction of any escape route. Equipment panel doors shall be arranged so that they do not impede any emergency escape route.

Detailed requirements and standard drawings for the fences (palisade & boundary), gates and buildings are included in the Functional Specification Package.

4.2.2 Note on Battery Rooms

Particular consideration shall be given to providing suitable maintenance access and working clearances around batteries not less than manufacturer recommendations. A minimum of 1m between parallel racks of batteries shall be provided.

Suitable clearances shall also be provided between batteries (including isolated battery stands) and any nearby earthed metalwork to prevent inadvertent earthing.

4.2.3 Substation Arrangement

To ensure consistency, a standard approach to substation layout based on a defined orientation shall be adopted. This orientation shall be defined by a reference point and forward direction as per sample illustrations. The illustrations are for guidance, information only. For scenarios outside those shown below, or in case of doubt, clarification shall be provided by EirGrid.

Table 6 Substation Orientation Convention

Figure	Scenario	Reference point	Forward direction
drawing OFD-SSS-501	AIS Single voltage substation	An observer standing at the central Control & Protection building[4]	Facing the high voltage switchgear
1, 2	GIS Single voltage substation	An observer standing at the operational side of the Switchgear	Facing the high voltage switchgear[5]

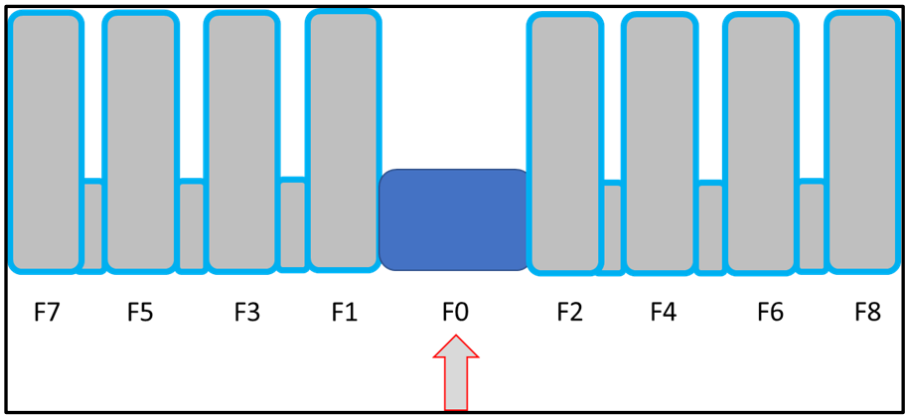

Figure 1 Orientation for bay designation - GIS with integrated LCC

[4] Where there are multiple control rooms or where the location of the control building would cause the forward direction to be perpendicular to the main busbar, the location of an alternative reference point shall be confirmed by EirGrid on a case-by-case basis.

[5] Note: If the GIS LCCs are mounted separately and opposite the switchgear, the forward direction / operational control should be such that an observer standing in the centre of the station facing the LCCs will see LCC bays to the left of the mid sectionaliser given odd numbers and those to the right even numbers. This scenario is illustrated in Figure 2.

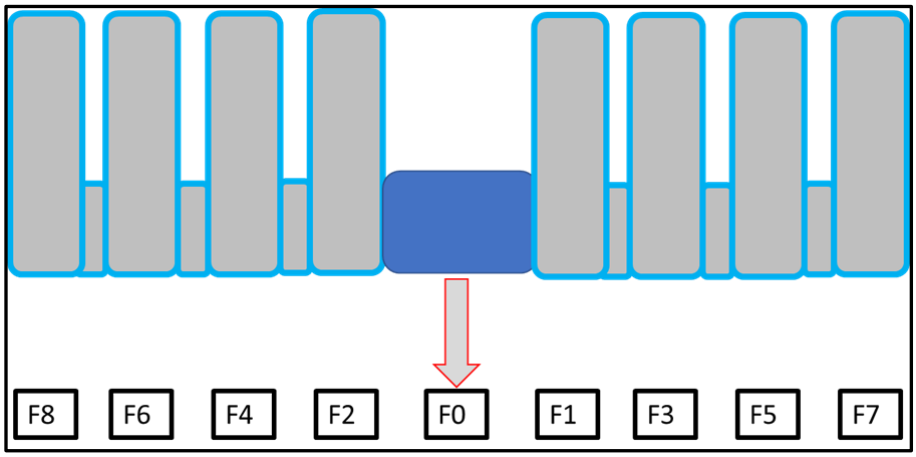

Figure 2 Orientation for bay designation - GIS with standalone LCC separate/opposite switchgear

The central sectionaliser circuit breaker bay F0A shall be defined as the midpoint of the busbar for a future station extension.

The bays to the left of the future central sectionaliser shall be given odd numbers and those to the right even numbers.

Busbar sections to the left of the future central sectionaliser shall be given odd numbers and those to the right even numbers.

Transformers (for STATCOM connection or otherwise) to the left of the central sectionaliser shall be given odd numbers and those to the right even numbers.

In double busbar AIS substations the nearer busbar shall be designated A and the other B (when applicable).

GIS substation busbar arrangements shall be arranged depending on the specific requirements of the switchgear type.

In the case of existing (brownfield) substations, consistency with existing substation orientation and naming convention shall take precedence over this specification unless explicitly agreed with EirGrid.

Phasing within the feeder (including transformer, reactor, filter etc.) bays shall be arranged based on the connected line, cable or plant to avoid unnecessary transposition of conductors.

The Customer shall confirm and verify phase arrangement with relevant site visits and, when applicable with as-built documentation.

4.2.4 Busbar Designation and Phasing

In single or double busbar AIS substations the nearest busbar phase to the reference point shall be R, then S and T. See drawing OFS-SSD-501 for further information.

4.2.5 Clearances

Minimum clearance distances for the rated voltage conditions must be maintained to ensure appropriate insulation co-ordination between different live parts and also between live parts and ground. These clearances must be applied throughout the installation. Smaller clearances are only

accepted where the arrangement concerned has been tested in accordance with the prescribed insulation test.

Adequate safety clearances shall also be taken into account. Safety clearances are the distances in air that must be applied in the design of an installation to allow personnel safe access to install, operate, maintain, repair and demolish equipment in the vicinity of live equipment/conductors.

These must allow for the:

- Effect of swinging conductors due to cross winds (reduced clearance per IEC is acceptable).
- Effect of swinging conductors short circuit (a 50% reduction in clearance during short circuit may be permitted).
- Sagging of stranded conductors due to increased temperature or to ice load.
- Disconnector arms in the open position and/or earth maintenance switch blade in the open position.

Lower clearance values may be accepted on manufactured equipment if the equipment has been subjected to the appropriate insulation type tests. This is subject to formal agreement with EirGrid. Customer should seek formal agreement with EirGrid in a timely manner to suit their schedule.

Clearance between live parts of the same insulation level which may be operated out of synchronism shall be a minimum of 1.2 times the normal phase to phase value .

The mandatory minimum electrical clearances in air are shown in Table 4.

Table 7 Minimum Clearances in Air

Item	Description	Clearance (mm) @ 400 kV	Clearance (mm) @ 220 kV
1	Phase-earth[6] (Basic electrical clearance in air)	4100	2400
2	Phase-phase (Basic electrical clearance in air)	4750	2700
3	Minimum height of bottom of unscreened live bushings above ground[7]	2300	2300

[6] Phase-phase and phase-earth clearances do not apply to manufactured equipment which has been tested to prove compliance with the rated insulation level.

[7] For low level mounted HV AIS equipment where the bottom of insulator <2300 mm above ground, and >1 kV e.g. HV capacitor banks, SVC, STATCOMs, HV reactors etc. Access

Item	Description	Clearance (mm) @ 400 kV	Clearance (mm) @ 220 kV
4	Minimum height of live parts above pedestrian passageway	6400	4700
5	Minimum height of live parts above vehicle Passageways	10500	9000
6	Minimum height of lines above ground (other than the road)	9000	8000
7	Minimum horizontal distance between live parts and compound fence[8]	5600	4500
8	Minimum distance from live parts to screens, walls etc	4200	2500
9	Live part to a wall (>2300 mm height)	4100	2400
10	Live part to a screen (>2300 mm height)	4200	2500
11	Clearance across an open break	5700	3240

The OCC shall be located away from existing overhead electrical Transmission or Distribution lines not terminating within the OCC or ESBN substation compounds. A minimum separation distance (from the compound fence to the nearest phase conductor of the OHL) of twice the height of the tallest point on the OHL infrastructure shall apply. The OHLs approaching the station shall be routed not to sterilise the land reserved for the ultimate development of the station.

Proximity and approach of lines terminating at the substation shall be by agreement with EirGrid, however, sections of lines running parallel to the compound fence shall respect the above separation distances as far as practically possible.

[8] The minimum horizontal distance between live parts and compound fence/wall prescribed above is the minimum clearance required to guard against anyone outside a boundary fence being able to come into contact with live equipment. The space between a boundary fence and live equipment may also be needed for use as a vehicle passageway for construction or maintenance purposes. If this access is to be used without needing an outage of the relevant HV equipment then the clearance may need to be increased and/or appropriate screening measures installed.

gates or panels shall be secured using fixing bolts at minimum of 2 no. fixing points and shall not be secured with a lock.

4.2.6 Mechanical Loading

The most extreme of the below listed conditions shall be used to calculate the loads imposed by conductor on support structures:

Table 8 Mechanical Loading on Conductors

Item	Temperature	Ice Thickness (mm)	Wind speed (m/s)
1	-20	0	0
2	0	40 (stranded) 10 (tubular)	0
3	0	25 (stranded) 6.25 (tubular)	25

A design wind velocity based on the maximum 3 second gust value (as outlined in section 4.1.2) shall be used to calculate the effect of wind load on all structures. Design loads shall not exceed the failure strength of the structure. All designs shall be submitted to EirGrid for review.

4.2.7 Service Continuity Requirements for AIS OCC

The following minimum service continuity requirements shall apply.

- All circuit bay equipment (i.e. circuit breaker, instrument transformers, disconnectors, Earth switches, surge arresters, post insulators etc.) excluding busbar disconnectors & associated connections shall be capable of being maintained, repaired, removed and replaced without the need for busbar or adjacent circuit outages.
- Work on high level busbar equipment (busbar conductor, supports etc.) may necessitate circuit outages where the low-level circuit bay conductor span crosses underneath the associated busbar between busbar disconnectors DA and DB.

4.2.8 Working Clearances

Due consideration shall be given to the clearances required to allow for a safe working area within the OCC compound during maintenance, extension works, fault finding, repairs, decommissioning and other works.

The Customer shall consider in its design the minimum distance required between adjacent bays, bays and busbar and bays and other structure/devices within the OCC compound to control the risk of coming into contact with live electrical equipment during the activities before mentioned.

Equipment layout designs shall mitigate against any unnecessary / avoidable prolonged outages.

The Customer, when defining the minimum clearances, starting from Table 4 dimensions shall also consider the required tools and access associated with installation, operation, maintenance, fault finding, repairs and decommissioning of all installed plants.

The Customer shall provide details of their proposed approach to facilitate the design life of the substation including features permitting the replacement of components. The assumptions or limitations in relation to how these works are expected to be performed shall be clearly indicated.

For GIS layouts, further requirements are outlined in EirGrid functional specification OFS-SSS-413.

Further details on inspection and maintenance requirements can be found in section5.

The designer shall also consider any potential future extension of the substation as outlined in the Connection Agreement. For example, extension from a four bays station to an eight-bay station.

4.2.9 Fire Separation Clearances

The required separation clearances in outdoor installations between a transformer (includes reactors or other items of plant containing a minimum of 1000 litres of flammable liquid) and other transformers or objects shall be in compliance with IEC 61936-1.

If the fire separation clearances are not achievable then fire-resistant separating walls or fire-resistant construction are required.

Fire separation clearance is not required between a transformer and any equipment which is directly associated with that transformer.

The consideration of reduced clearances based on automatically activated fire extinguishing equipment is not permitted.

Clearances between buildings and to property boundaries shall be in accordance with the requirements of the Irish Building Regulations (Technical Guidance Document B - Fire Safety (2006)).

4.2.10 Workshop Facilities

A suitable workshop shall be provided to cater for storage of earthing stirrups and earth parking bars in accordance with the requirements of functional specification OFS-SSS-407 to allow application of portable earthing sets on AIS equipment.

The workshop will also include a work bench and will be sized sufficiently to store all necessary tools and equipment for the lifecycle of the equipment.

Proposals for the storage of these and other tools/accessories (e.g. switchgear tools, battery tools / accessories, etc.) shall be submitted to EirGrid for review.

5 Inspection and Maintenance Requirements

The OCC and associated assets shall be subject to regular local operation, inspection and maintenance intervals in accordance with EirGrid asset management policies.

Refer to EirGrid Operation and Maintenance General Specification for Offshore Windfarm projects, document number **OFS-GEN-009**.

"Customer shall take due account of relevant legislation, regulations and standards to ensure safe operation and maintenance of the contestably built works. During the proofing period prior to handover of the assets, the Customer will be responsible for the O&M and shall base the maintenance activities on industry best practice and suppliers recommendations and as a minimum as per relevant warranty provisions to maximise availability and reliability of the assets."

These activities shall be included in the Customer's Risk Assessment for the installation as a whole to ensure safe operation, inspection and maintenance can be carried out throughout the lifetime of the installation without undue risk to the personnel involved in these activities.

Any additional inspection and maintenance recommendations for the installation shall be identified by the Customer and incorporated into the maintenance requirements for the particular asset to be included in the associated safety file.

The Customer shall develop and issue an inspection and maintenance layout drawing illustrating that all HV equipment can be safely maintained.

6 Health and Safety Requirements

The Customer will be assumed to be the client in the context of the applicable statutes, including Safety, Health and Welfare at Work Act 2005).

The Customer shall comply, at all times, with all statutory duties or provisions imposed upon them by any current Legislation, new Legislation or amendments to Legislation as these may occur during the Project, specifically:

- The installation shall comply with the Safety, Health and Welfare at Work (General Application) Regulations 2007, in particular Part 3: Electricity. In these documents, 'higher voltage' means any voltage exceeding 1000 V a.c. or 1500 V d.c. and its amendment of 2020 S.I. No 2/2020
- Safety, Health and Welfare at Work Act 2005
- Latest Safety, Health and Welfare (Construction) Regulations
- Latest EU ROHS (Restriction of Hazardous Substances)
- Latest WEEE (Waste Electrical and Electronic Equipment) Directives
- REACH Regulation (Regulation (EC) No.1907/2006)
- CLP Regulation (EC) No.1272/2008

In making the required statutory appointments the Customer shall assure itself of the Competence of such appointees.

Where such appointments are internal the Customer shall ensure that sufficient resource, including competent personnel are available and that no conflict of interest arises during the Project.

The Customer shall provide manufacturer's declaration of materials in accordance with IEC 62474. Such material declarations shall include any regulatory exemptions that are applicable to the use of declarable substances and declarable substance groups.

The Customer shall also ensure that all relevant requirements of local and national planning and environmental agencies are built into the design and build as necessary.

The Customer shall submit the equipment manufacturer's declaration of all substances classified as hazardous in the equipment proposed to EirGrid for review. These materials may be either hazardous to health (e.g. carcinogens, toxic, radioactive, dermatitis-inducing) or to the environment (e.g. contribute to global warming, ozone depletion, water pollution).

The Customer shall submit a proposal of how known hazardous substances such as excess or redundant SF6 gas or contaminated oil shall be managed during the lifetime of the asset based on risk assessments to EirGrid for review.

The Customer shall submit the equipment manufacturer's Safety Data Sheets for hazardous substances used in the equipment to EirGrid for review. They shall be classified in accordance with Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. 299 of 2007) and SI 176 (2010) Amendment. This also refers to packing waste that can have associated biological issues such as transmission of disease or introduction of unwanted flora and fauna.

6.1 PLANNING

In all cases, the Customer is responsible for ensuring compliance with relevant planning and legislative requirements.

It is the responsibility of the Customer, to prepare the planning permission application, to apply for planning permission, and to obtain full planning permission.

Prior to planning application, the Customer shall submit to EirGrid all planning permission documentation associated with all plant to be built including all submittals required in connection with protection of the environment.

The Customer shall submit to EirGrid any documents revised or updated as a result of any change and/or update to any of the required documentation submitted as part of the planning application.

6.1.1 NOISE

The Customer shall ensure that the noise arising from site activities and subsequently from the operational of the plant and installed equipment do not exceed the noise level exposure limits for general work areas as specified in the Safety, Health and Welfare at Work (General Application) Regulations 2007.

Noise level exposure from the site shall also comply with any conditions of the planning permission or other local authority or Environmental Protection Agency requirements.

The Customer shall be responsible for all necessary background, construction and operational measurements to demonstrate compliance.

Procedures for the purpose of determining compliance with the neighbourhood noise limits shall be submitted to, and agreed in writing with, the relevant Planning Authority. The Customer shall provide a copy of these agreed procedures if requested by EirGrid.

Silencing equipment (e.g. noise enclosure) shall be provided for equipment where required. Any silencing equipment used shall meet the requirements of this specification and the relevant individual EirGrid functional specifications.

6.1.2 SAFETY LIMITS

The Customer shall bring to the attention of EirGrid, any items of plant or operating scenarios which are likely to cause the lower exposure action value (LEX,8h = 80 dB(A)) to be exceeded. The Customer shall provide a noise risk assessment and clearly outline the proposed mitigation for all such items of plant or operating scenario.

6.1.3 NEIGHBOURHOOD NOISE

Neighbourhood noise shall be in compliance with local planning limits and relevant regulations.

All neighbourhood sound measurements shall be carried out in accordance with ISO 1996: Acoustics – Description, Measurement and Assessment of Environmental noise.

The requirements of S.I. No. 140/2006 - Environmental Noise Regulations 2006 shall be adhered to.

6.2 DESIGN

The Customer shall ensure that all designs are prepared by a competent Designer(s), to meet the requirements of the Functional Specifications issued by EirGrid. In commissioning the preparation of any Design, the Customer shall ensure that any relevant information, which may have a material effect on the Design or Construction phase of the Project is provided in a timely manner to all parties.

The customer shall demonstrate that the design, construction, testing and installation of any asset connecting to the Irish Transmission System is safe by design and residual risks are sufficiently identified to allow for the safe energisation, operation, maintenance and decommissioning of the asset.

Please refer to EirGrid's Safe by Design Methodology (XDS-SDM-00-001) for further details.

6.2.1 PROTECTION AGAINST MOVING EQUIPMENT

Shafts, belts, pulleys and other moving parts shall be provided with guards which shall provide a degree of protection IP2X according to IEC Publication 60529.

6.3 CONSTRUCTION

The Customer shall ensure that Construction work is carried out with due regard for the health, safety and welfare of anyone who may be affected by the works in compliance with all relevant Regulations. This will include, as appropriate, workers, contractors, 3rd parties and members of the Public, and in compliance with statutory requirements.

See OFS-GEN-12- Review & Oversight Procedure for detail on site audits or inspections that may be carried out by EirGrid and/or their representatives.

Refer to OFS-GEN-004 for 3rd party independent certification or verification requirements.

6.3.1 OFFICES, STORES AND WELFARE FACILITIES AND LAYDOWN AREA

The Customer shall provide their own temporary site offices and site stores and shall provide appropriate (shared) site office accommodation and welfare facilities. These facilities shall be made available to EirGrid Representatives if required. Any temporary designs associated with the temporary storage are subject to the SI No 299/2007 Safety, Health and Welfare at Work regulations.

Laydown and amenity areas shall be within the red-line boundary as shown in the planning permission drawings but outside the existing substation fence.

Once the Works are made live, the Customer shall ensure that their laydown areas/welfare facilities are located outside the substation compound fences unless it is specifically allowed in a risk assessment.

The Customer shall provide their own temporary LV power supplies for construction and testing purposes if permanent LV rural supply connection is not available.

6.4 Pre-commissioning and Commissioning

6.4.1 Pre-commissioning and Commissioning Testing

Customer shall be responsible for pre-commissioning and commissioning of the entire plant. To facilitate the inspection and testing, Customer shall develop ITPs (Inspection and Test Plans) and Test procedures for all plant equipment and systems. These shall be submitted to EirGrid for review. EirGrid will witness some of the inspections and tests as it will be agreed through ITP reviews.

Results and records of all such activities shall be in such a form as may be included in the Health & Safety File.

Where any works may involve connections to existing Transmission infrastructure, then such works shall be conducted in accordance with EirGrid functional and operation requirements for connection to the Irish transmission system.

6.4.2 Health and Safety File

The principal document required at Project Completion / Handover is the completed Health & Safety File, required under the Safety, Health & Welfare at Work (Construction) Regulations 2013 [S.I. 291 of 2013].

The Customer shall ensure that a suitable Health & Safety File is prepared by the Project Supervisor Design Process (PSDP) and that the file meets the requirements of Regulation 13, specifically: The project supervisor for the design process shall

a) Prepare a written safety file appropriate to the characteristics of the project, containing relevant safety and health information, including any information provided under Regulation 21, to be considered during any subsequent construction work following completion of the project, and
b) Promptly deliver the safety file to the client on completion of the project.

7 Customer Interface Requirements

7.1 Physical Interface

The Onshore compensation compound shall be built on one site with a fence separating the OCC compound from any adjacent ESBN substation compound. Each compound shall be separately accessible via its own access gates.

A common substation access road may connect to both the ESBN substation, where applicable, and OCC compound roads providing that the requirement for unrestricted 24/7 access to the ESBN compound and to the OCC compound, per section 1.5.1, is not affected.

Where overhead HV conductor crosses the dividing substation compound fence, all clearances as listed in this specification, shall be maintained.

7.2 CIVIL INTERFACE

The drainage work of both ESBN and OCC compounds shall be designed to prevent excess water run-off from one compound into the other. The levels on both sides of the separation fence shall be the same.

Further details of civil requirements are outlined in EirGrid functional specification OFS-SSS-417.

7.3 HIGH VOLTAGE INTERFACE

The High voltage interface (including connection points and ownership boundaries) will be assessed on a case-by-case basis and outlined in the Connection Agreement.

7.4 LOW VOLTAGE INTERFACE

An interface kiosk shall be provided in the palisade fence separating the EirGrid compound (OCC) from an ESBN compound. This kiosk shall be accessible via a lockable door on the EirGrid and on the ESBN sides. The interface signals between EirGrid and the ESBN shall be marshalled in this kiosk via isolating links, to enable signal testing and safe installation.

Please refer to the following documents for further information:

- EirGrid functional specification OFS-GEN-016 for Control, Protection and Metering.
- EirGrid functional specification OFS-SSS-402 for Substation Control and Protection Cabinets and Marshalling Kiosks.
- EirGrid functional specification OFS-SSS-403: Onshore Compensation Compound Auxiliary Power Supplies
- EirGrid Policy Statement 13: Access to TSO Current and Voltage Instrument Transformer Cores.

LV power, control and protection interface requirements, wiring diagrams between EirGrid and Customer and between ESBN and EirGrid will be developed during detailed design stage.

8 General Requirements

8.1 General Technical Requirements

8.1.1 Oil and Gas

Unless otherwise specified, sufficient oil or gas shall be supplied to fill all equipment provided under this specification. The oil and gas shall be of appropriate type, shall meet all Irish and European legislative requirements and shall be suitable in all respects for use in the equipment, when it is operated under the conditions laid down in this specification.

8.1.2 Prevention of Acidity

The design, and all materials and processes used in the construction of the equipment, shall be such as to reduce the risk of development of acidity in the oil or gas to a minimum.

8.1.3 Corona and Radio Interference

All equipment shall be designed so as to minimise corona or electrical discharge and radio interference. Limit values for individual items of plant are outlined in the relevant EirGrid Functional Specification.

8.1.4 Corrosion

Individual functional specifications define surface treatment of metals for particular items of equipment.

The painting of all electrical and control equipment shall be of the highest quality and consider the atmospheric conditions where the equipment will be located. Unless otherwise stated, painting systems used shall be suitable for long duration (> 15 years) in a C5-M environment as per EN ISO 12944.

Appropriate controlled conditions shall be implemented by Customer when carrying out repair or touch-up works to any painted surface on site.

8.1.5 Welding

Where possible, onsite welding of HV equipment and support structures should be avoided.

Where this cannot be achieved, welding of proprietary items, including switchgear enclosures and busbars, shall be carried out in accordance with an approved standard or code of practice. The welding plants and processes used shall be suited to the materials, configurations and purposes of the welded parts.

Only qualified welders, certified for the type of welding required are permitted to undertake the works. The Customer shall exercise strict control over the welding conditions and parameters and shall continuously monitor the standard of welding achieved. Testing, including non-destructive evaluation (NDE), of welds shall be carried out.

The Customer shall also ensure that anti-corrosion measures are applied to ensure that the final assembly meets the requirements of the associated functional specification.

8.1.6 ELECTROMAGNETIC COMPATIBILITY

The equipment shall conform to Standards IEC 60204-1, IEC 61000-6-2 and IEC 61000-6-4. High voltage and electronic equipment supplied shall be designed such that it does not cause mal-operation of any other equipment.

The Customer's design shall eliminate electromagnetic interference from lightning strikes to the building or to equipment installed outside of the building. The Customer shall detail measures taken to eliminate electromagnetic interference to control equipment or to low level control circuits from power cables or from power switching devices.

8.2 TOOLS, ACCESSORIES AND SPARE PARTS

The Customer shall submit details of all tools and accessories recommended for correct operation and maintenance of the substation.

Any special tools required for operation or maintenance of the equipment shall be listed by the Customer in the relevant technical schedule.

The Customer shall confirm with EirGrid the list of required tools, accessories and spare parts based on project-specific parameters.

All recommended spare parts shall be provided with associated drawings and instructions.

Refer to OFS-GEN-009 for more details.

The Customer shall provide secure and lockable storage in each substation for spare parts of equipment, operating handles for outdoor equipment, portable earthing equipment, tools and all other loose equipment.

Proposals for storage shall be submitted to EirGrid for review. These proposals shall include dimensioned drawings of the proposed storage device(s), its location and proposed labelling/identification arrangements for the tools/accessories.

The tools, accessories and spare parts shall be delivered prior to putting the substation into service and shall be listed in the safety file with their location stated.

8.3 TRANSPORT, HANDLING, PRESERVATION, INSTALLATION

All OCC equipment, system and/or tools shall be transported, handled, preserved and installed in accordance with the manufacturer's instructions and recommendations. These instructions shall be clear and shall be specific to the equipment being supplied. They shall cover all aspects of transport, handling, storage, preservation, installation up to and including equipment and/or system being put into service.

8.4 SERVICE EXPERIENCE

The Customer shall supply details of the proposed location of manufacture of all plant, indicating the number of the particular plant type being offered that has been manufactured at that particular location.

The Customer shall also include a reference list of locations and clients to whom the specific plant type being offered has already been supplied.

8.5 Signs, Labels and Rating Plates

The EirGrid standard nomenclature shall apply as outlined in the project specific Single Line Diagram.

Labels and nameplates shall be provided to clearly identify the function and circuit designation and phase of each item of HV and LV equipment. Labels size, colour and material shall be in accordance with relevant regulations. For more details please refer to the EirGrid standard label design OFD-SSS-511.

All switchgear bays and all cabinets shall be labelled front and back and at each operating position. All withdrawable equipment including detachable doors/panels shall be labelled both on the withdrawable item and on the fixed part with which it mates.

All rating plates, nameplates, labels and wiring plates shall be of non-corrosive material. Where etched labels are proposed, clear Perspex covers shall be provided to prevent dust accumulation obscuring inscription text. Inscriptions shall be clearly legible from the operating distance and shall be in English throughout.

In general, all labels shall be screw fixed. Labels shall not be fitted to removable items, e.g. trunking covers.

8.6 Substation Signs and Notices

The substation shall be fitted out with notices and signs as required by the latest revision of the Safety, Health and Welfare at Work (General Application) Regulations.

In general, all signs and notices shall be bolted, or screw fixed. Cable ties are not acceptable.

8.7 Rating Plates

Each item of equipment shall be provided with manufacturer fitted rating plate listing the type and serial number together with its ratings and service conditions and any other information required by the relevant functional specification and IEC recommendations.

The rating plates installed on plant shall be legible by personnel viewing plant at ground level.

8.8 Nameplates

Name plates shall be provided and fitted throughout the substation to identify the equipment, circuit/bay name, and phase designation of HV and LV equipment.

Circuit titles shall be as shown on the substation single line diagrams.

All cabinets and mechanism boxes shall be labelled front and back. This label shall include the highest voltage present in the cabinet. All withdrawable and detachable items and equipment shall be labelled both on the withdrawable / detachable part as well as the fixed part to which it attaches or mates.

A list of proposed substation labels shall be submitted to EirGrid for review. The location of the labels shall be indicated on the substation layout design drawings submitted to EirGrid for review.

Standard name plates for labels, signs are listed in the latest revision of the EirGrid standard drawing XDN-LAB-STND-001.

8.9 DELIVERY

The Customer shall ensure that a delivery monitor (impact / shock recorder) is used for equipment susceptible to internal damage from mechanical shock and that these monitors are mounted in locations such that they are visible without opening the packaging. The Customer shall provide assurance to EirGrid, that the equipment has not experienced excessive shocks during transportation to its installed position.

The Customer shall be responsible for the off-loading of all material on site and storage of material in a secure area, including free-issue material. Off-loading of material shall be planned and sequenced to suit the size of the site. Security will be required if material cannot be housed indoors.

The Customer shall inspect all material deliveries for compliance with the relevant designs and functional specifications in advance of inspection, including free-issue material. This inspection will also include inspection for defects within 1 day of delivery and report any findings to the EirGrid.

Transportation, storage of equipment shall follow manufacturer's recommendations.

8.10 TRAINING

The Customer shall submit a training plan which shall describe in detail how the Customer proposes to train EirGrid staff for operation of future EirGrid assets.

Training requirements are detailed further in OFS-GEN-009 - Operation and Maintenance General Specification.