

110 / 220 / 400 kV Air Insulated Circuit Breakers Functional Specification

XDS-GFS-36-001-R1

July 2026



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Revision History						
Revision	Date	Description	Originator	Reviewer	Checker	Approver
R0	March 29th 2021	First Issue - Combination of previous 110kV, 220kV and 400kV specs	Niall McMahon	-	-	
R1	July 23 rd 2026	Revision due to new EU regulation 2024/573 on Fluorinated Gases General update see table below for details	Moses Igbinsosa	Niall McMahon ESB Due Diligence	Marty Hassan	Neil Cowap

A summary of the main changes in this specification are listed below, this may not a definitive list

Section	Theme	Why it matters
1.1	110 kV SF6-free requirement	Default expectation for SF6-free 110 kV breakers unless approved by EirGrid. Clarification on "Putting into operation"
1.1 / 16	F-gas regulation and compliance schedules	Revision due to new EU regulation 2024/573 on Fluorinated Gases New regulatory obligations, handover declarations and evidence retention
4.1	Service experience	Alternative AIS and MTBF evidence requirements significantly expanded.
7.1	Short-circuit ratings	Typical short-circuit/peak values updated; project protection spec/X/R remains critical.
7.12	Corrosion protection	Mechanism boxes and external devices strengthened for C5-VH/CX and Irish saline environment.
7.9	Gas system rewrite	Technology-neutral gas system with alternative gas testing, labelling, handling, F-gas portal and reporting.
7.9.1	Gas monitoring	A 4-20mA analogue pressure output to allow trending pressure to be monitored External mounted gauges to be IP65 and CX rated. Or provided with a protective housing
10.3.5	Long-term storage	Dedicated storage and preservation requirements added.

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1 Introduction

This functional specification, together with the accompanying technical schedules, defines requirements for 110 kV, 220 kV and 400 kV Air Insulated circuit breakers for use on and connection to the transmission system¹.

In addition to the requirements of this specification, the equipment shall comply with:

EirGrid Functional Specification XDS-GFS-00-001 “110/220/400 kV Substation General Requirements”, and other applicable EirGrid requirements including but not limited to those listed in section 1.1.

Project specific requirements including the project functional specification, project protection specification and single line diagram.

In case of conflict with international or national standards, EirGrid specifications shall take precedence.

For the purposes of this specification the “Customer” is the point of contact to EirGrid for the supply of the equipment, it could be an OEM, ESBN, the contestable project owner or the contestable project design representative.

1.1 Updates due to EU Directive 2024/573

Fluorinated gases (‘F-gases’) are man-made greenhouse gases used in various products and appliances (e.g. fridges, air-conditioning units). Their emissions contribute to climate warming. EU Regulations enforces rules to reduce F-gas emissions significantly. Fluorinated greenhouse gases (F-gases) are used in numerous applications and include three types of gases: HFCs, PFCs and SF6. (Fluorinated Gases: Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF6) are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes).

For electrical switchgear, fluorinated greenhouse gases are used as an insulating or breaking medium.

The F-gas legislation includes measures to manage and control use of F-gases such as recording and reporting use, volumes imported/exported, containment during handling and recovery/recycling at end of life, training and certification, labelling, leak checks and leakage detection systems, and bans on some uses.

¹ All references to Technical Schedules within this document refer to XDS-GTS-36-001 “Technical Schedules for AIS Circuit breakers”. The Customer shall submit a completed set of Technical Schedules for Eirgrid approval.

The F-gas Regulation - Article 13 (Item 9): F-gas shall be restricted in the use of switchgear as follows :



Figure 1 EU F-Gas Regulation (2024/573)

The AIS CB offered by the customer shall be in accordance with Article 13 of EU Directive 2024/573. In accordance with this article of the regulation, EirGrid shall apply the cascading principle Figure 1 provides a graphical representation of the cascading principles.

The AIS CB offered by the customer shall be made applicable for the specific site of installation

Table 1 Insulating Gas requirements per voltage Level

Switchgear Voltage	Requirement
110kV Switchgear	Unless approved by EirGrid, the insulating medium used shall be SF6 -free
220 and 400 kV Switchgear	In this revision of the specification, EirGrid does not stipulate the use of SF6 -free switchgear at 220 kV and above.

Due to the EU legislation the requirements of Table 1 are retrospective. It would be expected that all 110 kV circuit breakers ordered from the date of this specification are SF6 free.

EirGrid cannot derogate against Regulation (EU) 2024/573,

1.1.1 Putting Into Operation

With regards to switchgear containing SF6 which is to be installed before the ban date as specified in the Regulation (EU) 2024/573, please note the following:

The term 'Putting into Operation' is central to a consideration of the relevant dates pursuant to Article 13.9 of the Regulation (EU) 2024/573.

EirGrid's interpretation of 'Putting into operation' is taken from the EU Climate action department which states that "Putting into operation is the moment of handover of the equipment to the operator for

use/exploitation, after completion of any necessary tests of functionality, performance or other, and any required inspections. Energization or connection to the grid is not a requirement. “²

Based on the above, for present purposes “Putting into Operation” of switchgear shall include the following:

- Installed at its intended final location
- Visual inspection
- (On site) Electrical testing
- Operational testing

The customer shall furnish to EirGrid a handover document verifying the above within three weeks of “Putting into operation” and before the relevant ban date. See Schedule A - Handover Document

1.1.2 Temporary Point-on-Wave (POW) switching Derogation for Circuit breakers

At the time of publishing this document, we are aware of only one (1) OEM offering a 110 kV non SF₆ gas solution capable of performing Point on Wave (POW) switching. On this basis, customers can consider applying for a derogation to permit the installation of SF₆ gas equipment if POW switching is a requirement.

This is not a derogation to comply with EU Directive 2024/573, but a derogation for the requirement for non SF₆ breakers from the effective date of this specification as per table 1.

² FAQ on switchgear as regulated by the F-gas Regulation (EU) 2024/573 Version 3 2024/573 [cfe52d31-9203-435d-b043-62f74900fd96_en](#).

2 Abbreviations

Abbreviation	Meaning
AC	Alternating current
AISI	American Iron and Steel Institute
ASTM	American Society for Testing and Materials
CLP	Classifying, labelling, packaging regulation
CD-ROM	Optical compact disc that contains data, a type of read-only memory
CPR	EU Construction products regulation
DC	Direct current
DIN	German institute for standardisation (Deutsches Institut für Normung)
EN	European standard
EMC	Electromagnetic compatibility
HV	High voltage
IEC	International Electrotechnical Commission
IPP	Independent Power Producer
I.S.	Irish Standard
ISO	International Organization for Standardization
pC	Picocoulomb
PCB	Polychlorinated biphenyl
ppm	Parts per million
PVC	Polyvinyl chloride
QC	Quality control
rms	Root-mean-square
RUSCD	Reference unified specific creepage distance
REACH	Registration, Evaluation, Authorization and Restriction of chemicals
ROHS	Restriction Of Hazardous Substances directive
SI	Statutory instrument
SLD	Single Line Diagram
VDE	Association of German electrical engineers (Verband Deutscher Elektrotechniker)
WEEE	Waste electrical and electronic equipment (WEEE Directive)

2.1 Network Parameters

The equipment shall be suitable for installation on the Transmission system.

The technical parameters are further detailed in the 110/220/400kV Circuit Breaker Technical Schedules XDS-HTS-01-001 / XDS-FTS-01-001 / XDS-ETS-01-001.

The Customer shall submit fully completed and signed set of technical schedules for EirGrid review in advance of equipment order.

2.2 AC short-circuit breaking current

The design parameters are specified in EirGrid's 110/ General Requirements functional specification XDS-GFS-00-001 and the project specific Single Line Diagram and protection specification.

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, EU regulations and EU directives. These include the following or latest versions/ amendments at time of issue of this specification as appropriate:

Table 2 Legislation

Reference	Name
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
S.I. No. 30/2019	Radiological Protection Act 1991 (Ionising Radiation) Regulations 2019
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)
EU Reg 2024/573	REGULATION (EU) 2024/573 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 7 February 2024 on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014
Implementing Regulation (EU) 2024/2174	Commission Implementing Regulation (EU) 2024/2174 of 2 September 2024 laying down rules for the application of Regulation (EU) 2024/573 of the European Parliament and of the Council as regards the format of the labels for certain products and equipment containing fluorinated greenhouse gases and repealing Commission Implementing Regulation (EU) 2015/2068
Implementing Regulation (EU) 2025/1907	Commission Implementing Regulation (EU) 2025/1907 of 19 September 2025 establishing, pursuant to Regulation (EU) 2024/573 of the European Parliament and of the Council, the format for notification of the training and certification programmes of the Member States and repealing Commission Implementing Regulation (EU) 2015/2065
Implementing Regulation (EU) 2025/627	COMMISSION IMPLEMENTING REGULATION (EU) 2025/627 of 28 March 2025 establishing, pursuant to Regulation (EU) 2024/573 of the European Parliament and of the Council, minimum requirements for certificates of natural persons and the conditions for the mutual recognition of such certificates, as regards the installation, maintenance or servicing, repair or decommissioning of stationary electrical switchgear containing fluorinated greenhouse gases and recovery of fluorinated greenhouse gases from stationary electrical switchgear and repealing Commission Implementing Regulation (EU) 2015/2066
Directive 2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS)
Directive 2012/19/EU	Waste electrical and electronic equipment (WEEE)
Directive 2014/30/EU	Harmonisation of the laws of the Member States relating to electromagnetic compatibility
ECE/TRANS/275	Vol. I and II ("ADR 2019") European Agreement Concerning the International Carriage of Dangerous Goods by Road

Unless the Customer can show to Eirgrid's satisfaction that CE marking is not required, equipment shall carry the CE Mark in accordance with Directive 768/2008/EC and the EU Construction Products Regulation (No. 305/2011 - CPR) and adequate documentation to demonstrate full compliance should be retained.

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

3.2 EirGrid Requirements

Table 3 EirGrid Standards

Reference	Name
XDS-GFS-00-001	110/220/400 kV Substation General Requirements
XDS-GFS-06-001	110/220/400kV Control, Protection and Metering
XDS-GFS-07-001	Station Control and Protection Cabinets and Marshalling Kiosks
XDS-GFS-08-001	Station Auxiliary Power Supplies
XDS-GFS-10-001	Station 220V/48V/24V DC and 230/400V AC Distribution Boards
XDS-GFS-12-001	Earthing and Lightning Protection
XDS-GFS-17-001	Galvanised Fabricated Steelwork
XDS-GFS-18-001	Specification for the hot-dip galvanising of iron and steel other than wire.
XDS-GFS-20-001	Pre-commissioning Requirements
XDS-SDM-00-001	Safe by Design Methodology
XDS-GGD-00-001	Derogation Process Guidance Document
XDS-DGS-00-004	Earthing Practice

Table EirGrid Drawings

Reference	Name
XDN-LAB-STND-001	Station Signage
XDS-DGA-00-001	Earthing Practice

Table 4 Other EirGrid Documents

Reference	Name
XDS-GGD-00-001	Derogation Process
XDS-SDM-00-001	Safe by Design

3.3 National, International and Other Applicable Standards

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.

Where a particular subject is not covered by one of the above international standards then a recognised national standard shall apply.

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, International or British Standard shall be applied. The latest edition and amendments shall apply in all cases. Where no IEC/EN standards have been issued to cover a particular subject a recognised international standard shall be applied.

Reference	Standard Name
I.S. 10101	National rules for Electrical Installations
IEC 62474	Material Declaration for Products of and for the electrotechnical industry
IEC TS 60815	Guide for the selection of insulators in respect of polluted conditions
IEC 60529	Degrees of Protection provided by Enclosures (IP Code)

Reference	Standard Name
IEC 62271-1	High voltage switchgear and controlgear – Part 1 Common specifications for alternating current switchgear and controlgear
IEC 62271-100	High voltage switchgear and controlgear - Part 100: Alternating-current circuit-breaker
IEC 62271-110	High voltage switchgear and controlgear – Part 110: Inductive load switching
IEC 62271-301	High voltage switchgear and controlgear - Part 301: Dimensional standardisation of HV terminals
IEC 62271-306	High voltage switchgear and controlgear - Part 306: Guide to IEC 62271-100, IEC 62271-1 and other IEC standards related to alternating current circuit-breakers
IEC 60270	High-voltage test techniques - Partial discharge measurements
IEC 60137	Insulated bushings for alternating voltages above 1000 V
IEC 60034	Rotating electrical machines - ALL PARTS
IEC 60376	Specification of technical grade sulphur hexafluoride (SF6) and complementary gases to be used in its mixtures for use in electrical equipment
IEC 60480	Specifications for the re-use of sulphur hexafluoride (SF6) and its mixtures in electrical equipment
IEC 63359	Fluids for electrotechnical application: Specifications for the re-use of mixtures of gases alternative to SF6
IEC 63360	Fluids for electrotechnical application – Specification of gases alternative to SF6 to be used in electrical power equipment
IEC 60507	Artificial pollution tests on high voltage insulators to be used on AC systems
IEC 60865-1	Short-circuit currents – Calculation of effects - Part 1: Definitions and calculation methods
IEC 61462	Composite hollow insulators
IEC 62155	Hollow pressurised and unpressurised ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1000V
IEC 61439-1	Low-voltage switchgear and control-gear assemblies - Part 1: General rules (IEC 61439-1:(Ed.3.0) 2020; PRV - Prerelease version)
IEC 61439-2	Low-voltage switchgear and control-gear assemblies - Part 2: Power switchgear and control-gear assemblies
ISO 12944	Corrosion Protection of Steel Structures by protective paint systems
EN 50089	Cast resin partitions for metal enclosed gas-filled high-voltage switchgear and controlgear
ISO 2409	Paints and varnishes. Cross-cut test
ISO 2813	Paints and varnishes. Determination of gloss value at 20 °, 60 ° and 85 °
ISO 4892-3	Plastics. Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps
ISO 9227	Corrosion tests in artificial atmospheres. Salt spray tests
ISO 5817	Welding - Fusion-welded joints in steel, nickel, titanium and their alloys
ASTM D2247	Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
ASTM D2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3359	Standard Test Methods for Rating Adhesion by Tape Test
ASTM D3363	Standard Test Method for Film Hardness by Pencil Test (standard + redline)
ASTM D4752	Standard Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub (standard + redline)

3.4 Other References

Brochure Number	Title
CIGRE Brochure 234	SF ₆ Recycling Guide. Re-use of SF ₆ gas in electrical power equipment and final disposal (Revision 2003) - 2003
CIGRE Brochure 276	Guide for the Preparation of Customised “Practical SF ₆ Handling Instructions” - 2005
CIGRE Brochure 430	SF ₆ Tightness Guide - 2010
CIGRE Brochure 567	SF ₆ Analysis for AIS, GIS and MTS - 2014
CIGRE Brochure 730	DRY AIR, N ₂ , CO ₂ AND N ₂ /SF ₆ MIXTURES FOR GAS-INSULATED SYSTEMS - 2018
CIGRE Brochure 802	Application of non-SF ₆ gases or gas-mixtures in medium and high voltage gas-insulated switchgear - 2020
CIGRE Brochure 871	Current Interruption in SF ₆ -free Switchgear - 2022

4 Service Conditions

4.1 Service Experience

Satisfactory service experience defined whereby there has been no major failures requiring an unscheduled outage of the air-insulated switchgear to occur throughout the defined five-year period. The customer shall comply with each of (1), (2a), (2b), (4), (5), (6), (7) and (8) below.

The Contractor shall have:

- 1) Ongoing experience for at least the past 10 years from the date of this tender enquiry in the production air-insulated switchgear (SF6 and/or SF6-free) in the relevant voltage range (110 kV) or higher as specified.
- 2) Satisfactory² Service experience of the air-insulated switchgear, in the voltage range from 110 kV and higher:
 - a) across a minimum of three Utilities in either EU, UK, USA, Canada, Norway, Switzerland, Japan, Australia, New Zealand or South Korea, with proof of service experience in writing from these Utilities and acceptance of these by the Employer.

AND

- b) with a minimum of 100 circuit breaker units SF6-AIS in total in these Utilities EACH of which shall have a minimum of five years satisfactory² service experience at date of this enquiry issue. Relevant service experience in Irish and other Utility experience not referenced in tender submission may be used by the Employer in the evaluation of this criterion at their discretion.

AND

- c) with a minimum of 25 circuit breaker units alternative AIS (i.e. SF6 free) in total in these Utilities EACH of which shall have a minimum of three years satisfactory² service experience at date of this enquiry issue. The relevant service experience in alternative AIS (i.e. SF6 free) shall specifically include the insulating medium and interrupter device being offered by the Contractor. Experience with other insulating mediums or interrupter devices not being offered shall not be considered. Relevant service experience in Irish and other Utility experience not referenced in tender submission may be used by the Employer in the evaluation of this criterion at their discretion.

AND

- d) Minimum of 250 Circuit Breaker-years AIS in service experience in total.
- 3) The AIS on offer in compliance with this specification shall be manufactured in the same plants which produced the AIS cited as meeting the service experience requirements outlined in 2(a), 2(b), 2(c) and 2(d).
- 4) At least 5 years production in the particular manufacturing plant proposed is required, although if the particular plant proposed is a relocated existing plant using substantially the same workforce the combined time of both plants would be considered.
- 5) Acceptance by the Employer of any factory listed during the Tendering Process shall be subject to a detailed Factory Quality and Production Audit by the Employer and /or its representative.
- 6) Contractors shall provide evidence of compliance with ALL relevant sections of this specification, and these would be considered by the Employer subject to proof of satisfactory² service experience in writing from a minimum of three reference Utilities and acceptance of these by the Employer.

- 7) The AIS on offer shall comply with service experience requirements of Specification 18272 'Corrosion Protection of HV Equipment and Materials' and clause 2.23 of this specification whereby the Contractor shall demonstrate relevant satisfactory service experience of AIS, with the corrosion protection system on offer meeting this specification, in environments with high condensation, pollution and salinity.
- 8) In order to confirm satisfactory service experience, the Contractor shall submit 'reliability/ Mean Time Between Failures (MTBF) statistics' for their AIS over the past 10 years from the date of this tender enquiry per CIGRE Technical Brochure 510, titled "International Enquiry on Reliability of High Voltage Equipment - Part 2: Reliability of High Voltage SF₆ Circuit Breakers.

The Contractor shall also provide details of the exact nature of the major failures.

5 General Requirements

5.1 Health and Safety

The Customer shall ensure that a satisfactory safety risk assessment in accordance with the EirGrid Safe by Design methodology has been completed.

Risk assessments shall include, but not be limited to consideration of alternative gases, leaks, environmental impact arcing events and decomposition products.

If vacuum interrupters are proposed as an alternative to gas interrupters, the Customer shall provide datasheets and both type test certification and factory test results under rated voltage and rated power-frequency withstand voltage (for 1 minute according to IEC 62271-1) to show that the design meets S.I. No. 30/2019. Only complete test documents will be accepted, not cover pages or similar excerpts. The Customer shall include the possibility of ionising radiation in the design risk assessment which includes tested radiation at distances of 0.1 metre from the vacuum interrupter and any calculated distances required to reach a safe radiation level of less than 1µSv/hour..

General Health and Safety requirements are outlined in XDS-GFS-00-001.

Refer to EirGrid Specification XDS-GFS-20-001 "Pre-commissioning Requirements" for standard precautions relating to filling and first operation of circuit breakers.

5.2 Warranty

Warranty requirements shall be as outlined in 110/220/400 kV Station General Requirements (XDS-GFS-00-001).

5.3 Quality Assurance

Quality Assurance requirements shall be as outlined in EirGrid 110 / General Requirement's functional specification XDS-GFS-00-001.

The Customer shall ensure the circuit breaker is manufactured in accordance with the requirements of this specification.

The customer and equipment manufacturers shall have ISO 9001 registration and maintain a documented quality control and quality assurance system which shall be in accordance with ISO 9001 or an equivalent international standard"

Details of particular quality requirements must also be observed, such as:

- Maintenance of a risk register.
- Recording of non-conformances and follow-up corrective action.
- Evidence of continuous improvement and reviewing of targets and objectives.

- Procedures and work instructions to facilitate quality production.
- Statistical records of Quality Control Tests:

Sample copies of completed statistical records on tests and quality control checks within the factory should be provided, in order to provide confirmation of Quality Control Procedures.

Details of the Inspection tests and Procedures for incoming Raw material should be provided. Where the Supplier relies on Quality Control testing being performed by the Supplier, details shall be provided of the tests carried out by the Supplier and the confirmatory control tests by the Customer. Copies of the actual record sheets being used are required. Auditing:

In the event of quality problems which are likely to cause an impact on EirGrid equipment being supplied, the Supplier must inform EirGrid immediately. In the case of faulty equipment being returned by EirGrid, the Supplier must provide a preliminary report within two weeks of receipt of the goods, and a final comprehensive report within a further 4 weeks.

The Customer also undertakes that in the event of any contract award, the Customer will notify EirGrid immediately of any quality issues or defects which may subsequently come to light either with this particular equipment or with similar equipment with other customers. EirGrid reserves the right to conduct an audit to ensure compliance.

- Changes in Product details:

As per the initial submission documentation, the supplier undertakes that the product(s) will be manufactured as specified and agreed and that there will be no change to the product or manufacturing process during the life of the contract without prior written approval from EirGrid. In addition, the supplier undertakes to notify EirGrid in advance of any proposed changes to the installation/maintenance procedures of the product(s) on this contract.

Any deviations to the Functional Specifications shall be outlined in the TECHNICAL SCHEDULES for EirGrid review prior to equipment ordering.

Where deviations are proposed in the design the Customer shall submit a formal Derogation Request outlining an explanation of why the non-compliance is expected and any additional information to support the request for EirGrid to consider. Further information is outlined in EirGrid's Derogation Process XDS-GGD-00-001.

5.4 Training

The Customer shall provide training to ESBN and EirGrid staff as specified in [110/220/400 kV Station General Requirements](#) (XDS-GFS-00-001).

The training shall be held on the substation site and shall consist of two separate sessions to be held on two consecutive days each attended by the necessary staff.

The training on the equipment is required prior to handover at a time to be mutually agreed and is generally an item for discussion at the Operational Instruction kick off meeting.

Special training shall be provided for the operation and maintenance of Circuit Breaker using gases other than SF6. This shall include health and safety, recommended practices and precautions, gas handling operations, quality limits and associated treatments, recommended operating pressures, end of life recovery and recycling, etc.

Details shall be given of the degree of gas deterioration, which can be tolerated before treatment, or replacement of the gas is necessary for both a leak (affecting percentage insulation and moisture) and for normal switching and internal arcing event (affecting percentage insulation, moisture and by-products). Details of necessary treatment shall be given with supporting material.

Details shall be provided to cater for end of life and to support a circular economy, outlining the limit where such gases may be treated for re-use or require disposal, or are deemed safe to be released into the atmosphere - supported by laboratory or on site tests to demonstrate the gas quality achievable pre and

post treatment for re-use as per IEC 60480 (re-use of SF₆) / IEC 63359 (re-use of non-SF₆ gases), supporting documents outlining the safe re-use process using specialist reclamation facilities and environmentally responsible methods of disposal or limits deemed safe for release of gas to the environment.

6 Type and Duty

Breakers shall be live tank type for use as part of an air insulated switchgear arrangement.

Unless otherwise indicated breakers shall be suitable for outdoor use. With a C5-VH classification as per ISO 12944. CX classification can be considered, provided sufficient support documentation and testing is provided.

The equipment shall be designed to last a minimum of 20 years. The interrupting medium shall be gas and all circuit breakers shall be supplied complete with the first filling of gas.

If vacuum interrupters are offered as an alternative, the Customer shall provide datasheets and test certification to show that the design meets S.I. No. 30/2019, and shall include the possibility of ionising radiation in the design risk assessment. If there are technologies available that can improve electric field distribution across the CB chambers without grading capacitors, these should be selected.

6.1 110 kV Breakers

Circuit breakers shall be supplied as a triple pole unit or three independently operated poles.

Circuit breakers switching overhead lines shall be capable of auto reclose. Refer to section 8.2 for the required operating sequence.

Independently operated poles are required for Point On Wave (POW) switching of shunt reactors, series reactors, shunt capacitors, harmonic filters and for some transformers.⁵

Circuit breakers which switch 110 kV capacitor banks may be manually switched twice per day (close and open), in addition to automatic switching by protective devices.

EirGrid may or may not require that the control relay for soft closing be included in the scope of supply.

Refer to the SLD and project protection specification for project specific requirements.

6.2 220 kV and 400 kV Breakers

Independently operated poles are required by default. Triple pole circuit breakers may however be accepted by agreement in certain locations. Although single pole operation with POW is typically required.

Circuit breakers switching overhead lines shall be capable of auto reclose. Refer to section 8.2 for the required operating sequence.

Circuit breakers which switch 220 kV capacitor banks may be manually switched twice per day (close and open), in addition to automatic switching by protective devices.

EirGrid may or may not require that the control relay for soft closing be included in the scope of supply. Refer to the SLD and project protection specification for project specific requirements.

6.3 Circuit breaker Technologies

If vacuum interrupters are proposed, then test documentation shall be provided detailing the radiation levels in microsievert per hour at a distance of 0.1 Metres at rated voltage.

Datasheets to be supplied for all insulation gases to be used in circuit breakers.

⁵ For new 110 kV Customer connection transformers POW switching is typically required above 70 MVA. This may vary however depending on the strength of the network, and should be confirmed on a project by project basis.

7 Design and Construction

7.1 Ratings

All circuit breakers shall be in accordance with IEC 62271-1, IEC 62271-100 and associated specifications. Some ratings are project specific. The appropriate rating should be determined from the project single line diagram and/or protection specification as appropriate.

Table 5 Main Circuit Breaker Ratings

Rated frequency (f_r)		50 Hz		
Nominal System Voltage		110 kV	220 kV	400 kV
Minimum Rated voltage (U_r)		123 kV	245 kV	420 kV
Transient Recovery Voltage ⁶		211 kV	420 kV	943 kV
Rated insulation level		See Technical Schedule and XDS-GFS-00-001		
Rated continuous current (I_r):	Typical Values	1250 A, 2500 A, 3150 A	2500 A, 3150 A	3150 A, 4000 A
	See SLD and protection spec for project specific requirements			
Rated short-time withstand current (I_k) / rated peak withstand current (I_p) ⁷	Typical Values	40 kA/ 100kA	50 kA/ 120 kA	50 kA/ 135 kA
	See SLD and protection spec for project specific requirements			
Rated duration of short-circuit (t_k)		1 s		
Insulation level of secondary circuits (50 Hz, 1 min)		2 kV		

Refer to the X/R value required in the protection specification

7.2 Operating Sequence and Times

Table 6 Rated Operating Sequence and Times

Rated operating sequence	O - 0.3 s - CO - 3min - CO
Maximum closing time	100 ms
Maximum dead time	300 ms

7.3 Transient Recovery Voltage

Transient Recovery Voltage (TRV) shall be in accordance with IEC 62271-100 except for a first-pole-to-clear factor which is required to be 1.5 for all test duties.

⁶ See section 7.3

⁷ The Typical values of Rated Short-time withstand (I_k) exceed the Network parameters. This is because a high peak withstand current (I_p) is required

Parameters in IEC 62271-100, which specify parameters for a first-pole-to-clear factor of 1.3, shall be adjusted to give appropriate figures for the first-pole-to-clear factor of 1.5.

Note: The Customer shall confirm the peak prospective TRV for the installation concerned by performing detailed switching studies in order to determine the suitability of the circuit breaker proposed.

7.4 Capacitive switching

Capacitive switching currents may compromise part or all of the operating duty of a circuit breaker. When guaranteeing compliance in the Technical Schedules the rating of the circuit breaker for capacitive current switching shall include:

- rated line-charging breaking current
- rated cable-charging breaking current
- rated single capacitor bank breaking current (110 kV and 220 kV breakers only)
- rated back-to-back capacitor bank breaking current (110 kV and 220 kV breakers only)
- rated single capacitor bank inrush making current (110 kV and 220 kV breakers only)
- rated back-to back capacitor bank inrush making current (110 kV and 220 kV breakers only)

Rated capacitive switching currents shall meet the requirements of Table 9 of IEC 62271-100⁹

Note that 220 kV breakers may be required to exceed the requirements of Table 9 as 220 kV capacitor banks may be sized up to 250 MVar.

Refer to the SLD or project specific documentation for confirmation of capacitor MVar to be switched.

Circuit breakers which switch capacitor banks shall be independent pole operated with soft closing implemented by means of a control switching relay, and may be manually switched twice per day (close and open), in addition to automatic switching by protective devices.

When guaranteeing compliance in the Technical Schedules, the associated maximum switching overvoltage shall be stated. The circuit breakers shall be class C2 very low probability of restrike when breaking the full range of capacitive switching currents up to and including the rated values.

7.5 Inductive Switching

The Customer shall state in the Technical Schedules the associated guaranteed maximum switching over-voltages at the minimum value and when breaking currents in the range assigned by the manufacturer.

The circuit breaker shall be required to switch shunt reactors and the rated current shall be taken as 126 A for 110 kV breakers, 306 A for 220 kV breakers and 173 A to 289 A for 400 kV breakers as specified in IEC 62271-306. The Tenderer shall also state in the technical schedules the guaranteed maximum switching overvoltages when breaking currents in the stated range.

The Supplier shall calculate the amplitude of over-voltages generated by switching inrush currents associated with transformers of the ratings illustrated on the single line or equipment diagrams. The transformer data to be used in the calculations may be assumed to be typical of transformers of similar ratings, listed in reports produced by CIGRE SC.13. The purpose of this exercise is to advise on the necessity or otherwise of fitting surge arresters on cable/transformer connections.

The Customer shall provide type test documentation to demonstrate that circuit breakers have been type tested for inductive load switching in accordance with IEC 62271-110.

⁹ The highest system voltage shall be used as the rated voltage in Table 9.

The details of any device incorporated in the circuit breaker to limit or control the rate of rise of recovery voltage across the circuit breaker contacts or to divide the voltage across multiple series breaking contacts shall be given.

7.6 Radio Interference Voltage (RIV) Test

The radio interference level at $1.1 \cdot U_r / \sqrt{3}$, when measured in accordance with IEC 62271-1, shall not exceed 2500 μV .

7.7 Mechanical Terminal Load

The circuit breakers shall be capable of withstanding the specified static loads which include for the effects of wind and ice and shall be able to perform their switching duties 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) not exceeding 1.4 times the static withstand load.

Typical requirements for static withstand loads on the networks covered by this specification are as follows;

Table 7 Static Mechanical Terminal Loads

System Voltage	Static horizontal load parallel to the pole/current circuit (kN)	Static horizontal load perpendicular to the pole/current circuit (kN)
110 kV	3	2
220 kV	4	3
400 kV	6	4

The mechanical loadings offered shall be included on the outline drawing supplied.

The Customer shall appropriately design the installation to ensure the rated withstand load of the circuit breaker is not exceeded for short circuit events occurring on the conductors connected to the circuit breaker terminals.

7.8 Control and Mechanism Boxes

7.8.1 Operating Mechanism

The operating mechanism shall be of the stored energy type, with motor operated spring charge or hydraulic type. Compressed air mechanisms are not acceptable.

The operating mechanisms of circuit breakers with independent pole operation shall be mechanical endurance class M2.

All wiring shall be brought out to easily accessible terminals.

The mechanism box shall be designed in such a way that water is not retained in the seals and water should be directed away from the door and vents.

Door handles shall be C5-VH.

A means of manually charging the operating spring must be provided and should be located inside the mechanism/control cabinet. When in use the manual charging method should isolate the ac supply to the motor to prevent re-engagement of the motor and possible injury to the operator. This mechanism should

be comfortably operable by an operator standing at ground level and the operator should remain outside the limit of close proximity to a live part when manually charging the spring.

Table 8 Limit of Proximity to Live Parts

System Voltage	Limit of Proximity to Live Parts (mm)
110 kV	1200
220 kV	2100
400 kV	3500

*In addition, the complete insulator shall be regarded as being within the close proximity zone to a minimum distance of 300 mm in all directions.

All mech boxes shall be located below the close proximity zone to ensure the operator can not contravene safety clearances during operation.

Failure of supply to the spring charging motor shall not cause lockout of the circuit breaker. Suitable overload protection shall be provided for the motor.

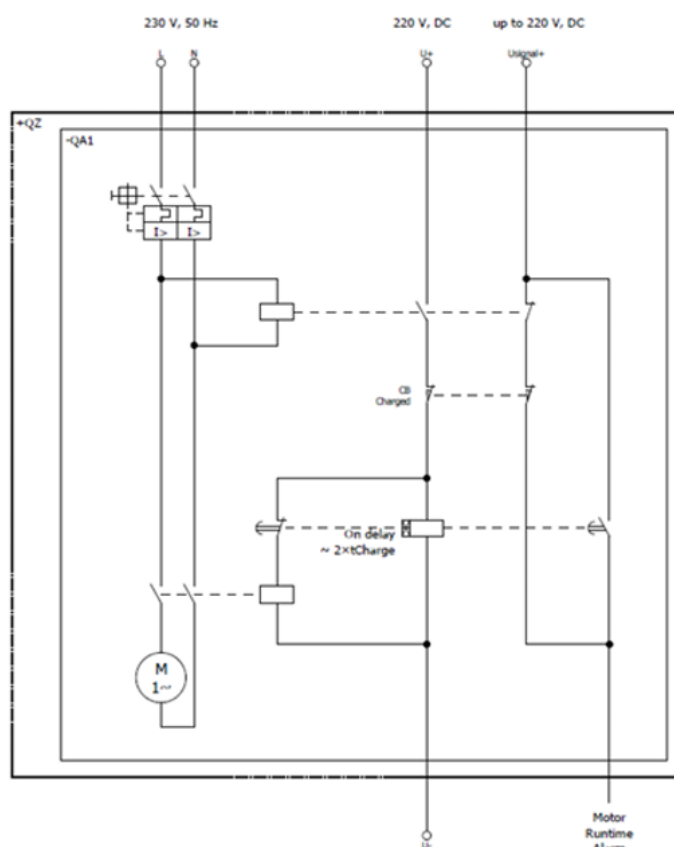


Figure Example of Runtime Monitoring Circuit

The mechanism shall have provision for manual “slow closing” for maintenance purposes, if applicable. A slow closing device, if required, shall be provided with each circuit breaker.

Reclosing relays are not described in this specification.

7.8.2 Auxiliary Power Supplies

The DC voltage for tripping and closing is 220 V DC.

The DC voltage for signals and alarm circuits will be either 220DC, 48V DC or 24V DC, and will be defined on a project basis. Refer to the project specific documentation.

All DC coils shall operate between 70 % and 110 % of 220V DC.

Spring winding motors and heaters shall be 230 V AC, 50 Hz, single phase with satisfactory operation at all voltages between 80 % and 110 % of the rated voltage.

Auxiliary supplies shall be in accordance with EirGrid functional specification XDS-GFS-08-001 “Station Auxiliary Power Supplies”.

Operating coils and other auxiliary equipment shall be rated according to EirGrid functional specification XDS-GFS-10-001 ‘Station 220V/48V/24V DC and 230/400V AC Distribution Boards’.

Supplier low voltage equipment shall be in accordance with IEC 60364.

LV supply circuits shall be in accordance with NSAI 10101 National Rules for Electrical Installations, and shall demonstrate automatic disconnection and protection discrimination between supply and local equipment protective devices.

7.8.3 Control and Protection

Control and Protection and Metering facilities shall be in accordance XDS-GFS-06-001 “110/220/400kV Control, Protection and Metering”.

- a) The circuit breakers will normally be operated electrically from a control room and shall, therefore, be equipped with the facility for remote control operation.

The circuit breaker drive mechanisms/control cabinets shall also be equipped with facilities for local electrical opening operation by push-button.

Local close and open pushbutton circuits, to the close and open coils respectively, shall each be wired via adjacent terminals bridged together in the factory, to allow external supervisory contacts to be added in series.

A local/remote changeover switch shall not be fitted.

The soft closing circuit breakers shall in all cases be closed through a control switching relay for soft closing and the control system shall be equipped accordingly.

Control switches and push buttons shall be located at a convenient height above ground level for a standing operator with unobstructed access for their operation. The electrical close pushbutton shall be coloured as follows:

- Circuit breaker “OFF”, “Trip” or “OPEN” = Black pushbutton
 - Circuit Breaker “ON” or “Close” = White Pushbutton.
- b) Circuit breakers having individual drives per pole shall have two independent trip coils and one close coil per pole, otherwise the quantities apply per triple-pole unit.
 - c) The circuit breakers shall have a facility for local mechanical emergency trip of the circuit breaker
 - d) Both positive and negative poles of close circuits shall be switched by all devices which initiate closing operations. Trip circuits shall be positively switched only.
 - e)

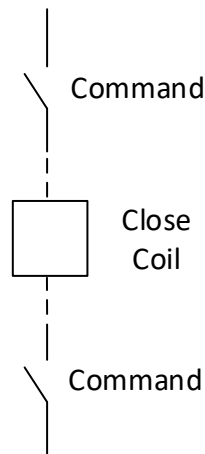


Figure 2 Example of double pole switching of a close circuit

- f) All circuit breakers shall be provided with anti-pumping protection.
- g) The anti-pumping facility shall be provided
- h) All auxiliary relays shall have surge suppression to protect components from back emf and potential damage.
- i) Circuit breakers having individual drives per pole shall be provided with automatic tripping on pole-discrepancy. The tripping device shall have a time delay, which is adjustable from zero to 2.5 sec. The discrepancy trip device shall operate an alarm contact and trip coil 1
- j) The operating mechanism shall be arranged so that no moving parts are accessible without removing covers including during opening of mechanism doors to access trip and close pushbuttons. Where controls and mechanisms will be accessed during operation of the switchgear and are located in the same box containing moving parts, then shields or covers shall be fitted internally to guard against accidental contact. An operator shall be able to insert the manual winding handle without exposure to moving parts.

Hinged and clip-on covers allowing access to mechanisms shall be lockable. Where locking is by padlock, the locking brackets shall be capable of accepting a padlock with shackle bend of 30 mm, shackle length of 23 mm and cross-section of 6.3 mm.

The guards must provide a minimum ingress protection of IP2X in accordance with IEC 60529.

- k) Auxiliary relays mounted in control cabinet shall be suppressed to prevent generation of voltage transients.
- l) A mechanical operation counter shall be provided.

7.8.4 Position indication

A mechanically operated position indicator shall be provided in a position clearly visible from the operating side of the breaker.

- a) The word **OFF** in white letters on a green background shall be used to indicate that the breaker is in the open position.
- b) The word **ON** in white letters on a red background shall be used to indicate that the breaker is in the closed position.
- c) A visual indication of the state of charge of the main energy storage device shall be provided. The marking shall be "Spring Wound" and "Spring Discharged".

7.8.5 Auxiliary Switches

A minimum of 9 normally open and nine normally closed auxiliary contacts shall be supplied. These quantities apply per pole for circuit breakers having individual drives per pole; otherwise the quantities apply per triple-pole unit.

For single pole CBs, at least 3 pairs of open and close contact shall be available individually per pole, others can be put in series to indicate that all 3 poles are closed or open.

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

These auxiliary switches shall be spare, i.e. additional to those required for circuit breaker operation, reclosing, anti-pumping, pole-discrepancy tripping etc. or for other purposes.

Two spare primary auxiliary contacts (spring) are needed to indicate “circuit breaker ready”.

Spare contacts on densimeters are required to switch two separate 220 VDC supplies in addition to the signalling contact (see also clause 7.9.1).

The following contacts shall be provided for remote indication of the state of the stored energy device.

- 2 volt free contacts required to indicate “not charged”
- 2 volt free contacts to indicate “charged”

All contacts shall be rated to switch 220 V DC at max. operating current of 10 A and short-circuit current (30 ms) of 100 A.

All spare auxiliary switches shall be wired to terminals so that they are accessible.

7.8.6 Motors

Motors shall be 230 V AC, 50 Hz, single phase with satisfactory operation at all voltages

Motors shall be in accordance with IEC 60034.

Motors shall be protected by a suitable overcurrent and overload device with auxiliary contacts for indication.

7.8.7 Enclosure/Miscellaneous

Control and mechanism boxes shall meet the requirements for outdoor marshalling kiosks in XDS-GFS-07-00 “Station Control Protection and Marshalling Kiosks”, with the following exceptions and notes:

- Control and mechanism boxes shall be situated outside the limits of close proximity as defined in XDS-GFS-00-001.
- The ingress protection shall be IP55 in accordance with IEC 60529
- Dimensions can be in accordance with the supplier’s standard range - consistent with provision of the required features.
- The heater shall be fitted with a thermostat.
- The live parts of heaters shall be enclosed with a minimum ingress protection of IP2X.
- Consideration will be given to LED lighting instead of fluorescent lighting
- MCB protection shall be provided for each circuit
- Overload protection shall be provided for motors (in mechanism boxes)
- A separate gland plate shall be provided for the customer to remove, drill and gland their control cables.
- Earthing

Internal earth bars shall be provided as described in XDS-GFS-07-001, and shall be equipotentially bonded to internal metallic parts by copper conductors of at least 6 mm².

Overall earthing and bonding towards external metallic parts shall be provided by:

- a) Metallic mechanical interconnections to the supporting structure which itself will be earthed to the station earthing system.
- or
- b) Provision of an earthing terminal (12 mm corrosion-free bolt) allowing for the connection of an external bonding cable. This terminal shall be bonded to the internal copper bars by a copper conductor of at least 6 mm².

Refer also to section 9 for overall earthing requirements.

7.9 Gas System

7.9.1 Gas Monitoring:

A visual indication of the level of the gas shall be provided. Gauges shall indicate ‘gauge’ pressure in bar, i.e. pressure relative to atmospheric pressure, and shall be temperature compensated for a temperature of 20°C.

Scales shall have sufficient gradations to facilitate visual confirmation of pressure changes over a period of time and shall be coloured in accordance with the gas operating levels and alarms as follows:

Table 9 Gas Pressure/ Density Gauge Markings

Green:	Correct operating pressure range
Yellow:	Low gas pressure corresponding to first stage alarm
Red:	Insufficient gas pressure corresponding to second stage alarm lockout

Where gauges are of the analogue type they shall be fitted with a mechanical pointer, damping mechanism and scaled faceplate.

Each gauge shall provide a 4-20mA analogue pressure output.

Each gauge shall have three voltage free contacts arranged as follows:

- The first stage alarm contact shall operate when the gas has dropped below “normal operating pressure”.
- Two second stage contacts shall operate when the gas reaches the limit for safe operation of the equipment.

Second stage contacts shall be normally open (NO) at atmospheric pressure¹⁰.

Each second stage contact shall be wired to energize the coil of a dedicated contactor¹¹.

Auxiliary contacts from each contactor shall be wired to carry out the following functions:

¹⁰ The contacts shall be open under atmospheric pressure, and shall close only when there is sufficient gas pressure for breaker operation (above the second stage pressure threshold).

¹¹ Each contactor shall be energised only when all three poles have healthy gas pressure.

- Prevent breaker tripping (with each contactor used to prevent tripping from a different trip coil)
- Prevent breaker closing
- Provide two second stage alarms

The gas system shall incorporate a means of continuously filtering or extracting gas contaminants such as moisture, arc products etc. Gas filter locations shall be shown on diagrams and visual labels affixed to the external access and inspection points to the filter.

Each gauge shall be clearly visible from ground level.

Externally mounted gauges shall be IP65 and corrosion category class CX offshore rated or provided with a suitable protective housing or rain cover to ensure offshore rating is maintained, while allowing the gauge to be read without being opened.

7.9.2 Gas Sealing

- a) The lifetime of the gas-tight seals shall be at least equal to the anticipated life-span of the whole switchgear.
- b) The Customer shall quote the guaranteed maximum annual leakage rate tests performed.
- c) The Customer shall submit details of the routine gas leakage rate.
- d) The Customer shall supply:
 - e) Details of seals
 - f) Design life of seals
- g) A calibrated pressure or gas density monitoring device shall be provided to ensure a leakage rate of less than 0.1 %.

7.9.3 Gas Handling and Testing Equipment

The Customer shall provide a gas filling/sampling valve, type Dilo DN20, fitted to the equipment specific to the gas type being used and which cannot be used for SF₆ or other gases. Details of the thread diameter, pitch and designation such as M45x2, M48x2, M43x2, M50x2 or other.

Gas-tight covering caps shall be provided for all fittings. The fitting/fitting caps shall be coloured in a specific colour to clearly designate the type of filling gas required, whether SF₆, NOG (natural origin gas), F-gas mixtures. This shall be agreed with the Employer on confirmation of the insulation gas composition offered. The Employer's preference is blue for NOG and green for F-gas. Brushed aluminium shall be used for SF₆ only.

It shall be possible to check the operation of the density monitor without need for evacuation of the gas or removal of the density monitor.

The Customer shall supply details of a recommended complete gas handling and testing equipment package (DILO or approved equivalent) suitable for use during installation, commissioning, maintenance and high-voltage (HV) testing of the equipment.

EirGrid may order all or any of this equipment at EirGrid's discretion.

The gas test equipment shall be capable of performing the following measurements and functions:

- Gas leakage detection with suitable sensitivity for high-voltage gas-insulated equipment,
- Measurement of moisture content (dew point),
- Measurement of overall gas purity and gas content,
- Determination of air content within the gas compartment,

- Analysis of principal gas constituents, including but not limited to N₂, O₂, CO₂, and C₄FN (where applicable),
- Detection and quantification of gas decomposition products.
- recovering gas down to a pressure of 1mbar or less within 60 minutes.
- compatible with the installed gas system, including valves, couplings, and monitoring points, and shall comply with IEC 62271-4 requirements for safe gas handling connections and procedures. Only wire braided hoses shall be supplied, to a maximum length from ground to the tallest gas valve to minimise gas losses, trapped air and moisture. A calibrated digital gauge shall be provided to enable the testing and verification of the analogue pressure gauge of density monitors and to correlate with the digital output measurement to verify functionality and accuracy.
- Where alternative gases or gas mixtures are used, the Contractor shall ensure that the supplied testing equipment is specifically suitable and validated for those gas types, including compatibility with decomposition product detection and gas composition analysis.

All gas handling and testing equipment shall be:

- Portable and suitable for field use,
- Supplied with calibration certificates traceable to recognised standards,
- Supplied with a dust and weather tarpaulin cover to minimise dust contamination/deterioration when not in use.
- Supplied with all required hoses, connectors, adapters, and consumables necessary for safe and effective operation.

The Contractor shall provide detailed operating instructions, calibration procedures, and maintenance requirements for all supplied gas handling and testing equipment.

7.9.4 Gas Specification and Treatment

All gas used to fill/top up equipment shall comply with IEC 60376 or IEC 63360 as related to the gas used.

New gas within the switchgear shall comply with Table when sampled from the compartment after filling:

Table Gas Specification

<u>Gas</u>	<u>Parameter</u>	<u>Minimum Threshold</u>
SF ₆	Minimum % SF ₆ gas purity and quality	99 %
SF ₆	Maximum SO ₂ value	0 ppmv
All	Minimum Dew point value measured at 20 °C and 1 bar atmospheric pressure	- 36 °C (200 ppmv)
Alternatives	Minimum % of main constituent components in mixture (N ₂ , O ₂ , CO ₂ , C ₄ FN)	IEC 63360

For alternative gas-based switchgear; measurements of the dewpoint and main constituent components (N₂, O₂, CO₂, C₄FN) shall be taken of all compartments prior to the HV test on site and detailed in the site test report to be provided to the Employer. Minimum values of gas quality shall comply with IEC 63360 (new non-SF₆ gases) when tested after being filled into a compartment.

Details of gas quality deterioration for a leak (affecting percentage insulation and moisture) and for normal switching and internal arcing event (affecting percentage insulation, moisture and by-products) shall be provided by the Contractor. Details shall be provided by the Contractor of the degree of gas deterioration,

which can be tolerated before treatment, and when replacement of the gas is necessary. Details shall be provided of the degree of gas deterioration which can be tolerated in circuit breaker interrupter

The gas shall be tested to verify compliance with the Employer gas specification after HV testing is completed and all chambers are at nominal pressure. Gas may have to “settle” for a period of time to get optimal results. Gas results then need to be sent for review prior to handover to ensure they comply with Employer’s requirements and values listed in relevant Employer gas specification.

Details shall be provided of the degree of gas deterioration which can be tolerated in circuit breaker interrupter compartments and the recommended time interval between replacement of any absorber material. Details of necessary absorber material and gas treatment shall be given.

Documentation shall be provided for each installation and item of equipment filled on site with gas. The documentation shall record the above measurements; the quantity of gas placed in each compartment in kg and the total overall volume of gas in the equipment.

Colour coding shall be applied to the fitting/fitting cap to distinguish the gas used between specific gases and gas mixtures - SF₆, NOG (natural origin gas), F-gas mixtures.

In addition, the gas/gas mixture used shall be easily identifiable using labels/notices/integrated branding on switchgear main body with text outlining composition of gas and not to be filled with SF₆ gas or other gases such as “Contains ‘ABC’ gas (80% A, 10% B, 10% C), Do not fill with SF₆”.

Awareness of gas/gas mixtures is critical for long term operation and maintenance, and safety of staff to prevent incorrect handling and in case of internal fault. Any proposed labelling shall be provided to the Employer for review and comment.

The cumulative test described in IEC 60068-2-17:1994 is the preferred method to determine the relative leakage rate in gas systems and calculate the time between replenishments. This method shall be used by the Contractor unless an alternative method is agreed upon between the Contractor and the Employer. Detailed information about test procedure, sensitivity of measurement and example of calculation are also given in IEC TR 62271-306. Details shall be provided to cater for end of life and to support a circular economy, outlining the lower limit where such gases may be treated for re-use or require disposal, or are deemed safe to be released into the atmosphere - supported by:

- Laboratory, site tests or studies to demonstrate the gas quality achievable pre and post treatment for re-use as per IEC 60480 (re-use of SF₆) / IEC 63359 (re-use of non-SF₆ gases)
- Procedures outlining safe re-use/reclamation processes using specialist recycling/reclamation facilities and
- Procedures outlining environmentally responsible methods of disposal and/or permissible limits deemed safe for release of gas to the environment.

7.9.5 EU F-Gas Compliance and Reporting

Where equipment containing fluorinated gases (F-gases) is supplied from outside the European Union, the Contractor (OEM) shall ensure full compliance with all applicable EU F-gas regulatory requirements.

The Contractor shall be responsible for:

- Registration in the EU F-gas Portal & Registry, where required,
- Reporting and declaration of all fluorinated gas quantities associated with the equipment placed on the EU market,
- Compliance with applicable quota, reporting, and traceability obligations.
- Evidence of compliance with the EU F-gas regulations, including confirmation of successful registration and submission within the F-gas Portal, shall be provided to the Employer prior to delivery of the equipment.

- Requirements for Putting into Operation as per Section 1.1.1

7.9.6 Pressure Relief

The circuit breaker shall be designed in such a way that overpressure resulting from an internal arc shall not result in hazardous emission of decomposition products or material fragments of the circuit breaker.

Details of the pressure relief design shall be provided including the basic principle of its design and operation.

7.10 Mounting Arrangement

All support structures shall be included in the scope of supply.

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

The minimum height of live parts shall be

- 3400 mm above ground for 110 kV breakers
- 4700 mm above ground for 220 kV breakers.
- 6400 mm above ground for 400 kV breakers.

The minimum pole spacing (centre to centre) shall be

- 1600 mm for 110 kV breakers.
- 3200 mm for 220 kV breakers.
- 5300 mm for 400 kV breakers.

(See GFS-00-001 for further information).

Support structures shall be galvanised steel in accordance with XDS-GFS-17-001 “Galvanised Fabricated Steelwork Galvanised Fabricated Steelwork” and XDS-GFS-18-001 “Station Hot Dip Galvanising of Iron and Steel”.

Support structures shall include provision for earthing. Refer also to section

High Voltage Terminals

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

High voltage terminals shall be flat aluminium plates meeting EN 62271-301.

HV terminals shall be in accordance with Table 10.

Table 10 High Voltage Terminals

System Voltage	Nominal Plate Size	Current Rating	Hole Diameters and spacings
110 kV 220 kV	100 mm x 100 mm	≤ 2000 A	4 off 14 mm holes at 50 mm centres
400 kV	125 mm x 125 mm	> 2000 A	9 off 14 mm holes at 40 mm centres

Each HV terminal shall allow for connections from either side of the circuit breaker.

The Customer shall include full particulars of the proposed terminals in the Technical Schedules.

7.11 Corrosion Protection

All exposed ferrous parts, including nuts and bolts, shall be hot-dip galvanised to comply with EirGrid specification XDS-GFS-18-001, “Hot Dip Galvanising of Iron and Steel Other Than Wire”.

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.

Customers are required to confirm that the overall treatment meets the requirements of Paint System, Table 1 of ISO 12944-2 (Corrosion Protection of Steel Structures), to provide very high durability (more than 25 years) coating with category C5-VH corrosion protection, suited to environments with high condensation, pollution and salinity.

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

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

The painting and corrosion protection system proposed by the customer is subject to approval by EirGrid. A full description of the proposed system shall be given in the schedule of Corrosion Protection (part of Technical Schedules), including standards applicable, surface preparation, rust inhibition, galvanising, paint thickness, treatment of bolts, nuts, threads, and tests/checks to be performed to confirm the adequacy of the protection.

The special test for corrosion protection described by IEC 61869-1 shall be carried out as part of the tests.

7.11.1 Hot Dip Galvanised Steel

Hot dip galvanising of steel shall be fully compliant with the requirements of EirGrid specification XDS-GFS-18-001: Hot-dip galvanising of iron and steel articles other than wire’

Customer shall confirm that the paint system for hot-dip-galvanised steel surfaces meets or exceeds the requirements of Paint System, Tables B.3 & D.1 of ISO 12944-5 (Corrosion Protection of Steel Structures),

to provide high durability (more than 20 years) coating with category C5-VH corrosion protection, suited to environments with high condensation, pollution and salinity as per ISO 12944-2.

The process for painting hot-dip galvanised steel is detailed below:

PROCESS	MATERIALS	MINIMUM REQUIREMENTS	MINIMUM VALUE
Clean	Appropriate solvents or other cleaning agents	A grease / oil free substrate	-
Sweep blast	Aluminium oxide or other inert abrasive medium	A light texture on the zinc layer with no more than 3 % of the zinc removed by the process	SA 2.5
Priming	As per Paint System G5.05 of ISO 12944-5	As per Paint System G5.05 of ISO 12944-5	80 microns
Undercoat, Base + Intermediate layer	As per Paint System G5.05 of ISO 12944-5	As per Paint System G5.05 of ISO 12944-5	160 microns (2 x 80 microns)
Finish coating	As per Paint System G5.05 of ISO 12944-5	As per Paint System G5.05 of ISO 12944-5	80 microns

7.11.2 Thermally Sprayed Zinc Coated Steel

The minimum thickness of the zinc coat shall be (NDFT) 150 µm

Customers shall confirm that the paint system for thermally sprayed metal surfaces meets or exceeds the requirements of Paint System, Tables B.4 & E.1 of ISO 12944-5 (Corrosion Protection of Steel Structures), to provide high durability (more than 20 years) coating with category C5-VH corrosion protection, suited to environments with high condensation, pollution and salinity as per ISO 12944-2.

The process for thermally sprayed zinc coating and application of the required painting system is detailed below:

PROCESS	MATERIALS	MINIMUM REQUIREMENTS	MINIMUM VALUES
Metal spraying to ISO 2063	Zinc	150 microns (µm)	
Priming	As per Paint System TSM 5.02 of ISO 12944-5	As per Paint System TSM 5.02 of ISO 12944-5	80 microns
Stripe coat	As per Paint System TSM 5.02 of ISO 12944-5	As per Paint System TSM 5.02 of ISO 12944-5	Per paint application guidelines
Undercoating	As per Paint System TSM 5.02 of ISO 12944-5	As per Paint System TSM 5.02 of ISO 12944-5	160 microns (2 coats of 80 microns)
Finish coating	As per Paint System TSM 5.02 of ISO 12944-5	As per Paint System TSM 5.02 of ISO 12944-5	80 microns
Minimum total dry film thickness:			320 microns

7.11.3 Mechanism Boxes

The enclosures of all mechanism/control cabinets of all outdoor equipment shall be constructed to prevent the ingress of water and the deterioration of the mechanism due to condensation. They shall be constructed

of a suitable material for the size and mechanical requirements of the equipment to be housed within. Suitable materials are;

- Stainless steel, grade 316 or 316L_- minimum thickness 2.5 mm. Stainless steel grade 316/316L will not be painted unless agreed with the Employer.
- Hot dipped galvanised sheet steel painted with a corrosion protection system in accordance with Paint System G5.05 per Table D.1 of ISO 12944-5 (2019). The minimum thickness/mass of galvanizing shall be according to Table 3 of clause 2.04.09.02 of the specification 05030
- Anodized or conversion treated aluminium alloys grade 3000 series or greater – minimum thickness 2.5 mm (grade 1000 or 2000's series are not acceptable for this purpose) and painted with corrosion protection system to meet the requirement of corrosivity category C5-vh.
- Small terminals boxes constructed of aluminium shall be conversion treated (chemically anodised or electroplated) before protective painting is applied. Bare untreated aluminium marshalling or terminal boxes shall not be considered acceptable on outdoor equipment without these additional treatment measures. Powder coating of aluminium components is not acceptable in the Irish offshore environment. In case of equipment or devices mounted externally from mechanism boxes, such as gas density monitors for circuit breakers, pressure or level gauges on transformers, thermostats or gas sampling devices – all these devices shall be rated for to suit an offshore environment and shall meet class CX corrosion category.

7.11.4 Corrosion Protection of Individual Items

The following are the minimum requirements for the corrosion protection system which shall be applied to individual items:

(a) Fasteners larger than 12 mm diameter and pipes:

- Hot-dip galvanising, in accordance with EirGrid Specification XDS-GFS-18-001
- Refer to ESB Specification 05301, 2.05.02 for the painting process for hot-dip galvanised steel.

(b) Smaller Fasteners, Cable Clips:

Use of non-ferrous material or stainless steel; otherwise use of appropriate plated components.

(c) Nuts and Bolts:

All nuts, bolts and washers shall be stainless steel with grade AISI 304L or better.

All external surfaces shall be primed and finished in grey colour RAL 7033.

The standard applicable to seals and gaskets shall be stated and is subject to approval by the EirGrid.

Customers shall state clearly the corrosion protection applied to metal parts.

Customers 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. If there are aluminium or aluminium alloy parts used such parts shall be anodised with painted or equivalent finish.

7.12 Rating Plates and Labels

7.12.1 Rating plates

Rating plates shall be in accordance with IEC 62271 requirements for nameplates. Mandatory markings and ratings shall be provided in accordance with Table 9 of IEC 62271-1.

The following markings and ratings shall also be included:

1. Mass of switchgear and controlgear (including any fluid)
2. Capacitive Switching Class

The rating plate shall be mounted on the support frame of the circuit breaker near the operating mechanism box.

All rating plates shall be engraved, clear, indelible, corrosion proof, and shall be in English.

The Customer shall submit drawings of all rating plates for EirGrid approval.

Rating plates shall record the highest primary voltage and current ratings for which the breaker has been type tested, rather than the minimum ratings specified.

The following table does not include all primary and voltage and current ratings, but is provided as an example of this principle:

Table 11 Example of Actual values for Rating plate

		Minimum Specified Rating	Highest Rating to Which the Breaker has been Type tested	Rating to be included on rating plate
Rated Voltage	Ur	123 kV	145 kV	145 kV
Rated Continuous Current	Ir	2500 A	3150 A	3150 A

Labels and safety signs shall be provided for all equipment in accordance with XDN-LAB-STND-001 “Station Design Standard 110/ 220/ 400 kV Station Signage” and XDS-GFS-007 “Station Control and Protection Cabinets and Marshalling Kiosks”.

The Customer shall submit drawings of all labels for EirGrid approval.

7.13 Assemblies

The circuit breaker where possible should be factory assembled. If it is deemed that complete assembly of the circuit breaker at the factory will prevent convenient transportation, it may be delivered to site partially assembled. Assembly instructions specific to the equipment being supplied shall be included.

7.14 Lifting Lugs

Suitable lifting lugs shall be provided for supporting the full weight of the circuit breaker.

These shall be identified on drawings supplied with the packing list on the crate, in English.

7.15 Padlocking

Provision for padlocking the operating mechanism cabinet shall be provided and a hole approximately 7 mm diameter should be available for accepting padlocks with a 6.3 mm diameter shackle.

7.16 Insulators

The Reference Unified Specific Creepage Distance (RUSCD) for the phase to earth insulators shall be in accordance with IEC 62271-1 and IEC TS 60815-1:2008 for rated voltages 123 kV/ 245 kV/ 420 kV as appropriate and very heavy pollution level 53.7 mm/kV (31 mm/kV phase to earth).

The RUSCD shall be corrected for insulator diameter using the method given in IEC 60815-2.

The Customer shall also state the profile factors (as defined in IEC 60815-2 or-3) for the proposed insulator design in the Technical Schedules.

If Composite material are used, test certificates to be provided (See Cigre Brochure 184 for guidance)

8 Earthing

All equipment including circuit breakers, support steelwork, control and mechanism boxes shall be provided with facilities for earthing and bonding meeting the requirements of XDS-GFS-12-001 “Functional Specification Earthing and Lightning Protection”.

Typical arrangements for earthing of circuit breakers and their metallic support steelwork to the earth grid are indicated on the circuit breaker page(s) of EirGrid Drawing series XDS-DGS-00-004 “Earthing Practice”.

Other than earthing conductors, additional copper bonds are not shown in these drawings.

The Customer shall indicate which of the following design approaches will be used for the interfaces between the circuit breaker and steelwork and between control and mechanism boxes and steelwork.

- h) Additional copper bonding is not required, i.e. the equipment is designed in such a way that metallic mechanical interconnections of equipment are sufficient,

OR

- i) Additional cabled bonds are required and all necessary infrastructure e.g. cables, earth terminals etc. will be provided.

Where approach a) is followed the customer shall provide evidence of the suitability of mechanical connections for the required earthing/ bonding duty.

9 Tests

9.1 General

Eirgrid reserves the right to witness type, special and/or routine tests or visit the factory during the manufacture of any or all circuit breakers. The Customer shall provide adequate notice of tests and manufacturing programmes.

Refer also to XDS-GFS-00-001 110/220/400 kV Substation General Requirements.

9.2 Type Tests

All equipment offered shall have been fully type-tested in accordance with the tests listed in the IEC 62271-100 and the results shall demonstrate, in relevant respects, the capability to meet the requirements of this specification.

These type 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 to EirGrid for review.

Certificates/ Reports may be considered as an alternative to carrying out type testing. The Tenderer should however, in all cases submit a priced option to conduct Type Tests.

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.

The circuit breaker or breakers available for type tests shall be identical in all respects to those to be supplied to EirGrid.

In the event of a type test failure, the purchaser will not be charged for any additional type tests.

Full details of any modifications (no matter how minor) which have been made to the drive mechanism since the full set of type test were carried out shall be submitted together with the reports on the tests which were carried out to prove the modification.

The attention of the Tenderer is further drawn to the following special requirements:

- a) Critical Current Tests to EN 62271-100 Clause 6.107 are to be carried out.
- b) A single phase short circuit test to meet the provisions of Clause 6.108 of EN 62271-100 is required.
- c) A Mechanical Type Test is to be carried out in accordance with EN 62271-100 latest edition.
- d) A Degree of Protection Test to EN 60529 shall be performed and witnessed by EirGrid on the first delivery. This shall include the witnessing of flange sealing assemblies and inspection of the moisture exclusion provision as described in the corrosion protection section 7.11.

9.3 Routine Tests

All circuit breakers shall be fully routine-tested in accordance with IEC 62271-100.

There are no partial discharge requirements for the complete circuit breaker. However, in the case of components for which the relevant IEC Publication includes partial discharge measurement (e.g. bushings covered by IEC 60137, insulators covered by IEC 60270) evidence shall be submitted by the Supplier showing that those components have passed the partial discharge tests in accordance with the IEC 60270.

10 Delivery

10.1 Prerequisites

At the conclusion of routine tests, results and other documentation, as described in section 15.4 shall be submitted to EirGrid for approval.

Equipment shall not be dispatched until such approval has been given in writing.

10.2 Delivery Terms

Refer to XDS-GFS-00-001 and relevant project specific documentation.

10.3 Packaging & Labelling

10.3.1 General Requirements

All packaging shall confirm to Reg (EC) No. 1272/2008 Classification, Labelling and Packaging of Substances and Mixtures (CLP).

All packing materials shall conform to EirGrid's requirements and to Irish Government Regulations which are available from the Department of Agriculture¹², Kildare Street, Dublin 2.

Goods from within the EU should have no bark on any Wood Packaging Material.

All packaging materials originating from outside the European Union shall be accompanied by certification confirming that any wood or transport materials used for the crating of the circuit breaker and its components are free from invasive species.

Goods at variance with these requirements will be returned to the Supplier and all costs including repacking etc. will be charged to the Supplier.

The equipment shall be suitably packed in strong non returnable cases or crates, as required, for protection against transport risks, damage by water and open air storage.

The packing method must be robust, resistant to impact damage from handling equipment and suitable for the applied weight load.

Each case shall be accompanied by a detailed packing note.

In order to prevent damage during transportation or damage caused by environmental conditions during storage, all plant and accessories be suitably packed and spare parts be suitably packed and treated for long term storage. See section 10.3.5.

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.

The equipment shall be packed, as far as possible, on a triple-pole basis.

10.3.2 Labelling

Each Unit on a pallet must be labelled as described in the next section. Where individual units can contain different quantities of items, it is preferable that the weight in each unit be restricted to less than 10 kg.

All sides and top of each case shall be marked clearly using weatherproof labelling with:

¹²www.agriculture.gov.ie/

- Order No,
- Manufacturers Name,
- Manufacturer's Serial Number,
- Manufacturer's Order Number,
- Gross Weight in kg,
- Substation or store's name

10.3.3 For large items which may be stored outdoor:

1. Packing shall facilitate handling by fork lift, with 4 way access.
2. Items unsuitable for fork lift should have suitable lifting points to facilitate movement by crane and must be built robustly to resist impact damage from handling.
3. When multiple sets of disconnectors and earthing switches are being delivered, transport via curtain-sided truck is required as this facilitates offloading using forklift trucks. Containers may also be used if specifically agreed in particular instances but equipment enclosed must have been packed suitably so that it can readily be unloaded by fork lift without the use of manual handling. Container contents must have been packed so that they do not shift during transportation.

10.3.4 For large items or smaller items ordered in bulk to be stored indoor:

Items to be stored indoor must be packed on a pallet of dimensions 1200 mm x1000 mm.

The height of the equipment measured from the base of the pallet must be no more than 1.2 m (approx) to facilitate storage on warehouse shelves.

The weight of the equipment on the pallet must be no more than 1.5 tons approximately.

10.3.5 Long-Term Storage Requirements

Long-term storage shall be defined as a period exceeding 6 months from delivery to installation and up to the maximum time permitted by the OEM for storage; for example 5/10 years.

The Contractor shall ensure that the equipment can be stored outdoors under the following conditions without deterioration:

- Temperature range: -25°C to +40°C (or project-specific conditions),
- Relative humidity: up to 100%,
- Exposure to rain, condensation, and UV radiation.

Appropriate preservation measures shall be implemented to maintain the integrity of the equipment during storage. All exposed metallic parts shall be adequately protected against corrosion, for example by galvanisation or protective coatings, and shall be covered or sealed where necessary to prevent environmental degradation.

Critical components, including but not limited to operating mechanisms and control panels, shall be supplied within sealed, weatherproof enclosures with a minimum protection rating of IP54 or IP65, as applicable. Such enclosures shall incorporate desiccants or other suitable humidity control measures to prevent moisture ingress.

Internal compartments shall be protected against moisture ingress through the use of moisture barriers, desiccants, or inert gas filling where required to ensure preservation of internal components.

With respect to storage monitoring, the Supplier shall provide detailed storage instructions, including specified inspection intervals and maintenance requirements applicable during the storage period. The Supplier shall also define requirements for periodic inspection of seals, pressure indicators, and packaging integrity, and shall provide clear reconditioning procedures to be followed where the storage duration exceeds the specified period.

10.3.6 Delivery requirements

Customers shall give a guaranteed lead time from date of order, or deliver in accordance with the schedule set out in the Enquiry documentation.

When delivering to EirGrid depots/substations, delivery personnel must wear appropriate protective footwear, helmet and high visibility waistcoat.

10.3.7 Delivery documentation

All suppliers are required to furnish delivery documents that contain the following information when making deliveries to our supply stores.

1. Supplier Name
2. The complete Order Number
3. The quantity of/and Code delivered including description
4. A clearly defined Delivery Docket Number
5. A complete packaging configuration for the material delivered i.e. on which details the major and minor packing that makes up the total received.

10.3.8 Data requirements

10.3.8.1 Provision of Serialised Data

Serialised data and routine test results relating to the equipment shall be entered onto an excel spreadsheet, in accordance with the template provided by EirGrid and sent electronically to EirGrid when the equipment is dispatched from the manufacturer's premises. The template and rules for its completion shall be provided by EirGrid and is fully detailed in ESB Specification 17011 -Equipment Data Requirements.

The list of equipment is constantly being updated, so that the latest version should be used.

10.3.8.2 Label and Barcode

Weatherproof labels shall also be provided and displayed accessibly on the equipment, with barcode, and shall display the following information

- Manufacturer's Name
- Year of Manufacture
- Serial Number of Equipment

A detachable, weatherproof label displaying the above information, with barcode, shall also be securely attached, in an accessible location to be removed when equipment is commissioned.

11 Installation Instructions

11.1 Installation

Details of installation are specified in EirGrid functional specification XDS-GFS-00-001 '110/220/400 kV Substation General Requirements' in section 7.2.6 - Operation and Maintenance Instruction Manuals.

The instructions shall be specific to the equipment being supplied and shall be in English. These instructions shall cover all aspects of installation including putting into service, recommended maintenance and de-commissioning instructions.

Installation shall be carried out in accordance with OEM recommendations.

The Customer shall use suitably qualified persons for on-site installation, and shall be certified under EU 573/2024 for handling of F gases.

11.2 Installation Support

The supplier may be required to provide suitably qualified persons for on-site corrections/ modifications/ installation.

These staff shall be subject to all Health & Safety requirements. See section 6.1 for further information.

12 Maintenance

12.1 General

All circuit breakers 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.

Details shall be provided in the Technical Schedules of the design approaches used to ensure that all moving joints continue to operate correctly for the design life of the equipment.

12.2 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.

12.3 Spare Parts

Refer to general spare parts requirements in EirGrid functional specification XDS-GFS-00-001 '110/220/400 kV Substation General Requirements'.

The Customer shall guarantee the continuing availability of the complete range of spare parts for the lifetime of the equipment offered.

The Customer shall list spare parts which the manufacturer recommends should be held by EirGrid in the schedule of Recommended Spares (part of Technical Schedules).

The decision to order any spare part will be at Eirgrid discretion.

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

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

Spare parts shall be delivered suitably packed and treated for long periods in storage.

Each packing shall be clearly and indelibly marked with its contents, including a designation number corresponding to the spare parts list in the maintenance instruction.

For gas insulated equipment the Customer shall provide the following:

- A spare cylinder of insulating Gas (per order or/and substation)
- A simple gas handling device enabling filling and recovery for maintenance

12.4 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.

13 Warranty

The equipment, including all components and accessories, shall be fully guaranteed against all defects arising from faults in design, manufacture and workmanship for a two year period post-handover of the Substation.

However, the warranty period shall be extended to five years to cover all defects attributable to inadequate corrosion protection.

The manufacturer shall chose accessories that offer a suitable level of moisture ingress protection and corrosion resistance to meet this requirement.

Should any defect occur during the above period, the Customer shall deliver all components necessary to correct the fault, together with any necessary instructions and specialist assistance free of charge. All defects notified within the above warranty periods shall be rectified entirely at the manufacturer's expense.

14 Compliance with Specification

14.1 Deviations from Specification

The Customer shall list all deviations from the requirements of this Specification in the schedule of deviations within the Technical Schedules.

EirGrid reserves the right to reject proposals with do not comply with this specification.

Where deviations are proposed in the design The Customer shall also submit a formal Derogation Request outlining an explanation of why the non-compliance is expected and any additional information to support the request for EirGrid to consider. Further information is outlined in EirGrid's Derogation Process Guidance document XDS-GGD-00-001.

14.2 Conformity of Works With This Specification

Where the customer proposes a deviation from the detailed requirements of the Specification, he shall make a written application for approval of such deviation to EirGrid and he shall list each deviation in the Schedule of Deviations and highlight the proposed deviation on the relevant drawings. Except in the case of a deviation specifically approved in writing by EirGrid the successful Customer shall be responsible for ensuring the conformity of the Works with the Specification, notwithstanding any general approval or lack of approval of design submissions by EirGrid.

15 Documentation

All documentation shall be in English. The following sections outline the time by which certain types of documentation is required.

Please refer to the appropriate section of this specification for further requirements relating to each of these types of documentation. The Customer may submit information earlier than requested if available.

15.1 Initial Submission

General Requirements for initial project submissions are described in "Documentation to be Submitted Upon Project Initiation" in XDS-GFS-00-001.

15.2 To Be Submitted with Tender

The following information is required at this stage:

1. Any information which is required under section 15.1 which has not already been provided for the equipment being offered.
2. Any information required in the “Before Major Equipment Orders” section of XDS-GFS-00-001.
3. A fully completed copy of the Technical Schedules (in original file format and pdf), listing all deviations, service experience etc., etc. from this specification.
4. Supporting Documentation including the items listed in Appendix 9 of the Technical Schedules.

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

Plant offered without the complete submission of the above requirements may be rejected.

15.3 To be Submitted After Order

A detailed manufacturing programme, covering all the equipment, shall be submitted within six weeks of the date of order. Thereafter, reports of progress against this programme shall be submitted at 2-monthly intervals up to including the day of despatch of the completed order.

EirGrid shall be advised of any divergence from the submitted programme immediately on occurrence.

Complete final drawings of the equipment to be supplied, physical dimensions including all details necessary for the design of foundations, supports and support fixings, high voltage connections, equipment layout, details of secondary terminal arrangements and provision for control cables, shall be submitted for approval within six weeks of the date of order.

15.4 To be Submitted prior to Delivery

See also XDS-GFS-00-001 “Before the Delivery of Equipment”.

Four weeks prior to the delivery of the equipment 3 copies of the technical record folder shall be supplied in hardcopy and in electronic format via CD-ROM, internet or e-mail in one of the following formats:

- Microstation.dgn – compatible with latest version Microstation
- Acad.dwg – Release 12
- Misc.dxf – compatible with latest version Microstation
- 3D stp file
- Pdf

The contents shall include:

- a) Completed Finalised Technical Schedules (in original file format and pdf) with guaranteed rated values and characteristics
- b) Final fully detailed drawings of the equipment to be supplied including physical dimensions including all details necessary for the design of foundations, support fixings, high voltage connections, equipment layout, details of secondary control circuit design, terminal arrangements and provision for control cables.
- c) Detailed storage, installation, operation and maintenance instructions.
- d) Required environmental certification.
- e) Final Test report comprising:
Summary sheet with list of all tests

Detailed results and measurements for all tests performed - including routine testing, factory acceptance testing, type tests and special tests.

Calibration certificates for all test equipment used

Quality documentation for the equipment - including incoming quality checks etc.

Type and special test certificates

Serial numbers of tested equipment

16 Schedule A - Handover Document

16.1 SCHEDULE A PART 1 - Electrical switchgear ordered On or AFTER 11th March 2024

FORM OF DECLARATION in respect of “Putting into Operation” Compliance - Electrical switchgear ordered On or AFTER 11th March 2024

In accordance with EU regulation 2024/573, all entities must confirm switchgear under their control has been compliantly “Put into Operation”.

DECLARATION OF COMPLIANCE ADDRESSED TO [TO WHOM IT MAY CONCERN – EMPLOYER AND / OR EPA]

We [The OEM, Contractor, or competent entity] declare (for electrical switchgear ordered on or after 11th March 2024), that the electrical switchgear using fluorinated gases is in compliance with Article 13.9 – “Putting into Operation”¹³ and all necessary tests and inspections as identified by the OEM have been completed

This shall include but not limited to: gas quality and tightness checks where gas filling/assembly is performed, electrical testing where switchgear is assembled, operational testing and visual inspections.

NAME (BLOCK CAPITAL + Signature):

COMPANY:

ROLE (Managing Director or Company Secretary):

FOR AND ON BEHALF OF [Company name]:

Project Name, Location, Substation Name (if applicable):

Details of switchgear (manufacturer, model, serial number):

Date of “Putting into Operation” (dd/mm/yyyy): _____

*NOTE:

The OEM, Contractor, or competent entity completing tests before the relevant prohibition date shall use the above template and reproduce on a company letterheaded document and furnish this completed document to the Employer within three weeks of “Putting into Operation”.

This document is required in addition to the regular on-site documentation provided to the Employer upon completion of switchgear testing.

Documentation establishing the evidence shall be kept for at least 5 years and shall be made available upon request.

¹³ Putting into Operation means the moment of documented handover after the completion of any necessary tests of functionality, performance or other, and any required inspections identified by the OEM or other competent entity, (whether completed by OEM or other competent entity) prior to overall system integration.

16.2 SCHEDULE A PART 2 - Electrical switchgear ordered BEFORE 11th March 2024

FORM OF DECLARATION in respect of “Putting into Operation” Compliance - Electrical switchgear ordered BEFORE 11th March 2024

For electrical switchgear using fluorinated gases that an order has been placed before 11th March 2024, documented evidence of the order date shall be provided.

DECLARATION OF COMPLIANCE ADDRESSED TO [TO WHOM IT MAY CONCERN – EMPLOYER AND / OR EPA]

We [The OEM, Contractor, or competent entity] declare the electrical switchgear containing fluorinated gases has been ordered before 11th March 2024 in compliance with Article 13.14

NAME (BLOCK CAPITAL + Signature):

COMPANY:

ROLE (Managing Director or Company Secretary):

FOR AND ON BEHALF OF [Company name]:

Project Name, Location, Substation Name (if applicable):

Details of switchgear (manufacturer, model, serial number):

Notification issued to the competent authority (date, reference and copy):

Date of Order (dd/mm/yyyy):

Purchase Order number: _____

Invoice reference number: _____

The OEM, Contractor, or competent entity undertaking tests shall use the above template and reproduce on a company letterheaded document and furnish this completed document to the Employer within three weeks of “Putting into Operation”.

This document is required in addition to the regular on-site documentation provided to the Employer upon completion of switchgear testing.

Under the legislation where electrical switchgear is Put into Operation, the Contractor or competent entity shall notify the competent authority.

Documentation establishing the evidence shall be kept for at least 5 years and shall be made available upon request, to the competent authority of the Member State concerned or to the EU Commission.

16.3 SCHEDULE A PART 3 - Putting into Operation AFTER the respective Prohibition Date

Cascade Principle assessment - “Putting into Operation” of electrical switchgear AFTER the respective Prohibition Date

“Putting into Operation” of electrical switchgear AFTER the respective Prohibition Dates in Article 13, there must be evidence that the Cascade Principle requirements are met (as outlined in Article 13.11 and Article 13.12) before switchgear using higher GWP can be considered during procurement evaluation and subsequently “Put into Operation”.

See Figure 1 EU F-Gas Regulation (2024/573)

DECLARATION OF COMPLIANCE ADDRESSED TO [TO WHOM IT MAY CONCERN – EMPLOYER AND / OR EPA]

We [The OEM, Contractor, or competent entity] declare for electrical switchgear containing fluorinated gases being “Put into Operation” after the prohibition dates that the procurement process in compliance with Article 13.11 and 13.12 (Cascade Principle) of F-Gas Regulation 2024/573 has been followed.

NAME (BLOCK CAPITAL + Signature):

COMPANY:

ROLE (Managing Director or Company Secretary):

FOR AND ON BEHALF OF [Company name]:

Project Name, Location, Substation Name (if applicable):

Details of switchgear (manufacturer, model, serial number, GWP):

Notification issued to the competent authority (date, reference and copy):

Date of “Putting into Operation” (dd/mm/yyyy): _____

The OEM, Contractor, or competent entity shall use the above template and reproduce on a company letterheaded document and furnish this completed document to the Employer prior to Tender award.

This document is required in addition to the regular on-site documentation provided to the Employer upon completion of switchgear testing.

Under the legislation where electrical switchgear is Put into Operation, the Contractor or competent entity shall notify the competent authority.

Documentation establishing the evidence shall be kept for at least 5 years and shall be made available upon request, to the competent authority of the Member State concerned or to the EU Commission.

16.4 SCHEDULE A PART 4 - after being “Taken Out of Operation” from different location

Compliance for electrical switchgear - “Putting into Operation” after being “Taken Out of Operation” from different location

Switchgear which was “Operating” in the EU is permitted to be “taken out of operation” and redeployed in the EU under F-Gas regulation 2024/573, Article 13.10.

DECLARATION OF COMPLIANCE ADDRESSED TO [TO WHOM IT MAY CONCERN – EMPLOYER AND / OR EPA]

We [The OEM, Contractor, or competent entity] declare “operating” location information for electrical switchgear containing fluorinated gases which has been “taken out of operation” and intended to be redeployed after the prohibition dates in compliance with Article 13.10 of F-Gas Regulation 2024/573.

By signing below, you are confirming switchgear has previously been “operating” in the EU.

NAME (BLOCK CAPITAL + Signature):

COMPANY:

ROLE (Managing Director or Company Secretary):

FOR AND ON BEHALF OF [Company name]:

Project Name:

“Putting into Operation” Original Location and Substation Name (if applicable):

Details of switchgear (manufacturer, model, serial number, GWP):

Original Date of “Putting into Operation” (dd/mm/yyyy)*:

*NOTE: Switchgear installed prior to 11th March 2024 (EU Reg 2024/573 effective date) may only have installation or nameplate date of manufacture as reference date for “Putting into Operation”.

“Putting into Operation” New Location and Substation Name (if applicable):

This document is required in addition to the regular on-site documentation provided to the Employer upon completion of switchgear testing.

For ESB owned assets, SAP and GAR (General Asset Registry) records demonstrate previous “operating” location.

Documentation establishing the evidence shall be kept for at least 5 years and shall be made available upon request, to the competent authority of the Member State concerned or to the EU Commission.

16.5 SCHEDULE A PART 5 - Extension of existing electrical switchgear containing fluorinated gases

Compliance for switchgear – Extension of existing electrical switchgear containing fluorinated gases

“Putting into Operation”⁵ prohibition dates in Article 13.9 do not apply for electrical switchgear extension provided the criteria under Article 13.15 are met as follows:

1. Devices to extend existing electrical switchgear that use fluorinated greenhouse gases with a lower global warming potential than the fluorinated greenhouse gases used in the existing electrical switchgear are not compatible with the existing electrical switchgear,
2. And the use of those devices would require the replacement of the existing entire electrical switchgear.

DECLARATION OF COMPLIANCE ADDRESSED TO [TO WHOM IT MAY CONCERN – EMPLOYER AND / OR EPA]

We [The OEM, Contractor, or competent entity] declare extension of existing electrical switchgear is permitted in compliance with Article 13.15 of F-Gas Regulation 2024/573 considering the above compatibility and existing replacement constraints.

By signing below, you are confirming criteria outlined in Art.13.15 has been met and therefore it is permitted to extend existing switchgear with the same technology.

NAME (BLOCK CAPITAL + Signature):

COMPANY:

ROLE (Managing Director or Company Secretary):

FOR AND ON BEHALF OF [Company name]:

Project Name:

Location and Substation Name (if applicable):

Notification issued to the competent authority (date, reference and copy):

Details of switchgear (manufacturer, model, serial number, GWP):

- Existing switchgear:
- Extension switchgear option:

The OEM, Contractor, or competent entity shall furnish all details of electrical switchgear and extension options to the Employer prior to Tender award. Details of the criteria and assessment for extension of existing electrical switchgear containing fluorinated gases shall be recorded.

Under the legislation where electrical switchgear is Put into Operation, the Contractor or competent entity shall notify the competent authority.

Documentation establishing the evidence shall be kept for at least 5 years and shall be made available upon request, to the competent authority of the Member State concerned or to the EU Commission.