# Document Reference: OFS-SSS-422-R1

# Functional Specification

# 220kV Circuit Breakers for Air Insulated Stations

| Revision | Date | Description | Originator | Reviewer | Checker | Approver |
|---|---|---|---|---|---|---|
| R0 | 20/04/2022 | First Issue | Vitali Garon | Niall McMahon<br>Daniele Giustini | Leon Notkevich,<br>Neil Cowap | Aidan Corcoran,<br>Richard Blanchfield |
| R1 | 29/092022 | Issued for use after industry feedback | Vitali Garon | Daniele Giustini | Neil Cowap | Louise O'Flanagan |

# 1 SCOPE

This Functional Specification covers the requirements for supply of 220 kV circuit breakers for onshore compensation compounds (OCC) for use in offshore wind transmission links delivered by the Customer as Contestable Works, to be owned and operated by EirGrid.

The TECHNICAL SCHEDULE OTS-SSS-422 gives further requirements and shall be filled for each type of 220kV circuit breaker offered.

# 2 LEGISLATION CODES AND STANDARDS

## 2.1 LEGISLATION

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

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

| Reference | Title |
|---|---|
| SI No. 132 | Safety signs regulations 1995 (implements EEC Directive 92/58) |
| SI No. 291 | Safety, Health and Welfare at Work (Construction) Regulations |
| SI No. 299 | Safety, Health and Welfare at Work (General Application) Regulations 2007 |
| SI No. 445 | Safety, Health and Welfare at Work (General Application) (Amendment) Reg. 2012 |
| Reg (EC) No 1907/2006 | Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) |
| Reg (EC) No 1272/2008 | Classification, Labelling and Packaging of Substances and Mixtures (CLP) |
| Reg (EU) No 517/2014 | Fluorinated greenhouse gases and repealing regulation (EC) No 842/2006 |
| Reg (EU) 2015/2068 | Format of labels for products and equipment containing fluorinated greenhouse gases |
| Reg (EU) 2015/2065 | Format for notification of the training and certification programmes of the Member States |
| Reg EU 2015/2066 | Minimum requirements and the conditions for mutual recognition for the certification of natural persons carrying out installation, servicing, maintenance, repair, or decommissioning of electrical switchgear containing fluorinated greenhouse gases or recovery of fluorinated greenhouse gases from stationary electrical switchgear |
| Directive 2011/65/EU | Restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS) |

| | |
|---|---|
| Directive 2012/19/EU | Waste electrical and electronic equipment (WEEE) |
| Directive 2014/30/EU | Harmonisation of the laws of the Member States relating to electromagnetic compatibility |
| ECE/TRANS/275 | Vol. I and II ("ADR 2019") European Agreement Concerning the International Carriage of Dangerous Goods by Road |

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

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

## 2.2 National International and Other Applicable Standards

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

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

Where no IEC standard or EN standard has been issued to cover a particular subject then an international or British Standard shall be applied. The latest edition and amendments shall apply in all cases. The equipment shall comply with the latest editions of the international standards, codes and normative references indicated below, and the latest editions of the standards that they reference.

| Reference | Standard Name |
|---|---|
| I.S. 10101 | National rules for Electrical Installations |
| ET103 | National rules for electrical installations – Power installations exceeding 1 kV AC |
| IEC 60273 | Characteristics of Indoor and Outdoor Post Insulators for systems with Nominal Voltages Greater than 1000V |
| IEC 60060 | High voltage test techniques |
| IEC 60068 | Environmental testing |
| IEC 60255-5 | Insulation Tests for Electrical Relays |
| IEC 60265 | High Voltage Switches |

| Reference | Standard Name |
|---|---|
| IEC 61166 | Guide for seismic qualification of high-voltage alternating current circuit-breakers |
| IEC 61463 | Bushings- Seismic qualification |
| 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) |
| IEC 62271-1 | High voltage switchgear and control gear – Part 1 Common specifications for alternating current switchgear and control gear |
| IEC 62271-100 | High voltage switchgear and control gear - Part 100:<br>Alternating-current circuit-breaker |
| IEC 62271-110 | High voltage switchgear and control gear – Part 110: Inductive load switching |
| IEC 62271-301 | High voltage switchgear and control gear - Part 301: Dimensional standardisation of HV terminals |
| IEC 62271-306 | High voltage switchgear and control gear - 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 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 |

| Reference | Standard Name |
|---|---|
| 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 - Pre-release 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 control gear |

This specification shall take precedence in case of conflict between it and any of the listed standards.

In addition, there shall be compliance with the provisions of all relevant Directives of the European Communities relating to work equipment, i.e. in regard to safety of personnel who operate and maintain the equipment. In order to prove compliance, the equipment shall carry the CE Mark in accordance with Direction 93/465/EEC.

## 3 Network Parameters

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

The rated withstand voltage of auxiliary circuits shall be 2kV r.m.s. Lower test voltage can be used only if agreed with EirGrid.

## 4 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.

Circuit breakers shall have three independent poles. EirGrid may or may not require that the control relay for soft closing be included in the scope of supply. Refer to project specific requirements.

Circuit breakers shall be designed to last a minimum of 40 years.

The interrupting medium shall be SF6 (Sulphur Hexafluoride) gas and the circuit breaker as supplied shall be complete with first filling of gas. Other interrupting medium can be used only if agreed with EirGrid.

Circuit breakers shall be designed and rated to switch overhead transmission lines, underground cables, offshore cables and shunt reactors, harmonic filters, transformers, and combined busbar sections.

## 4.1 RATINGS

All circuit breakers shall be in accordance with IEC 62271-1, IEC 62271-100, and associated specifications. The appropriate ratings should be determined depending on project design requirements.

### 4.1.1 VOLTAGE AND INSULATION LEVEL

The rated voltages of the circuit breakers shall be the highest network voltages as specified under NETWORK PARAMETERS in OFS-SSS-400 specification.

The insulation withstand levels, the normal and higher creepage distances and insulation level of auxiliary circuits shall be as specified under NETWORK PARAMETERS. In the case of creepage, it will be specified in the TECHNICAL SCHEDULES whether the normal or higher value is required.

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

### 4.1.2 SHORT TIME CURRENT WITHSTAND

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

### 4.1.3 DURATION OF SHORT-CIRCUIT

The rated duration of short-circuit shall be the standard value of 1 second according to IEC 62271-100.

### 4.1.4 SHORT-CIRCUIT BREAKING CURRENT

The minimum RMS value of the AC component, for each network voltage, shall be the three-phase short circuit current specified under NETWORK PARAMETERS sub-section in OFS-SSS-400 specification.

The percentage DC component shall be determined according to IEC 62271-100.

### 4.1.5 TRANSIENT RECOVERY VOLTAGE

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

**Table 1 Transient Recovery Voltage**

| System Voltage | TRV |
|---|---|
| 220 kV | (364*1.5/1.3) = 420 kV |
| 400 kV | 943 kV |

The Customer shall perform detailed switching studies for each installation and demonstrate the suitability of each breaker by confirming the resulting calculated peak TRV.

### 4.1.6 Operating Sequence

All circuit breakers shall be suitable for auto-reclosing in accordance with Table 2.

**Table 2 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 |

### 4.1.7 Short-Line Fault Characteristics

In accordance with IEC 62271-100.

### 4.1.8 Out-Of-Phase Breaking Current

The out-of-phase breaking current shall be 25% of the rated short circuit breaking current in accordance with IEC 62271-100. The power frequency recovery voltage and rate of rise shall be those applicable to networks with earthed neutrals.

### 4.1.9 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 capacitive switching currents shall meet the requirements of Table 9 of IEC 62271-100[1]

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

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.

### 4.1.10 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.

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

The circuit breaker shall be required to switch shunt reactors and the rated current shall be taken as per IEC 62271-306 or another relevant IEC standard. The Customer should also state in the technical schedules the guaranteed maximum switching overvoltage's when breaking currents in the stated range.

The Customer shall calculate the amplitude of over-voltages generated by switching inrush currents associated with reactors of the ratings. The reactor 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 62771-110.

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.

#### 4.1.11 PARTIAL DISCHARGE

There are no partial discharge requirements of 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), evidence shall be submitted by the Supplier / Customer showing that those components have passed the partial discharge tests in accordance with the IEC Publication.

#### 4.1.12RADIO INTERFERENCE LEVEL

The radio interference level at 1.1Ur/√3, when measured in accordance with IEC 62271-1, shall not exceed 2500 μV.

### 4.2 MECHANICAL TERMINAL LOAD

The rated static withstand loads in a horizontal direction shall be as required for the specific application. The minimum requirements are outlined in the TECHNICAL SCHEDULES.

The circuit breakers shall be capable of withstanding the specified static loads which include for the effects of wind, 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) as per relevant IEC standards but minimum of 1.4 times the static withstand load.

Typical requirements for static withstand loads on the networks covered by this

specification are as follows;

- 3kN for horizontal loads parallel to the pole/current circuit,
- 3kN for horizontal loads perpendicular to the pole/current circuit.

# 5 SF6 GAS SYSTEM

A visual indication of the level of an $SF_6$ shall be provided. Gauges shall indicate 'gauge' pressure in bar and kPa, i.e. pressure relative to atmospheric pressure, and shall be temperature compensated for a temperature of 20ºC.

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 3 SF6 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.

Gauges shall be clearly visible from ground level.

Local gauges have three voltage free contacts for alarm and tripping purposes, 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. One of these contacts will be used for alarm purposes and the other for tripping/ lockout.

The gas system shall incorporate a means of continuously 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.

## 5.1 GAS SEALING

a) The lifetime of the gas-tight seals shall be at least equal to the anticipated lifespan of the whole switchgear.

b) The Customer shall quote the guaranteed maximum annual leakage tests rates.

c) The Customer shall submit details of the routine gas leakage test.

d) The Customer shall supply:

- Details of seals
- Design life of seals

- A calibrated pressure or gas density monitoring device shall be provided to ensure a leakage rate of less than 0.1 %.

## 5.2 SF6 GAS SYSTEM

The Customer shall provide a gas filling/sampling valve, type Dilo DN20, fitted to the equipment.

It shall be possible to check the operation of the densimeter without need for evacuation of the entire gas volume.

The Customer shall supply details of recommended gas handling and testing equipment required for the installation and maintenance of the equipment.

If the insulating medium is SF6 gas, the circuit breaker shall be equipped with:

(a) A visual indication of the pressure level of insulating medium, e.g. an SF6 pressure gauge. The densimeter shall be filled with a damping medium. The indicator shall be clearly visible to an operator standing at ground level.

(b) The densimeter shall be graduated in bar and kPa and shall indicate temperature compensated relative pressure.

(c) Each separate enclosure shall be fitted with a densimeter.

(d) A plate showing the pressure/temperature characteristics for the SF6 in the circuit breaker at normal, alarm and lockout SF6 density.

(e) A two-stage pressure monitoring system to provide an alarm in the event of a significant drop in SF6 pressure and block operation of the circuit breaker when the SF6 pressure falls to the minimum safe operating level.

(f) Built-in means of continuously extracting gas contaminants such as moisture, arc products etc.

### 5.2.1 GAS SPECIFICATION AND TREATMENT

(a) The Customer shall give a complete specification for the gas used in the initial filling of the plant.

(b) Details shall be given of the degree of gas deterioration which can be tolerated before treatment or replacement of the gas is necessary. Details of necessary treatment shall be given.

### 5.2.2 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.

# 6 Operating Mechanism

## 6.1 Type

The operating mechanism shall be of the motor operated spring charge. Pneumatic or hydraulic type **will not** be considered.

A means of manually charging the operating spring must be provided and should be located inside the mechanism/control cabinet. Further when in use the manual charging method should isolate the ac supply to the motor. This mechanism should be 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.

The limits of close proximity to live parts shall be 2100 mm.

Failure of supply to the spring charging motor shall not cause lockout of the circuit breaker.

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.

Each mechanism shall be supplied with a separate (removable) handle/lever for the manual charging of the spring or operating the mechanism and this shall be fixed to the mechanism box, preferably inside the weatherproof door. A mechanical and/or electrical interlock shall inhibit electrical spring charge operation if handle lever is inserted in position for manual charge to prevent the accidental movement of the handle by the spring charge motor.

Suitable thermal overload protection must be provided for the motor.

A mechanically operated device shall indicate whether the spring is charged or free and this shall be visible without opening the operating cubicle doors.

The operating mechanisms shall be so arranged that no moving parts are accessible without removing covers.

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

Details of how to manually ‘slow close’ the circuit breaker should be provided if this function is available on the circuit breaker.

**Circuit breakers shall be suitable for single or triple-pole rapid auto-reclosing.**

Auxiliary Power Supplies

The following auxiliary supplies will be available in the stations in which the circuit breakers will be installed. Operating coils and other auxiliary equipment shall be rated accordingly.

| | |
|---|---|
| 220V DC | For trip and close circuits |
| 220V DC | For signal and alarm circuits |

Tolerances: 85% to 110% of rated voltage.

| | |
|---|---|
| 400/230V AC 50 Hz | for spring winding motors, compressor motors, heaters, etc. as applicable |

The spring winding motor and heaters shall have satisfactory operation at all voltages between 85% and 110% of the rated voltage. They shall be protected by MCB and the motor tested as per IEC 60034.

## 6.2 CONTROL & PROTECTION

Control and Protection and Metering facilities shall be in accordance with OFS-GEN-016 specification for Control, Protection and Metering".

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 operation by push-button.

A local\remote changeover switch shall not be fitted.

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

Circuit breakers having individual drives per pole shall have two independent trip coils and one close coil per pole.

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 one second. The discrepancy trip devices shall operate both trip coils.

Both positive and negative poles of close circuits shall be switched by all devices which initiate closing operations and each pole shall be connected to individual terminals.

All circuit breakers shall be provided with anti-pumping protection.

The circuit breakers shall have a facility for local emergency manual operation; this shall be such that power drives are automatically disabled while it is in use.

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

Each pole of a circuit breaker shall be equipped with a mechanical position indicator. This indicator shall have the words "ON" and "OFF" clearly marked in black lettering on red and green backgrounds respectively.

The mechanism shall be fitted with an operation counter.

## 6.3 AUXILIARY SWITCHES

Auxiliary switches having at least 9 normally-open and 9 normally-closed contacts shall be provided.

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

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

Two spare primary auxiliary contacts (spring) are needed to indicate "circuit breaker ready". These contacts are required to switch two separate 220 V DC supplies.

Spare contacts on densimeters are required to switch two separate 220 V DC supplies.

These quantities apply per pole for circuit breakers having individual drives per pole; otherwise the quantities apply per triple-pole unit.

All contacts shall be rated to switch 220V DC.

These spare auxiliary switches shall be wired to individual terminals in the bay control/marshalling cabinets of the CB.

A contact shall be provided for remote indication of the state of the stored energy device.

### 6.4 Mechanism Boxes/Control Cabinets

Mechanism boxes/control cabinets shall be accessible from the ground. The operating handle must be operable from ground level.

The enclosures of all drive mechanisms/control cabinets shall have degree of protection IP54 in accordance with IEC 60529 and shall be equipped with suitable automatically controlled (230VAC) anti-condensation heaters. The live parts of heaters shall be enclosed with degree of protection IP2X.

The mechanism box shall be provided with a means of ventilation.

Where necessary, provision shall be made at the file terminals for connecting and earthing the Purchaser's multi-core screened 1.5 mm² control cables.

All internal wiring shall be labelled appropriately. All wiring shall have suitable connections for terminating.

An earthing terminal or terminals (12 mm corrosion-free bolt) shall be provided to allow bonding of the circuit breaker chassis and the mechanism box to the system earth grid.

## 7 Mounting Arrangement

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 2300mm. This applies to all voltage ratings.

The minimum height of live parts shall be 4700mm above ground.

The minimum pole spacing (centre to centre) will be 4000mm.

## 8 High Voltage Terminals

The terminals, which shall comply with IEC 62271-301, shall be flat with hole/holes 14mm diameter at 50mm centres or, alternatively, 30mm diameter round copper terminals, as required by the TECHNICAL SCHEDULES.

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.

## 9 Corrosion Protection

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

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

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

Experience has shown that extreme precautions are necessary, because of the high humidity, to prevent the aggressive ingress of moisture between flange plates, around gaskets and 0-rings, at insulator/flange interfaces, etc.

## 10 MARKINGS

Rating plates, labels and other marking shall be clear, indelible, corrosion proof, and shall be in English. The information on rating plates shall be in accordance with IEC 62271-100 and IEC 60694. Rated gas pressure and year of manufacture shall be included. Drawings of all rating plates and labels shall be submitted for EirGrid review .

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

## 11 LIFTING LUGS

Suitable lifting lugs shall be provided for supporting the full weight of the circuit breaker including suitable safety factors for lifting dynamics.

## 12 PADLOCKING

Provision for padlocking operating mechanism cabinet shall be provided with a hole approximately 7mm diameter should be available for accepting padlocks with a shackle bend radius of 30mm, shackle length of 23mm and cross-section of 6.3mm diameter shackle.

## 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.

## 14 TESTS

### 14.1 TYPE

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

The 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.

The Customer shall, in the Schedule of Type Tests (part of TECHNICAL SCHEDULES), list for each type test performed, the test specification, location and date of testing and the Type Test Certificate/Report No. In addition, the Customer shall submit a copy of each Type Test Certificate/Report which shall incorporate full details of test parameters as well as test

results and shall state where the tests were carried out and by whom they were witnessed.

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 Customer is further drawn to the following special requirements:

(a) Critical Current Tests to IEC 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 IEC 62271-100 is required.

(c) A Mechanical Type Test is to be carried out in accordance with IEC 62271-100 latest edition.

(d) A Degree of Protection Test to IEC 60529 shall be performed and witnessed by the Purchaser on the first delivery.

### 14.2 Routine

All circuit breakers shall be routine-tested in accordance with IEC62271-100. The tests may be witnessed by EirGrid.

## 15 Delivery

### 15.1 Review Of Test Results

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

Installation Instructions

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

## 16 Maintenance

### 16.1 Gas Handling Plant

The Customer shall provide the following

A Spare cylinder full of SF6 Gas, for topping up

A simple topping up trolley

### 16.2 Special Tools

The Customer shall list in the 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.

### 16.3 Spare Parts

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

The Customer shall list in the schedule of Recommended Spares (part of TECHNICAL

SCHEDULES) those spare parts which the manufacturer recommends should be held by the EirGrid.

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 and a complete installation instruction with associated drawings. All instructions shall be in English.

### 16.4 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.

## 17 COMPLIANCE WITH SPECIFICATION

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

Documentation

All documentation shall be in English

### 17.1 SUBMISSION FOR DESIGN REVIEW

The following information shall be submitted for review

1) Completion of all technical schedules. Terms and definitions shall be in accordance with IEC 60056 and IEC 60694
2) Fully detailed Type test certificates and reports
3) Complete drawings, detailing physical dimensions, layout of equipment, support structures, fixing details and high voltage connections.
4) Complete set of Electrical drawings detailing in full all electrical circuits and associated accessories.
5) Details of routine testing carried out on equipment at any stage prior to dispatch
6) Completed list of deviations.
7) Full details of any modifications made to the drive mechanism since type testing. This shall require a complete report of testing carried out to prove the modification.
8) Complete technical documentation
9) Complete set of technical drawings
10) Complete list of recommended spare parts
11) Complete list of specialist tools
12) Complete installation instructions
13) Complete operational instructions
14) Complete maintenance instructions
15) Complete decommissioning and dismantling instructions
16) Statement of acceptance of EirGrid warranty
17) Reference list of the specific equipment proposed

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

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