

## **GAS INSULATED SWITCHGEAR**

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## **PURPOSE AND SCOPE**

This document describes the technical requirements for User's equipment directly connected to the England and Wales Transmission system and located within NGET's busbar protection zone operating at nominal voltages of 400 kV, 275 kV, 132 kV and 66 kV unless otherwise agreed with the user as defined in the Bilateral agreement. The principles of this document applies to equipment connected at other voltages".

This document defines the functional and performance requirements for gas-insulated switchgear (GIS). It supports the more general requirements defined in TS 1(RES), TS 2.1(RES) and TS 2.2 (RES).

In addition to busbars and connectors, GIS includes individual components for which separate standards and specifications apply. This document complements the requirements for these components specified in the relevant standards and specifications.

## **PART 1 – PROCEDURAL**

### **1 GENERAL REQUIREMENTS**

Gas-insulated switchgear (GIS) shall comply with IEC 62271-203

Pressurised gas-filled enclosures shall comply with the following CENELEC standards:

EN 50-052  
EN 50-064  
BS EN 50-068  
BS EN 50-069

Cast resin partitions shall comply with CENELEC Standard EN 50-089.

## 1.1 Outage Constraints

Faults occurring in gas zones containing circuit breakers, disconnectors and earth switches shall not force an outage greater than a single bar section to effect repair of the device. Additionally, where the adjacent bay is owned by another utility, sufficient gas zone segregation shall exist between the bays to allow a gas zone at reduced (atmospheric) pressure to sit between the faulted gas zone, where it contains either a circuit breaker, disconnector or earth switch, and the gas zone containing the Point of Isolation for the adjacent bay.

*Informative: To comply with this requirement it may be necessary to introduce additional gas zones between the switching devices and the points of isolation.*

Where a fault would result in the need to switch out parts of a bus coupler or bus section, there is no requirement to have the bus coupler or bus section bay gas zones put back into service provided the fault doesn't necessitate an outage of more than 1 busbar section.

The supplier shall demonstrate by means of gas zone diagrams or otherwise, how compliance with the outage constraint requirements above can be achieved.

## 1.2 SF6 Gas Alarm Scheme

Provision shall be made for connection of each gas density alarm to the substation alarm scheme.

Facilities shall be provided to allow temporary blocking of the density alarm signals from an individual gas compartment so that grouped alarms are not initiated.

*Informative: The objective is to ensure that, during maintenance of primary equipment, standing common alarms do not mask genuine SF6 density alarms from in-service equipment. This is particularly important where a disconnector gas compartment forming the 'point of isolation' for work would normally initiate the same common SF6 density alarm as the compartment that has been opened for maintenance.*

All SF6 gas 'low' alarms shall be enunciated individually such that the section of the substation that requires isolation from the system can be readily identified.

*Informative: Gas zone identification shall use the actual zone name: e.g. X103G1*

Gas alarm systems shall be sufficiently robust so that any single point of failure will not necessitate an outage greater than the outage constraint requirements defined in TS 2.1. (RES).

## 2 PERFORMANCE REQUIREMENTS

### 2.1 Performance at 0 Bar Gauge (barg)

GIS circuit breakers and disconnectors shall be able to withstand two fully asynchronous power frequency voltages applied to the opposite terminals of the same pole when in the OPEN position with each voltage equal to the rated phase to earth power frequency voltage when filled with the insulating gas at a pressure of 0 barg.

GIS equipment shall be able to withstand 1.5 times the rated phase to earth power frequency voltage between its conducting parts and earth and, where appropriate, between phases for a duration of 1 minute when filled with the insulating gas at a pressure of 0 barg.

## 2.2 Internal Arcing

Enclosures shall be capable of withstanding an internal arc of rated short-time current for a duration not less than the main protection fault clearance time given in Table 2 such that no external effect other than operation of the pressure relief device on small gas compartments shall result.

Enclosures shall be capable of withstanding an internal arc of rated short-time current for a duration not less than the back-up or circuit breaker fail protection fault clearance time given in Table 2 such that the resulting effect shall be limited to operation of the pressure relief device(s) or the appearance of a hole, provided there is no ejection of fragmented parts.

Table 2 Fault clearance times for internal arcing design

Rated voltage (kV)	Main protection (ms)	Back-up or breaker fail protection (ms)
420	140	300
300	160	500
145	200	1000

On equipment having three phases in a common enclosure, or gas zone, allowance shall be made for the possibility of faults evolving to include two or more phases.

## 2.3 Partitions

Partitions shall withstand the differential pressures to which they may be subjected during preventative or corrective maintenance.

## 3 ROUTINE TESTS AT SITE

### 3.1 Partial Discharge Tests

Partial discharge activity shall be monitored throughout the site power-frequency high voltage tests of GIS equipment at all voltages in accordance with Dielectric Test Procedure B for tests after installation on site. Where capacitive couplers have not been installed on 132kV equipment and below as standard, alternative arrangements shall be made to monitor partial discharge during power-frequency high voltage testing and at rated voltage.

Prior to site testing, suppliers shall declare the maximum acceptable partial discharge level for a site test at  $1.1U/\sqrt{3}$ . This measurement shall be made on reducing voltage following the power frequency withstand test. The partial discharge level at nominal voltage shall also be recorded.

## 4 FORMS AND RECORDS

Not applicable

## PART 2 - DEFINITIONS AND DOCUMENT HISTORY

### 5 DEFINITIONS

NSI – National Safety Instructions.

PMED – Portable Maintenance Earthing Device.

HVSCC – High Voltage System Changes Certificate

### 6 AMENDMENTS RECORD

Issue	Date	Summary of Changes / Reasons	Author(s)	Approved By (Inc. Job Title)
1	October 2014	New Document	Matthew Iles/ Richard Poole	GCRP

#### 6.1 Procedure Review Date

5 years from publication date.

## PART 3 - GUIDANCE NOTES

### 7 REFERENCES

IEC 61639	Direct connection between power transformers and gas-insulated metal-enclosed switchgear for rated voltages of 72.5 kV and above
IEC 62271-1	High-voltage switchgear and controlgear – Part 1: Common Specifications
IEC 62271-102	High-voltage switchgear and controlgear – Part 102: High-voltage alternating current disconnectors and earthing switches
IEC 62271-203	Gas-insulated metal enclosed switchgear for rated voltages above 52 kV
EN 50052 (BS 6878)	Specification for high-voltage switchgear and controlgear for industrial use. Cast aluminium alloy enclosures for gas-filled high-voltage switchgear and controlgear.
EN 50064 (BS 7315)	Specification for wrought aluminium and aluminium alloy enclosures for gas-filled high-voltage switchgear and controlgear
BS EN 50068	Specification for wrought steel enclosures for gas-filled high-voltage switchgear and controlgear
BS EN 50069	Specification for welded composite enclosures of cast and wrought aluminium alloys for gas-filled high-voltage switchgear and controlgear
BS EN 50089	Specification for cast resin partitions for metal-enclosed gas-filled high-voltage switchgear and controlgear
BS EN 60529	Degrees of protection for enclosures (IP Code)

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BS 1710	Specification for identification of pipelines and services
ELECTRA No 183	Partial discharge detection system for GIS: Sensitivity verification for the UHF method and the acoustic method
TS 1 (RES)	Ratings and General Requirements for Plant, Equipment, Apparatus and Services for the National Grid System and Connection Points to it
TS 2.1 (RES)	Substations
TS 2.2 (RES)	Switchgear for the National Grid System
TS 3.2.2 (RES)	Disconnectors and Earthing Switches

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