

GAS INSULATED SWITCHGEAR

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PURPOSE AND SCOPE

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

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

For gas zones which contain active switching devices (circuit breakers, disconnectors, earth switches, surge arresters, etc) the design of the equipment shall allow the outage constraint requirements of TS 2.1 to be met. It shall be possible to perform foreseeable activities including maintenance (including replacement of any enclosure and any necessary dismantling of equipment), circuit breaker timing, primary injection tests on CTs and the

construction and testing of substation extensions while meeting the above requirements. It shall be possible to perform such activities with the adjacent gas compartments reduced to atmospheric pressure. This shall be achieved using additional gas zones and without the need for complex working procedures or equipment reconfiguration works.

Faults in active gas zones associated with a bus section or bus coupler bay shall not necessitate an outage of more than 1 bar section.

The maximum allowable outage to repair a fault in a gas zone which contains no active parts (a passive gas zone) is the same as for active zones with an additional allowance of utilising a single equipment reconfiguration with a single associated HVSCC to recover to a situation meeting the requirements of TS 2.1. To limit the amount of reconfiguration works and reduce outage time, complex working procedures may also be acceptable provided a documented method is agreed during Type Registration.

Informative: For the purposes of this statement “a single equipment reconfiguration” refers to the changing of one components or module, whether that be removal, re-orientation, bypass, installation, etc resulting in the network being altered and needing an HVSCC. For phase segregated equipment it is recognised that this may be 3 individual modules or components to cover all 3 phases. Complex working procedures relate to activities which allow specific functions to be carried out under specific conditions. An example of this may be instructions on how to work adjacent to pressurised barriers while not applying any stress to the pressurised barrier.

Informative: The single HVSCC is enacted using the emergency process in TP119, however a second emergency change cannot then be enacted to re-instate the equipment following completion. A short turn around of the diagrams inside the TP119 time scales will be required to get the second HVSCC ready to re-instate the equipment back onto the system

Informative: Where adjacent bays perform the same function due to the inability to sufficiently disseminate them across the substation, i.e. adjacent bays both feed Grid Supply Points, sufficient buffer zones shall be provided to ensure faults in any of their associated passive zones meet the requirements of TS 2.1 without the need for complex working procedures or equipment reconfiguration works.

Where a fault in either a passive or active gas zone 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 of TS 2.1 can be achieved.

1.2 Fault Identification

Large gas zones shall be sufficiently segregated to allow the location of faults to be readily identified. This is to limit the size of outage required to accurately locate the fault and minimise gas handling.

1.3 Multiple Ended Circuits

Bays which are to be connected to multiple ended circuits shall have sufficient provisions to allow works requiring long outage periods, including removing the circuit breaker pole, to be carried out with the remote ends of the circuit in operational service.

Informative: For the purposes of this statement multiple ended circuits are deemed to be any circuit containing more than 2 ends even if two of these go to the same substation at different voltages or extensions

Informative: Where this cannot be achieved using the line disconnecter within the constraints of NSI10 and the bay to circuit interface is in air, the preference is for isolation to be achieved in air to minimise the cost and complexity of achieving isolation. Where practicable this shall not be achieved by removing the overhead line down droppers. Where the bay to circuit interface is not in air National Grid – Policy should be consulted. A short outage to allow system re-configuration works to achieve this isolation may be acceptable.

1.4 Earthing Switches

Earthing switches of class E1 as defined in IEC 62271-102 shall be provided on the circuit side of each line disconnector and at one position on each section of busbar.

Earthing switches installed at positions where the only means of dissipating trapped charge is by closing the earthing switch shall be capable of remote operation.

Informative: This is where a de-energised section of GIS cannot be connected to any of the following: Power transformer/shunt reactor winding; electromagnetic VT on all three phases or external air insulated equipment (bushings, etc).

Earthing switches shall have a directly connected path to the substation Earth Mat to eliminate the risk of accidental disconnection of the Earth Switch from the Earth Mat and provide confidence in its connection with an easily locatable and traceable path. The direct connection shall match the full rating of the earth switch and be located in a convenient position on either the earth switch or the module it is mounted on.

Informative: Where multiple earth switches are located on a single module a single path to earth may be acceptable provided removal/modification of one earth switch doesn't impact on the integrity of the direct path of other earth switches.

1.5 Provisions for Maintenance, Testing and Fault Rectification

Provision shall be made for fitting portable maintenance earthing devices (PMEDs) or utilising special working procedures where these are required to permit maintenance, testing, fault rectification and other works as follows:

- a) To allow an earthing switch that would normally be the point of earthing to be itself maintained.
- b) To earth cable terminations where disconnecting facilities are provided for cable testing.
- c) To provide an earth connection where a section of busbar is removed. This includes the removal of a "T" section of bar connecting a bay to a bar or the bay to its associated selector disconnectors.
- d) To provide an earth connection visible from the point of work.
- e) To provide an earth connection in long runs of busbar or GIB which exceeds 30 meters where no other earth switches can be applied without the need to defeat interlocks.

Special working procedures shall be defined and written in the general O&M manual and designed to work alongside existing working practices and within the procedures defined in the Safety Rules and NSIs. This may require special provisions for locking / interlocking purposes to comply with the Safety Rules, NSIs and legislative requirements. The use of special working procedures shall be agreed during Type Registration.

The positions on the GIS at which PMEDs may be fitted shall be clearly identified by painting in a conspicuous colour/pattern or other means of equivalent durability. The PMEDs shall be clearly visible when applied by painting in a conspicuous colour/pattern or other means of equivalent durability.

1.6 SF6 Gas Service Connections

Equipment shall be laid out in such a way that gas service connections not at ground level by design shall be accessible using standard access equipment. The ability to gain access and perform gas handling with the equipment in service using standard access equipment shall be demonstrated by the manufacturer.

Informative note: Accessing gas service connections using standard access equipment shall be achieved using either a MEWP, scaffolding or existing fixed platforms.

A schematic diagram shall be provided showing the gas compartments within a bay and their relationship to the primary plant of that circuit or busbar section.

Filling points shall be fitted with DILO DX(20/50) self-sealing valves.

A lockable arrangement to prevent unauthorised operation of the gas service valves shall be provided at each filling point.

1.7 Pressure/Density Indication

A permanently installed system for monitoring the temperature compensated gas pressure or density in each compartment shall be provided.

The system shall provide a visual indication of the gas pressure or density in each gas compartment.

The system shall be capable of initiating gas density alarms at user configurable trigger levels.

The system shall be capable of detecting a gas loss equivalent to 0.5% of the gas compartment volume per annum or shall provide trend analysis facilities.

It shall be possible to replace a pressure or density sensor without taking the GIS out of service.

1.8 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 disconnect 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