

GAS INSULATED TRANSMISSION LINES

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PURPOSE AND SCOPE

This document gives the requirements for gas-insulated transmission lines connected to the National Grid system. Any reference to TS within this document refers to National Grid's Technical Specifications. This document supports the more general conditions defined in TS 1 and associated documents.

National Grid specification for gas-insulated transmission lines is by reference to IEC 62271-204 and associated documents. This document defines enabling parameters and additional technical requirements for gas-insulated transmission lines for use on, and directly connected to, the National Grid Company Transmission System (National Grid System) and rated from 132 kV to 420 kV.

PART 1 – PROCEDURAL

1 GENERAL REQUIREMENTS FOR GAS-INSULATED TRANSMISSION LINES

The GIL shall be designed for a service life of at least 40 years subject to periodic preventive maintenance being carried out in accordance with the supplier's instructions. The supplier shall indicate the maintenance requirements and the period for application to achieve this and shall indicate the life cycle costs of this pattern of maintenance during the tender phase.

The specific maintenance requirements following internal arcing or other severe conditions shall be recommended to National Grid by the supplier.

1.1 Requirements for Gases

Gases shall conform with the requirements of TS 2.2 for compressed gas. This includes sulphur hexafluoride (SF₆) gas, and any other gases and gas mixtures.

The Installation shall be designed to minimise the volume of insulating gas installed e.g. SF₆. The supplier shall provide details of the proposed insulating gas or gas mixture.

Gas service connections shall conform with TS 3.2.14.

1.2 Earthing and Bonding

Provision shall be made for earthing the main circuits where required to permit maintenance and testing. The requirements of IEC 62271-204 shall be met regarding trapped charge.

The earthing requirements for buried GIL shall comply with TS 3.5.7.

The earth connections are specified in TS 3.1.2 for adjacent substation and overhead line earth systems.

The enclosures of the GIL shall be solidly bonded and earthed at both ends unless otherwise agreed.

Enclosures and any additional earth continuity conductor shall be connected to earth via suitable low impedance connections at terminations, at any locations where personnel may come in contact with the GIL enclosure, e.g. commissioning and monitoring pits, and where electronic devices are mounted on the enclosure.

Where metalwork may be subject to a standing voltage in excess of 10 V a.c. precautions shall be taken to prevent accidental contact.

For directly buried GIL, the design of the earthing of the enclosure shall be compatible with the measures for corrosion protection. Enclosure-disconnecting links shall be provided to permit electrical testing of the passive corrosion protection (over sheath).

1.2.1 Requirements for Link Housings and Bonding Leads and Earth Continuity Conductor are specified in Appendix A and Appendix B of TS 3.5.4. Transient Enclosure Voltages

It may be necessary to use enclosure sectionalising insulation. Where it is necessary to control transient voltages non-linear resistors may be used.

1.2.2 Steady state enclosure voltages

Where non-linear resistors are fitted the enclosure voltage shall not exceed their maximum a.c. continuous rating under both normal loading, emergency loading and the external single-phase-to-earth short-circuit conditions as defined in TS 1.

The requirements for conductors for adjacent substation and overhead line earth systems are specified in TS 3.1.2.

1.2.3 Termination into Metalclad Equipment

The sectionalising insulation on terminations into metalclad equipment, where there is no transformer between the termination and the switchgear, shall be protected against induced transient voltages during switching operations.

Note: Suitable methods are non-linear resistors or short circuit links across the sectionalising insulation. Typically two or more connections shall be provided not more than 500mm in length evenly spaced around the enclosure sectionalising insulation. These links or non-linear resistors do not need to be enclosed by a link housing.

For any links or non-linear resistors across the sectionalising insulation, the arrangement shall be designed so that the link or non-linear resistor can be removed during maintenance without disturbing fixings of the accessory or GIS.

Note: In order to facilitate maintenance in accordance with UK BP/SE/NSI/NSI 5, it may be necessary to use additional links housed in lockable link housings.

By preference, unearthed enclosures should be avoided on terminations into metalclad equipment where there is no transformer between the termination and the switchgear.

1.3 Monitoring Systems

Sensors for UHF partial discharge monitoring are required to be located on all phases adjacent to the extremities of the GIL and at intervals between these points. The supplier shall indicate the maximum interval between sensors required in order that effective coverage of the GIL is achieved.

A fault location system shall be provided to facilitate the inspection and repair of the affected section of GIL in the event of an internal fault. The manufacturer shall state the means by which the fault location system operates and the accuracy with which a fault can be located under service conditions.

1.4 Low and High Pressure Signalling Devices

Low and high gas / pressure gas density signalling shall follow the requirements of TS 3.2.14. together with the following:

Systems offering facilities for remote indication are preferred. Where the indication is of density this shall be displayed as an equivalent pressure at a reference temperature. The equipment shall be permanently installed.

Each density monitor shall be provided with a means of checking initiation of the 'falling' and 'low' density alarms without reducing the pressure in the main compartment. The method of providing this facility shall be to the approval of National Grid.

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

1.5 Nameplates, Identification and Marking

Plant and equipment shall be identified in accordance with TS 2.1. The position of each non-breathing gas zone partition shall be clearly identified by painting a band round the GIL enclosure where the barrier is fitted in a distinctive colour.

Each gas zone and each length of auxiliary cable shall be allocated a distinctive and separate manufacturers reference number. This number shall be used on all appropriate test sheets and documentation.

Directly buried GIL shall be marked in accordance with IEC 62271-204. The markings shall run along the GIL in four or more lines, equally spaced around the circumference of the enclosure, and the distance between the end of one marking and the start of the next marking shall not be greater than 150mm. The characters shall be at least 10mm in height.

Marker posts and plates shall be provided as specified in TS 3.5.7.

Fixed gas pipework shall be identified in accordance with BS 1710.

1.6 Partitions

The plant shall be segregated into independent gas zones. It shall be possible to perform foreseeable activities, including maintenance, without the need to work adjacent to a gas compartment partition when pressurised on one side.

The GIL-system shall be sectionalised and partitioned as required in order to meet the objectives of a cost effective installation, the limitation of the fault affected GIL part, the

reduction of environmental impacts and the convenience of operation and maintenance activities.

Gas zone barriers shall conform with TS 3.2.14

1.7 Pressure Relief

Where bursting disks and explosion vents are provided, these shall be as specified in TS 3.2.14.

Informative: Depending on the volume of the gas zone, the pressure, in case of a fault, may not exceed the routine test pressure of the enclosure; in such a case a bursting disk is not mandatory.

1.8 Corrosion Protection for Buried Installations

Directly buried GIL shall be provided with passive corrosion protection in the form of a corrosion resistant coating as specified in section 1.8.1 below.

In addition to the passive corrosion protection, an active corrosion protection system may also be provided.

The proposed corrosion protection system shall achieve a service life of at least 40 years in full working order subject to periodic preventive maintenance being carried out in accordance with the supplier's instructions.

Where a cathodic protection system is to be installed on behalf of National Grid this shall comply with the requirements of BS EN13636 'Cathodic Protection' and in addition no part of any buried steel in concrete shall be subjected to a positive charge that exceeds 20 mV.

1.8.1 Anticorrosion Coating

The anticorrosion coating shall be seamless and shall be sealed to the metal enclosure to prevent the passage of moisture along the interface between the two components.

The anticorrosion coating shall be free from imperfections, lumps and indentations.

To reduce the penetration of moisture through the anticorrosion coating it shall comply with the requirements of the Vapour Transmission Test specified in the Type Test Requirements below.

Note: The rate of corrosion of enclosure materials is highly dependent on the chemical behaviour of all components. Research suggests that anticorrosion coating materials with high vapour transmission capability provide poorer protection against corrosion than those with low vapour transmission capability.

The anticorrosion coating shall not be constructed of materials that may cause unnecessary hazards in the event of fire.

Note: These requirements will exclude the use of currently available polyvinyl chloride (PVC) materials.

The anticorrosion coating shall be covered with a conducting layer of graphite, or other conductive material, with good adhesion properties to assist testing of the anticorrosion coating. The application of the conducting layer shall be designed so as not to interfere with any active corrosion protection system.