

BUSHINGS FOR HIGH VOLTAGE ALTERNATING CURRENT SYSTEMS

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PURPOSE AND SCOPE

This Specification defines the functional and performance requirements for bushings for connection to the National Grid UK Electricity Transmission System. It supports the more general requirements defined in the companion documents TS 1, TS 2.1, TS 2.02 and TS 2.03.

This specification is applicable to bushings intended for use on alternating current systems only.

PART 1 – PROCEDURAL

1 GENERAL REQUIREMENTS

Bushings shall comply with TS 1, TS 2.1, TS 2.02 and BS EN 60137. In addition, the following clauses apply:

1.1 General Requirements for all Bushings

Bushings with capacitance grading shall be provided with a test terminal (test tap) as defined in BS EN 60137.

External insulation shall comply with TS 3.01.07.

1.2 Additional Requirements for Power Transformer Bushings

Bushings shall comply with TS 2.03.

To comply with the requirements of TS 2.03, bushings shall be of a type that if they fail externally shall not release liquid from the transformer.

The oil end of power transformer bushings shall be suitable for accommodating current transformers in accordance with TS 2.03 and TS 3.02.04.

Oil/SF₆ power transformer bushings (completely immersed type), one end of which is intended to be immersed in SF₆ to form a direct GIS connection, shall be selected to facilitate interchangeability of transformer spares in accordance with TS 2.03.

Oil/SF₆ power transformer bushings connected to GIS shall comply with the temperature rise criteria of BS EN 60137, operating at the GIS rated temperature limit as specified in BS EN 62271-203.

Oil/air power transformer bushings which are intended for operation with phase isolated busbar systems shall be suitable for operation at a maximum air temperature of 75°C and a maximum oil temperature of 80°C.

Oil/air power transformer bushings shall have provision for co-ordinating gaps in accordance with TS 3.3.3.

1.3 Additional Requirements for Oil Filled Bushings

For bushings containing oil, an indicator to check the correct amount of oil is in the equipment shall be provided (generally a sight glass).

All oil-filled equipment shall be fitted with an oil sample valve, situated on the earth flange, suitable for taking oil samples for Dissolved Gas Analysis (DGA) in accordance with BS EN 60567. Valves where the oil is extracted by using a hypodermic needle are not acceptable.

For oil impregnated paper bushings, the bushing design shall have sufficient oil capacity to allow 1 litre of oil to be extracted over the lifetime of the bushing for dissolved gas analysis purposes. Alternatively, the supplier shall provide instructions on how to replenish the bushing with oil.

Oil/SF₆ power transformer bushings of the oil impregnated paper type shall be fitted with a suitable pressure gauge and switch to give indication and alarm facilities in the event of:

- a) Leakage of SF₆ gas from the GIS enclosure into the self-contained bushing oil.
- b) Loss of oil from the bushing.

The switch (or switches) shall be capable of giving an alarm at abnormally low or abnormally high operating pressures of the internal bushing oil zone. The switches shall comply with BS EN 61810-2. Alarm pressure settings shall be appropriate to the bushing design and application.

2 PERFORMANCE REQUIREMENTS

Bushings shall comply with the performance requirements of BS EN 60137 according to the relevant rating requirements detailed in TS 1, TS 2.02 and TS 2.03.

3 TEST REQUIREMENTS

Bushings shall be type tested to BS EN 60137.

Cantilever load withstand – The test load shall be to Level II (heavy load) of BS EN 60137.

During the Temperature Rise Test the thermal time constant shall be determined on raising and lowering the temperature.

Routine tests shall be performed before and after all type tests.

An oil sample for DGA shall be taken from all oil filled bushings, before and after the dielectric type tests. There shall be no change in the dissolved gas levels before and after type tests.

3.1 Additional Type Test for Bushings of the Capacitively Graded Type

Bushings for all switchgear applications shall have chopped impulse tests similar to those specified for transformer bushings in BS EN 60137. The bushings shall be subjected to 5 impulses of negative polarity, chopping of the impulse being made by means of an air insulated gap. The peak voltage level shall be 100% of the rated BIL. The time to sparkover of the chopping gap shall be between 1 µs and 6 µs.

Bushings for gas insulated switchgear shall also be subjected to 30 impulses of both positive and negative polarities with a chopping gap immersed in SF₆ and located adjacent to the SF₆ end of the bushing. The peak voltage level shall be 60% of the rated BIL. The time to sparkover of the chopping gap shall be between 1 µs and 6 µs.