

DISCONNECTORS AND EARTHING SWITCHES

This document is for internal and contract specific use only.

Disclaimer

NGG and NGET or their agents, servants or contractors do not accept any liability for any losses arising under or in connection with this information. This limit on liability applies to all and any claims in contract, tort (including negligence), misrepresentation (excluding fraudulent misrepresentation), breach of statutory duty or otherwise. This limit on liability does not exclude or restrict liability where prohibited by the law nor does it supersede the express terms of any related agreements."

TABLE OF CONTENTS

PURPOSE AND SCOPE	1
PART 1 – PROCEDURAL	1
1 RATINGS AND PERFORMANCE REQUIREMENTS	1
2 GENERAL REQUIREMENTS FOR DISCONNECTORS AND EARTHING SWITCHES	4
3 OPERATING MECHANISMS, ANCILLARY EQUIPMENT AND THEIR ENCLOSURES	8
4 TYPE TEST REQUIREMENTS	10
5 TYPE REGISTRATION OF EQUIPMENT	11
6 ROUTINE TEST REQUIREMENTS	11
7 COMMISSIONING TEST REQUIREMENTS	11
8 FORMS AND RECORDS	11
PART 2 - DEFINITIONS AND DOCUMENT HISTORY	11
9 DEFINITIONS	11
10 AMENDMENTS RECORD	12
11 IMPLEMENTATION	12
PART 3 - GUIDANCE NOTES AND APPENDICES	13
12 REFERENCES	13
APPENDIX A - AUXILIARY SWITCH POSITIONS IN RELATIONSHIP TO THE DISCONNECTOR POSITION	15

PURPOSE AND SCOPE

This specification for disconnectors and earthing switches is by reference to BS EN 62271-102, BS EN 62271-1, BS EN 62271-203 and associated documents. This document defines the functional performance requirements for disconnectors and earthing switches for use on, and directly connected to, the National Grid Transmission System, rated from 72.5kV to 420 kV. It supports the more general conditions defined in the companion documents TS 1, TS 2.1, and TS 2.2.

PART 1 – PROCEDURAL

1 RATINGS AND PERFORMANCE REQUIREMENTS

1.1 Compliance with Technical Specifications

1.1.1 Disconnectors and earthing switches shall comply with the general ratings and performance requirements defined in TS 1, TS 2.1 and TS 2.2

1.2 Compliance with International Standards

1.2.1 In addition to compliance with National Grid Technical Specifications, disconnectors and earthing switches shall satisfy;

- (a) the common requirements of BS EN 62271-1
- (b) the specific requirements of BS EN 62271-102

1.3 Gas Insulated Switchgear (GIS) General requirements

- 1.3.1 The requirements for GIS switchgear specified in the Technical Specifications and International Standards, referenced in clauses 1.1.1 and 1.2.1 above, shall apply. In addition, the requirements of BS EN 62271-102 and TS 3.2.14 shall apply.

1.4 Rated Short-Time Withstand Current

- 1.4.1 If an earthing switch is combined with a disconnector as a single unit, the rated short-time withstand current of the earthing switch shall be at least equal to that of the disconnector.

1.5 Divided Support Disconnectors and Earthing Switches

- 1.5.1 Divided Support (i.e. Pantograph/Semi-Pantograph design) disconnectors, and associated earthing switches, shall be capable of operating to the limits of their rated contact zone as detailed in Table 1 and Table 2 of BS EN 62271-102.

1.6 Bus-transfer Duty

- 1.6.1 Disconnectors intended for bus-transfer or mesh-corner switching shall comply with the bus transfer requirements of BS EN 62271-102 Annex B. For disconnectors having a rated normal current greater than 2000A, a rated bus-transfer current switching capability of 80% of rated normal current shall also be demonstrated. Other test conditions shall be in accordance with IEC 62771-102 Annex B but the test shall be limited to 10 make-break operating cycles. .
- 1.6.2 Where GIS disconnectors are used to switch AIS busbars, the bus transfer voltage specified in BS EN 62271-102 Annex B for AIS disconnectors shall be the applicable value.
- 1.6.3 Bus transfer switching contacts fitted to disconnectors shall be designed so that their operation is independent of the speed of operation of the main contacts.
- 1.6.4 The design of the disconnector shall ensure that the operator is not endangered by arc debris during bus-transfer switching.
- 1.6.5 Disconnectors intended for bus-transfer or mesh-corner switching shall comply with the auxiliary switch requirements for disconnectors with bus transfer duty, as per clause 3.6 and 3.7 of this specification.

1.7 Overhead Line Induced Current Switching Earthing Switches

- 1.7.1 Earthing switches for application to overhead line circuits shall meet the requirements of, and be subjected to the tests identified within BS EN 62271-102 Annex C to the rating of Class B, however, the test current levels should be calculated with consideration given to the informative statement below.

Informative: It has been identified that the current ratings specified in BS EN 62271-102 are not sufficient for the National Grid Transmission system (electrical). System studies have shown a potential circulating current of up to 10 % of the circuit rating may exist in some circuit configurations.

- 1.7.2 420 kV and 300 kV rated earthing switches shall be capable of withstanding 500 A rms electromagnetic coupling.
- 1.7.3 The design of the earthing switch shall ensure that the operator is not endangered by arc debris during the switching operation.

Informative: Preference is given towards designs which contain the switching arc and prevent operator exposure to the arc, and arc debris.

- 1.7.4 The design of the earthing switch shall ensure that any voltage present on the transmission circuit is not transferred down to a level below the design safety clearance distance defined within TS 2.1. If this is inherent within the design, the operator shall be physically shielded from accidentally coming in to contact with the charged components, and suitable warning labels shall be fitted, drawing attention to the potential hazard.
- 1.7.5 A timing test (Type Test) to demonstrate the timing of the “Class B” contacts in relation to the primary contacts during a normal open and close sequence shall be performed and recorded.

1.8 Ferroresonance Suppression

- 1.8.1 Earthing switches designed for ferroresonance suppression shall be capable of making onto a ferroresonant condition without damage to the main moving and fixed contacts used for the prime earthing function.
- 1.8.2 All earthing switches classified as ferroresonance switching devices shall be capable of an electrical duty consisting of 10 making operations each followed by a breaking operation. The value of the making current for this duty is detailed in clauses 1.8.3 for 420 kV and 1.8.4 for 300 kV earthing switches.
- 1.8.3 420 kV rated earthing switches shall be capable of making onto a peak current of 350 A pk (100 A rms).
- 1.8.4 300 kV rated earthing switches shall be capable of making onto a peak current of 300 A pk (80 A rms).
- 1.8.5 The ferroresonance test voltage during the making operation shall be at 1.2 p.u. of the maximum continuous system voltage as defined in TS 1.
- 1.8.6 The breaking operations shall demonstrate satisfactory performance for the values of current appropriate to Class B (Electrostatic) of BS EN 62271-102, Annex C.
- 1.8.7 Following the ferroresonance switching test, the earthing switch shall be checked to confirm it is capable of carrying its’ rated short circuit current. This can be achieved by following the checks outlined in BS EN 62271-102 clauses 6.6.4 and C6.105.9.
- 1.8.8 A timing test (Type Test) to demonstrate the timing of the “Ferroresonance” contacts in relation to the primary contacts during a normal open and close sequence shall be performed and recorded.

1.9 Rated Values of Mechanical Endurance for Disconnectors

- 1.9.1 Disconnectors shall be rated to Class M1 as specified in BS EN 62271-102.

1.10 Rated Values of Electrical Endurance for Earthing Switches

- 1.10.1 Air Insulated earthing switches shall be rated to Class E0 as specified in BS EN 62271-102.
- 1.10.2 GIS earthing switches shall be rated to Class E0, or E1, as specified in BS EN 62271-102.
- 1.10.3 Class E1 rated earthing switches shall be required in locations specified in TS 2.1.

Informative: Portable Maintenance Earthing Device requirements are not within the scope of this Technical Specification. Requirements for this equipment are contained within TS 2.1 and TS 3.2.14

2 GENERAL REQUIREMENTS FOR DISCONNECTORS AND EARTHING SWITCHES

2.1 Motor operation

- 2.1.1 Unless specified by NG, disconnectors and earthing switches shall be motor/power operated, and be capable of manual (hand) operation from a local operating position. Use of manual operation devices (e.g. hand-crank, lever etc) shall render the power-operated mechanism drive inoperative.

Informative: Situations where NG may specify provision of non-motorised manually operated mechanisms shall be defined in TS 2.1.

- 2.1.2 The power operated mechanism shall be capable of local and remote operation. A means of selecting local/remote control modes, and initiating mechanism open and close operations, shall be available at the local operating position.
- 2.1.3 When the equipment is 'in service', and slow operation (i.e. by manual operation) of the primary contacts could result in damage to the equipment, or danger to the operator, then warning labels shall be fitted to the operating mechanism at suitable points. The warning labels shall be permanently fixed and clearly state "Prior to manual operation, ensure this Equipment is made Dead".

Informative: 'In – service' defined in this context means connected to the HV system, and charged at normal operating voltage.

2.2 Post Insulators

- 2.2.1 Disconnectors and earthing switches shall use post insulators, which have been assessed, and comply with the requirements of TS 3.2.9.

Informative: The disconnector / earthing switch Solution Provider shall select a Type Registered post insulator which complies with the requirements of TS 3.2.9, alternatively, the Solution Provider shall offer an insulator which shall be assessed against the requirements of TS 3.2.9.

- 2.2.2 The Solution Provider shall be responsible to select a suitably rated insulator for the purpose of its intended application.

Informative: 'suitably rated' shall include all the aspects which are critical for satisfactory performance i.e. mechanical, electrical, pollution performance, dimensions, fixings, weight and any other characteristics. .

2.3 Primary Interface Terminal

- 2.3.1 A primary interface terminal shall be provided to allow connection of the equipment to the substation. The terminal shall be designed to have sufficient strength and stiffness for connection of the primary conductors, without causing undue deflection of the primary equipment fixed contacts, or affecting the performance of the main contact system.
- 2.3.2 For each voltage classification the rated static mechanical terminal loads shall, as a minimum, be the highest values defined in Table 3 of BS EN 62271-102. The "mechanical endurance" type test and the "operation during application of the rated static mechanical terminal load" type tests shall be undertaken with terminal loadings appropriate for the declared rated values.
- 2.3.3 Maximum permissible terminal loads, rated values of contact zone, and maximum permissible terminal deflection shall be declared for each disconnector or earthing switch derivative, by the equipment manufacturer.

2.4 Clearance Distances For Air Insulated Switchgear Designs

- 2.4.1 Phase-to-phase and phase-to-earth clearance distances shall be as specified in TS 2.1, unless the disconnector or earthing switch has been type tested in accordance with the relevant requirements of BS EN 62271-102, for the rated dielectric performance specified in TS 1. Phase-to-phase and phase-to-earth distances indicated are applicable to disconnectors in any position, including partially operated. Phase-to-phase distances indicated are applicable to earthing switches in any position, including partially operated.

2.5 Design of Primary Contacts

- 2.5.1 The design of disconnector primary contacts shall be such that they do not require inspection or maintenance work for a minimum period of 12 years, under normal operating conditions.
- 2.5.2 The design of earthing switch primary contacts shall be such that they do not require inspection or maintenance work for a minimum period of 12 years, under normal operating conditions.
- 2.5.3 The design of the primary contact system shall not be affected by insulator / primary connection deflection, in accordance with clauses 2.2 and 2.3 of this specification.

Informative: NG strategy is to reduce the need, frequency of intervention (i.e. lubrication) and therefore increase maintenance intervals through the use of technology in the design of primary contacts.

2.6 Simultaneous Operation of Poles

- 2.6.1 The primary contacts of all poles shall operate (open or close) simultaneously, with a maximum spread of 0.5 seconds between first pole contact to open (or close) to the last pole contact to open (or close).

2.7 Flexibility of Design and Setting Adjustment Tolerances

- 2.7.1 All disconnectors and earthing switches shall be designed and constructed with enough flexibility to cater for both coarse and fine adjustments associated with the dimensional tolerances required to achieve the correct settings under site conditions.
- 2.7.2 The manufacturer shall provide adequate installation instructions to ensure that the installer is able to install and set the equipment to the manufacturer's recommendations, and that the installer is aware of any restriction associated with such adjustment. These instructions shall be included in the product operating manual(s).
- 2.7.3 The manufacturer shall provide adequate operation and maintenance instructions to ensure that the equipment is operated in accordance with the manufacturer's recommendations, and that appropriate checks and adjustments are performed during the life of the equipment.

2.8 Position Indication

- 2.8.1 A clear and unambiguous open/closed indication (O/I) label/indicator shall be fitted, identifying the position of the main contacts when the operator is operating the disconnector or earthing switch. This indication shall be visible following operation with the control cubicle secure. The indication shall only be visible when viewed from the local operating position of the equipment.
- 2.8.2 Provision shall be made for remote indication of disconnector and earthing switch primary contact position. The indication shall verify that the contacts of the main circuit are in the fully closed or fully open position, and the mechanical movement of both main contacts, and operating mechanism, is complete.