

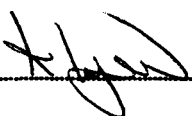
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Business Process Document

Portable d.c. short circuiting devices

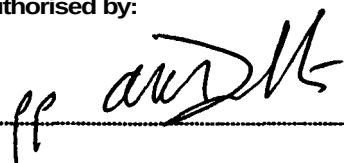
Endorsement & Authorisation

Endorsed by:



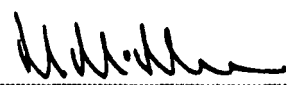
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Issue record

Issue	Date	Comments
2	April 2006	Re-issued as a SAF3 Business Process Document (<i>formerly RT/E/PS/00006</i>)

Implementation

1 April 2006

Compliance

This Network Rail product specification is mandatory and must be complied with by Network Rail and its contractors from 1 April 2006

When this product specification is implemented, it is permissible for all projects, which have formally completed GRIP Level 4 to continue to comply with the Issue of any relevant Network Rail standards current when GRIP Level 4 was reached and not to comply with requirements contained herein unless the head of electrification and plant has stipulated otherwise in the accompanying briefing note.

Where the head of electrification and plant has specified that all projects will comply with the requirements, specific authority not to comply can be sought in the usual manner using the appropriate non-compliance authority processes described in Network Rail standard, [NR/SP/STP/045](#) *Managing the process for non-compliance authority* (formerly RT/LS/P/045).

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1 Purpose

This Product Specification gives the minimum performance requirements for the design, manufacture and testing of portable short circuiting devices to be used on d.c. electrified lines.

2 Scope

This Product Specification shall apply to all portable short circuiting devices: both short circuiting bars and short circuiting straps, used on d.c. electrified lines.

3 Reference documentation

GO/RT3091	Railway Group Standard - DC Electrified Lines Working Instructions
NR/WI/ELP/27051	Network Rail Business Process Document - Working instructions for d.c. electrified lines in the Liverpool area
NR/WI/ELP/27052	Network Rail Business Process Document - Working instructions for d.c. electrified lines Northern City line – local instructions
NR/GN/ELP/27006	Network Rail Business Process Document - Calculation of Protection Settings for D.C. Track Feeders
BS 11: 1985	Specification for Railway Rails
BS 7865 : 1997	Specification for Steel Electrical Conductor Rail for Railway Motive Power Supply

4 Definitions

Electrical Section	A length of conductor and associated running rail(s) and cables which can be isolated electrically by the use of circuit breakers.
Live	Charged with electricity.
Negative Circuit	A circuit at traction negative potential comprising dc negative cables, running rails, bonds, switches and fittings, through which the electricity returns to the source of supply.
Positive Circuit	A circuit nominally at 650/750 V dc through which electricity flows from the source of supply to the train, comprising of positive cables conductor rails, bonds, switches and overhead trolley systems etc.
Short Circuit	A path of insignificant impedance between the positive and negative circuits of an electrical section.
Short Circuiting Device	General term used to describe a dc short circuiting device, either a short circuiting bar or a short circuiting strap.

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Short Circuiting Bar	A device which, when applied between a live conductor rail and the nearest running rail, creates a short circuit.
Short Circuiting Strap	A device for electrically connecting the conductor rail to the traction return rail(s), once the supply has been switched off, in order to prevent the conductor rail being accidentally made live.

5 Background information

5.1 D.C. electrification system

The Network Rail dc electrification system consists of an open, top-contact, third rail configuration, supplied nominally at either 750 V or 660 V from trackside substations. Trains are supplied via shoe gear running along the conductor rail, adjacent to the running rails, and traction current returns to the substation via the interconnected running rail system.

5.2 System voltage

The nominal conductor rail voltage on dc-electrified lines is 650 V or 750 V, depending upon the location. However, the system is designed to operate with conductor rail voltages as low as 400 V, and may experience short term overvoltages up to 900 V. Transient overvoltages up to 5 kV may be produced by switching events.

5.3 System current

Traction currents on dc-electrified lines may be as high as 6.8 kA per train. Consequently, the supply impedance is low, generally less than 100 mΩ. Fault currents are high, and a fault at a substation busbar may have a prospective peak current of 200 kA. Remote faults have prospective current levels generally less than 10 kA. However, these currents are generally interrupted by the track feeder breakers before these prospective levels are reached. The breakers used are high speed dc circuit breakers, which are capable of interrupting a prospective fault current of 200 kA within 20 ms, and lower fault currents within 500 ms.

5.4 D.C. short circuiting devices

Short circuiting devices are used to short circuit the positive and negative circuits of a dc feeder section. In the event of an emergency or inadvertent re-energisation of the supply the devices cause the supply protection to operate. The calculation of protection settings to ensure correct operation under short circuit conditions is given by [NR/GN/ELP/27006](#). Short circuiting devices are to be used in accordance with the requirements of [GO/RT3091](#), [NR/WI/ELP/27051](#) and [NR/WI/ELP/27052](#).

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6 Requirements

6.1 General

When applied across the conductor rail and the running rail(s), the device must present a short circuit between them.

The design of device shall ensure that the length is restricted to prevent fouling of adjacent lines when properly attached to the track, and shall permit use where adjacent lines are open to train movements.

The manufacturer shall clearly specify the limitations of use of the device, taking account of the requirements of this specification.

The manufacturer shall specify routine inspection and repair procedures.

The manufacturer shall specify handling techniques and storage conditions.

The manufacturer shall supply application instructions.

The length of the device shall facilitate easy attachment to the track without causing undue mechanical stress to the device or the rails. Appendix A gives the dimensional layout of a dc electrified track section.

The device shall be fully portable, and (using container where supplied) shall be designed to be carried comfortably by one person for several kilometres over unmade ground such that at least one hand remains free. The design shall aim to minimise the total weight of the device and its container. The optimum design weight shall be less than 3 kg.

Where practicable, the device or its container shall be made of suitable high visibility material, so as not to impair the function of the operator's high visibility clothing during transportation.

The device or its container should be designed or suitably protected to prevent inadvertent contact of any conductive component with the conductor rail during transportation.

The device shall be designed to be conspicuous to staff by day and night when attached to the track.

The device shall be suitable for use in areas fitted with fourth rail electrification, and where necessary shall pass under the fourth rail, not over it.

The design of the device shall aim for zero maintenance and minimal adjustment.

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The design shall ensure that the device is restrained and protected against mechanical damage during transportation and storage.

The design shall allow the device to be left in position unattended.

Where the device is not designed for bright metal rail contact, the design shall ensure positive contact with the rail surface.

The design of the device shall as far as practicable prevent injuries to the operator during proper application and removal, including minor cuts, grazes and trapped fingers.

The device shall withstand the magnetic forces associated with a short circuit without becoming detached from any rail, and without loss of its essential function.

The device shall withstand being trodden on by a typical 100 kg person without suffering damage and whilst maintaining its essential function.

6.1.1 Additional general requirements for short circuiting straps

The device shall be capable of being stored and transported in a volume not exceeding 1500 mm x 200 mm x 200 mm without suffering damage.

Where the design is intended to permit vehicles to pass over it when applied to the rails, it shall not interfere or endanger the passage of vehicles along the track. The device shall maintain its essential function during the passage of vehicles over it or alongside it.

The device shall be capable of being supplied with a secure rail locking arrangement. The locking arrangement shall prevent inadvertent removal of the device from the rails and deter unauthorised removal. The design shall ensure that the rail attachment and locking mechanisms are separate.

The design of the device shall be such that a correctly applied and locked device is not damaged or deformed in any way when a legitimate attempt is made to remove it from the rail without first unlocking it.

6.2 Environment

The device and its container shall be suitable for use in the environment of the track.

The device shall meet the specified requirements over an ambient temperature range of -25°C to +50°C, including the effects of temperature cycling. Flexible devices shall remain flexible over the full working temperature range.

The device and its container shall be suitable for use in wet weather conditions without risk to the operator.