

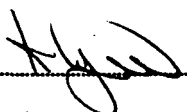
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Date	April 2006

Business Process Document

750 V d.c. switchgear for traction substations and track paralleling huts

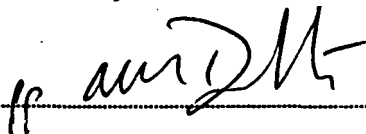
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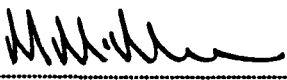
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2	December 2001	Supersedes issue 1
3	April 2006	Re-issued as a SAF3 Business Process Document (formerly RT/E/PS/00018)

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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I Purpose

This product specification states the requirements for the supply of 750 V rated d.c. withdrawable circuit breakers and withdrawable or fixed disconnectors suitable for use in d.c. traction substations and track paralleling huts for the control and protection of d.c. traction power supplies having a nominal voltage in the range 650 V to 750 V. The actual voltage required will be specified and it is expected that only voltage sensing components will need to be suitably modified to meet the actual voltage requirements at specified sites. The requirements cover track feeder circuit breakers, rectifier circuit breakers or disconnectors and bus section circuit breakers or disconnectors.

The document is to be read in conjunction with the relevant procurement specification which states the actual rating values required.

2 Scope

This product specification applies to new d.c. traction switchgear installed on the D.C. Electrified Lines.

3 Reference documentation

NR/SP/ELP/21023	Network Rail Specification for Rectifier D.C. Disconnector Switch for D.C. Traction Substations
NR/SP/ELP/21024	Network Rail Specification for impedance protection relay for 650/750 V d.c. track feeder circuit breakers
NR/SP/ELP/21028	Network Rail Specification for ancillary wiring of electrical distribution equipment on a.c. and d.c. electrified lines
NR/SP/ELP/21032	Network Rail Specification for earthing systems for d.c. traction substations, track paralleling huts and similar equipment locations
EN 50122-1	Railway applications – Fixed installations - Protective provisions relating to electrical safety and earthing
EN 50123	Railway applications – Fixed installations D.C. switchgear Part 1 General Part 2 Circuit breakers Part 3 Indoor disconnectors, switch-disconnectors and earthing switches Part 6 Switchgear assemblies Part 7 Measurement, control and protection devices for specific use in d.c. traction systems 1 Application Guide 2 Isolating voltage transducers and other voltage measuring devices 3 Isolating current transducers and other current measuring devices

EN 50124-1	Railway application – Insulation co-ordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment
EN 50163	Railway applications – Supply voltages of traction systems
EN 60269	Low voltage fuses
EN 60529	Specification for degrees of protection provided by enclosures
BS 5378	Safety signs and colours
BS 7211	Specification for thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire
BS 7430	Code of practice for earthing

4 Definitions

For the purpose of this product specification the following definitions shall apply:

British Standard	A standard published by the British Standards Institution. Its alphanumeric identity is prefixed by BS or BS EN.
Equipment	Equipment including all component parts and accessories.
European Standard	A standard published by the European Committee for Standardisation or by the European Committee for Electrotechnical Standardisation. Its alphanumeric identity is prefixed by EN.
International Standard	A standard published by the International Electrotechnical Commission. Its alphanumeric identity is prefixed by IEC.
Procurement Specification	The contract specific Network Rail documentation, which, together with product specification(s) forms part of an Invitation to Tender or Technical Worksopce.
Product Specification	The Network Rail document which states the main requirements of the equipment to be supplied.
Network Rail Line Standard	A collective term for a Network Rail Line Product specification, Network Rail Line Procedure or a Network Rail Line Guidance Note, published by a directorate of Network Rail plc (in Railway Administration).
SCADA	Supervisory control and data acquisition
T.P.H.	Track paralleling hut.

5 General clauses

5.1 Safety, legislation and regulations

At all times the equipment shall be safe. Measures shall be taken to ensure the safety of persons concerned in its installation, operation, maintenance, repair and its eventual disposal. All apparatus and connections for the safe and satisfactory operation, control and protection of the equipment concerned, shall be provided whether or not specifically mentioned.

The equipment shall be adequately provided with interlocking and locking facilities, earthed, insulated, screened, enclosed etc. Safe and appropriate access shall be provided for operation and maintenance purposes.

The manufacturer shall provide recommendations for training in safe operation and maintenance of the equipment.

5.2 Design, manufacture and workmanship

The equipment shall be designed and manufactured in accordance with best practice, taking cognisance of the system in which it will operate. All material shall be of the quality and of the type most suitable for working under the conditions specified for the full service life of the equipment.

5.3 Spare parts and consumables

The manufacturer shall make recommendations to the purchaser for holdings of spare parts and consumables based on estimated replacement rates and delivery periods to ensure that the equipment complies with this product specification throughout its specified service life. The manufacturer shall indicate the extent of commonality with equipment previously supplied.

5.4 Instruction manual

The manufacturer shall produce a comprehensive and specific instruction manual covering all aspects of installation, operation and maintenance and eventual disposal, and shall supply the number of copies stated in Appendix C. The manual shall provide guidance to enable all work to be carried out safely and efficiently. The manual shall contain only relevant information and shall include:

- a) A description of the construction, installation, functioning and rating of the equipment;
- b) Operating instructions, including safety and isolation procedure;

- c) Routine maintenance including any special precautions, faultfinding and major overhaul procedures and periodicity;
- d) Full details of recommended adjustments and settings for the equipment and its protective devices where appropriate;
- e) Instructions for eventual disposal including safety and handling precautions and recommendations;
- f) Drawings, illustrations and data enabling all component parts to be readily identified and to allow procurement for replacement purposes;
- g) The drawings listed in clause entitled 'Drawings';
- h) A list of locations and associated serial numbers.

The manual shall be of loose-leaf design with at least four retaining rings and with oil resistant hard covers. It shall be of A4 size and include drawings reduced to A3 or A4 size. Drawings reduced in size shall remain clearly legible. The purchaser may accept drawings larger than A3 subject to suitable, clearly labelled protective drawing storage folders being provided for inclusion in the manual.

Three copies of the draft manual shall be submitted to the purchaser not later than the end of the third quarter of the period between the contract date and scheduled delivery date and in sufficient time to enable any modifications to be incorporated and the full quantity of final copies to be available prior to delivery of the equipment.

Before the purchaser takes over full responsibility for the equipment, for example, at the expiry of the maintenance period, any necessary modifications shall be made and sufficient copies provided to the purchaser for incorporating into the full quantity of manuals supplied.

5.5 Delivery

The equipment shall be suitably prepared to withstand, without damage or deterioration, the method of transport to site, crantage, storage and positioning as stated in Appendix C. The equipment shall be protected, as necessary, against the weather. The destination for delivery shall be stated.

Any factor that may affect the onward delivery to a final site, (e.g. dimensions and weight limits) shall be subject to agreement between the manufacturer and the purchaser.

6 Compliance with standards

6.1 European, International and British Standards

The equipment shall comply with relevant European Standards (EN's) whether or not reference is made to them.

In the absence of European Standards, International Standards or national standards having currency within the European Community shall apply subject to the prior agreement of the purchaser.

The editions of standards current at the date of tender shall apply.

6.2 Specific equipment standards

The equipment shall comply with the appropriate standards listed in section 3, Reference Documentation, and all other relevant standards.

7 Performance requirements

7.1 General

The equipment shall be fit for its intended purpose and as may be supplemented by the manufacturer after consideration of the issues in Appendix C.

The equipment shall be free standing, extensible, indoor, metal-enclosed of the metal-clad or compartmented type of switchgear of the air insulated, single pole, single busbar type incorporating withdrawable high speed H circuit breakers and withdrawable or fixed disconnectors.

The equipment shall be complete with all items, including parts, consumables and first fillings of lubricants, desiccants etc, necessary for service operation.

7.2 Environmental conditions

The equipment shall be suitable for its rated characteristics when installed at locations adjacent to railway tracks.

The service conditions are as [EN 50123-1](#) clause 4.1 for normal service conditions as modified for the following special service conditions:

- a) The ambient air is polluted by the presence of airborne metallic dust from train brakes;

- b) The equipment is subject to vibrations caused by passing trains. See [EN50123-1](#) clause B.7. Where more severe conditions are specified these shall be met by the manufacturer who shall be responsible for the design of any necessary specially dampened foundations.
- c) The equipment is subject to strong magnetic fields emanating from adjacent electrical equipment. Hand-held portable radio transmitter/receiver apparatus will be used near the equipment;
- d) Any additional conditions as stated in Appendix C.

The micro environment of electronic equipment shall ensure that such equipment remains within its specified environmental limits at all times.

7.3 Noise emission

Noise emission from indoor and outdoor equipment shall be the minimum practicable and shall be less than 55 dBA measured at any point 2 metres in a horizontal direction from the envelope of any item. In addition, the level in any of the octave bands of centre frequency 250 Hz, 500 Hz, 1 kHz, 4 kHz and 8 kHz shall be less than 58 dB. All levels shall apply to the equipment when operating over its full working range. Ambient noise level shall be assumed to be 10 dB below these values.

The noise emission limits do not apply to the closing and opening operations of the circuit breakers. In accordance with [EN50123-2](#) clause 6.8, the manufacturer shall indicate the noise level of circuit breakers when interrupting their rated service current I_{Ne} .

The installation building or housing shall be considered to have reverberant surfaces.

7.4 Maintainability

The equipment shall be designed for minimum maintenance and should not require a shutdown for routine preventive maintenance for more than a single period of five hours duration in a two year period or as stated in Appendix C.

7.5 Reliability and availability

The equipment will normally remain continuously energised and in service to provide traction power supplies. As failure of the equipment can cause operational delays to the railway, a high level of reliability is required. For critical items of the equipment offered the manufacturer shall state the mean time to failure, the mean time to repair and the mean time to preventive maintenance to maintain full operational performance. For equipment with novel features or where insufficient historical data is available the manufacturer shall state the methods used to determine reliability performance.

7.6 Service life

The equipment including components, but excluding consumable items, shall be capable of complying with this product specification, including performing its intended purpose, for at least thirty years and, in the case of electronic devices, fifteen years, without deterioration in reliability and without preventive maintenance requirements in excess of those stated in clause entitled 'Maintainability'.

7.7 Interchangeability

All like equipment shall be interchangeable as a whole and also as regards its parts. in accordance with [EN50123- 6](#) clause 6.1. Any such change or replacement shall not reduce the capability of the equipment to conform to the requirements of this product specification.

Measures shall be included to prevent inadvertent interchange of circuit breakers or withdrawable disconnectors equipped with differing protection or control circuitry or current rating.

7.8 Finish and resistance to corrosion

Enclosure(s), equipment metalwork, components, accessories, fittings and fastenings (e.g. nuts, bolts, washers etc) shall be protected against corrosion, including galvanic corrosion of dissimilar materials, for the life of the equipment at the specified location with a minimum of periodic restoration work. The treatment and finish method of enclosures and equipment metalwork shall be submitted to the purchaser for agreement.

In the event of sustaining damage or deterioration in service, the finish used shall be capable of being restored to its full protective standard on site. Routine inspection of areas liable to corrosion shall be practicable without the need to dismantle or remove the equipment from service.

7.9 Circuit breaker and disconnecter ratings

7.9.1 Rated voltages

All equipment connected to the positive and negative poles of the d.c. traction supply system shall have the following rated voltages:

Nominal voltage. U_n 750 V d.c.

Note: U_n may be 650 V d.c., but all other rated voltages still apply.

Rated voltage. U_{Ne} 900 V d.c.

Rated insulation voltage. U_{Nm} 1200 V d.c.

Power frequency withstand voltage to earth U_a A 3.6 kV a.c.

Power frequency withstand voltage across break U_a B 4.3 kV a.c.

Note: The above values are selected from [EN50124-1](#).

7.9.2 Circuit breakers as points of electrical isolation

Each circuit breaker shall be suitable for use as a point of isolation whilst in the service position for the purpose of effecting and maintaining electrical isolation. The circuit breaker in the service position and open, shall meet the test requirements U_a B for this condition as specified in [EN50123-6](#) clause 8.3.3.1(b).

7.9.3 Rated service current (I_{Ne}) of circuit breakers and disconnectors

These equipments shall be capable of carrying the rated service current I_{Ne} , or the load cycle for each equipment as stated in Appendix C. The rated service current shall be in accordance with [EN50123-1](#) clause 3.2.10 addressing the requirements for any overload current.

The values of the rated service current I_{Ne} will be selected from one of the following:

$$I_{Ne} = 2000, 3150, 4000 \text{ or } 6000 \text{ A.}$$

If an overload cycle is specified then the manufacturer shall verify that the equipment meets the requirements of [EN50123-1](#) clause 3.2.10.

7.9.4 Rated short circuit current (I_{Nss})

The rated short circuit current I_{Nss} will be as stated in Appendix C and will have one of the following values:

$$I_{Nss} = 31,5 \text{ kA, } 63\text{kA, } 100\text{kA and } 125\text{kA}$$

Note: The above values of rated short circuit current I_{Nss} are the maximum values of the prospective sustained short circuit current that the device will carry.