

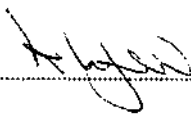
Ref	NR/SP/ELP/21026
Issue	2
Date	December 2005

Business Process Document

Specification for 400/415 V and 440 V changeover switchboards for d.c. traction substations

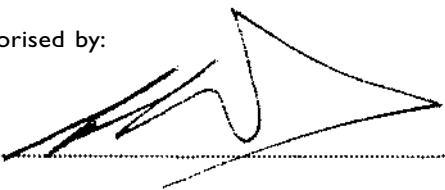
Endorsement & Authorisation

Endorsed by:



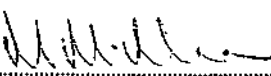
K. Lydford, Head of Electrification & Plant Engineering

Authorised by:



A. McNaughton, Chief Engineer

Accepted for issue by:



M. McManus, National Standards Manager

This document is the property of Network Rail. It shall not be reproduced in whole or part nor disclosed to a third party without the written permission of the Standard Owner.

©Copyright 2005 Network Rail

Uncontrolled copy once printed from its electronic source.

Published & Issued by: Network Rail 40 Melton Street, London NW1 2EE



Documents
Document Sharing Hub

Ref:	NR/SP/ELP/21026
Issue:	2
Date:	December 2005

Issue record

Issue	Date	Comments
2	December 2005	Re-issued as a SAF3 Business Process Document

Implementation

3 December 2005

Compliance

This Network Rail specification is mandatory and must be complied with by Network Rail and its contractors from 3 December 2005.

When this 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 fixed plant has stipulated otherwise in the accompanying briefing note.

Where the head of electrification and fixed 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).

Disclaimer

In issuing this document for its stated purpose, Network Rail makes no warranties, express or implied, that compliance with all or any documents it issues is sufficient on its own to ensure safe systems of work or operation. Users are reminded of their own duties under health and safety legislation.

Supply

Copies of documents are available electronically, within Network Rail's organisation. Hard copies of this document will be available to Network Rail employees on request to the document controller and to other organisations from IHS Technical Indexes (01344 404409)

Contents

1	Purpose	6
2	Scope	6
3	Reference documentation	6
4	Definitions	6
5	Changeover of auxiliary supplies	7
6	General clauses	9
6.1	Design, manufacture and workmanship	9
6.2	Spare parts and consumables	9
6.3	Drawings	9
6.4	Instruction manual	10
6.5	Delivery	11
6.6	Specific equipment standards	11
7	Performance requirements	11
7.1	General	11
7.2	Environmental conditions	12
7.3	Noise emission	12
7.4	Maintainability	12
7.5	Reliability and availability	13
7.6	Service life	13
7.7	Interchangeability	13
7.8	Finish and resistance to corrosion	13
7.9	Rating and configuration	14
7.10	Through fault withstand	14
7.11	Inspection and testing	14
7.12	Tests at site	15
7.13	Test certificates	15
8	Technical and construction requirements	16
8.1	Enclosures	16
8.2	Ancillary wiring	16
8.3	Labels	17

8.4	Cooling	17
8.5	Monitoring equipment	17
8.6	Auxiliary supplies	18
8.7	Protection of auxiliary circuits	18
8.8	Keys and locks	18
8.9	Security of isolation	18
8.10	Arrangement of main circuits	18
8.11	Operational requirements for switchboard with two railway derived incoming supplies	19
8.11.1	With high voltage system electrically continuous	19
8.11.2	With high voltage system not electrically continuous	19
8.11.3	Loss of Both Incoming Supplies	20
8.12	Operational requirements for switchboard with two railway derived incoming supplies and an DNO incoming supply	20
8.12.1	With high voltage supplies electrically continuous	20
8.12.2	With high voltage system not electrically continuous	21
8.12.3	DNO incoming supply	22
8.13	Operational requirements for switchboard with one railway derived incoming supply and an DNO incoming supply	22
8.14	High voltage circuit breaker auxiliary contacts	23
8.15	Isolation requirements	23
8.16	Switchboard layout	23
8.16.1	Contactor compartments	24
8.16.2	Busbar compartments	24
8.16.3	Control compartment	24
8.16.4	Power equipment compartment	24
8.16.5	Fuse-switch compartments	24
8.16.6	Cable terminating compartments	25
8.16.7	Power conductors	25
8.17	Low voltage distribution equipment	25
8.18	Contactors	25
8.18.1	Auxiliary contacts	26
8.18.2	Mechanical Indication	26
8.18.3	Drop out voltage	26
8.18.4	Control circuits	27
8.19	Earthing	27

Ref:	NR/SP/ELP/21026
Issue:	2
Date:	December 2005

8.20	Remote supervisory control interposing relays	27
8.21	Indication and monitoring of supply voltages	27
8.22	Metering of signal supplies	28
8.23	Indication of out-of-synchronism of high voltage supply sources	28
8.24	Special tools and test equipment	28
Appendix A	Tests at works	29
Appendix B	Tests at site	30

1 Purpose

This specification states the requirements for the design, manufacture and testing of low voltage changeover switchboards used in d.c. traction substations for the control and distribution of 400 V or 440 V, 50 Hz auxiliary supplies for substation domestic and for signalling and other trackside purposes.

The document is to be read in conjunction with the relevant procurement specification.

2 Scope

This specification applies to new 400 V and 440 V changeover switchboards installed on the D.C. Electrified Lines. The specification does not include switchboards with bypass switching facilities.

3 Reference documentation

RT/E/S/21028	Network Rail Line specification for ancillary wiring of electrical distribution equipment on A.C. and D.C. Electrified Lines
RT/E/G/27004	Network Rail Guidance Document for wire identification codes for ancillary wiring of electrical distribution equipment on A.C. and D.C. Electrified Lines
EN 60947 IEC 947	Specification for low voltage switchgear and controlgear
EN 60439 IEC 439	Low-voltage switchgear and controlgear assemblies
EN 60529 IEC 529	Specification for degrees of protection provided by enclosures (IP code)
BS 7626 IEC 185	Specification for current transformers
BS 7625 IEC 186	Specification for voltage transformers
EN 60269-1 BS 88 IEC 269	Low-voltage fuses
BS 5378	Safety signs and colours

4 Definitions

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

British Standard	A standard published by the British Standards Institution. Its alphanumeric identity is prefixed by BS.
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, such as, Invitation to Tender or Technical Worksopce.
Network Rail Line Standard	A collective term for a Network Rail Line Specification, Network Rail Line Procedure or a Network Rail Guidance Document, published by a directorate of Network Rail PLC.
SCADA	Supervisory control and data acquisition.
DNO	Designated Network Operator

5 Changeover of auxiliary supplies

The changeover switchboards provide facilities for the changeover between a number of incoming supplies, derived from different sources, in order to ensure secure outgoing supplies for substation domestic and signalling purposes.

The incoming supplies are in one of the following arrangements:

- (a) two railway derived incoming supplies; or
- (b) two railway derived incoming supplies and an independent DNO derived supply; or
- (c) one railway derived incoming supply and an independent DNO derived supply.

Where an incoming supply is derived from the Network Rail high voltage distribution network, this is provided by way of an auxiliary transformer. Unless specified otherwise in the procurement specification, auxiliary transformers are of the following types:

Auxiliary Transformer Ratio	No of phases	Secondary Voltage (Full load)
33kV/433V	3	415
22kV/433V	3	415
11kV/433V	3	415
33kV/417V	3	400
22kV/417V	3	400
11kV/417V	3	400
33kV/452V	1	440
22kV/452V	1	440
11kV/452V	1	440

In the case of an independent DNO derived supply this is provided generally by way of an isolation transformer.

Normally all incoming supplies are live but only one supply is in use at any one time. Changeover between the incoming supplies is effected either automatically or by a controlled operation.

The automatic method provides changeover to a healthy incoming supply in the event of failure of the 'in-use' supply.

The controlled method provides changeover from one healthy incoming supply to another by means of supervisory or local control.

Where an DNO derived supply is provided, paralleling of the DNO supply with a railway supply is not permitted at any time.

In the case of two railway derived incoming supplies, the Network Rail high voltage system feeding the two auxiliary transformers may be either electrically continuous or not electrically continuous. This condition depends upon the configuration of the high voltage distribution network at the time. The configuration is altered from time to time.

When the high voltage system feeding the two auxiliary transformers providing the two railway derived supplies is electrically continuous, the controlled changeover is effected by momentary paralleling and without loss of outgoing supplies.

Ref:	NR/SP/ELP/21026
Issue:	2
Date:	December 2005

When the high voltage system feeding the two auxiliary transformers is not electrically continuous, the controlled changeover is effected by opening the 'in-use' contactor resulting in temporary loss of outgoing supplies. Paralleling of supplies is not permitted in this situation.

At certain locations an independent third incoming supply provides further reliability. Unless specified otherwise in the procurement specification, this supply is derived from an DNO source. Changeover to the third supply occurs in the event of the failure of both railway derived supplies. Paralleling of the DNO supply with a railway supply is not permitted at any time.

6 General clauses

6.1 Design, manufacture and workmanship

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.

6.2 Spare parts and consumables

The supplier 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 specification throughout its specified service life. The supplier shall indicate the extent of commonality with equipment previously supplied.

6.3 Drawings

Drawings of the equipment covering each of the following aspects shall be submitted to the purchaser for scrutiny:

- (a) General arrangement (internal and external)
- (b) Static and dynamic loadings and foundation and fixing requirements.
- (c) Schematic/circuit diagrams
- (d) Diagram and rating plates
- (e) Details of cable entries and terminations
- (f) Detailed wiring diagram or schedules.

All drawings shall be of good, legible quality. Four copies of each drawing or as varied by the procurement specification shall be provided.

Where it is essential for clear understanding of the circuits, block or circuit diagrams shall include details of components which are existing or are not being provided by the supplier. Wiring diagrams shall include any unused wires, contacts, plugs, sockets, terminals and the like.

Ref:	NR/SP/ELP/21026
Issue:	2
Date:	December 2005

As an alternative to separate circuit and wiring diagrams, combined diagrams may be provided. In this case the position of each wire termination shall be indicated either on the drawing or by means of a schedule of terminations.

A short description of each revision shall be provided under consecutive revision letters or numbers together with the date.

Wherever feasible, some means shall be used to identify the location of the most recent revision, for instance by circling the locations.

All drawings shall be brought up to date as necessary, to provide a permanent as-fitted record and shall be supplied in the software format specified in the procurement specification.

6.4 Instruction manual

The supplier 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 the procurement specification. 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) Procedures with periodicities for routine maintenance including any special precautions, fault finding 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) list of locations and associated serial numbers.
- (i) List of all consumable items with Part Numbers or references.