

Information for users

The following document:

NR/GN/ELP/27020
Issue 2

has had changes made to it, most recently, with effect from **23 May 2008**.

Instructions for use

It is essential that you first read and understand each letter of instruction pertaining to the standard before proceeding to use the standard. You must then apply the requirements of each letter to the standard.

NR/BS/LI/091	Issue 1	23 May 2008	Proceed to letter ►
NR/GN/ELP/27020	Issue 2	01 April 2006	Proceed to standard ►

For further information, please contact:

IHS Customer Support

Please click here to proceed to the Network Rail Standards' 'Support Contacts' for their latest contact details.

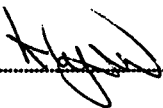
Ref	NR/GN/ELP/27020
Issue	2
Date	April 2006

Business Process Document

Design and installation of steel conductor rail and associated equipment for d.c. electrified lines

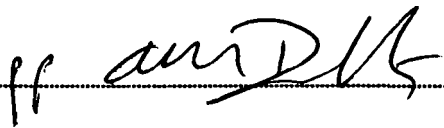
Endorsement & Authorisation

Endorsed by:



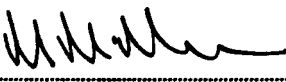
K. Lydford, Head of Electrification & Plant Engineering

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 2006 Network Rail

Uncontrolled copy once printed from its electronic source.

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



Ref:	NR/GN/ELP/27020
Issue:	2
Date:	April 2006

Contents

1	Purpose	5
2	Scope	5
3	Reference documentation	5
4	Definitions	6
5	Steel conductor rail	6
5.1	Rail selection	6
5.2	New installations	6
5.2.1	Alterations to existing rails	6
5.3	Conductor rail joints	7
5.4	Dynamic and electrical clearances	7
5.5	Position of conductor rail	7
5.6	Conductor rail ramps	7
5.6.1	End ramps	7
5.7	Side ramps	8
6	Support insulators	8
6.1	Material of manufacture	8
6.2	Porcelain	8
6.3	Caps	8
6.4	Marking	9
6.5	Support and fixing arrangements	9
6.6	Insulator spacing	11
6.7	Conductor rail ramp end insulators	11
6.8	Conductor rail anchoring	11
7	Conductor rail protective boarding and shrouding	12
7.1	General	12
7.2	Location of protective boarding	12
7.3	Single protective boarding.	12
7.4	Double protective boarding	13

Ref:	NR/GN/ELP/27020
Issue:	2
Date:	April 2006

8	Cables and cable connections	14
8.1	General	14
8.2	Cable sizes	14
9	Jointing and termination of cables	14
9.1	Cable connections	14
9.2	Position of cable connections	15
9.3	Jointing and termination of cables	15
10	Track cable routing	16
10.1	General	16
10.2	Routes between sleepers	16
10.3	Cables adjacent to lineside buildings and apparatus cases	17
10.4	Crossing of cable routes	17
10.5	Buried duct routes	17
10.6	Routes through authorised walking routes	18
10.7	Cable risers	18
10.8	Cables adjacent to AWS track magnets	18
11	Manual isolating switches	18
11.1	Hook switches	18
11.1.1	Position of hook switches	18
11.1.2	Types of hook switch	19
11.1.3	Un-commissioned hook switches	19
11.2	Track isolating switches	19
11.2.1	Position of track isolating switches	19
11.2.2	Types of track isolating switches	19
12	Anti-trespass guards	20
Appendix A	Tests on conductor rail insulators	21
Appendix B	Tests on conductor rail protective boarding	23
Appendix C	Tests on manual isolating switches	25

Ref:	NR/GN/ELP/27020
Issue:	2
Date:	April 2006

I Purpose

This guidance note states the best practice for the design and installation of steel conductor rail and associated electric track equipment on Network Rail D.C. Electrified Lines including those which are designated 'standard current' and 'high current'

This document is to be read in conjunction with the Electric Track Equipment drawings and [NR/SP/ELP/21104](#) 'Design and Installation of Electric Track Equipment for D.C. Electrified Lines'.

2 Scope

This code of practice applies to the design and installation of steel conductor rail and associated electric track equipment on D.C. Electrified Lines, including the requirements for new installations and alterations to existing equipment.

3 Reference documentation

NR/SP/ELP/27224	Network Rail Business Process Document - Specification for Installation of Cable Routes, Cable Laying, Testing and Jointing on Cable Routes Forming Part of the Traction Distribution System (formerly AC/DC 242)
NR/SP/TRK/135	Network Rail Business Process Document – Flash-Welded Rails: Depot Welded Strings (formerly RT/CE/S/001)
NR/SP/TRK/130	Network Rail Business Process Document – Flash-Welded Rails: Site Welded Strings (formerly RT/CE/S/130)
NR/SP/CIV/044	Network Rail Business Process Document – Design & Construction of Undertrack Crossings
RT/E/S/21101	Network Rail Business Process Document - Track Cable for D.C. Electrified Lines
BS 137	Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000 V. Part I Methods of test
BS 309	Whiteheart malleable iron castings
BS 310	Blackheart malleable iron castings
BS 476	Fire tests on building materials and structures
BS 729	Hot dip galvanised coatings on iron and steel articles
BS 7865	Specification for steel electrical conductor rail for railway motive power supply
BS EN 50123	Railway applications. Fixed installations. D.C. switchgear.
BS EN 60529	Specification for degrees of protection provided by enclosures (IP code)

4 Definitions

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

Electric Track Equipment	Equipment associated with the railway track used for the transmission and collection of electrical current for traction purposes.
Electric Track Equipment Drawings	A series of Network Rail Drawings prefixed by an alphanumeric identity RT/ETE which detail information related to the Electric Track Equipment. These are commonly referred to as ETE Drawings.
High Current Railway	A d.c. system capable of supplying trains with a sustained peak total traction current of 6.5 kA and above.
Standard current traction systems	A d.c. system capable of supplying trains with a sustained peak total traction current below 6.5 kA.

5 Steel conductor rail

5.1 Rail selection

Steel conductor rail should comply with the requirements of [BS 7865](#).

5.2 New installations

74 FB section conductor rail is used for all new installations on all running lines.

Used, serviceable 52 kg/metre (105 lb/yd) and 52.6 kg/metre (106 lb/yd) conductor rail may be used in sidings and depots subject to meeting the system design and protection parameters.

5.2.1 Alterations to existing rails

Where alterations are proposed to the existing conductor rail system, serviceable rail, including 52 kg/metre (105 lb/yd) and 52.6 kg/metre (106 lb/yd) steel rail in main line applications can be reused.

Steel rail should be considered serviceable when the cross-sectional-area meets the service life, system design requirements and is not normally less than 75% of the cross-sectional-area when new.

Ref:	NR/GN/ELP/27020
Issue:	2
Date:	April 2006

5.3 Conductor rail joints

All new conductor rail joints should be welded in accordance with the requirements of [NR/SP/TRK/I30](#) and [NR/SP/TRK/I35](#) for flash welding and an approved aluminothermic process for site welding.

Conductor rails of different sections should not normally be welded together.

Where alterations are carried-out to existing rails with fish-plated and bonded joints or where these joints become defective, the bottom edge of the fish-plate should be welded to the foot of the conductor rails.

Where a significant number of defective fish-plated rail joints in a rail length are repaired by welding, consideration should be given to reducing the overall length of rail involved in line with the requirements to accommodate expansion.

Where alterations are proposed to conductor rails with fish-plated and bonded joints, consideration should be given to welding the joints in the area of work.

5.4 Dynamic and electrical clearances

The static distance between any exposed conductor rail and any metalwork connected thereto, and any other fixed metalwork should be at least 75 mm. Metal parts of protective board supports may, infringe the 75 mm dimension.

The minimum vertical clearance between the lowest part of any collector shoe and the running rail should be 25 mm.

5.5 Position of conductor rail

The conductor rail should be positioned with its centre line 405 mm from the running rail gauge face at a height 76 mm above it.

5.6 Conductor rail ramps

5.6.1 End ramps

A conductor rail ramp with a gradient appropriate for the line speed should be provided at all locations where the conductor rail terminates. The ramp should be supported on a terminal type insulator appropriate to the type of track and length of ramp.

On slab track, slope ended sleepers or concrete bearers, steel decked bridges and in areas subject to flooding the ramp should be of the horizontal base type.

Ref:	NR/GN/ELP/27020
Issue:	2
Date:	April 2006

Pre-formed end ramps welded onto the conductor rail may be used to replace worn end ramps or where economies in conductor rail alteration work may be achieved.

5.7 Side ramps

Where required, a side ramp to suit the associated switch and rolling stock should be installed with fastenings appropriate to the type of conductor rail and located in accordance with the standard drawing.

6 Support insulators

6.1 Material of manufacture

Insulators should be manufactured from porcelain or other material with suitable electrical and mechanical properties for special applications.

6.2 Porcelain

Porcelain insulators should be manufactured and tested to [BS 137](#) and the additional test requirements shown in Appendix B.

The bodies of porcelain insulators should be vitrified throughout, and white or light cream in colour.

The whole surface, except the part to which the cap is cemented, should be glazed, presenting a smooth hard surface resistant to the collection of dirt, so as to avoid pitting, hair cracks, crazing or other changes, during the working life of the insulator.

6.3 Caps

The caps should be made of whiteheart malleable cast iron to BS 309 Grade W410/4, or blackheart malleable cast iron to BS 310 Grade B340/12.

All castings should be sound, free from blow-holes and other imperfections, and of clean and sharp finish.

The caps should have a firm bearing on the insulator bodies, and should fit evenly and accurately. They should be cemented firmly to the bodies with neat Portland cement or other approved material and should be square and central therewith. An approved jig should be used for setting the caps in position. Care should be taken to minimise internal expansion stresses due to temperature variations or the absorption of moisture by the cement.

Ref:	NR/GN/ELP/27020
Issue:	2
Date:	April 2006

All caps should be treated with one coat of each of the following finishes, or equivalent:

- a) Griffiths 'ARMOUR 1471' self-etching primer;
- b) 'Air Speed 255', colour black, to a film thickness of 0.03-0.04 mm.

Alternatively, caps may be galvanised to BS 729.

6.4 Marking

Each insulator should before glazing have the following indelibly marked on it in 6 millimetres high lettering:

- a) the name or trademark of the manufacturer;
- b) the year of manufacture;
- c) the word 'TYPE' with the type number of the insulator;
- d) 'Network Rail'.

Each cap should have embossed on the top an approved marking indicating the foundry of origin, care being taken that the height of the marking is not in excess of the height of the pads on which the conductor rail will rest.

6.5 Support and fixing arrangements

Conductor rails should be supported on insulators of an appropriate height to suit the type of track rail fastening/base plate and sleeper used:

- a) 74.4 kg/metre (150 lb/yd) conductor supported on 100 type (C type) insulators;
- b) 74.4 kg/metre (150 lb/yd) conductor supported on 120 type (B or BK type) insulators;
- c) 52.6 kg/metre (106 lb/yd) conductor supported on 120 type (B or BK type) insulators;
- d) 52.6 kg/metre (106 lb/yd) conductor supported on 140 type (A or AK type) insulators;
- e) 49.6 kg/metre (100 lb/yd) conductor supported on 120 type (B or BK type) insulators;
- f) 49.6 kg/metre (100 lb/yd) conductor supported on 140 type (A or AK type) insulators.

Insulators on concrete sleeper track should have a resilient rubber base pad.

Where both conductor rail and running rail are new, the correct gauge should be obtained with a maximum of 2 No. top packing - additional durable bottom packing should be used on timber sleepers to attain the correct gauge.

Adjustment for wear of running or conductor rail should be achieved with top packing up to a maximum of 4 No. plastic and steel top packing, the steel packing being adjacent to the underside of the rail.

Conductor rail insulators should be fixed to timber or concrete sleepers using insulator clips secured by four coach screws of a size to suit the type of fixing and its associated packing in accordance with the following table:

Screw Diameter	Screw Length	Use
13	76	For use with plastic inserts and EVA sleeves in concrete sleepers. For fastening conductor rail insulator clips, 'D' type insulators, protective boarding support brackets and associated bottom packing not exceeding 13 mm thick.
13	102	as above with bottom packing exceeding 13 mm and where coach screw holes are reused.
16	102	For fastening anchor insulators and insulator clips and associated bottom packing not exceeding 13 mm thick.
16	127	as above with bottom packing exceeding 13 mm and where coach screw holes are reused.

Where a concrete sleeper has no prepared fixing holes, insulators and protective boarding support brackets may be secured using M12 by 110 'Hilti' bolts or equivalent.

Mounting on concrete sleepers should be with male type 'SEETRU' bolts utilising the holes cast in the sleeper or, where ethyl vinyl acetate (EVA) sleeves are inserted in the fixing holes of the sleeper, by four coach screws

Insulators should be located one sleeper clear of a conductor rail fish-plated joint and clear of sleepers adjacent to running rail fish-plated joints.

On slope ended sleepers, dough moulded insulators should be used, supported on special steelwork fastened to the sleepers.

On slab track insulator fastening holes should be provided to facilitate fixing of standard conductor rail support insulators.

Site drilling of concrete sleepers or bearers should not be undertaken without the prior approval of Network Rail.