

Letter of instruction

Information for users

The following document:

NR/SP/ELP/27224
Issue 2

has had changes made to it, most recently, with effect from
25 January 2016.

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/040	Issue 1	20 December 2005	Proceed to letter ►
NR/BS/LI/217	Issue 4	25 January 2016	Proceed to letter ►
NR/SP/ELP/27224	Issue 2	01 April 2006	Proceed to standard ►

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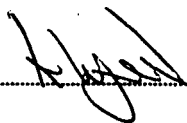
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Issue	2
Date	April 2006

Business Process Document

Specification for installation of cable routes forming part of the traction distribution system

Endorsement & Authorisation

Endorsed by:



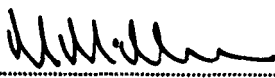
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Issue record

Issue	Date	Comments
2	April 2006	Re-issued as a SAF3 Business Process Document

Implementation

1 April 2006

Compliance

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

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 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).

Disclaimer

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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)

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I Purpose

This document details the requirements for the design, refurbishment and construction of new cable routes and the refurbishment of existing cable routes for high voltage a.c. power distribution cables and associated pilot supervisory cables, signalling supply distribution and point heater cables, a.c. and d.c. traction cables and other cables used on electrical distribution systems.

2 Scope

This specification states the requirements for the design, refurbishment and construction of cable routes on electrical distribution systems.

3 Reference documentation

RT/CE/S/039	Network Rail Company Specification – Protective treatments for Network Rail infrastructure
RT/CE/S/044	Network Rail Company Specification – Undertrack crossings
NR/PS/ELP/00008	Network Rail Company Specification – High voltage cables and accessories for traction supplies
NR/PS/TEL/00013	Network Rail Company Specification – Cable troughing
RT/LS/CAT/004	Network Rail Company Specification – Signalling standard drawings
NR/LS/S/011	Network Rail Company Specification – Prevention of damage to and danger from surface and buried services
EN ISO 9001	Model for quality assurance in design, development, production, installation and servicing
EN 124	Gully tops and manhole tops for vehicular and pedestrian areas. Design requirements, type testing, marking, quality control
BS 7671	Requirements for electrical installations: IEE Wiring Regulations

4 Definitions

Approval	Prior approval or acceptance, as appropriate, by Network Rail, or other where specifically designated in the text.
Bellmouth	Transition section between surface trough route and duct route.
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.
Network Rail Company Standard	A collective term for a Network Rail Product Specification, Network Rail Procedure or a Network Rail Guidance Note, published by a directorate of Network Rail.
Procurement Specification	The contract specific Network Rail documentation, which, together with product specification(s) forms part of an Invitation to Tender or Technical Worksopce.
Traction cables	25 kV ac and 750/660 V d.c. positive and negative cables for distribution of traction supplies from substations and along the track

5 General clauses

5.1 Safety, legislation and regulations

Measures shall be taken to ensure the safety of persons concerned in the installation, operation, maintenance, repair and its eventual disposal of cable route.

At all times the cable installation shall comply with the requirements of all relevant statutory acts, rules, regulations or orders.

5.2 Design, manufacture and workmanship

Materials used 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 cable route.

5.3 General

The cable route shall be designed, constructed and refurbished so as to be compatible in every respect with the required performance of the cables and shall be fit for its intended purpose when the cables are connected into the systems described in clause 5 and as may be supplemented in the procurement specification.

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The cable route shall also provide adequate mechanical and fire protection to the cables and shall be designed to ensure that the minimum bending radius of the cables is not compromised. It shall be the most cost effective design, taking into consideration the type of cable to be installed, the topography of the site, the trackside environment, the method of installation and the cost of materials.

5.4 Environmental, service and installation conditions

The completed cable route system shall be suitable for the rated characteristics of the cables to be installed or already installed.

The service conditions are:

- a) the minimum ambient air temperature shall be -15 °C;
- b) the maximum ambient air temperature shall be +40 °C;
- c) the cable route is subject to step heating from direct sunlight and is located in areas where trackside fires are likely;
- d) the ambient air is polluted by the presence of airborne iron dust from train brakes;
- e) the cable route is subject to vibration caused by passing trains;
- f) the cable route is subject to physical damage from trackside works;
- g) the cable route will be exposed to electromagnetic interference expected on the railway infrastructure;
- h) the cable route may be installed in areas electrified at 25 kV a.c., 1500 V d.c., or 750 V d.c.

5.5 Maintainability

The cable route shall be designed for minimum maintenance during its service life. Individual components of the route shall be readily replaceable with minimum effect on the installed cables.

5.6 Reliability and availability

The electrical power distribution system will normally remain continuously energised and in service to provide power supplies to traction and signalling equipment. Failure can cause interruption of the operation of the railway; hence a high level of reliability of the cable route to protect the installed cables is required.

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5.7 Service life

The cable route material shall be capable of complying with this specification, including performing its intended purpose, for at least thirty years or as specified in the procurement specification, without deterioration in reliability. The cable route shall be so installed and adequately supported to ensure that under normal ground conditions it is retained in its design position for its service life (at least thirty years or as specified in the procurement specification).

5.8 Resistance to mechanical and environmental damage

The cable route shall be robust and shall provide the cables throughout their length with a high degree of protection from mechanical, abrasive, fire and other environmental damage.

5.9 Bending and other mechanical stresses

The bending radius of the cable route shall not be less than that recommended by the cable manufacturer. Any other stresses imposed on the cable by the design and construction of the cable route shall not exceed the cable manufacturer's recommendations. Wherever practicable, all cables shall be continuously supported throughout the route.

Particular consideration shall be given to the movement of the cable within the route due to thermal expansion and contraction of the cable during ambient temperature variations and cyclic loading conditions.

Cable routes using intermittent cleated supports will be accepted where continuous support cannot be achieved such as vertical runs or limited clearance situations. Such installations shall be designed to ensure that the stresses imposed on the cable do not exceed the cable manufacturer's recommendations. The spacing between support cleats and the cable sag between supports shall be in accordance with the cable manufacturer's recommendations.

5.10 Interfaces with existing cable systems

New cable routes, or extensions to existing cable routes shall ensure that the requirements of this specification are totally maintained at interfaces with existing cable route installations.

5.11 Interchangeability

All like equipment shall be interchangeable as a whole and also as regards its parts. Any such change or replacement shall not reduce the capability of the cable route to conform to the requirements of this specification.

5.12 Finish and resistance to corrosion

Metal 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 cable route. All ferrous material shall be galvanised or manufactured from stainless steel. Protective finishes shall comply with RT/CE/S/039 as appropriate. Procedures for preparation and applying protective finishes shall be submitted for approval.

6 Drawings and documentation

The following drawings and other documentation shall be provided by the contractor for approval:

6.1 Cable route diagrams

Cable route diagrams scale 1/1250 based on Ordinance Survey Mapping, with reference given to any relevant buried cable sections, and showing:

- a) mile post and/or kilometre posts;
 - b) measurements in metres from the route start;
 - c) type of route laid over various sections of the route;
 - d) details of cables laid over the various sections of the route;
 - e) details of existing route(s) in near vicinity and the methods of crossing them when applicable;
 - f) joint positions with measurements to nearest mile post and/or kilometre post;
 - g) cross section of cable route showing cable type and arrangement;
- Note: Cross section needs to be shown wherever there is a change of route parameters e.g., trenching size change or presence of an undertrack crossing.
- h) cable drum or batch numbers and cable manufacturer;
 - i) date of work.

6.2 Buried cable charts

Buried cable charts or drawings for buried sections of the route and for road and track crossings showing:

- a) position of the route with respect to fixed locations and cross sections indicating the type of route;
- b) number of ducts in the crossing;
- c) position of the new cable;
- d) redundant cable within the route;
- e) depth and type of backfill used.

- f) contents of the route, e.g. type and sizes of cables, troughing material/size/reference details.

6.3 Other drawings

Drawings of sections of the route where special support arrangements are used with detailed drawings of supporting steelwork, cleating arrangements etc.

6.4 Record drawings

All drawings shall be provided as hard copy and in electronic format suitable for Microstation or as specified in the engineering specification.

7 Technical requirements for cable route materials

Ducts and troughing, and other cable route components and accessories shall provide adequate robustness to withstand the mechanical stresses experienced during installation and all service conditions, including during short circuits on the cables contained within the route.

The cable route components shall be of an interlocking design and shall provide a continuous smooth internal surface for the cable. Covers and lids shall be a close fit and positively located using registration to prevent inadvertent displacement after installation.

7.1 Reinforced concrete troughing and lids

The troughing and associated materials shall comply with the requirements of Network Rail specification [NR/PS/TEL/00013](#) and shall be supplied in lengths not exceeding 1000 mm.

7.2 Troughing manufactured in alternative materials

Troughing shall comply with the requirements of Network Rail specification [NR/PS/TEL/00013](#) and may be supplied in lengths up to 3000 mm dependant upon weight and strength.

Metallic troughing shall not be used except for approved exceptional circumstances.

Troughing manufactured from glass reinforced polyester or from heavy duty polyvinyl chloride (PVC) will be acceptable subject to meeting the material requirements of Network Rail specification [NR/PS/TEL/00013](#). In particular, these materials shall comply with the fire resistance requirements and shall have satisfactorily completed the fire resistance test laid down in Network Rail specification [NR/PS/TEL/00013](#).

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7.3 Ducts for under road and under track crossings

Ducts shall normally be of the reinforced flexible type but other materials as specified in Network Rail specification [RT/CE/S/044](#) may also be used. Metallic ducts shall not be used.

7.4 Tubes for use in routes through station platforms

Heavy duty rigid polyvinyl chloride tubes or preformed duct blocks shall be used through station platforms. These shall be to an acceptable design.

7.5 Buried cable route and joint markers

Each marker shall consist of a label engraved yellow laminate or similar approved material with black lettering securely fitted to a concrete marker, adjacent wall or building with non removable fixings as required by Network Rail specification [NR/LS/S/011](#).

Monumental or block concrete cable route and joint markers shall be designed such that the label is supported and protected against long term damage.

8 Route design requirements

Concrete cable troughing shall be set into the ground for a minimum depth of 100 mm, and where practicable, at a minimum distance of 3.0 m from the gauge face of the nearest running rail.

At obstructions or where topographic features prevent this distance being achieved, the cable troughing shall be installed at the maximum practicable distance but not less than 1410 mm from the gauge face of the nearest running rail.

Routes shall be designed so that the minimum bending radius of the largest cable to be installed in the route is not infringed.

Route capacity shall comply with [BS 7671](#), where applicable.

For 25kV electrification, 2 track feeder cables per route can be designed.

For dc electrification, 2 dc track feeder cables per route can be designed and installed.

Where possible, a maximum gradient of 1 in 5 shall not be exceeded except in duct/tube routes and locations where the cables are to be positively fixed by cleats or other approved means. At locations where there are changes of gradient, special arrangements shall be applied to ensure that the cables are not subject to mechanical stress or are damaged by movement.