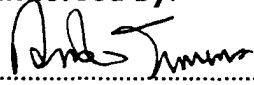


RAILTRACK LINE PRODUCT SPECIFICATION

RAILWAY SIGNALLING CABLE

Approval and Authorisation

Endorsed by:

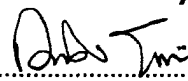

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Published & Issued by

Railtrack plc
Railtrack House
Euston Square
LONDON
NW1 2EE

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Summary

This Line Specification specifies the manufacturing requirements for railway signalling cables detailed in the scope of this Specification.

Standard Issue/Revision Record

This specification will be updated when necessary by the distribution of a complete document. Amendments will be marked by a vertical black line in the adjacent right hand margin. The latest issue of this specification shall be implemented immediately upon receipt.

Issue	Date	Comments
Issue 1	April 2000	New Issue

Implementation

The requirements of this Specification shall apply to Railway Signalling Cable as defined in the scope of this specification, supplied for use on Railtrack controlled infrastructure with effect from April 2000. It is not retrospective. The following documents are superseded:

Superseded document reference number	Issue	Date
GS/ES0872	2	Sept 93

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Safety

All persons are reminded that all appropriate safety precautions must be observed when undertaking any work involving the subject of this specification.

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I INTRODUCTION

I.1 Purpose

This Specification details the requirements for Railway Signalling Cable.

I.2 Scope

I.2.1 This specification defines the requirements for Railway Signalling Cable that shall have an insulation that is either elastomer or ZHLS, tinned annealed copper conductors and have a maximum voltage rating of 650/1100 volts being power frequency rating to earth and 1100 volts being the core-to-core rating. Cables shall be suitable for use in d.c. circuits where the nominal voltage to earth does not exceed 1100 volts. The following types may be ordered:-

I.2.2 **Type A** - Cables with cores comprising stranded conductors, insulated with flame retardant ZHLS Compound. To be either single core with insulation only (A1 Table 2), single with ZHLS oversheath (A2 Table 2) or multicore with ZHLS sheath (A3 Tables 3 and 8).

I.2.3 **Type B** - Cables with cores comprising stranded conductors, insulated with EPR (Ethylene Polypropylene Rubber), and with HDPCP (Heavy Duty PolyChloroprene) sheathing.

To be either single (B1 - Table 4) or multicore (B2 Tables 5, 6 and 8)

I.2.4 **Type C** - Single or multicore cables as per Type B but with flexible conductors (C1, C2 and C3 Tables 7 and 8).

I.2.5 **Type D** - As per Type B but with additional fire performance attributes (D1 and D2 Tables 4, 5, 6 and 8).

I.2.6 **Type E** - As per Type C but with additional fire performance attributes (E1, E2 and E3 Tables 7 and 8).

I.3 Definitions

For the purpose of this standard, the definitions relating to electric cables in BS 4727: Part 2: Group 08 Electric Cables , shall apply.

2 GENERAL REQUIREMENTS

2.1 Conductors

- 2.1.1 These shall consist of circular tinned, annealed, high conductivity copper wire in accordance with BS 6360 and Table I of this standard.
- 2.1.2 Stranded and flexible conductors shall be approximately circular in section, and non-compacted, in as much as they shall comply with the requirement of clause 6.2.2 of BS 6360, with respect to all strands within the conductor being of the same nominal diameter.
- 2.1.3 A separator of polyethylene terephthalate (polyester) film may be applied to stranded or flexible conductors. It shall be opaque or coloured, and not render the insulation capable of sliding along the conductor during installation.
- 2.1.4 The conductor tin coating is to be capable of passing the test contained within Appendix B of BS 6360. In addition, when the conductor is used in conjunction with ZHLS insulation, the coating is to have a minimum thickness of 2 microns.

2.2 Insulation

- 2.2.1 Insulation materials shall be elastomeric or ZHLS cross-linked and as in the scope above.
- 2.2.2 Core insulation shall be coloured black, unless otherwise stated.
- 2.2.3 Insulation shall be applied by extrusion.
- 2.2.4 The core surface shall be reasonably smooth, free from indentations and shall not be sticky.
- 2.2.5 It shall be possible to remove the insulation easily and without damaging the remaining insulation or conductors.
- 2.2.6 Preparation of test pieces shall be in accordance with BS EN 60811.
- 2.2.7 EPR insulation shall conform with type GP4 properties in BS 7655: Section I.2.

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- 2.2.8 ZHLS insulation may be formed as a single extrusion, or constructed from composite layers (e.g. an inner layer of GP4). This insulation, tested as a composite shall meet the following criteria:-

Tensile strength	7N/mm ²	Min
Elongation at break	180%	Min

After accelerated ageing, 10 days at 100°C

Variation of value for unaged sample:-

Tensile strength	25%	Max
Elongation at break	35%	Max

Insulation resistance constant (K value) @ 20°C	1100MΩkm	Min
--	----------	-----

Hot set test (BS EN 60811) @ 200 ± 2°C and stress 0.2N/mm²:-

Elongation	175%	Max
Permanent elongation	25%	Max

- 2.2.9 In addition, unless the inner layer of the insulation conforms with GP4, a sample of the material shall have a water take up, by weight of less than 2%, and a decrease in tensile strength of less than 10%, when subjected to the test described in clause 4.6.11 of this standard.
- 2.2.10 The average insulation thickness, measured in accordance with BS 6007 and BS EN 60811, shall not be less than the value in the relevant table. The smallest of the measured values shall not be less than the standard value by more than 10% plus 0.1mm.
- 2.2.11 Type A1 and A2 cables, shall be resistant to damage from abrasion or local frictional heating, encountered when cables are pulled through trunking, ducting, conduit or other wiring supports, in the course of installation.
- 2.2.12 A1 single core cables shall be capable of enduring the core to core abrasion test described in clause 4.5.3 of this standard.
- 2.2.13 Individual cores of all cable types, with conductors of 2.5mm² or less, are to pass the test described in clause 4.5.4 of this standard.

2.3 Tape

- 2.3.1 Binder tape of polyethylene terephthalate or proofed textile may be applied over laid up cores. If binder tapes are used a suitable overlap shall be provided.
- 2.3.2 Tapes may be applied between layers of cores, these may be overlapped or open spiralled.
- 2.3.3 Proofed textile used for lapping individual cores of twin cables should be high quality, without selvedge and rubber proofed on one side.

2.4 Sheaths

- 2.4.1 For cables type B and C, sheaths shall made of HDPCP to BS7655 Section 2.3 type RS2.

- 2.4.2 ZHLS sheath shall meet the following requirements:-

Tensile strength	8N/mm ²	Min
Elongation at break	150%	Min

After accelerated ageing, 10 days at 100°C

Variation of value for unaged sample:-

Tensile strength	30%	Max
Elongation at break	30%	Max

After immersion in ASTM No2 oil for
24 hours at 100°C.

Variation of value for unaged sample:-

Tensile strength	40%	Max
Elongation at break	40%	Max

Hot set test (BS EN 60811) @ 200 ± 2°C and stress 0.2N/mm²:-

Elongation	175%	Max
Permanent elongation	25%	Max

- 2.4.3 The sheath shall be continuous, close fitting, applied uniformly and symmetrically, free from flaws and defects and shall fill the interstices between the outer layer cores completely, where no binder tape is used.

- 2.4.4 The sheath shall be readily removable from the cable without core insulation damage.
- 2.4.5 The sheath shall be coloured black, unless specifically ordered.
- 2.4.6 Sheath thickness shall be measured in accordance with BS6007, to be not less than the value in the appropriate table. The smallest measured value shall not be less than the standard value by more than 15% plus 0.1mm. Where the sheath enters the interstices between the cores, the minimum average thickness applies at all points where the thickness is at its geometrical minimum.

2.5 Tolerance on Core Diameter

- 2.5.1 The core (over insulation) diameters (of all cables indicated) shall be subject to the tolerances detailed in Table 10.

2.6 Tolerance on Overall Diameter

- 2.6.1 The mean overall diameter of cables shall be subject to the tolerances in the relevant tables. Tests for compliance are to be in accordance with BS EN 60811.
- 2.6.2 The difference between any two values of the overall diameter at the same cross section (ovality) shall not exceed 15% of the maximum overall diameter in the relevant table.
- 2.6.3 Tests for compliance are to be in accordance with BS EN 60811. One sample shall be taken from each of three places. Two measurements shall be taken at the same cross section of the cable covering the maximum and minimum values.

2.7 Single Core Identification

- 2.7.1 The core insulation shall be coloured black or, if of type A1, red, orange, violet, brown, grey or blue, to be a reasonable match with BS 6746C, as ordered.

2.8 Core Identification for Circular Twin

- 2.8.1 The cores shall either be coloured; one black and one red, by extrusion or tape covering, or both black printed in accordance with clause 2.10 of this standard.

2.9 Core Identification for Multicore

- 2.9.1 The insulation shall be black, the outer surface of which is to be printed in accordance with clause 2.10 of this standard.

2.10 Core Numbering

- 2.10.1 If the outer layer of the core is numbered it shall be printed in a contrasting colour, distinctly and permanently with figures and interspersed with words corresponding to those figures.
- 2.10.2 The marking shall be legible after light rubbing (10 times) with a piece of cotton wool or cloth soaked in water.
- 2.10.3 The core numbering in all cable layers shall increment consecutively in a clockwise direction from one end of the cable (to be known as the A end). The other end to be referred to as the Z end. The numbering shall start with 1 in the centre and increment through successive layers.

2.11 Manufacturer s Identification

- 2.11.1 The cable maker s name, the date of manufacture (e.g. 2/8/00), the name of this standard (RT/E/PS/00005), the railway catalogue number and the cable type (e.g. 27c 1.5mm² type B), shall be legibly printed at intervals not exceeding 300mm throughout the length of the cable on the outer surface of the cable.
- 2.11.2 ZHLS sheaths shall additionally have the letters ZHLS or Z , distinctly marked on the surface at intervals not exceeding 300mm.
- 2.11.3 All cable markings shall be durable and waterproof.

2.12 Direction of Lay when Laying up

- 2.12.1 The direction of lay shall alternate for successive core layers unless agreed otherwise.

2.13 Length of Lay

- 2.13.1 For C2 and E2 flexible circular twin cables, the pitch of the laid up cores shall not exceed 75 mm.
- 2.13.2 For C3 and E3 flexible circular twin cables, the pitch of the laid up cores shall not exceed 120 mm.

2.14 Fillers between core layers

- 2.14.1 When fillers are used, they shall be composed of either an elastomeric compound, or natural or synthetic textiles. The fillers shall be non-hygroscopic and there shall be no harmful reactions between the filler and/or the sheath materials. They shall be capable of being removed easily and without damage to other components in the cable.
- 2.14.2 Alternatively, fillers may be applied integrally with the sheath of the cable.
- 2.14.3 Fillers in cables to types A, D and E shall be selected with due consideration to the ZHLS requirements of clause 4.7 of this standard.

2.15 Capacitance

- 2.15.1 Manufacturers may be asked to measure and record the maximum capacitance in nF per km. The test is to be carried out in accordance with IEC 189-1. The exact detail regarding the test criteria to be applied shall be defined by the customer at the time of ordering.
- 2.15.2 Screened twisted pair cables will be tested generally in accordance with the methods defined in IEC 189-1 and shall have:
- i) a maximum capacitance between the conductors and the screen/drain of 420nF/km at 65kHz;
 - ii) a mutual capacitance in the range of 95 ± 10 nF/km at 65kHz

2.16 Characteristic Impedance

- 2.16.1 Screened twisted pair cables (C3 & E3), shall maintain a stable characteristic impedance of $75\Omega + 12 - 5\Omega$ at 65kHz.

2.17 Attenuation

- 2.17.1 Screened twisted pair cables shall have maximum attenuation of 0.5dB/100m at 65kHz.

2.18 Sealing and Labelling

- 2.18.1 After completion of electrical tests, and before external storage, cable ends are to be sealed and plainly marked A or Z in accordance with clause 2.10 of this standard. Cables supplied on drums shall have the Z end inside unless ordered specifically otherwise.

2.19 Delivery

- 2.19.1 Single core cable of type A1 and A2, shall be supplied on drums or non-returnable reels in 500m lengths ($\pm 5\%$), as may be ordered.
- 2.19.2 Cable types A3, B, C, D and E, shall be supplied on drums in lengths as ordered. where specific lengths are not shown on the order, the standard despatch length is to be 500m ($\pm 5\%$).
- 2.19.3 Where special requirements for drum sizes apply, these shall be specified on the order.
- 2.19.4 Cable drums shall be lagged with stout cross battens to ensure adequate protection against damage to the cable.
- 2.19.5 The central hole in the cable drums shall be approximately 82mm in diameter and be suitable for use with 75mm (3 inch) spindles.

2.20 Drum Marking

- 2.20.1 Drums shall be clearly and legibly marked with:
- i) an arrow to indicate the direction in which the drum may safely be rolled;
 - ii) a description (including RT/E/PS/00005 and the railway catalogue number) of the cable and its length (in a sealed plastic envelope) securely fastened to the inner and outer flange of the drum;
 - iii) the gross weight of the cable and drum;
 - iv) a pictorial label, explaining safe drum handling techniques.