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Level 2

Supply of Optical Fibre Patchcord and Pigtail Assemblies

Endorsement and Authorisation

Endorsed by:



Pete Farnsworth, Working Group Chairman

Authorised by:



Steve Hailes, TSSG Chairman

Accepted for issue by:



Mick McManus, National Standards Manager

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Issue record

Issue	Date	Comments
1.0	June 2011	New standard containing content from SP/FTN(D&D)/012.

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 03 September 2011.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Reference documentation

Reference is made in this instruction to the following documents:

RIS-7700-INS	Rail Industry Standard for Station Infrastructure
NR/L2/EBM/029	Product Acceptance
NR/PS/TEL/00014	Optical Fibre Telecommunications Cables
BR 967	Specification for Railway Signalling Apparatus Environmental Conditions (included in Appendix A)
ETS 300-019	European Telecommunications Standard for Environmental Conditions
ETS 300-119	European Telecommunications Standard for Equipment Practice
BS EN 186 000	Test methods for optical connector sets
BS EN 187 000	Generic Specification for Optical Fibre cables
BS EN 188 000	Generic Specification for Optical Fibres
BS EN 61300	Basic test and measurement procedures for fibre optic interconnecting devices and passive components
BS EN 50377-2-1	Product Specification for FC/PC Optical Connectors
BS EN 50377-7-4	Product Specification for LC/UPC Optical Connectors
IEC 60874-14-9	Tuned, 8-degree SC/APC connectors for optical fibres and cables
IEC 61754-13	Fibre optic connector interfaces for FC/PC connectors
IEC 61754-20	Fibre optic connector interfaces for LC/UPC connectors
IEC 61755	Fibre optic connector optical interfaces
ITU-T G.652	Characteristics of Singlemode Optical Fibre Cable

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Supply

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1 Purpose

This standard sets out the technical requirements that optical patchcords and pigtails procured for use in Network Rail's optical fibre telecommunications network.

2 Scope

This standard applies to all patchcords and pigtails that are used to interconnect optical elements of Network Rail's optical fibre telecommunications networks.

3 Abbreviations

ETSI	European Telecommunications Standards Institute
FC/UPC	Fibre connector/ultra-polished physical contact
FTN	Network Rail's Fixed Telecom Network
GSM-R	Global System for Mobiles, for Railways
LC/UPC	Local connector/ultra-polished physical contact
MBR	Minimum Bending Radius
MTBF	Mean time between failures
REB	Relocatable Equipment Building
SC/APC	Subscriber connector/angled physical contact
SU	System Unit, measuring 25 mm
ZHLS	Zero halogen, low smoke

4 Glossary

Aramid	Heat-resistant, strong, aromatic (polyamide) polymer fibres that are laid up into a tough, stranded yarn.
Buffering	Secondary coating
Optical connector	A demountable device designed to couple optical fibres with controlled optical loss
Optical fibre tail cable	Singlemode optical fibre that is protected with a secondary coating and/or ruggedising
Optical fibre tail cable assembly	An optical patchcord or an optical pigtail
Optical Patchcord	Ruggedised optical fibre used for connecting terminated optical fibres to transmission equipment having a SC/APC optical connector on one end and typically a FC/PC optical connector on the opposite end
Optical pigtail	Buffered optical fibre used for terminating a bare optical fibre, having a SC/APC optical connector on one end
Optical termination	Equipment to facilitate and manage the termination of optical fibres by splicing onto optical pigtails
Primary coating	A coating applied to an optical waveguide to afford limited physical protection and strip unwanted modes

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Ruggedising	Providing protection for a secondary coated optical fibre by surrounding it in aramid yarn and an outer sheath
Secondary coating	Providing protection for a primary coated optical fibre by coating it in Nylon, pvc or ZHLS
Uniter	A device designed to couple two optical connectors

5 Scope

The requirements set out in this standard shall apply to all patchcords and pigtails that are used to interconnect optical elements of Network Rail's optical fibre telecommunications networks.

6 Optical Pigtails and Patchcords

Network Rail intends that the optical fibre in its cables, patchcords and pigtails shall be consistent so as to benefit from economies of scale and minimisation of the number of maintenance spares. Accordingly, Network Rail desires that similar products from differing sources shall be compatible and shall provide supreme interconnection performance.

6.1 Optical Pigtails

Double-ended optical pigtails shall be assembled from secondary coated (buffered) optical fibre tail cable as specified in section 7 in lengths of 3, +0.5, -0 metres measured from the end of the strain relief gland furthest from the connector with a SC/APC connector in accordance with section 8 at each end. Pigtails are supplied double-ended to facilitate testing on site and will be divided during installation.

6.2 Optical Patchcords

Optical patchcords shall be assembled from ruggedised optical fibre tail cable as specified in section 7 with a specified optical connector at each end in accordance with section 8. The specified optical connectors at each end may be of different types.

Optical patchcords shall be available in the following lengths, measured from the end of the strain relief gland furthest from the connector:

Length	Tolerance
1 metre	+0.1m, -0m
2 metres	+0.2m, -0m
3 metres	+0.3m, -0m
5 metres	+0.5m, -0m
10 metres	+0.5m, -0m
15 metres	+0.5m, -0m
20 metres	+0.5m, -0m
30 metres	+0.5m, -0m

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7 Optical Fibre Tail Cable

Optical fibre tail cable shall be available in either of two types: secondary coated (buffered) or ruggedised.

7.1 Secondary Coated Optical Fibre Tail Cable (for Pigtails)

Secondary coated optical fibre tail cable shall be constructed with a tight-buffered, Nylon, pvc or ZHLS coating with an external diameter falling within the range of $900 \pm 50 \mu\text{m}$.

Secondary coated optical fibre tail cable shall be constructed from singlemode optical fibre to Network Rail Company Standard NR/PS/TEL/00014, with the following modifications:

Section 5.6 Geometric Requirements

The concentricity error between the core and the reference surface shall not exceed $0.30 \mu\text{m}$

The cladding diameter shall be $125.0 \pm 0.3 \mu\text{m}$.

The maximum value of cladding non-circularity shall be 0.7 %

7.2 Ruggedised Optical Fibre Tail Cable (for Patchcords)

Ruggedised optical fibre tail cable shall be constructed from secondary coated optical fibre tail cable as specified in section 7.1 with peripheral strength members and a ZHLS outer sheath.

Completed ruggedised optical fibre tail cable shall meet the requirements of the qualitative tests described in sections 11 and 12.

7.2.1 Tightness of Ruggedising

The ruggedising shall be designed to permit relative movement of the secondary coated optical fibre cable inside the peripheral strength members so as to eliminate the risk of creating a macrobend in the optical fibre inside the connector housing.

The material forming the outer sheath shall be fully cured at sufficient temperature to ensure that there is no subsequent shrinkage or retraction after manufacture of the ruggedised optical fibre tail cable has been completed.

It is acceptable to cure the outer sheath after the ruggedised optical fibre tail cable has been produced providing that this process does not alter the properties or performance of the ruggedised optical fibre tail cable or any of its elements.

7.2.2 Peripheral strength members

The peripheral strength members shall comprise a number of layers of aramid yarns laid up longitudinally over the secondary coated optical fibre tail cable.

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7.2.3 Outer sheath and cable diameter

The peripheral strength members shall be uniformly covered with a closely-fitted protective low-smoke, zero-halogen outer sheath that complies with the requirements of section 7.2.4.

The completed ruggedised optical fibre cable shall be reasonably circular, its diameter shall lie within the range $3 +0, -0.2$ mm, and the sheath thickness shall be not less than 0.5 mm at any radial point.

7.2.4 Additional Requirements for ZHLS Sheath.

Except for trace levels, materials used in the construction of the ZHLS outer sheath shall comply with the requirements set out in RIS-7700-INS.

The ZHLS outer sheath shall pass the tests specified in section 11.1.8.

7.2.5 Colour

The outer sheath shall be available in red, yellow, green, orange or blue to assist in the discrimination of optical path separation.

7.2.6 Sheath Marking

The outer sheath of each patchcord shall be legibly and indelibly marked with the following details in 2 mm high lettering that contrasts with the colour of the outer sheath and at intervals not greater than 500mm:

- The manufacturer's name
- The date of manufacture
- The manufacturer's unique number for batch tracing

7.2.7 Labelling

The Supplier shall propose a suitable label that can be permanently marked on site and which will securely attach to a ruggedised optical fibre tail cable without degrading its performance. It shall also be possible to remove the label without damage to the tail cable. The label shall be required to bear details of the points it shall connect in the format:

XXXX-XXXX-XXXX-XX to XXXX-XXXX-XXXX-XX

where X is alpha-numeric.

8 Demountable Optical connectors

Demountable optical connectors to be terminated on pigtailed shall be tuned, 8-degree, SC/APC connectors to IEC 60874-14-9 and IEC 61754-4.

Demountable optical connectors to be terminated on pigtailed or patchcords shall comply with the mechanical interface standard series (IEC 61754-series), describing mechanical intermateability as well as to the optical interface standard series (IEC 61755-series), describing optical performances.

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Demountable optical connectors to be terminated on ruggedised patchcords shall be one of the following types:

- tuned 8-degree SC/APC connectors to IEC 60874-14-9 and IEC61754-4
- tuned FC/PC connectors with ceramic ferrules to IEC 61754-13 and BS 50377-2-1
- LC/UPC connectors to IEC 61754-20 and BS 50377-7-4.

The Supplier shall propose a method for permanently and unequivocally identifying that an optical connector has been tuned with reference to the keyway.

9 Environment

All goods supplied shall be suitable for installation into, and extended operation in, an environment described by ETS 300 019-1-3 class 3.2 and BR 967, Category D in Appendix A.

10 Product Acceptance and Supporting Information

10.1 Product Acceptance

All products for supply to Network Rail are subject to the requirements of NR/L2/EBM/029 Product Acceptance.

The Supplier shall state whether the products offered currently hold Network Rail product acceptance and, if so, the reference number of the acceptance certificate and the terms of the acceptance.

The Supplier's products shall successfully meet the requirements set out in section 11 as a condition of obtaining Network Rail's Product Acceptance.

10.2 History of Use in a Railway Environment

The Supplier shall state details of the offered termination's use in a railway, or similar appropriate, environment.

10.3 MTBF

The Supplier shall supply appropriate MTBF data where available for individual components and the full termination in the following categories:

- Calculated MTBF data including the parameters used
- Actual MTBF data including any apparent failure patterns

10.4 Materials

The materials used in the optical fibre tail cable assemblies shall be sufficiently durable to provide a service life of at least 30 years within an environment specified in section 9.