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Level 2

Jointing, Terminating and Testing Optical Fibre Cables

Endorsement and Authorisation

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Issue record

Issue	Date	Comments
1	June 2011	New standard containing content from SP/FTN(D&D)/005

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/MTC/088	Arrangements for maintenance of new and changed assets
NR/L3/MTC/089	Asset Management Plan
NR/L2/TEL/00014	Optical Fibre Telecommunications Cables
NR/L1/TEL/30092	Telecoms Testing and Commissioning
NR/L2/TEL/30098	Testing and Commissioning of Telecommunications Equipment and Systems
NR/GN/TEL/30140	Telecoms Cable Route Installation
NR/L2/TEL/30160	Optical Fibre Network Design
NR/L2/TEL/30161	Optical Fibre Patchcords and Pigtails
ETS 300-019-1-3	Environmental Tests for Telecommunications Equipment
BS EN 60825-2:2000	Safety of laser products: safety of optical fibre communications systems
IEC 60874-14-9	Specification for fibre optic connector type SC-APC
ITU-T Recommendation G.652	Characteristics of a Singlemode Optical Fibre Cable

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1 Purpose

This specification sets out the specific requirements and parameters for jointing, terminating and site acceptance testing of optical fibre cables that comprise, or connect to, Network Rail's optical fibre infrastructure.

2 Scope

This Network Rail standard sets out the principles and practices for jointing and terminating optical fibre cables and specifies optical fibre test methods and values of permissible optical loss.

In addition to the compliance requirement stated above, clause 7.1.2 applies to all optical fibre cables handed into maintenance on or after 03 September 2011.

The requirements of this standard apply only to cables containing optical fibres generally to ITU-T Recommendation G.652.

The requirements set out in this document and in NR/L1/TEL/30092, NR/L2/TEL/30098, NR/L2/MTC/088 and NR/L3/MTC/089 apply to projects involving jointing, terminating or testing optical fibre cables on any Network Rail Controlled Infrastructure.

3 Abbreviations

ADM	Add-Drop Multiplexor
CCMS2	Corporate Content Management System 2
CSM	Central Strength Member
DI-SAC	Double-Insulated Super Armoured optical fibre Cable
EVA	Ethylene vinyl acetate
FTN	Fixed Telecommunications Network
GSM-R	Global System for Mobiles for Railways
FUT	Fibre Under Test
HSAT	Handover Supplementary Acceptance Test
ILM	Insertion Loss Measurement
ODF	Optical Distribution Frame
OTDR	Optical Time Domain Reflectometer
PBT	Polybutylene Teraphthalate
PE	Polyethylene
PICOT	Party In Charge Of Testing
PMux	Primary Multiplexor
RAM	Route Asset Manager
REB	Relocatable Equipment Building
SAT	Site Acceptance Test
SDH	Synchronous Digital Hierarchy

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STM	Synchronous Transfer Module
STM-1	STM supporting data at 622 Mb/s
STM-16	STM supporting data at 2.5 Gb/s
SC/APC	Subscriber connector (with) angled physical contact
TECC	Telecoms Engineering Control Centre
ZHLS	Zero-Halogen, Low-Smoke

4 Definitions

For the purpose of this standard, the following terms and definitions apply.

Access Node:

A generic term for a FTN transmission node site containing one or more STM-1 ADMs and PMux, typically accommodated in an active trackside cabinet or relocatable building at a GSM-R site.

Access ring

A FTN SDH ring carrying access traffic

Access traffic

FTN transmission at STM-1 level

Active Transmission Equipment Housing:

A FTN lineside cabinet with climate control to accommodate active transmission equipment.

Buffered fibre

Primary-coated fibre clad in a 900 micron thick coating of nylon over the primary coating for protection. Also called "secondary-coated".

Centre-to-centre

Method of measurement of the length between adjacent joint locations

Core Node

A FTN transmission node site containing one or more STM-16 ADMs, typically accommodated in an REB or building

Core ring

A FTN SDH ring carrying core traffic

Core traffic

FTN transmission at STM-16 level or higher

DI-SAC

A heavily armoured 24-fibre cable that is designed for long-term, unprotected deployment on the ground surface.

Earth potential

The electrical potential of the general mass of earth in the vicinity of an object

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Express joint

An optical fibre joint where a cable is introduced uncut so that its optical fibres can be accessed subsequently. Express joints save the optical attenuation that would occur from splicing fibres not accessed at that joint.

Fibre section

Optical fibre connecting two adjacent Core Nodes

Fibre sub-section

Optical fibre connecting two adjacent Access Nodes or connecting an Access Node to a Core Node

Fibre tube

Tubes in an optical fibre cable manufactured from polybutylene terephthalate (PBT) designed to provide protection to the fibres with a low-friction surface.

Fixed Telecoms Network

Optical fibre cables, copper cables, and transmission equipment forming Network Rail's national telecommunications network that provides a platform for GSM-R, operational railway, and business applications.

Primary coated fibre

Fibre as it exists inside a cable with a 250 micron thick coating of Acrylate

5 Jointing

5.1 General

- 5.1.1 NOTE: The optical fibre cable will be manufactured to meet the requirements of NR/L2/TEL/00014 and the nominal operational wavelength will be 1550nm.
- 5.1.2 Optical fibre joint closures shall be housed in purpose-built joint bays or chambers as set out in NR/GN/TEL/30140 and optical fibre joint closures and their kits shall be installed in accordance with the manufacturer's instructions.
- 5.1.3 NOTE: Where optical joints are installed vertically then the cables should enter the closure from below to minimise the seepage of gel from the cable into the closure assembly.
- 5.1.4 Optical fibre joints shall be protected inside mechanically reopenable joint closures to facilitate testing and reconfiguration during the life of the network. NOTE: By preference, optical fibre joint closures should only afford entry of cables at one end to facilitate their repositioning to a position that is at least 4 metres from running lines, which will permit a jointer's tent to be safely erected on the lineside.
- 5.1.5 Cables of a twin sheath construction contain a void between the outer and inner sheaths, which if unsealed could provide a path for moisture to travel along the cable and into a joint closure. During preparation for jointing, the outer sheath, and armouring shall be cut back to expose the inner sheath and the void between the outer and inner sheaths shall be sealed using permanent heat-shrinkable tubing to form a watertight seal outside the joint

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closure. NOTE: This sealing kit should be supplied with the joint closure kit.

- 5.1.6 Cables shall enter joint closures through ports so that cross-overs of cables or fibre tubes inside joint closures are minimised.
- 5.1.7 Unless all spare ports are occupied or unusable, oval ports shall be reserved for entering uncut cables into joint closures.
- 5.1.8 No more than 10 metres of a PE-sheathed cable is to be accommodated within a building (excluding REBs) to prevent the cable from introducing a fire hazard. In this instance the incoming PE-sheathed cable shall be jointed to a suitably fire-rated cable to RIS-7700-INS, such as ZHLS-sheathed cable, by installing a building entry joint within 10 metres of entering the building.

5.2 Sheath gapping

- 5.2.1 Electrically conductive sheath elements shall be gapped as set out below to prevent potential electrical hazards owing to the presence of traction electrification systems and National Grid distribution systems.
- 5.2.2 Where the continuous electrical path length of metallic armouring exceeds the limits set out below then a 40 mm electrical discontinuity shall be introduced in the metallic sheath elements at the cable's midpoint using a sheath gapping kit.
- 5.2.3 In ac electrified areas where current returns to source through the return rail alone or where traction electrification supply is derived from autotransformers then the continuous electrical path length of any metallic armouring on any optical fibre cable shall not exceed 1,400 metres in length.
- 5.2.4 In ac electrified areas where the traction electrification employs booster transformers then the continuous electrical path length of any metallic armouring on any optical fibre cable shall not exceed 2,100 metres in length.
- 5.2.5 Cable sheaths shall be made electrically discontinuous at joints. Where a cable loop is introduced into an express joint with its outer sheath intact then the metallic sheath shall be permitted to remain intact and electrically continuous until the sheath needs to be removed to access the fibres inside.
- 5.2.6 Metallic CSMS of adjacent optical fibre cables shall be electrically isolated from each other, from other electrically conductive elements and from earth potential.
- 5.2.7 The metallic armouring on any optical fibre cable entering a building or lineside housing shall be gapped with a sheath gap kit between 3 and 30 metres before the cable's entry point.
- 5.2.8 The minimum bending radius and other mechanical limitations of optical fibre cable elements and the optical fibres themselves shall not exceed the manufacturer's specified limits during cable preparation, splicing and closure.
- 5.2.9 In order to maintain effective operation of Network Rail's optical fibre network and to protect against accidental injury from lasers, entry to optical joint closures by unauthorised persons shall be prevented by securing the dome to the base as specified by the Project Engineer using the security mechanism