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Terminating - Optical Fibre

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1 *Introduction*

This Document forms part of the Access Network Specification range of ISIS Documents and is applicable to both Openreach Direct Labour and External Contractors.

The information below details the performance requirements for optical fibre connectivity products in the Exchange and Customer Premises environments within the BT network. Practices and items of plant are only detailed where necessary to ensure BT's Network and plant is not compromised.

2 *Glossary*

2.1 **Product**

Item	Description
Optical Consolidation Rack 1A	A 2.2m high rack, 900mm wide by 300mm deep, for use with Next Generation Access. The rack accommodates 8 Optical Consolidation Sub-Racks 1A, and provides interconnection for up to 576 circuits.
Optical Consolidation Sub-Rack 1A	An Optical Fibre Sub-Rack which is to be used only with the Optical Consolidation Rack 1A. The Sub-Rack contains 12 sliding shelves, each shelf containing 6 fibre splicing trays.
OTIAN Generic Rack 3A	A 2.2m high rack, 900mm wide by 300mm deep, which accommodates OTIAN Rack Splicing Modules 3A and hardware items for cable management.
OTIAN Rack Splicing Module 3A	Module 125mm high, containing 12 modules, each containing 2 splicing trays. Compatible with Generic Rack 3A and Generic Sub Rack 3A.
OTIAN Generic Sub Rack 3A	Hardware for mounting in 19 inch, ETSI and TEP-1E racks. Accommodates one OTIAN Rack Splicing Module 3A.
OTIAN Splicing Shelf 19 inch	Optical fibre splicing shelf containing either 24 or 48 splicing trays. Approx. 125mm high.
OTIAN Splicing Shelf 2A	Optical fibre splicing shelf for mounting in 19 inch or ETSI racks, containing one splicing module with two splicing trays. Approx. 45mm high.
OTIAN External/Internal Customer Lead-In	Wall-mounted product for passing optical fibre cable through a customer premises wall, with integral bend management.

OTIAN Blown Fibre Gas Seal Box	Wall-mounted product that accommodates the interstitial gas block on the external Blown Fibre Cable, and up to 7 Gas Seal Connectors for the tubing.
OTIAN BF/COF Dual Circuit Box	Wall-mounted product that contains two splicing trays, for splicing Cable Optical Fibre 200 (COF200) or Blown Fibre to connectorised tails or COF8002.
OTIAN COF8002 Dual Circuit Box	Wall-mounted product that contains two splicing trays, for splicing Cable Optical Fibre 8002 to connectorised tails.
OTIAN Multi-circuit Splicing Box	Wall-mounted product that contains twelve splicing trays, for splicing Cable Optical Fibre 200 or Blown Fibre to connectorised tails or Blown Fibre.
NGA Internal / External Customer Splicing Point	Wall-mounted product that contains one splicing tray, for splicing blown fibre bundle to a connectorised tail. For use in NGA FTTP network only.
NGA Connectorised EZ Bend Pigtail	Single ruggedised singlemode fibre cable, 4.8mm in diameter, with Limited Fire Hazard sheath, terminated at one end with one SC/APC connector. For use in NGA FTTP network only.
NGA Multi Dwelling Unit Internal/External Fibre DP	A range of wall-mounted products that contain several splicing trays, for splicing various types of fibre cables. For use in NGA FTTP network only.
NGA Multi Dwelling Unit Breakout Box	A range of wall-mounted products that enable single customer fibres to be routed from a multi-element pullback cable. For use in NGA FTTP network only.
Termination Optical 8001C	Single ruggedised singlemode fibre cable, 2.5mm in diameter, with Limited Fire Hazard sheath, with one Connector Optical Fibre 8A (FC-type).
Termination Optical SC	Single ruggedised singlemode fibre cable, 2.5mm in diameter, with Limited Fire Hazard sheath, with one SC-type connector.
Termination Optical LC	Single ruggedised singlemode fibre cable, 2.5mm in diameter, with Limited Fire Hazard sheath, with one LC-type connector.
Termination Optical SC/APC	Single ruggedised singlemode fibre cable, 2.5mm in diameter, with Limited Fire Hazard sheath, with one SC-type connector, with 8 deg. angled ferrule.

2.2 Terms

Specifying Authority	Specification Authority (Openreach Network Capability & Development)
Works Executioner	The Person / Organisation undertaking the work

3 **Cleanliness**

On completion of work, the area shall be clear of any waste material, and the waste shall be disposed of using the agreed BT procedures.

Warning: IT IS THE WORKS EXECUTIONERS RESPONSIBILITY TO ENSURE THAT THE AREA IS CLEAR OF WASTE MATERIAL, AND THE AREA IS IN A SAFE CONDITION, BEFORE, DURING AND ON COMPLETION OF THE WORK.

4 **Safety**

The Safety requirements for BT Optical Fibre Systems are detailed in the Safety Specification Document EPT/ANS/A022.

5 **Connectivity Products**

Only currently approved connectivity products may be used. In the exchange and customer premises environments, the range of products includes rack mounted splicing shelves, wall-mounted splicing boxes, connectorised patching shelves and boxes, optical flexibility racks, single-fibre and two-fibre ruggedised cables, and connectorised pigtailed and patchcords.

The approved manufacturers' installation instructions shall be followed at all times.

5.1 **Current Exchange and Customer Premises Connectivity Products**

- Optical Consolidation Rack 1A
- Optical Consolidation Sub-Rack 1A
- OTIAN Generic Rack 3A
- OTIAN Rack Splicing Module 3A
- OTIAN Generic Sub Rack 3A
- OTIAN Splicing Shelf 19 inch
- OTIAN Splicing Shelf 2A
- OTIAN External/Internal Customer Lead-In
- OTIAN Blown Fibre Gas Seal Box
- OTIAN BF/COF Dual Circuit Box
- OTIAN COF8002 Dual Circuit Box

- OTIAN Multi-circuit Splicing Box
- NGA Internal/External Customer Splicing Point
- NGA Connectorised EZ Bend Pigtail
- NGA Multi Dwelling Unit Internal/External Fibre DP
- NGA Multi Dwelling Unit Breakout Box
- Termination Optical 8001C
- Termination Optical SC
- Termination Optical LC
- Termination Optical SC/APC

5.2 Fibre and Cable Management

5.2.1 Fibre – Minimum Bend Radius

Fibres shall be managed so as to comply with the agreed minimum bend radius of 30mm at all times.

5.2.2 Cable – Minimum Bend Radius

Cables shall be managed so as to comply with the agreed minimum bend radius for each cable type, as shown below.

- COF8001, COF8002 - 30 mm
- COF201 (12 to 72 fibres) - 100 mm
- COF201 (96 and 144 fibres) - 175 mm
- NGA EZ Bend Pigtail – 15 mm

6 *Optical Fibre Splicing Requirements*

6.1 Splicing Machines

Splicing Machines used in the BT fibre network must meet the following criteria, and proof of conformance must be submitted to the Specifying Authority.

1. Splicing machines must be capable of splicing both singlemode (CW1505) and multimode (CW1504) optical fibre.
2. A sample of 100 consecutive splice results shall be supplied. The test shall take place using fibre manufactured to CW 1505 with a known offset of not less than 0.4µm. The relative orientation of the fibres throughout the test shall

be randomized. The mean splice loss shall be not greater than 0.07dB with a standard deviation of not greater than 0.03dB measured using the single fibre "Break and Make" technique.

3. The machine shall be capable of automated fibre positioning the X, Y and Z axes.
4. The heat oven used shall not reach more than 125°C (+5 / - 0°C) and shall be capable of shrinking down Protectors Splice No.1, 3, 4 and 5 in such a way that full recovery of the heatshrink material is obtained and all air is expelled from the protector during the heating process.
5. A cooling period is necessary, therefore the splice protector must remain in the oven undisturbed for an additional period of 80 seconds.
6. The jointing machine shall be required to produce low loss splices having optical and mechanical stability over a period of at least 30 years. The failure rate of these splices over this duration shall not exceed 10 FITS. The contractor is required to produce evidence to support this with the tender submission.

Note: 1 FIT = 1 failure in 10⁹ hours.

7. The splice loss estimation system used by the jointing machine must be approved and be accurate to within +/- 0.1dB of the true splice loss. A sample of 100 consecutive splices shall be submitted to demonstrate that the mean difference between the true splice loss and the estimated splice loss varies by no more than 0.02dB.
8. The jointing machine shall be designed to apply a tensile load to the spliced fibre of 2N (200 grams) at the end of the splicing sequence. The method used to achieve this must be demonstrated at the time of tendering.

6.2 Splice Protectors

Only currently approved Splice Protectors shall be used in the BT fibre network.

7 *Optical Jumpers*

7.1 Rules to follow when installing jumpers on Optical Flexibility Racks or Frames (OFRs or OFFs)

- **DO** follow the installation instructions on the door, or on the BT Intranet. http://documents.intra.bt.com/bookstore/general/p_ig/
- **DO** replace the splice tray lids, fibre guiding pin and sliding cover on splice modules.

- **DO** ensure that the jumpers are correctly routed through the hinge clamp around the tray support pole, and are held within the retaining tabs. This avoids pinching of the fibres.
- **DO** ensure that the jumpers enter the correct bend manager slot to the right of the support pole. This avoids pinching / cutting fibres.
- **DO** ensure that the bend manager is fitted and locked into place for EVERY splicing module in the rack, before jumpering commences. This will avoid major service faults, by ensuring correct bend control of the fibre.
- **DO** ensure that the jumper leaves the bend manager DOWNWARDS.
- **DO** ensure that the jumpers are routed correctly over the bend managers when leaving the rack to the sides or rear.
- **DO** ensure that jumpers that are routed between trays in the same rack are routed AROUND the mandrel at the bottom of the OTIAN rack. This avoids transient losses caused by sharp bends in the fibre.
- **DO** ensure that there is sufficient, but not excessive, slack in the jumper so that it lays neatly in the jumpering area.
- **DO** ensure that jumpers remain within the confines of the jumper management hardware, particularly at the bottom of the rack, so that fibres are not accidentally bent, damaged or snagged.
- **DO** select the most viable route for new jumpers that provides the least interference with existing jumpers, and causes least effect on future provision.
- **DO** record the circuit information on the splicing trays, and on the record sheet provided.
- **DO** recover obsolete jumpers, see Section 3.
- **DO** ensure that changes to circuit information are communicated to the local planning office.
- **DO** seek assistance from your line manager if you are unable to follow these instructions.

7.2 **The following are instances of bad practice, and MUST NOT be used**

- **DON'T** run jumpers that are 'piano-wire' tight, either within or between racks.
- **DON'T** leave more slack than is necessary to route the jumpers neatly around the jumper management hardware.
- **DON'T** bend fibres when tracing faults or proving continuity, because this produces micro-stressing of the fibre which affects the fibre's ability to carry high bit rate transmission.

- **DON'T** use expedient solutions “just to get the job done”, as this can cause problems in the future.
- **DON'T** route jumpers upwards from the bend managers on OTIAN products.
- **DON'T** interweave new jumpers around existing jumpers.
- **DON'T** route jumpers over the top of racks, or outside of the racks, unless suitable dedicated trunking is used. Normal grid hardware does not give sufficient support or protection to jumpers.
- **DON'T** use Straps Cable Fixing on jumpers.
- **DON'T** use Cable Optical Fibre 8002 in Optical Flexibility Racks, as its application is for customer sites and has not been authorised or approved for normal use as a jumper. See warning below:-

Warning: COF8002 is ONLY approved as an optical jumper for use within exchange OFF/OFRs for use on Ultra Broadband (UBB) circuits. It is NOT approved for any other use within exchanges.

8 *Recovery of Optical Jumpers*

- a. Identify the jumper to be recovered and gently pull to check if it is free to move and does not interfere with or compromise other jumpers.
- b. Trace the jumper to the point where it changes direction and proceed to check that it remains free.
- c. Continue to trace the jumper through the racks until its end can be identified or the point is reached where to continue to trace it proves impossible, either due to it being locked in or where it would compromise other jumpers.
- d. At that point label/mark the jumper with details of where it is from and then, where records are available, locate the other end and trace back to this position following the steps a to c above.
- e. Having identified which sections of the jumper, if not all, can be recovered then cut and remove/withdraw those sections observing that other jumpers are not compromised.
- f. Seal any exposed ends left in situ, using PVC tape, to prevent injury from exposed fibre.
- g. Dispose of recovered jumper using recognised practices.

Warning: On no account must a fibre jumper be cut and the end left exposed. The exposed end must be taped over with adhesive tape to cover the exposed fibre to prevent injury.

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Recovery of Optical Jumpers

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