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# ***Optical Cable Underground Installation & Recovery***

## ***About this document ...***

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# 1 ***Introduction***

This document forms part of the Access Network Specifications range of ISIS documents and is applicable to both Openreach direct labour and external contractors. (See EPT/ANS/A001 for an index of all other documents in this range). This section details the performance requirements that shall be met when optical cables are installed, secured or recovered.

## 2 ***Cabling In Duct***

### 2.1 **General**

This sub-section should be read in conjunction with EPT/ANS/A003 (Underground Cabling Copper) and details the performance requirements that shall be met when optical cables, Sub-duct or Blown-Fibre Tubing are installed, into underground duct. Depending on the types of optical cable, subduct or blown fibre tubing, they are either installed by blowing techniques, rodding techniques or pulled in. Details of currently approved fittings and other items together with their applications are also given.

### 2.2 **Glossary/Application**

#### **Sub-duct Mono-bore**

This is generally known as Sub-duct and includes the following:

Sub-duct Mono-bore 4.

Sub-duct Mono-bore 5.

Sub-duct Mono-bore 6.

#### **Sub-duct Mono-bore 4, Connector Straight 1**

A dual purpose, plastic compression pipe fitting for joining two lengths of sub-duct mono-bore 4 together, and with a facility for introducing lubricant.

#### **Sub-duct Mono-bore 4, Plug Rope 1A**

An aluminium plug sized to fit within the end of the sub-duct mono-bore 4. The plug has a loop used to retain the rope contained within the Sub-duct.

#### **Sub-duct Mono-bore 5, Connector 1**

A plastic compression pipe fitting for joining two lengths sub-duct mono-bore 5 together.

#### **Sub-duct Mono-bore 5, Stop 1**

A plastic pipe fitting for capping of the open end of sub-duct mono-bore 5

### **Sub-duct Mono-bore 5, Air Guard 1**

A plastic pipe fitting that is fitted to the far end (opposite to blowing end) of sub-duct mono-bore 5 to prevent the cable being blown out of the sub-duct when the required length of cable has been installed.

**Other currently approved fittings and items together with their applications associated with cabling techniques are detailed in EPT/ANS/A003**

## **2.2.1 Performance Requirements**

The works executioner shall comply with the following performance requirements:

## **2.2.2 Cable Installation**

- a) Where Optical Fibre Cables are pulled in, the tensions shall not exceed those shown in Tables 2 & 3
- b) There shall be no damage to any of the fibres, or any other component part of the cable.
- c) A length of 8 to 10 metres of cable shall be left for jointing purposes. This jointing length allowance shall not include the part of the cable which was used for attachment of the pulling device as this is unsuitable for jointing. Prior to the removal from site, the ends of all surplus cable cut from the installed cable length must be sealed with PVC tape to restrain any loose fibres.
- d) For OTIAN® Networks a loop shall be left in the main track box where a jointing/splicing point may be required. The length to be left shall be in accordance with Table 1.
- e) The minimum bend radius for cabling and cable setting is shown in Tables 2 & 3.
- f) For COF200 and COF202 cables. These cables are specifically designed to be installed by blowing techniques into Sub-duct Mono-bore 5. Cable Lubricant **must not** be used to assist the installation of cables installed by blowing techniques.

However COF 200 and COF 202 can be installed directly into underground ducts using standard winched pulling practice. For this the following practice must be adhered to:

- 1) Attach the cabling rope to the cable via Connector Swivel 22mm 2A and Grip Cable Single Eye Closed 13 mm. Fit fuse Swivel 2A with 2 kN fuse into Connector Swivel 22 mm 2A.

Swivels are an important protection device. Prior to winching, open the component and check for damage & wear, ensure the bushings are clean, free to rotate and that the correct fuse is fitted. Excessively damaged or worn swivels or fuses must not be used and should be replaced as soon as possible. To prolong the life of the swivel, once a week, lightly greasing the internal bushings and stub with Multi-Purpose Grease I/C 104233.

**Do not use a fuse greater than 2kN (brass colour).**

2) Draw cable into main duct as per the practices detailed in ISIS EPT/UGP/E046.

**Caution:** Installing the cable at loads in excess of 2kN may cause irreversible damage to the fibres resulting in a reduced service lifetime for the cable.

g) When optical cables are being blown into sub-duct mono-bore 5, the sub-duct end opposite to the blowing end must be fitted with a Sub-duct Mono-bore Air Guard 1.

h) For COF205. This cable is specifically designed to be installed by blowing techniques into Sub-duct Mono-bore 6 only. Cable Lubricant must not be used to assist the installation of cables installed by blowing techniques. The minimum bend diameter of COF205 is 250mm.

i) When optical cables are being blown into sub-duct mono-bore 6, the sub-duct end opposite to the blowing end must be fitted with a Sub-duct Mono-bore Air Guard 1 via a Blown Cable Air Guard Adaptor SDMB 6.

j) Following installation of optical cables cut back any protruding strength member or damaged portion of cable butt and seal with an appropriate size of heat shrinkable end cap.

#### **2.2.2.1 Sealing Cable Ends**

Both ends of all Sub-duct, Cable and Blown Fibre Tubing shall be effectively sealed against the ingress of water and debris during and after cable installation.

Sub-duct shall be sealed with appropriate end cap. For Sub-duct Mono-bore 5, use Sub-duct Mono-bore 5 Stop 1.

For Cable and Blown Fibre Tubing use appropriate size of heat shrinkable end cap.

Additionally, after installation Blown Fibre Tubing can be sealed with Blown Fibre Tube Sealing Kit as an alternative to a heat shrinkable end cap.

#### **2.2.2.2 Additional Requirements for Blown Fibre Tube Installation**

a) The minimum bend radii for 5mm outside diameter tubing shall be as follows:

### **Product Minimum Setting Radius for Blowing**

7 tube sheathed PVC, PE, and RFH 225mm

4 tube sheathed PVC, PE, and RFH 200mm

2 tube sheathed PVC, PE, and RFH 115mm

1 tube sheathed PVC and PE, and RFH 115mm

1 tube unsheathed and 1 tube RFH 100mm unless smaller is unavoidable then 60mm however see this will limit the number of bends allowable in the route

b) All blown fibre tube elongation shall have recovered before tube jointing takes place.

c) Blown fibre tubing is colour coded to indicate clockwise or anti-clockwise orientation. It shall be installed so that clockwise ends are joined to anti-clockwise ends.

d) Blown Fibre tubing shall be installed at tensions no greater than those shown in Table 4.

The air flow through sections of blown fibre shall be within 10% of the values given in Graph 1 for 5mm tube and Graph 2 for 8mm tube.

**Note: Only air, from an air cylinder, to a standard equivalent to BOC SI No.1002 shall be used for this exercise. The essential qualities of the air are; a moisture content of no greater than 50 parts per million by volume, no detectable oil content, colourless and odourless with no added impurities.**

#### **2.2.2.3 Additional requirements for Sub-duct Installation**

a) Sub-duct shall not be installed into buildings from the underground network.

b) All Sub-duct elongation shall have recovered before jointing takes place.

c) Sub-duct Mono-bore 5 is installed by either pushing or pulling techniques, or a combination of both pushing and pulling.

d) When Sub-duct Mono-bore 5 is installed by pulling techniques the installation tension shall **not** be greater than 2kN.

e) Any joints in Sub-duct Mono-bore 5 shall be made using the correct Sub-duct Mono-bore 5 Connector 1.

f) Where Sub-duct Mono-bore 5 is to be left un-jointed it shall be capped off using a Sub-duct Mono-bore 5 Stop 1 to prevent ingress of moisture or debris.

g) At turning points, any bend in Sub-duct Mono-bore 5 must be greater than 0.5 m radius.

h) Sub-duct Mono-bore 6 is installed by either pushing or by pulling. When pulled, this must be at hand tension only. Installation can also be by a combination of both hand pulling and pushing.



- i) Any joints in Sub-duct Mono-bore 6 shall be made using the correct Sub-duct Mono-bore 6 Connector 1.
- j) Where Sub-duct Mono-bore 6 is to be left un-jointed it shall be capped off using a Sub-duct Mono-bore 6 Stop 1 to prevent ingress of moisture or debris.
- k) At turning points, any bend in Sub-duct Mono-bore 6 must be greater than 0.5 m radius.
- l) Sub-duct Mono-bore 4 shall be installed at tensions no greater than 5kN and shall have a Minimum Bend Radius of no less than 12 x Diameter (300mm)
- m) Any joints in Sub-duct Mono-bore 4 shall be made using a Sub-duct Mono-bore 4 Connector Straight 1A.
- n) Where Sub-duct Mono-bore 4 is to be left unjointed it shall be capped off using a Sub-duct Mono-bore 4 Plug Rope 1A to retain the rope and a Cap Sealing 16 E to prevent ingress of moisture or debris.

**2.2.2.4      Table 1 Loop through cable lengths to be left at OTIAN® splicing/Jointing positions**

Joint Box Type	Loop Length/metres
JUF 4	12.5
JUF 6	18.4
JUF 10	22.4

*Note:* Where an off track box is to be used the length of the loop shall be increased by a length equal to twice the distance from the main track box to the off track box.

**2.2.2.5      Table 2 Maximum Pulling Tensions of Blown Optical Fibre Cables**

Cable Types	Number of Fibres	Central Strength Member (mm	Maximum Pulling Tension (kN	Minimum Bend Diameter
COF 200	12 to 276	Non metallic	2	400mm
COF 202	Up to 24	Non metallic	2	400mm

**2.2.2.6      Table 3 Maximum Pulling Tensions of Optical Fibres Cables COF 24, COF25 & COF 27**

Cable Types	Number of Fibres	Central Strength Member (mm	Maximum Pulling Tension (kN	Minimum Bend Diameter
COF 24	Up to 24	4	8	24 x cable diameter

COF 25	Up to 24	4	8	24 x cable diameter
COF 27	8 to 48	3	4	24 x cable diameter
COF 27	72 to 96	3	5	24 x cable diameter
COF 27	144	3	5	24 x cable diameter
COF 27	240	4	8	24 x cable diameter

#### 2.2.2.7 **Table 4 Maximum Pulling Tensions of Blown Fibre Tubing**

Blown Fibre Tubing	Maximum Pulling Tension (kN)
2 PE (3.5/5 mm)	hand tension
4 PE (3.5/5 mm)	1 or hand tension
7 PE (3.5/5 mm)	up to 1.5

*Note:* Blown fibre tube bends should be kept to minimum and not be spaced less than one metre to each other to maintain blowing integrity. The maximum of 28 right angle bends applies to planning limitations of 600m for 5mm tubing.

Where equipment calibrated in metric Tons is used for cable installation the kN forces listed in the tables should be multiplied by 0.102. 1kN = 0.102 Metric Tons.

#### 2.2.2.8 **Table maximum Pulling tension for small Fibre Cables**

Hand Tension / Tensions up to but not exceeding 1200N for the following:-

Cable	Minimum Bend radius
4 Fibre Cable (6mm)	72mm
12 Fibre Cable (6mm)	72mm
36 Fibre Cable (7mm)	84mm
48 Fibre Cable (7mm)	84mm

#### 2.2.2.9 **COF600 36F UG Cable**

The **COF 600 36F UG** HDPE cable is 8.5m in diameter and is suitable to be pulled by hand through duct via rod / rope using a stocking grip.

Tensile pulling loads upto 2kN can be applied to the cable using a combination of Tape Cabling Adhesive and Cable Stocking Grip.

The cable ends should have layers of adhesive tape applied to the cable end prior to applying the cable stocking. Apply enough cable tape to still be able to fit cable stocking.

The sole use of cable stocking only will likely result in cable sheath damage at lower tensile strengths.

When pulling in cable ensure either a Connector Swivel 22mm 2A or a Connector Swivel 16mm is fitted to the rods. A 2kN fuse only should be used.

Fleeting from a central joint box on longer lengths is possible using the usual figure eight format.

<b>Rodding Items</b>	<b>Item Code</b>
Tape Cabling Adhesive	072129
Cable Stocking Grips	046077
Connector Swivel 22mm 2A	127404
Fuse Swivel 2A 2kN Brass	126917
Connector Swivel 16mm - Available on Ibuy and comes with 2kN fuse	088914

### **2.2.3 Cable Recovery**

#### **2.2.3.1 General**

This sub-section is detailed in EPT/ANS/A003

## **2.3 Cable / Joint Support & Protection**

The majority of information covering the support and protection of BT Cables in the UG Network is defined by BT ISIS documents, and EPT/ANS/A003 sections 2.4 & 2.5. Standards relating to cable support & protection for optical and blown fibre cables not detailed in EPT/ANS/A003 are covered in this section. In addition to bracket and bearers, methods of support include galvanized steel flat bars (Cable Support Bar) and Joint Support Kit 1A.

### **2.3.1 Rules for Support**

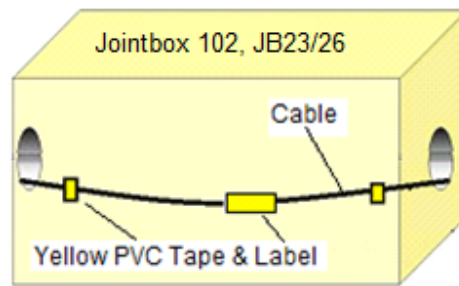
#### **2.3.1.1 Sub Duct Mono Bore 4 & 5**

No requirement to use support bars, merely support using existing brackets and bearers. When strapping to the bearers with straps cable fixing **hand tight only** do not over-tighten.

#### **2.3.1.2 Joint support Kit 1A used for Fibre cables & blown fibre tubing**

Where ironwork is missing from the chamber, it is no longer necessary to fit the bearers and support fibre cables passing through smaller footway jointing chambers.

**Cable support is no longer mandatory in JF2, JB26 and JB23 type jointing chambers.**



Fibre joints should must still be secured off the floor and placed on bearers or a Joint Support Kit 1A.

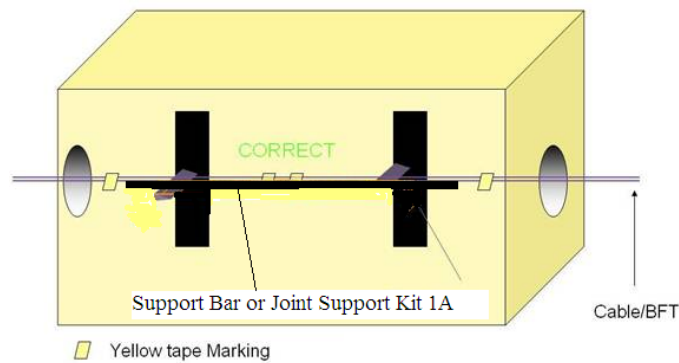


Fig 1. Brackets & Bearers are useable, cable/BFT/Sub-duct (less than 25mm) supported on installed Support Bar or Joint Support Kit 1A.

- (1) All unprotected Fibre Cables and all sizes of Blown Fibre Tubing (BFT) shall be supported with a Joint Support Kit 1A placed horizontally across and strapped to the cable bearers (an unprotected fibre cable is defined as a fibre cable not installed in sub-duct). The cable/BFT strapped to the Kit 1A using straps cable fixing **hand tight only do not over tighten** See Fig 1
- (2) All sub-ducts 25mm outside diameter and greater (i.e. sub-duct mono-bore 5 and above) do not need additional support across the cable bearers. Note: All bearers must be in place.
- (3) All small sub-ducts less than 25mm outside diameter shall be supported with a Joint Support Kit 1A, placed horizontally across the cable bearers as in (1) above. Rules for support of sub-ducts less than 25mm are the same as for unprotected fibres cables and blown fibre tubing.
- (4) Where brackets and bearers don't exist or are un-useable, the cable, blown fibre tubing or small sub-duct shall be strapped to a Joint Support Kit 1A using straps cable fixings. In this situation the Joint Support Kit 1A shall be installed in the jointing chamber by forming it in an arch as per the instructions supplied with the Joint Support Kit 1A. See Figs 3 & 5.

*Note:* The use of the Joint Support Kit 1A described in this document is to support unprotected fibre cables, blown fibre tubing and sub-ducts less than 25mm in diameter only. It is not for the support of fibre cable joints or blown fibre tubing joints.

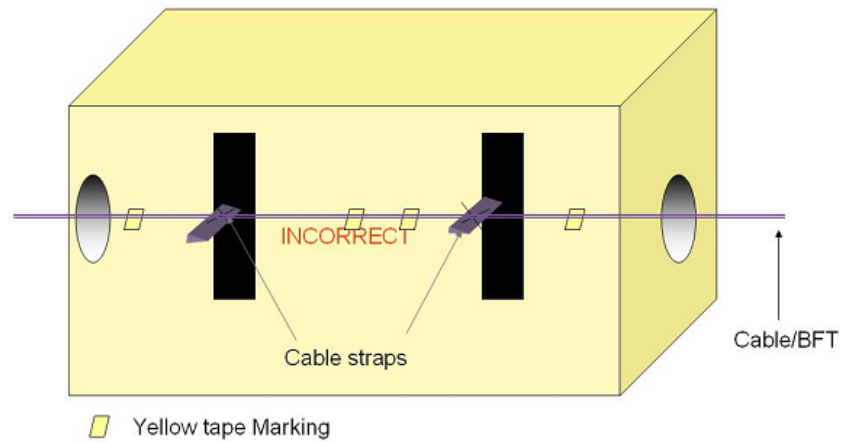


Fig 2. Brackets & bearers are useable, cable/BFT/Sub-duct (less than 25mm) supported on brackets. **Incorrect.**

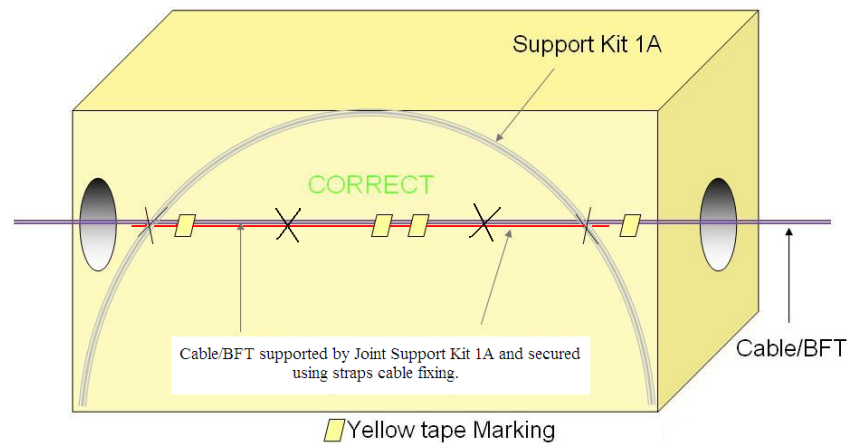


Fig 3. Cable/BFT/Sub-duct (less than 25mm) in JUF4 or no bolts in box for brackets and bearers, support using Joint Kit Support 1A (in arch as shown). Secure using straps cable fixing – hand tight only, do not over tighten.

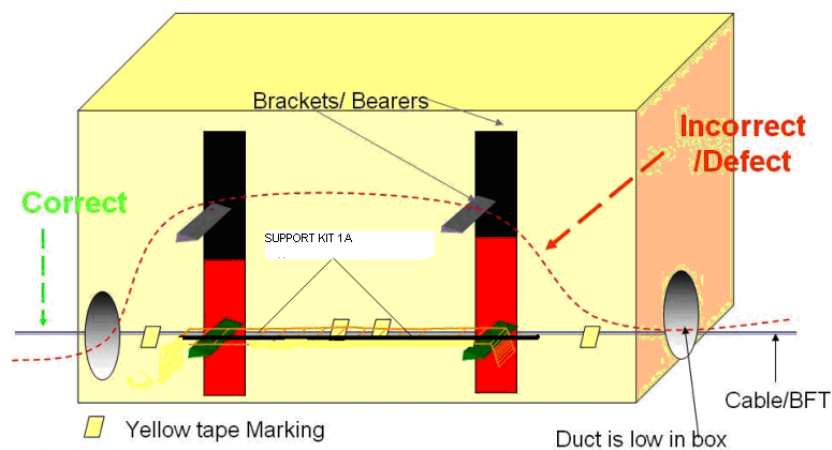


Fig 4. Duct is low in box bottom bore. Bracket & bearers are not useable (too short), change bearer for longer version and support with new brackets fitted lower down. Then support with relevant Support Bar or Joint Kit Support 1A. Dotted line shows cable/BFT/Sub-duct (less than 25mm) bent to go on supports, which is **incorrect**.

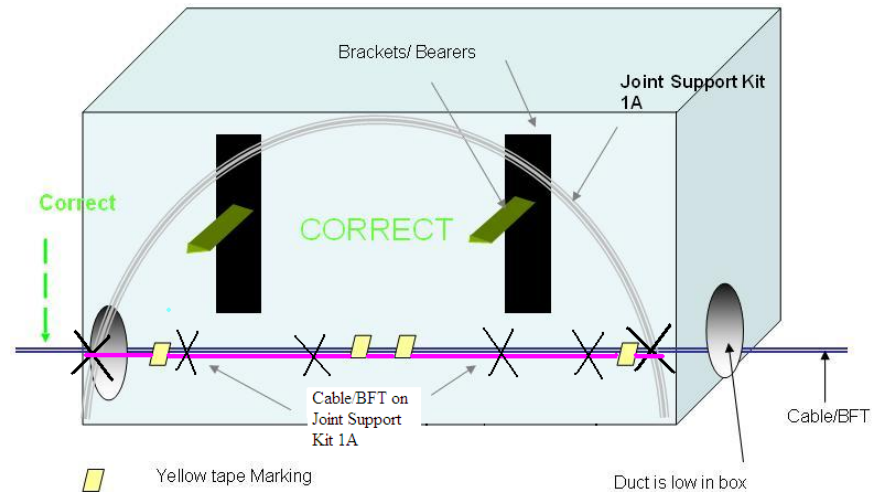


Fig 5. Bottom bore. No bolts in box or brackets & bearers are not useable, cable/BFT/Sub-duct (less than 25mm) is supported by using Joint Kit Support 1A (in arch as shown). This is correct. Secure using straps cable fixing – hand tight only, do not over tighten.

### 2.3.2 Supporting/Restraint in Terminating Chambers

Where practically possible, the cable entering the chamber should be restrained on a convenient bearer, so it cannot be accidentally pulled from the box during cabling operations or lose its Minimum Bend Radius routing. **Note: movement of smaller cables can compromise the bend radius of the cable and affect customer service, and make it more difficult to move/lift the joints where there's insufficient slack.**

Below is an example of a fully supported fibre cable on an existing 'cable support'. It is also possible to use Kit Joint Support 1A, **where practical**.



### **2.3.3           Layout of Cables in Jointing Chambers**

In order that the provision of good support should not be hindered by lack of space, and so that there is easy access to cable joints for maintenance purposes, every effort must be made to ensure that all cables occupying a particular duct-way are supported on brackets at one level, and that bracket levels are allocated to duct-ways in a systematic manner.

However, it is not always practicable to conform to this ideal layout, and attempts should be made to set the cable to minimise fibre transmission problems, and difficulty when blowing Blown Fibre Bundle and COF200 / COF202 Cable, as a result of excessive and tight bends

When setting Blown Fibre Tubing and Sub-Duct, attempts should be made to increase the bend radius for improved cable installation, whilst minimising the amount of unsupported and unprotected cable.

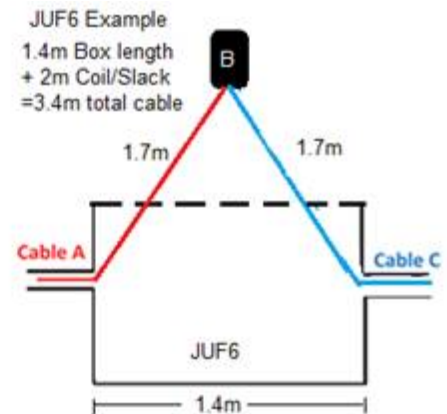
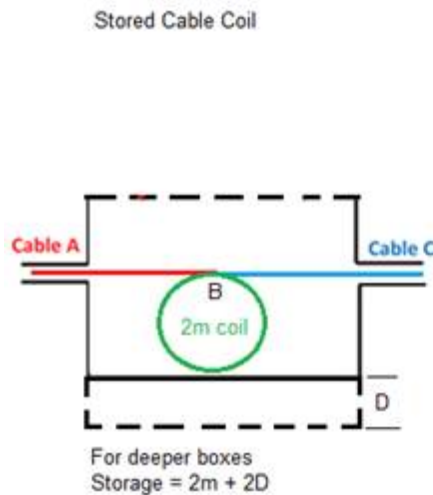
The routing of cables from the duct mouth to a suitable bearer, should:

1. provide a clear and safe working area in front of the joints,
2. provide secure support and protection for the plant, and
3. Accommodate cable bend limits and blown cable installation practices.

### **2.3.4           Storing Cables in Boxes**

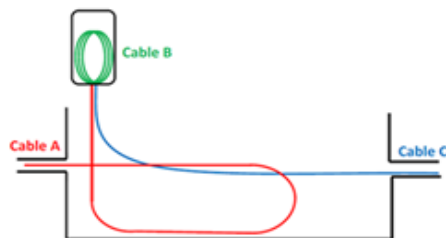
The size of cable that can be stored is dependent on the joint chamber, access to and location of the chamber, the amount of usable space available and the need to ensure that existing plant can be accessed and supported safely and securely. Based on current Openreach build standards, the table below lists the maximum length of coiled cable allowed. All coiled cables must be zip tied and placed against the side wall of the chamber to avoid creating obstructions and risking damage. Where bracket bearers are available, the cable must be hung from them.

Where installing a distribution joint/cable splice you are allowed up to 2 metres of cable (in addition to the length of the chamber) to be coiled in the respective jointing chamber before having to purchase the cable coil hosting product. E.g. Where the chamber is 1.4 metres in length you are permitted to 3.4 metres of cable before purchasing the cable coil product, see diagrams below:



### Maximum Cable Lengths

Based on current Openreach build standards, the table below lists the maximum length of coiled cable allowed.



Joint Box Type	JF11	JF10	JF6	JF4	JF2
Max Cable Length Coiled/Stored (A+C)	9.3m	9.3m	6.3m	4.3m	3.2m

Cable coil lengths may only exceed the maximum lengths outlined in the table above where there is a clear safety reason for doing so.

**Note:** CP's - This must be annotated on the Build Complete evidence report. In exceptional circumstances, where chambers are deeper than standard specification as defined on Annex 5 of the Product Description it is permitted to allow an extra 2 times the extra box depth to the maximum cable length allowed (shown in the table on the previous slide), e.g. if the extra depth is 150mm then you are permitted to install an additional 300mm of cable.

It is permissible to joint in the back of van if capacity exists in the box and you can get the van close enough, so long as you adhere to safe working



practices and the Engineer Principles including but not limited to cable lengths.

Permitted use for cable coils include to facilitate a distribution joint and to store cable in advance of completing a cable run but it is important that any such coils are used within a reasonable period of time to connect to a network and not used such as to prevent or limit others from using the duct or chamber, or as a pseudo 'reservation'. When leaving a cable coil in advance of completing a cable run you must label with the Nol reference and dated.

Manholes - Openreach do not stipulate maximum cable lengths for a 'slack network'.

## **2.4 Fibre Cable & Blown Fibre Tube Joint Support**

### **2.4.1 Rules for Support**

All fibre cable joints and blown fibre tubing joints shall be supported.

The MOBRA is the standard method of support for OTIAN joints, e.g. Generic Joints 2A & 3A, it provides bend management for the cables and a fixed work point for the operative when working on the joint.

All other fibre cable joints shall be supported on cable bearers with a Cable Support Bar (Galvanised Steel Flat Bar) - see list below.

All blown fibre tube joints shall be supported on cable bearers with a Cable Support Bar.

The following rules must be adopted when supporting OTIAN Joints in underground chambers:

1. Existing OTIAN Joints, in chambers without MOBRA fixing points, can remain supported & protected on the standard brackets & bearers already installed with the addition of Cable Support Bar.
2. New installations of OTIAN Joints, into chambers without Mobra fixing points, may also utilise existing brackets & bearers and Cable Support Bar.
3. The MOBRA support must continue to be used in all new chambers where the necessary fixing points do exist and drilling is not necessary (applies to all chambers from June 2004 and all modular chambers). **The lack of fixing points in new chambers must be reported back to Contracts Management as "an installation that does not meet specification", for remedial action to be taken.**
4. Where it is necessary to drill the chamber to fit bearers for supporting new/additional cables and joints, the MOBRA wall fixings should be provided as part of this operation.

**All Modular Chambers are supplied with MOBRA fixing points and therefore the MOBRA Bracket must be used in these chambers**

## 2.4.2 Cable Support Bars

The following is a list of the Cable Support Bars that can be used in certain boxes and their Item Codes, for ordering, if required. Please note, Openreach should be issuing these as part of the planned store items, for the estimate.

### **Suggested Cable Support for Footway & Carriageway Chambers**

A range of galvanised steel flat bars are available for different sizes of joint box

Cable Support 1	070288	Length 838mm
Cable Support 4	070291	Length 2134mm
Cable Support 9	075851	Length 1100mm

JF104	915mm box length	Cable Support 1
JF106	1310mm box length	Cable Support 1
JF110	2315mm box length	Cable Support 4 (or 9+9)
JF111	1690mm box length	Cable Support 9
JC12	1220mm box length	Cable Support 1
JC11	1820mm box length	Cable Support 9 + 1
JC14	2285mm box length	Cable Support 4 (or 9+9)

*Note: The table above is for guidance only.*

## 2.4.3 Multiple Joints on MOBRA's

### **Joint Chamber Space Utilisation & Use of Mobra Supports – Multiple Arms**

All joint and cable coils must be 'independently secured' in position, such that they are not liable to collapse as other plant is moved. Plant must be secured to avoid risk of injury and network damage.

No-Drill MOBRA frames must be placed flush against the narrow, end walls of the chamber. They must not obstruct any duct entries. Only MOBRA arms may be moved for access purposes, frames must remain in position.

Mobra frames must be installed with all appropriate bracing to protect the integrity of the joint chamber.

MOBRA arms may be placed above/below each other, providing they are on frames at different ends of the chamber, can be 'packed/unpacked' safely and allow reasonable access and safe working positions.

Where using MOBRA arms all joint must be secured such that they can be moved to access to other plant without risk of snagging other network components.

Multiple joints, with suitably approved brackets, may be mounted on MOBRA arms. The maximum MOBRA Arm loading of 25kg must not be exceeded.

Chamber steps must remain accessible to safely enter/exit the chamber.

The use of existing space, including MOBRA arm loading, must account for fully populated Joint/ CBTs/ Manifolds. A partially build joint must not be limited or obstructed for future build.

*Note:* CP's may fit a second MOBRA arms to an existing Openreach MOBRA Frame, providing the weight of the joints on each arm must not exceed 25kg.



*Note:* Where there are no brackets/bearers CPs must support their distribution joints (including Gel Wraps) using the Joint Support Kit 1a - Refer to the following section.

## **2.5 Cable Marking**

### **2.5.1 Underground structure locations requiring marking**

This section describes the requirements for cable identification and labelling within underground locations for all optical cables.

1. **Pull through points**
2. **Jointing points**
3. **Cable chambers:**
  - ◆ On all cables within 500mm of the duct seal
  - ◆ Adjacent to any joint within the cable chamber
  - ◆ At 50 metre intervals within the cable chamber
4. **Tunnels and Deep Level Tunnels:**

- ◆ At a point 4 to 8 metres either side of any fire doors / fire breaks
- ◆ Adjacent to all joints
- ◆ All jointing bay points – these bays are widened areas within the tunnel / deep level tunnel that allow for a change of cable direction or access to a higher level
- ◆ Either side of the duct face that interfaces with the tunnel / deep level tunnel shaft / access
- ◆ At a point immediately prior to shaft entry
- ◆ At the bottom of the shaft
- ◆ If any horizontal cable lengths >600 metres remain unmarked after the above requirements have been adhered to additional marking shall be applied at 600 metre intervals

## **2.5.2 Internal Locations within Buildings**

This section describes the requirements for cable identification and labelling within Exchange building locations for all optical cables.

### **Internal OFF/OFR Location**

Within 300mm of cable butt entering tray or sub-rack location

Within 300mm of frame top entry point to overhead cable run

## **2.5.3 Identification Methods**

The following methods shall be used.

1. Identify cables and sub-duct using yellow Cable Marker Labels.
2. Identify cables, blown fibre tubing and sub-duct (not Sub-duct Mono-bore 5) using yellow tape.

## **2.5.4 Cable Marker Label**

On new provision or repair cabling works all external optical cables must be clearly identified using the yellow Cable Marker Label Optical (Item code 129409).

Internal optical cables must be clearly marked using the yellow Laminate Marker Label Optical (Item code 006892) at the Optical Flexibility Rack (OFR).

Information appropriate to the installation shall be printed on the marker label using a Pen Marker No.1 (Item code 129408) or equivalent permanent marker pen.

**2.5.4.1 Cable Marker Label Optical (Item code 129409)**

This is a tag type label and shall be fixed to the cable using Straps Cable Fixing 1A or equivalent cable strap that is UV stabilised and suitable for use in an underground environment.

**2.5.4.2 Laminate Marker Label Optical (Item code 006892)**

The cable shall be free from dirt and grease before application of label. The label shall be applied such that the transparent section of the label shall encapsulate the printed label surface.

**2.5.5 Identification Marking of Optical Fibre Cables**

Where optical cables, sub-duct and blown fibre tubing is supplied with axial yellow stripes along the sheathing, the application of additional yellow tape is not required.

Where axial yellow stripes are not present on optical cables, sub-duct and blown fibre tubing, then yellow tape shall be applied as indicated in the following diagrams.

The JRF 10 and MR 2 are illustrated as a guide to show optical fibre cables and blown fibre tubing in footway boxes and manholes should be marked (see Figures 1, 2 and 3 below).

*Note:* Where cables are installed in Sub Ducts the markings and identification will be the same.

***Figure 1 (Below)***

***Pull Through Points***

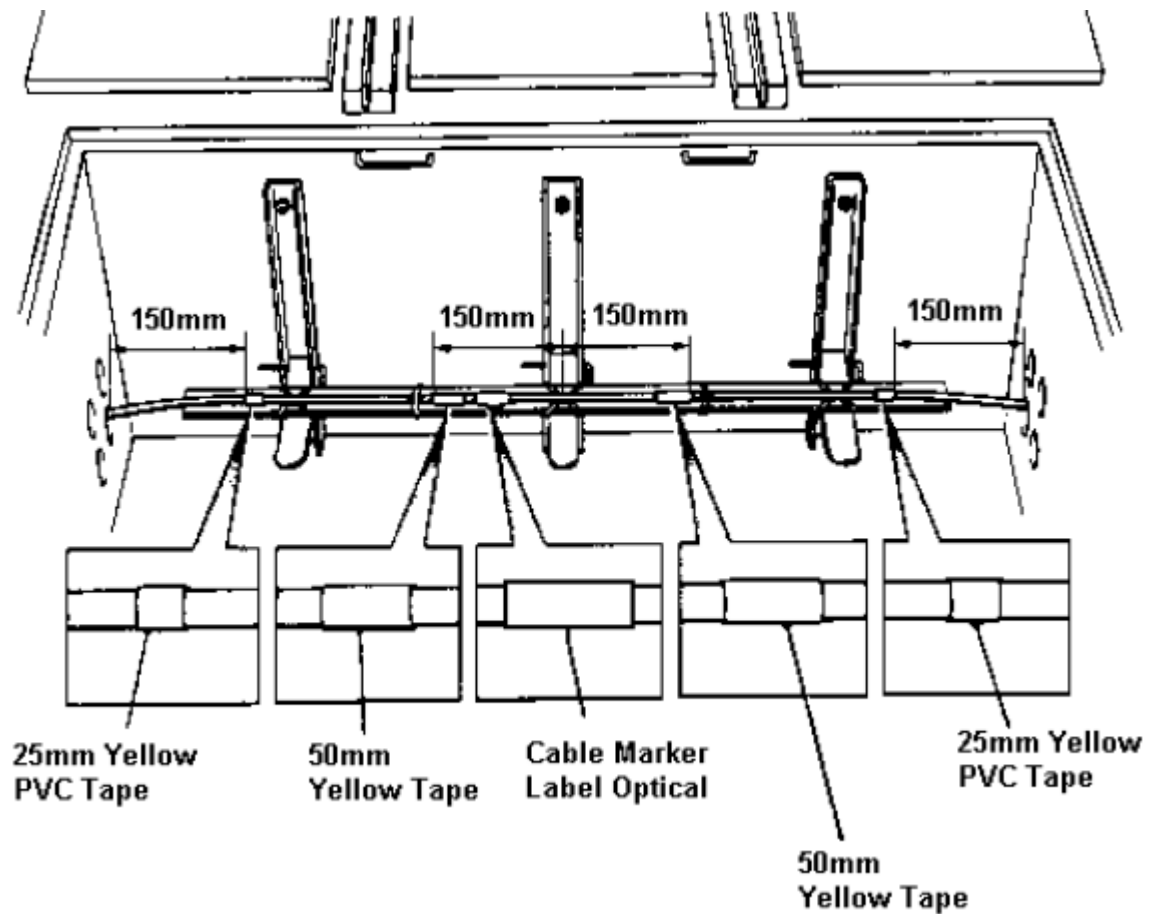


Figure 2 (Below)  
Jointing Point - Cables Entering Structures from One Side

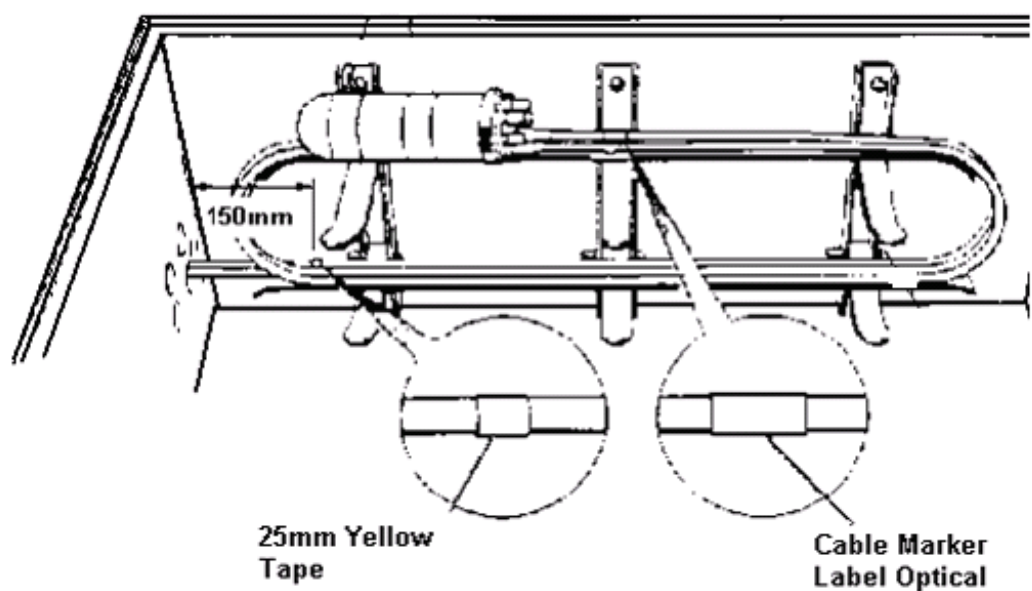
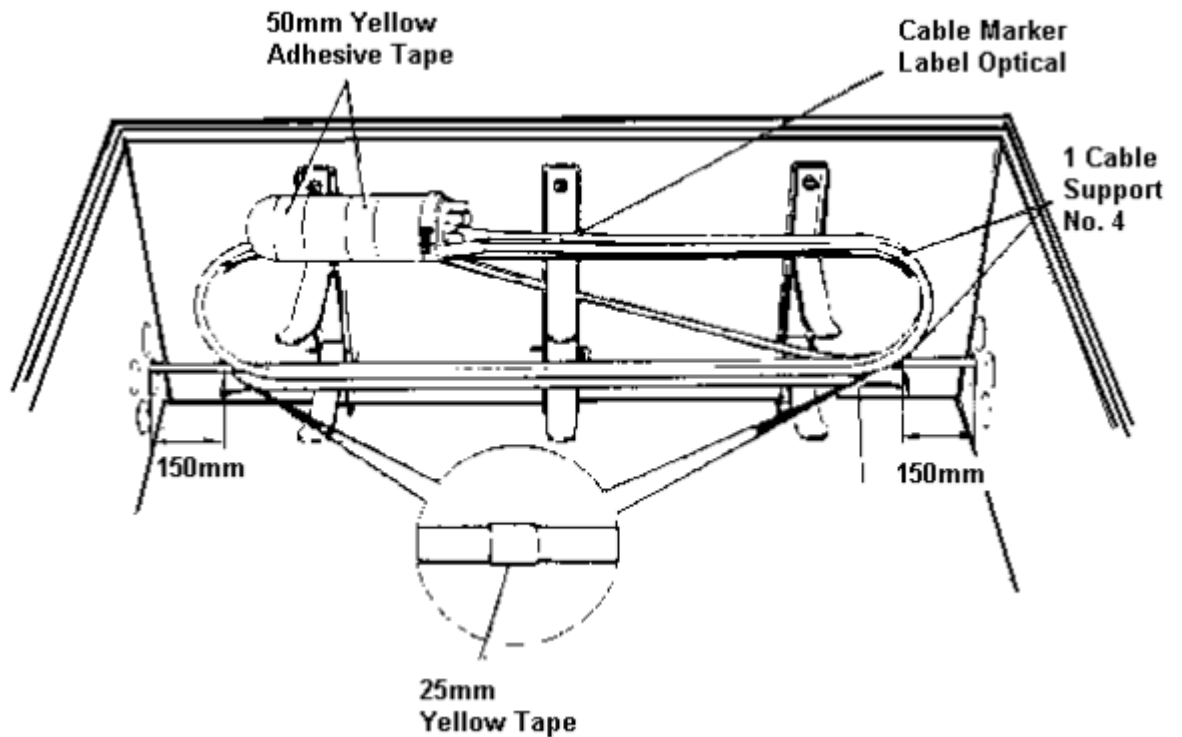


Figure 3 (Below)

Jointing Point - Cables Entering Structures from Both Sides of Structure



## 2.6 Duct Sealing

Duct sealing is detailed in section 2.3 of ISIS document EPT/ANS/A003.

## 2.7 References

BT ISIS EPT/ANS/A009 - Closure Systems Optical Fibre

BT ISIS EPT/ANS/A003 - Underground Cabling (Copper)

END OF DOCUMENT