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Cabling in Duct Manual

*Cable Optical Fibre 200 & 202 Installation &
Recovery*

About this document ...

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1 *Introduction*

Cable Optical Fibre 200 (COF 200) and Cable Optical Fibre 202 (COF 202) are designed for long length installation into Sub-duct Mono-bore 5 (SDMB5) using air blowing practices.

The outside diameter COF200 cables containing 12 to 144 fibres and the COF202 cable range are the same, ie 13mm (nominal). The outside diameter of the COF 200 cable containing 192-276 fibres is 15.5 mm (nominal).

A blowing machine comprising of a combined hydraulically driven caterpillar drive mechanism and blowing head (air box) is used to install these cables. The blowing machine will enable cable installation speeds of up to 60 metres/minute to be achieved. An emergency stop facility is provided on this machine. The maximum blowing pressure used is 12 bar.

In addition to air blowing practices for long length cable installation, these cables can also be drawn into main ducts in short lengths (up to a maximum of 50 metres), eg to off-track footway boxes and exchange manholes, using a rope.

All installations carried out within deep level tunnels are carried out manually by using normal cabling practices.

This document should be read in conjunction with the following documents:

EPT/UGP/E031 Cabling in Duct Manual

EPT/UGP/E050 Sub-duct Mono-bore 5 installation

EPT/COF/D525 Support, Restraint & Mrkg of Opt Fibre Cables

2 *Scope*

This document describes the works practices to be used during underground cabling operations for the installation and recovery of Cable Optical Fibre 200 and Cable Optical Fibre 202.

3 *Safety*

Underground cable installation and cabling associated operations **MUST** only be carried out by staff who have had the appropriate training.

Specific safety requirements are included within the practices detailed in this document. These practices should be applied in conjunction with the safety requirements referenced in the Cabling in Duct Manual - Safety and Reference Documents EPT/UGP/E031.

EPT/UGP/E031 details the Safety Precautions associated with underground cabling operations. The following precautions apply specifically to the installation of Cable Optical Fibre 200 and Cable Optical Fibre 202.

1. The safety precautions for Underground Cable Installation detailed in EPT/UGP/E046.
2. In addition to the information detailed in EPT/UGP/E046, as the installation of COF 200 and COF 202 requires the use of high-pressure air, the precautions detailed below must be adhered to.
 - People **MUST NOT** be in underground structures during cable blowing operations, or when Sub-duct Mono-bore is pressurised.
 - Establish effective communications before commencing any cable blowing operations.
 - Do not open the cable blowing machine, dis-assemble Sub-duct Mono-bore connectors or disconnect the air supply line from the compressor whilst pressurised. Always turn off compressed air first and let pressure subside.
 - Do not interfere with the cable whilst engaged in the caterpillar drive mechanism or air box of the blowing machine.
 - Exercise extreme caution when working around coils of moving cable.
 - In addition to the above, a Risk Assessment covering the risks and associated activities with the Cable Blowing Machine, Portable Power Pack and also the Machine Rodding Multipurpose 1 (detailed in ISIS EPT/UGP/E050) has been published. (See [Appendix A - Risk Assessment](#) for electronic link to this Risk Assessment).

4 ***Radio Communications***

Before commencing all rodding operations, or operations to install a cabling rope or cable, establish radio communications between the two underground structures.

It is mandatory that only BT approved radio equipment is used for Rodding and Cabling. Ensure and check that this equipment is maintained in good working order.

In exceptional circumstances, where it is possible to maintain clear visual and audible communications between the two points at all times, eg when hand rodding and pulling in a short length of cable by hand (eg using Drawrope 1 or on the back of hand rods), rodding and cabling may be carried out without radio communications. If there is a likelihood of either the audible or visual communication being interrupted, eg by passing traffic, members of the public or any other obstacles, radio communications must be established before attempting any rodding or cabling operations.

If in doubt, always establish radio communications between the two points for your own safety and that of the public.

4.1 Rules for Using Radios

1. Radios supplied for rodding and cabling must not be used for any other purpose.
2. Always identify yourself using approved call-signs.
3. Except in an emergency, do not transmit when the channel is being used by other operators.
4. Do NOT use obscene language.
5. Transmit as little as possible so that the channel is available to as many users as possible.
6. Do not hold the Press to Talk switch unless actually transmitting.
7. Observe all security precautions to prevent theft of radios. Unauthorised use of stolen radios can lead to serious consequences

5 Sub-duct Mono-bore 5

The installation practices for Sub-duct Mono-bore 5 (SDMB5) are detailed in ISIS EPT/UGP/E050.

6 COF 200/202 Installation

The Support, Restraint & Marking of Opt Fibre Cables are detailed in ISIS EPT/COF/D525.

6.1 Air Blowing Practice for COF200 12 to 144 Fibre, COF202 Cables & SDMB6

6.1.1 End to end Cable Installation

Note: During installation, it is important to observe the stop/start rules in order to minimise the risk of damage to the cable.

1. To ensure successful completion of the cable installation, select a blowing position that will provide a blowing distance within the capabilities of the system.
2. At proposed installation site always conduct Risk Assessment to establish if the practices described in this ISIS can be undertaken in a safe manner.

3. At the far end of SDMB5 route attach a temporary length of SDMB5 (enough for cable jointing purposes) using Connector 1. Bring free end of SDMB5 out of manhole/surface box and fit Air Guard 1 and road guard accordingly.
4. Set up Cable Blowing Machine at top of Manhole or surface box (see [Figure 1](#)). Position vehicle and cable drum such that the area can be safely road works guarded.
5. Open Cable Blowing Machine SDMB5 clamp and air box. Connect a temporary length of SDMB5 to the installed SDMB5 using Connector 1, cut to length as necessary and clamp into Blowing Machine subduct clamp.
6. Ensure that either binding the end with PVC tape, or fitting a heat shrinkable cap (Cap Sealing 16C, Item Code 072042) suitably protects the end of the cable. Open caterpillar drive and manually feed cable from drum through the cable blowing machine into the SDMB5. Close cover on Cable Retention housing and grip cable in the caterpillar drive (3 x half turns after spring washers stop rotating). Fit split air seals around cable and insert into the grooved cable guide within the air box housing. Locate upper half of cable guide and close air box, as detailed in the instructions supplied with blowing machine. Reset distance counter.

Note: When installing COF200 12 to 144 fibre & COF202 Cables use the red split air seal

7. Ensure the area around the path of cable, between the blowing machine and cable drum, is appropriately road works guarded.

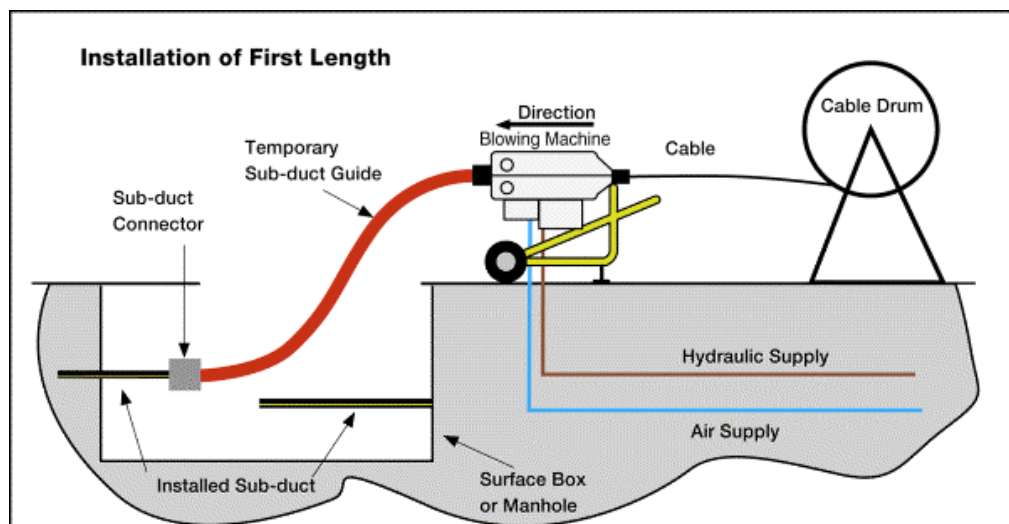


Figure 1 Schematic diagram showing correct position of plant and equipment for end to end installation

8. Connect 24 V supply, compressed air and hydraulic hoses to the cabling vehicle and the equipment.
9. With the cabling vehicle running engage Power Take Off (PTO) on control panel at the rear of the cabling vehicle. Turn lever to the cable blowing

position marked 'Fibre Optic Blowing' and operate 'Compressor' and 'Aux Tools' buttons (both are required for cabling blowing).

10. Turn on air supply at the blowing machine; ensure that there is air flow out of SDMB5 Guard 1 at the far end (this can take 1-2 minutes for air to reach the far end depending on route length).

Note: If the air fails to exit at the far end then either the SDMB5 is not fully connected or a connector has been incorrectly fitted somewhere along the route. At this point it will be necessary to walk the route with air supplied to the SDMB5, it may not be necessary in most conditions to lift manhole/joint box lid as the sound of air escaping from unconnected SDMB5 or an incorrectly fitted connector can be heard above ground. If it is found that a connector has not been fitted or incorrectly fitted, ensure the air is turned off and the pressure allowed to completely subside before entering the underground structure to rectify. When the route has been check and rectified re-apply the air and confirm that a good air flow is received.

11. Turn on hydraulic supply and hold down the start button (green) on blowing machine, adjust the speed control until the caterpillar drive exceeds 10 metres/min and then release the button. Adjust installation speed as necessary up to a maximum of 60 metres/min.

Caution: Operation of the green 'start' button outside of the start sequence can severely damage the cable blowing machine drive belts.
--

12. On the cable blowing machine note the pressure reading on the hydraulic gauge, if necessary reduce the installation speed in order to maintain the hydraulic pressure below 80 bar.

Note: It is recommended that the maximum installation pressure is kept to 80 bar as this will both prolong the life of the caterpillar drive belts and also ensure that the cable is installed at an even rate. The purpose of 'tuning' the installation pressure is to ensure that the cabling machine is feeding the cable into the SDMB5 at a similar installation speed to that being achieved by the air source acting on the cable within the SDMB5. If the installation pressure is allowed to increase unchecked, then premature activation of the 'high pressure cut-out' may result in the cable not reaching its destination.

13. The cable blowing machine will stall when the cable reaches the SDMB5 Guard 1 at the far end of the SDMB5 route.

14. Return the cabling vehicle air lever to the 'Vent When Compressor Off' (vertical) position before pressing the 'Compressor' and 'Aux Tools' stop buttons on the control panel. This ensures that all the moisture is dumped out of the system. Turn the air lever on the blowing machine to the 'open position' to allow the air in the SDMB5 to be exhausted.

15. Cut cable to the required length, leaving enough for jointing purposes (8 to 10 metres).

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.

Note: The minimum bend radius for COF200 & COF202 Cables is 200mm.

16. Remove cable and temporary SDMB5 guide from blowing machine.

Release temporary SDMB5 from Connector 1, slide along the cable and remove.

17. At both ends of route fit SDMB5 Seal 1 (split seal) around cable, insert into Connector 1 and tighten collar to compress seal to give a fully water tight cable/subduct seal, as shown in [Figure 2](#).

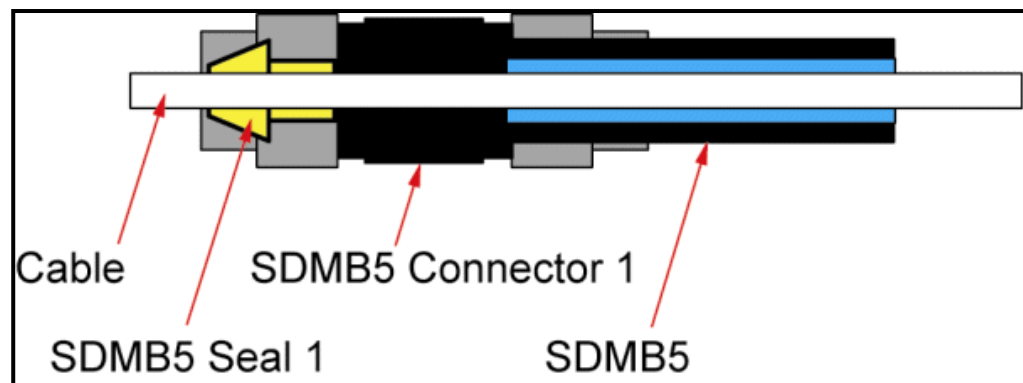


Figure 2 Schematic diagram of cable and sub-duct sealing arrangement

Note: In order to protect the cable as it is being installed, the blowing machine will stall if the maximum hydraulic pressure (110 bar) of the blowing machine is exceeded. If during the blowing operation the emergency stop is activated the caterpillar drive mechanism will immediately stop. To re-start the blowing machine the emergency stop button must be released, the speed control turned to the minimum and the green start button held down until a cable installation speed of 10 metres/minute is reached. A 'cable blow out safety device' is incorporated into the machine to ensure that in the event of the incorrect sequence of cable installation start up operations (ie compressed air being applied before the cable is clamped) the cable will be retained within the blowing machine.

6.1.2 Mid-point Cable Installation

Mid-point cable installation is a method used to install a continuous length of cable, which would otherwise not be possible from a single end location. This requires both cable and installation equipment to be re-positioned before changing the direction of installation. The mid-point box must be able to hold at least 15m of cable.

1. Set up and install first section of cable to the required manhole/surface box as per the procedures described in 6.1.1 above. Preference should be given to installing the longest length of cable first in order to minimise fleeing time of the second section of cable.
2. Set up and prepare fleeing equipment as [Figure 3](#). Clamp a temporary length of SDMB5 between the fleeter and cable blowing machine. Take a loop of cable and insert into the cut outs in the fleeing cage as shown in [Figure 4](#).

Note: A 15metre loop of cable is recommended between the fleeter trailer and the box, to allow the trailer to be moved back from the box as shown in [Figure 5](#). Failure to do this may make the configuration shown in [Figure 5](#) impossible. The 15 metre loop can then be used as a maintenance coil at that box. It is also recommended that the fleeter trailer is sited in a level position on firm ground, as this will ensure that the fleeing arm operates smoothly.

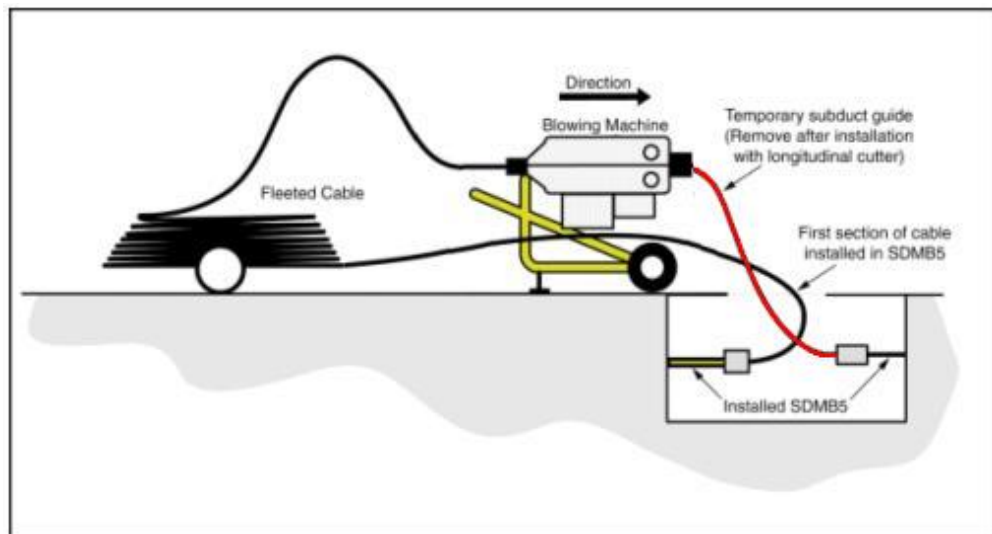


Figure 3 Schematic diagram showing correct position of plant and equipment to load cable into cable fleeter for second section of mid point installation

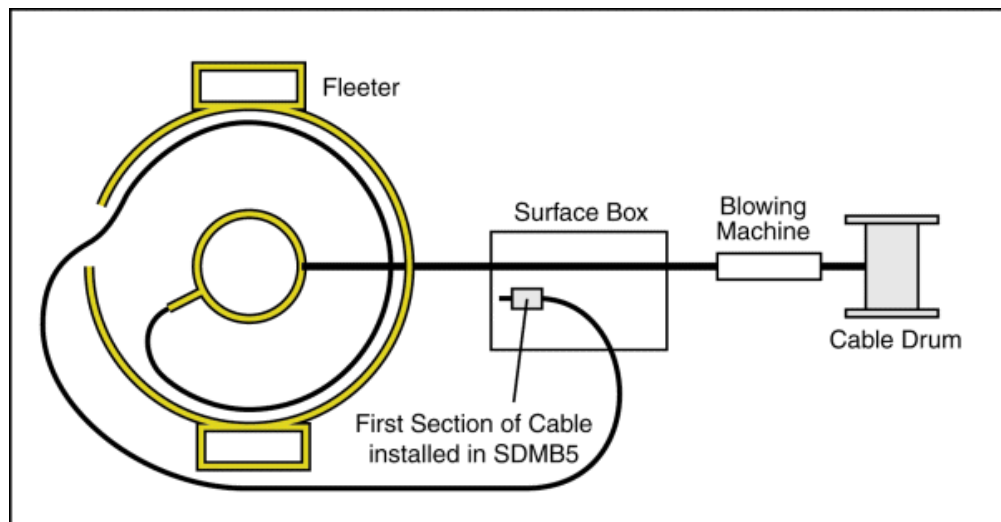


Figure 4 Schematic diagram showing correct position of cable in fleeting cage

3. Clamp cable in cable blowing machine caterpillar drive mechanism. Close cable blowing machine air box, do **NOT** fit air seals (air is not required for fleeting the cable into the fleeter). Start cable blowing machine caterpillar drive mechanism.

4. The rate that the cable is installed into the fleeting trailer is controlled by the speed of the cable-blowing machine.

Note: The individual cable coils must be ordered within the fleeting cage, ie no under-winds. This is to ensure that during the subsequent cable installation operation only one coil of cable is picked up at a time from the fleeter

5. Fleet required length of cable from the drum into the fleeting cage

6. Unclamp caterpillar drive, open cable blowing machine air box and Sub-duct clamp. Remove cable from blowing machine and release temporary SDMB5 from fleeting machine. Slide temporary SDMB5 along the cable and connect temporary SDMB5 to second section of installed SDMB5 with Connector 1.

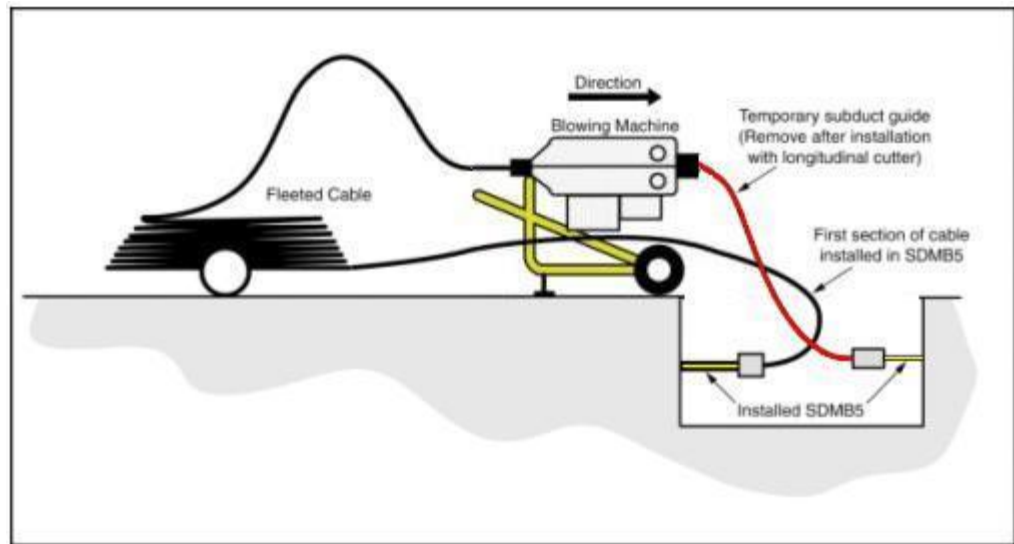


Figure 5 Schematic diagram showing correct layout of plant and equipment to install section of cable for mid point installation

7. Re-position Cable Blowing Machine and plant in preparation for installing second section of cable (see [Figure 5](#)). Ensure that neither the SDMB5 nor cable has been fed under any hoses or equipment.

Note: *Care should be taken to ensure that the cable is dispensed from the fleeter free from cable under-winds.*

8. Install second section of cable as per the procedures described in [6.1.1](#)

During installation it is important to observe the stop/start rules in order to minimise the risk of damage to the cable above.

9. When the cable has been installed the recommended resultant 'cable over length' shall be 15 metres, this shall be stored at that location for maintenance purposes.

Note: *The minimum bend radius for COF200 & COF202 Cables is 200mm.*

Note: *If there is cable in excess of 15 metres left when the cable stops in the Air Guard 1 at the central blowing position then the following procedure shall be adopted:*

10. Turn off air at cable blowing machine and wait for air to completely subside at far end (Air Guard 1 end of route). Either direct the Air Guard 1/SDMB5 back down into the empty manhole/surface box or to another safe area. Wearing appropriate eye protection and gloves, carefully remove the Air Guard 1; a few metres of cable will automatically exit from the open ended SDMB5. Radio the blowing machine operator to re-apply air and re-start the installation. Install the excess cable at a speed no greater than 15 m/min. Coil the cable as it exits from the SDMB5, stop the blowing machine when 15 m of cable is left at the central blowing position.

11. Cut the excess cable and leave 8-10 m of cable for jointing purposes.

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.

12. Remove the cable from the cable blowing machine, cut and remove the temporary SDMB5 using a Cutter Longitudinal 1A.

13. At both the blowing position and far end fit the appropriate split seal around cable, insert into Connector 1 and tighten collar to compress seal to give a fully watertight cable/sub-duct seal.

6.1.3 Tandem Blowing Cable Installation

Tandem-Blowing cable installation is a method used to install a continuous length of cable twice the distance of a single point installation. This method requires the use of 2 sets of blowing equipment set up as shown in [Figure 6](#) where one set is situated at the start of the installation (Primary Blowing Position) and the other is situated at a suitable mid-point along the route (Secondary Blowing Position). Furthermore, this procedure may be combined with the Mid-Point Blowing method to further extend the length of continuous cable (see Section [6.1.4](#))

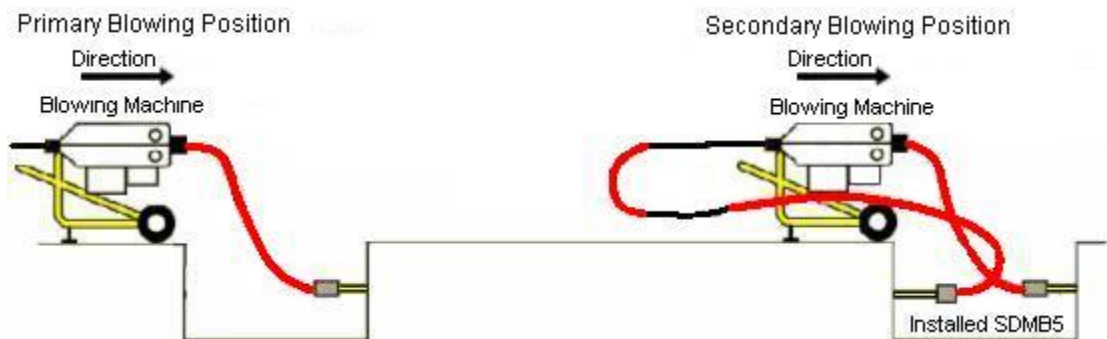


Figure 6 Schematic Diagram showing the general set up for Tandem Blowing

Set up the Primary Blowing Position and install first section of cable to the required manhole/surface box as per the procedures described in section [6.1.1](#). Preference should be given to installing the longest length of cable first.

Note: The minimum bend radius for COF200 & COF202 Cables is 200mm.

1. Set up and prepare the Secondary Blowing Position as shown in [Figure 7](#). Add a temporary length of SDMB5 between the emerging sub-duct in the joint box and a suitable fixing point eg the Blowing Machine frame.

Note: As the temporary section of SDMB5 has no Airguard, it MUST be directed at the ground and secured in this position.

2. Feed the cable to the Blowing Machine through a second section of SDMB5 approximately 1m in length which should be held by the Cable Controller situated behind the Blowing Machine.

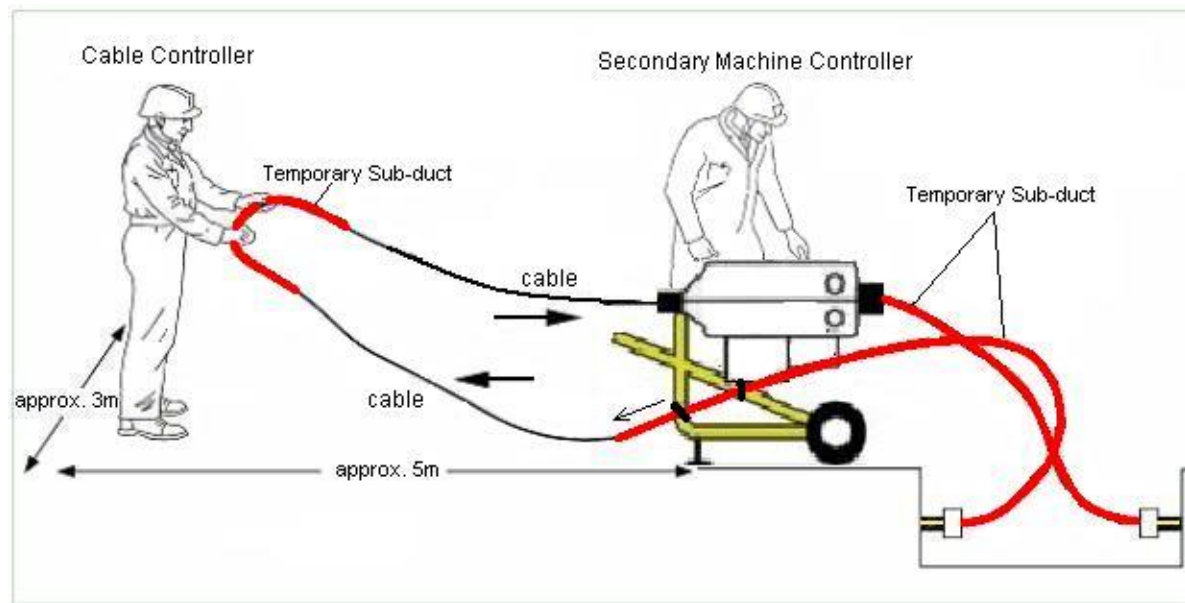


Figure 7 Schematic diagram showing correct position of plant and equipment at the Secondary Blowing Position

Note: Roadworks Guarding must be used to mark out the 3m x 5m area around the Cable Controller. A 10metre loop of cable is recommended between the emerging sub-duct and the rear of the Blowing Machine, to allow the slack cable to be controlled as shown in Figure 7. Failure to do this may make it difficult to accommodate the speed differences between the two blowing machines and fail to complete a smooth and continuous installation.

Warning: When lifting a cable from a de-pressurised state, ensure that the maximum air flow is achieved. This may take 2-5 minutes depending on the distance. Also ensure the blowing machine speed control is turned right down prior to feeding the cable through. The cable may be assisted at the receiving end to help lift it. Failure to comply with this process may lead to fibre damage.

The radio communications between the 'Primary' and 'Secondary' Machine Controllers is very important and should be fully understood before proceeding with any installation. The following rules apply:

Rule 1 - The speed of the overall installation should be **no greater than 60m/min**. It must be set by the 'Primary' Machine Controller who should communicate to the 'Secondary' Machine Controller, the installation distance at **50m** intervals. The 'Secondary' Machine Controller should then immediately respond, confirming the distance.

Rule 2 - If at any time the 'Primary' Machine Controller fails to receive a distance confirmation, the installation shall STOP immediately until communications are re-established.

Rule 3 - If at any time, the 'Secondary' Blowing Machine stops, the 'Secondary' Machine Controller shall advise the 'Primary' Machine Controller to "STOP, STOP, STOP Installation". If this communication fails, it will be necessary for the Cable Controller to manually fleet the cable whilst the Machine Controller uses the backup radio to stop the installation (or Rule 2 applies).

3. During installation, it will be necessary for the Cable Controller to move backwards and forwards as the cable slack changes. Whilst the Machine Controller monitors the cable installation speed and equipment pressures, the Cable Controller should constantly monitor the slack cable and advise the Machine Controller how to adjust the installation speed.
4. The Blowing Machine will stall when the cable reaches the SDMB5 Guard 1 at the far end of the SDMB5 route (it's good practice to monitor the installation distance and reduce the installation speed as the cable nears the end of the route, this will avoid sudden stalls and reduce drive-belt wear).
5. Return the cabling vehicle air lever to the 'Vent When Compressor Off' (vertical) position before pressing the 'Compressor' and 'Aux Tools' stop buttons on the control panel. This ensures that all the moisture is dumped out of the system. Turn the air lever on the blowing machine to the 'open position' to allow the air in the SDMB5 to be exhausted.
6. At the Primary Blowing Position, follow the procedures as described in section 6.1.1.
7. At the Secondary Blowing Position, remove cable and temporary SDMB5 guides from blowing machine. Release both temporary SDMB5's from Connector 1 and cut all three temporary SDBM5's from the cable using a Cutter Longitudinal 1A.
8. When the cable has been installed the recommended resultant 'cable over length' shall be approximately 15 metres, this shall be stored at the Secondary Blowing Position for maintenance purposes.

Note: *The minimum bend radius for COF200 & COF202 Cables is 200mm*

9. At both of the blowing positions and the far end of the installation, fit the appropriate split seals around cable, insert into Connector 1 and tighten collar to compress seal to give a fully watertight cable/sub-duct seal.

6.1.4 Combined Mid-Point & Tandem Blowing Installations

Where greater lengths of continuous cable are required, the procedures for Mid-Point and Tandem installations may be combined. This method will require a long length of cable to be fleeted at the mid-point of the installation.

As a guideline, the combination of Mid-Point and Tandem Blowing may allow the installation of the following cable lengths :

1. Up to 8km for COF200/202 144 fibres or less (nom 13mm dia).

2. Up to 6km for COF200/202 greater than 144 fibres (nom.15.5mm dia.).

[Appendix D - Cable Transport](#), provides information on the cable & drum sizes/weights, cable drum trailer types and Fleeting lengths.

6.1.5 Air Blowing Practice for SDMB6 into Duct 32/20

The Blowing Machine No.1 (i/c 129502) may be used to install the SDMB6.

Using a “32/20 Reducer (i/c 078637), connect a length of SDMB5 (25mm OD) to Duct 32/20 and back to the blowing machine.



Fit the Green Collets and prepare the SDMB6 for blowing.



To protect the duct from debris and moisture, Seal the end of SDMB6, using a heatshrink or PVC Tape.

Blow in the SDMB6, leaving a suitable length of excess duct coiled in chamber.

At the blowing machine end, remove SDMB5 section, leaving the connector (32/20 Reducer) in place. Then fit a SDMB5 Seal 1 (i/c 076051) and tighten the connector onto the installed SDMB6 (14mm OD).

Coil the SDMB6 in the chamber, ready for COF205 cable blowing (remember to seal the end of SDMB6)

At the far end, fit another “32/20 Reducer” with a SDMB5 Seal 1 and tighten the connector onto the installed SDMB6.

Coil the SDMB6 in the chamber, ready for COF205 cable blowing.

6.2 Installation of COF 200 192-276 fibre Cable

The practices used for the installation of COF200 containing 192-276 fibres are the same as those described previously in Section 6. 1 for COF200 12 to 144 Fibre & COF202 cables except for the following:

COF200 192-276 fibre cable has a diameter of 15. 5mm.

Note: The minimum bend radius for COF200 192-276 fibre Cable is 200mm.

With a diameter of 15. 5mm COF200 192-276 fibre cables will not pass through the existing air box Machine Blowing 1 cable Collet and will not fit the SDMB5 Connector Seal. Therefore the following items are required:

Cable Collets and Split Air Seals (Machine Blowing 1, 240 Fibre Collet, for 192+ fibres). Both items are coloured green to aid identification.

Replacement Split Air Seals (Machine Blowing 1, 240 Fibre Seal Kit, for 192+ fibres) are available as a separate item (Item Code 005653)

Seal for SDMB5 connector (SDMB5, Seal 2). This provides the seal between the cable and the SDMB5 at cable / jointing points and mid-point blowing locations, (see [Figure 8](#)).

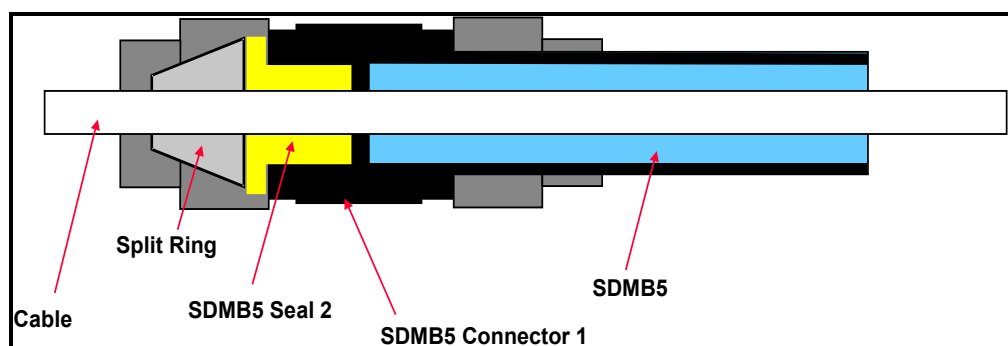


Figure 8 SDMB5 Seal 2

Note: Once the larger cable collets have been fitted they can be used for both the COF200 12 to 144/COF202 cables and the COF200 192-276 fibre cables, only the split air seals will need to be changed to suit the cable size being installed.

Cable Fibre Count	Split Air Seal Colour
COF200 12-144 Fibre COF202	Red
COF200 192-276	Green

Table 1 Split Air Seal Colour Per Cable Type

6.3 Direct Installation Techniques

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.

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.

6.4 Installations within Deep Level Tunnels

Cable Installations within deep level tunnels are carried out without the provision of SDMB5 hence the blowing installation techniques are replaced by conventional cabling methods.

The cable is run out manually and lifted on to the cable bearers tied back and labelled. If it is necessary to deploy any cable winching activity the correct swivel and a 2 kN 'fuse pin ' shall be used as referenced in section 6.3.

In instances where winching is deployed, because there is no duct to restrict the installation of the cable, it is permissible provided the cable is correctly fused to be winched in over distances greater than 50m. Working within this environment will be controlled as per the instructions detailed in ISIS SFY/NNS/V020.

6.5 Installation To Off-Track Boxes

In accordance with **Planning Guide NWK/LNK/C185**, it may be necessary to install fibre cable loops into Off-Track Boxes. This may be achieved by using either End To End or Mid-Point Cable Installation techniques.

All SDBM5 shall be installed in accordance with EPT/UGP/E050.

Note: The minimum bend radius for COF200 & COF202 Cables is 200mm.

6.5.1 End to End Installation (option 1)

Figure 9 shows how the SDBM5 may be installed through an Off-Track Box allowing a single blow from positions A to D and providing a suitable jointing length in the off-track box (see Section 6.1.1 for installation details).

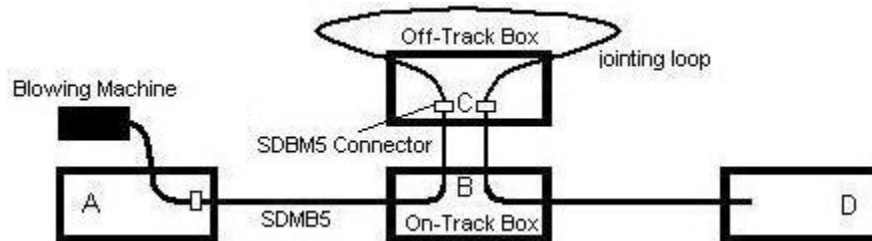


Figure 9 - Setup for End to End Installation

1. Install a length of SDBM5 from Jointbox A, through box B to the off-track box C, and install SDBM5 from box D, through box B to off-track box C.
2. Fit SDBM5 Connector 1's near the duct entry points in the off-track box C.
3. At the off-track box C, join the two lengths of SDBM5 with a loop of SDBM5 to allow cable management and subsequent jointing practices. For guidance on loop lengths see [Planning Application Guide AG122](#) (OTIAN Tyco External Plant Application Guide).
4. Install cable from A to D using End to End installation practice (section 6.1.1).

Note: During cable installation, it may be helpful to route the sub-duct outside of the boxes so as to minimise the bend resistance. The diagrams below show an example of how to route the sub-duct for installation.

Figure 10 shows the route opened to minimise bend restrictions and Figure 11 shows the sub-duct after installation, ready for coiling into the off-track box

or installation of a joint.

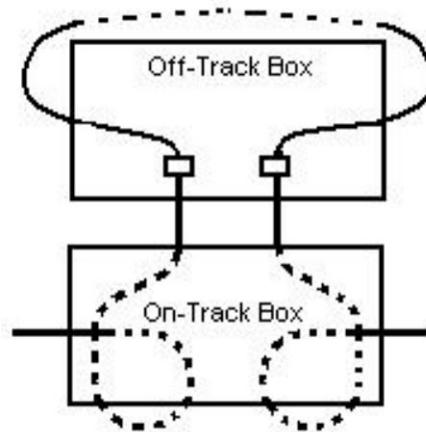


Figure 10- expanded routing

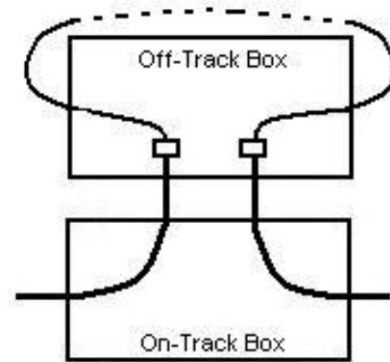


Figure 11- final routing

5. At off-track box C, disconnect SDBM5 loop, remove the loop from the cable using Cutter Longitudinal 1A.
6. Depending on cable size, fit SDBM5 Seal 1 or 2 (split seal) around cable where it emerges from each length of SDBM5. Insert into SDBM5 Connector 1 and tighten collar to compress seal to give a fully water tight cable/subduct seal, as shown in [Figure 2](#) or [Figure 8](#) (as appropriate).

6.5.2 End to End Installation (option 2)

This method avoids having to install a full loop of SDBM5 and then remove it.

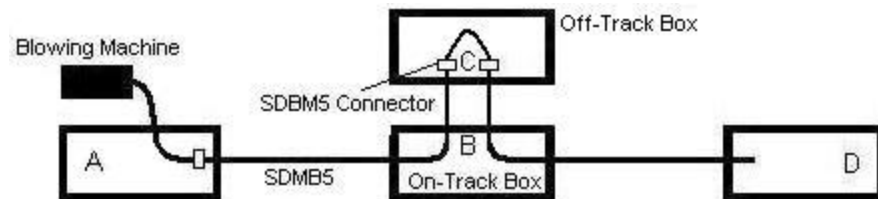


Figure 12 – Install of cable through SDBM5 'jumper'

1. Install a minimum length of loop between the SDBM5 Connectors 1's in the off-track box (see [Figure 12](#)).
2. Install the cable from end to end
3. Remove the short SDBM5 'jumper' and fit a seal to the out-going sub-duct.
4. Continue to install the cable to the off-track box until the required length is achieved for cable management and subsequent jointing practices (see [Figure 13](#)).

Warning: When lifting a cable from a de-pressurised state, ensure that the maximum air flow is achieved. This may take 2-5 minutes depending on the distance. Also ensure the blowing machine speed control is turned right down prior to feeding the cable through. The cable may be assisted at the receiving

end to help lift it. Failure to comply with this process may lead to fibre damage.

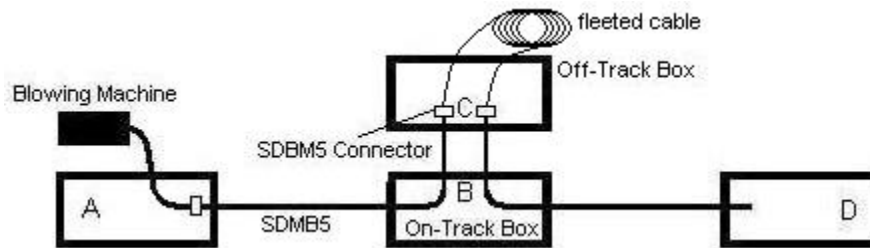


Figure 13 – Installation of additional cable

5. Seal the installation as described in Section 6.5.1 - 6.

6.5.3 End to End Installation (option 3)

This method avoids the installation of any SDBM5 to the off-track box and may be used where cable is to be stored in the on-track box, prior to the off-track being constructed.

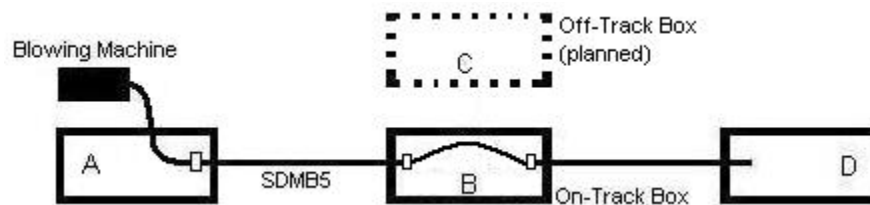


Figure 14 – Installation of cable through SDBM5 'jumper' in on-track box

1. Install a minimum length of 'jumper' between the SDBM5 Connectors in the on-track box (see Figure 14)
2. Install the cable from end to end
3. Remove the short SDBM5 'jumper' and fit a seal to the out-going sub-duct.
4. Continue to install the cable to the on-track box (see Figure 15), fleeting the cable until the required length is achieved for:
 - a. Installation to the off-track box and subsequent cable management and jointing. See [Appendix C – Loop Cable Insertion Practice](#).
 - b. Storage in the on-track box in accordance with the planners' works instructions.

Warning: When lifting a cable from a de-pressurised state, ensure that the maximum air flow is achieved. This may take 2-5 minutes depending on the distance. Also ensure the blowing machine speed control is turned right down prior to feeding the cable through. The cable may be assisted at the receiving end to help lift it. Failure to comply with this process may lead to fibre damage.

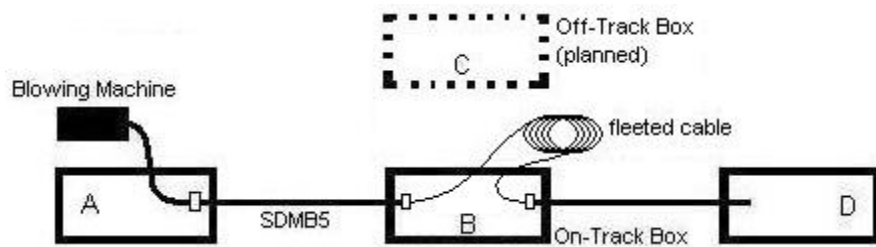


Figure 15 – Installation of cable to On-Track Box

5. Seal the installation as described in Section 6.5.1 - 6.

6.5.4 Mid-Point Installation (option 1)

Mid-point cable installation is used to install a continuous length of cable, which would otherwise not be possible from a single end location (see Figure 16).

The diagram below shows how the SDMB5 should be installed through an Off-Track Box where it allows mid-point blowing from position C (see Section 6.1.2 and Figures 8 & 9 for installation details).

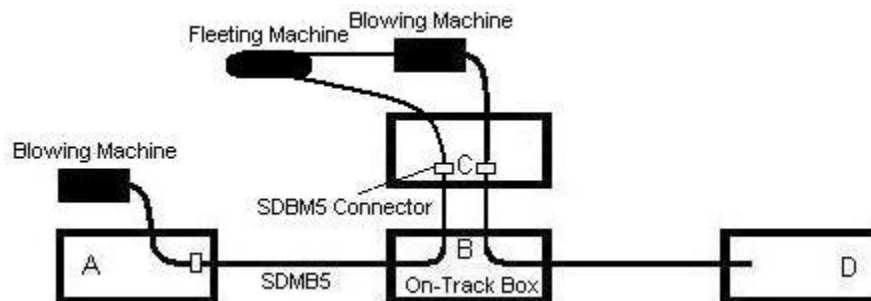


Figure 16 - Setup for Mid-Point Installation

1. Install a length of SDMB5 from Jointbox A, through box B to the off-track box C, and install SDMB5 from box D, through box B to off-track box C.
2. Fit SDMB5 Connector 1's near the duct entry points in the off-track box C.
3. Fit two short lengths of SDMB5 to act as temporary sub-duct guides.
4. Install cable from off-track box C using mid-point installation practice, as described in section 6.1.2. For guidance on loop lengths, see [Planning Application Guide AG122](#) (OTIAN Tyco External Plant Application Guide).
5. Seal the installation as described in Section 6.5.1 - 6.

6.5.5 Mid-Point Installation (option 2)

Similarly to Section 6.5.3, this method avoids the installation of any SDBM5 to the off-track box and may be used where cable is to be stored in the on-track box, prior to the off-track being constructed.

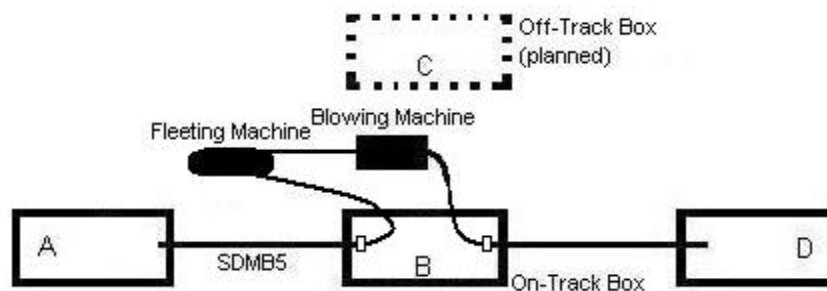


Figure 17 – Mid-Point Installation at On-Track Box

1. Install cable from on-track box B (see Figure 17) using mid-point installation practice as described in section 6.1.2.
2. Continue to install the cable from the on-track box, until the required length is achieved for:
 - a. Installation to the off-track box and subsequent cable management and jointing. See [Appendix C – Loop Cable Insertion Practice](#).
 - b. Storage in the on-track box in accordance with the planners' works instructions.
3. Seal the installation as described in Section 6.5.1 - 6.

7 Cable Recovery

Cables in routes longer than 1 km should be cut and recovered in two or more sections. Air is applied at the far end of the route and the blowing machine is positioned at the near end in order to pull out the cable. Figure 18 shows the layout of plant and equipment for cable recovery.

1. The cabling vehicle should be sited at the far end to supply the air. Connect the air hose to the cabling vehicle and onto the SDMB5 with the quick release air/SDMB5 fitting supplied with the blowing machine.
2. Set up the cable blowing machine at near end. To enable the use of the blowing machine remote from the cabling vehicle, use the portable hydraulic power pack and a Portable Battery 3 (Item Code No. 129286).
3. Terminate an Air Guard onto a temporary length of SDMB5 (distance SDMB5 to machine plus the length of the machine) and using a Connector 1 connect onto the installed SDMB5, as shown in Figure 18.
4. Turn on air at the cable blowing machine and blow cable to Air Guard. Turn off air supply and allow the air pressure to reduce to ambient before removing the Air Guard. Then reduce the SDMB5 length to give access to the cable. Clamp the SDMB5 into the rear of the cable-blowing machine.
5. Insert cable into the cable-blowing machine by passing it through the air box and subduct clamp (if the cable is to be reused, a short length of subduct may be placed in the clamp to protect the cable). Clamp the cable at blowing machine, close the air box. **DO NOT** use the split air seals.

Note: Do not attempt to obtain sufficient cable by applying air at far end of SDMB5 with the near end of SDMB5 disconnected from the blowing machine.

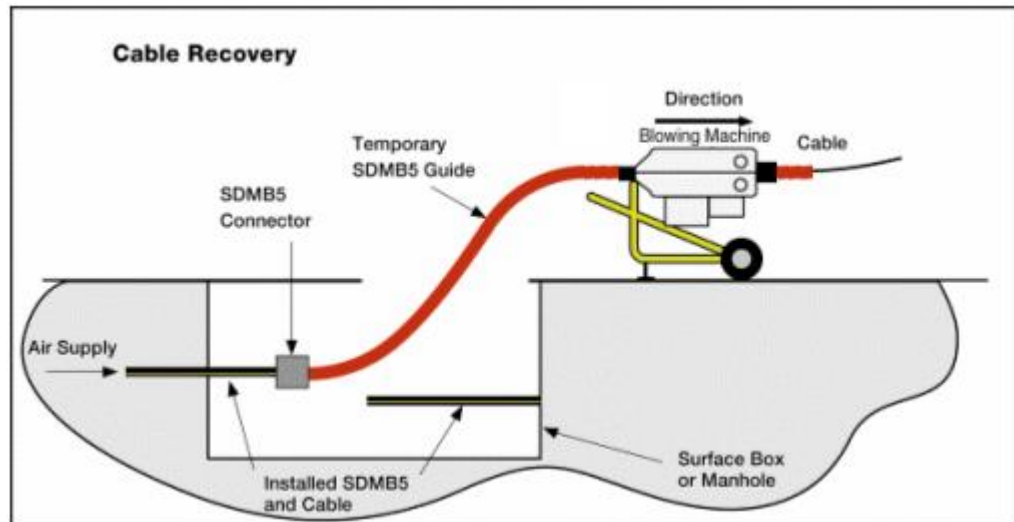


Figure 18 Schematic diagram showing correct position of plant and equipment for cable recovery

6. Apply air at the far end and wait for air to be exhausted at the near end before starting the blowing machine. Slowly bring the speed up to an acceptable level (maximum 25 m/min) to enable the cable to be managed in suitable manner for storage prior to removing from site. Do seal all the ends of recovered cable with PVC tape to restrain any loose fibres.

8 References

EPT/UGP/E031

Cabling in Duct Manual – Introduction and Index

EPT/UGP/E031

Cabling in Duct Manual - Safety and Reference Documents

EPT/UGP/E046

Cabling in Duct Manual – Underground Cable Installation

EPT/UGP/E050

Sub-duct Mono-bore 5 installation.

SFY/NNS/V020

UK Deep Level Access & Safety Regulations

EPT/COF/D525

Support, Restraint & Mrkg of Opt Fibre Cables

NWK/LNK/C185

Planning Guide

9 **Appendix A - Risk Assessment**



Click here

to link to the Risk Assessment of Cable Blowing Machine,
Machine Rodding Multipurpose 1 and Portable Power Pack.

10 **Appendix B – Stores**

Cutter Longitudinal 1A	Item Code 12742 0
Cutter Circumferential 1A	Item Code 12743 3
Cap Sealing 16C	Item Code 07204 2
SDMB5 Seal 1	Item Code 07605 1
SDMB5 Seal 2	Item Code 00536 7
SDMB5 Connector 1	Item Code 07605 5
Machine Blowing 1 240 Fibre Collet (for 192-276 fibres)	Item Code 00565 4

SDMB5 Guard 1	Item Code 07605 3
Machine Cable Blowing1	Item Code 12950 2
Connector Swivel 22 mm 2A	Item Code 12740 4
Fuse Swivel 2A	Item Code 12691 7
Grip Cable Single Eye Closed 13 mm	Item Code 12637 6
Machine Blowing 1 Seal Kit	Item Code 12951 5
Machine Blowing 1 240 Fibre Seal Kit (for 192-276 fibres)	Item Code 00565 3
OTIAN Loop Insertion Tool	Item Code 07563 3

11 ***Appendix C - Loop Cable Insertion Practice***

The following practice details the construction of a temporary closure for the installation of COF cable loops into off-track jointing chambers in preparation to convert the loop to a node at a later date.

Procedure to Prepare Temporary Cable Loop Closure

1. Identify mid point for intended cable loop position.

2. Apply sheath marks 500mm either side of loop mid point. Carefully apply two circumferential cuts to the outer sheath using Stripper Cable Sheath No. 7 (item code 126853) and remove the 1000mm section of sheath.
3. Access the central strength member and cut using Cutter Cable Hand 5A (item code 127451). This operation can be difficult and more sheathing may be removed to access the strength member if required. Remove the strength member leaving approximately 150mm at each end of the cable butts.
4. Obtain an OTIAN Loop Insertion Tool (item code 075633), remove the fixing screw from the assembly and separate the two halves of the tool. The outer protective cover of the tool is no longer required for this procedure.
5. At the mid point of the cable loop, assemble the elements into the mandrel part of the loop insertion tool. Secure the elements using 2 turns of PVC tape at the indents in the mandrel (see Figure 19).



Figure 19 - Loop Insertion Tool with Taped Elements

6. Construct a temporary closure using Sheet Rubber Self Adhesive (item code 073035) Figure 20 & Figure 21. The full practice for this can be found ISIS document EPT/CJT/C012 - Section 4 titled "Temporary Closing of Cable Joints".



Figure 20 - Temporary Closure



Figure 21 - Sealed Cable Ends

7. Place 3 knots at the end of the duct draw-rope approximately 15cm apart and using straps cable fixing 1A (item code 072492) secure the draw-rope at each knot to the cable (see Figure 22).

**Figure 22 - Attach drawrope to cable**

8. Tape the draw-rope to the temporary closure and ensure it is fully secured as shown in Figure 23.

**Figure 23 -Drawrope attached to closure**

9. The temporary closure with the mandrel enclosed can now be pulled along the duct into the off-track jointing chamber.

Note: Where possible ensure the duct is free from obstructions that would potentially cause damage the temporary closure and is dry.

12 **Appendix D - Cable Transport**

[Table 2](#) is for **guidance only** and provides information on the types of trailers and drums required to transport various lengths of fibre cable.

The table lists approximate values for:

- a) Total Weight of Cable + Drum
- b) Drum Dimensions (diameter x width)
- c) Recommended Cable Drum Trailer (CDT)



Click [HERE](#) for Table

2

		Cable Length				Max. Fleeting Length
		2km	4km	6km	8km	
Cable Type	COF200 & COF202 (12-144 fibre) 13mm nominal	661 kg 1.7m x 1m CDT 1 ⁽¹⁾	822 kg 1.9m x 1.1m CDT 1	1168 kg 2.2m x 1.1m CDT 1	1460 kg 2.2m x 1.1m CDT 1	3.5km ⁽²⁾
	COF200 (192+ fibre) 15.5mm nominal	555 kg 1.7m x 1m CDT 1	1010 kg 1.9m x 1.1m CDT 1	1460 kg 2.2m x 1.1m CDT 1	1930 kg 2.2m x 1.1m CDT 1	2.5 km

Table 2 Cable Transportation

Note: 1 For further details on Cable Drum Trailers, see Section 4, Table 1 in ISIS EPT/UGP/E040 - Cabling in Duct Manual.

Note: 2 Where additional cable is required, manual fleeting may be used.

END OF DOCUMENT
