# Installation Guide

## OPTICAL FIBRE CABLE
## LOOSE TUBE (LT) CABLE SUPPLEMENT

January 2014

Nexans

Nexans Cabling Solutions

# INSTALLATION GUIDE FOR OPTICAL FIBRE CABLE

# LOOSE TUBE (LT) CABLE SUPPLEMENT

## Table of Contents

*Important Note: Installation is to be performed by qualified service personnel*

# 1. Foreword

This document forms part of a series of documents related to optical fibre installation. Please see below for further information.

This document provides specific information related to **Loose Tube** fibre cables.

The General "Installation Guide For Optical Fibre Cable" document provides information related to key topics that need to be followed during installation.

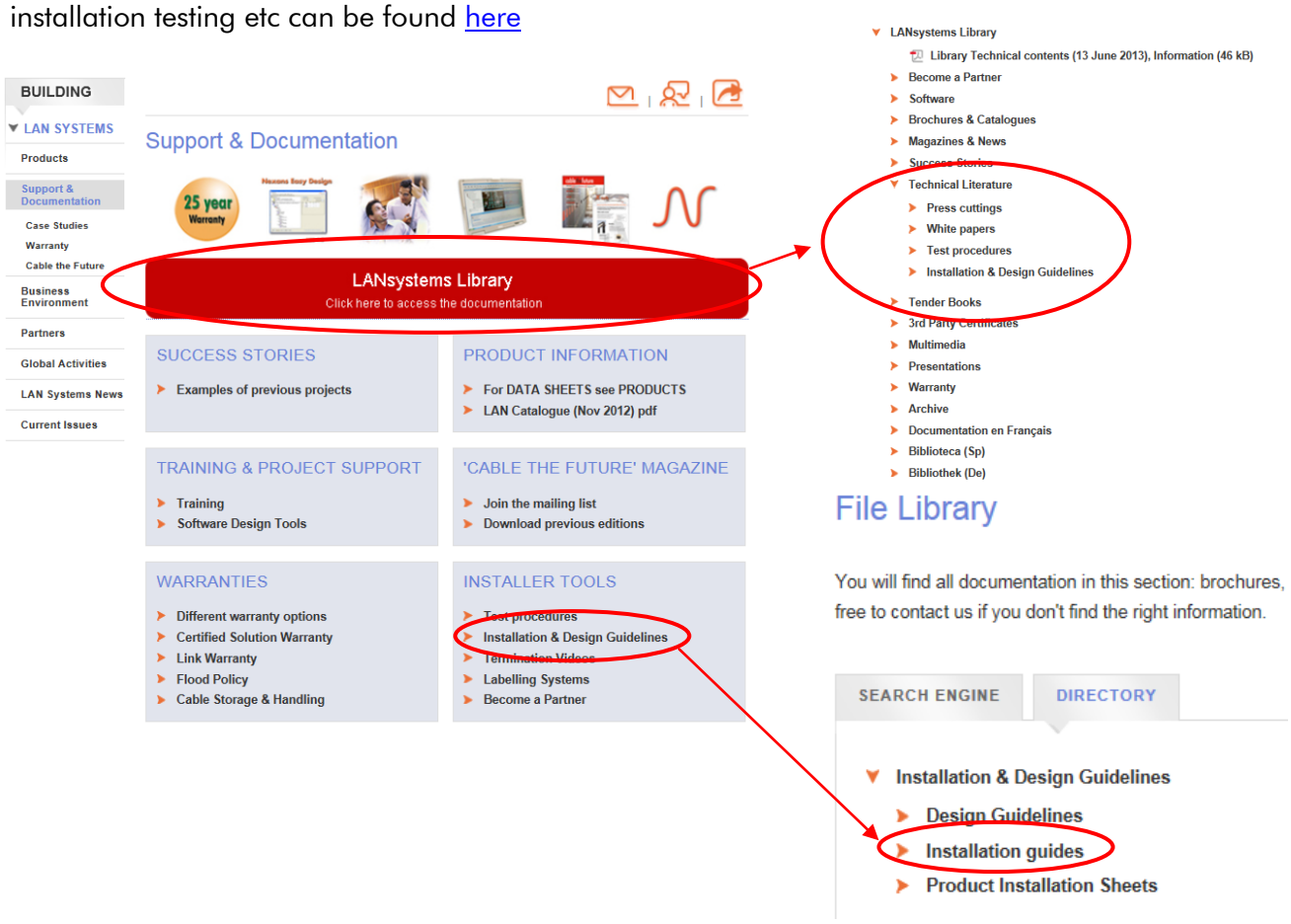
The following guides provide more detailed information on handling requirements for specific cable types:

- Tight Buffer Cable Supplement
- Loose Tube Cable Supplement (this document)
- Micro-Bundle Cable Supplement
- Pre-Terminated Cable Supplement

In addition, there is also a General Installation guide (for both copper and fibre) which includes further information.

**Please note:** The Nexans warranty may be invalidated if the cables have not been properly stored or handled according to Nexans Cabling Solutions (NCS) requirements.

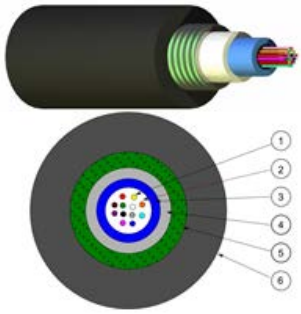
When logged into the NCS site, all these documents and also others relating to design and installation testing etc can be found here



## 2. Product references

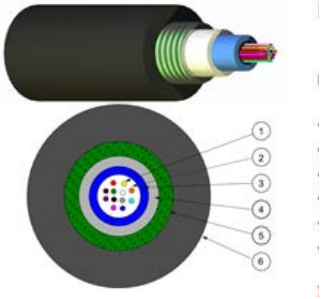
The rules described in the following chapters are applicable to the following NCS OF cable ranges:

LANmark-OF UC PE



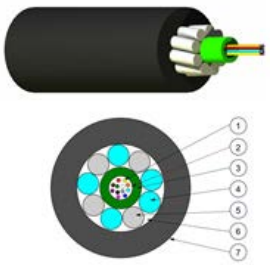
1. Optical fibres (250 um)
2. Gel
3. Loose tube
4. Reinforced watertight glass yarns
5. Corrugated steel tape armour
6. PE outer jacket with UV resistant additive

LANmark-OF UC LSZH



1. Optical fibres (250 um)
2. Gel
3. Loose tube
4. Reinforced watertight glass yarns
5. Corrugated steel tape armour
6. LSZH outer jacket with UV resistant additive

LANmark-OF UD PE



1. Optical fibres (250 um)
2. Gel
3. Loose tube
4. Fillers
5. Fibre Reinforced Plastic strength elements
6. Reinforced watertight glass yarns
7. PE outer jacket with UV resistant additive

**Important Note**

Loose Tube cable structures having a Polyethylene (PE) external jacket shall be selected for direct burial installation.

Note: Most of the rules are also applicable to Multi-tube cables: LANmark-OF MC and MD cables. However, the cable jacket removal process may differ and as a consequence chapters dedicated to the stripping of the MD and MC structures have been added.

# 3. Loose Tube OF cable pulling recommendations

**Important note**

In any fibre optic cable the load has be applied to the strength members of the cable. Failure to lock the cable components together can lead to elongation of the jacket material which when released will cause irreparable damage to the fibres resulting in significant performance degradation.

Fix the cable to the pulling rope / tape using a specially designed pulling grip for optical fibre cable (length of 600mm minimum) to ensure that the pulling tension is well distributed on all cable components (outer sheath and reinforcing elements).

**Pulling grip installed on a Loose Tube cable**

Before termination, approximately 3m of cable should be cut off to remove any piece that may have suffered stress from the pulling tape or grip.

## 3.1. About Intermediate Pulling

In many installations the distance to be covered is short and the path is straight enough to allow the cable to be easily pulled (with a pulling grip correctly installed onto the cable end) without the need for intermediate pulling.

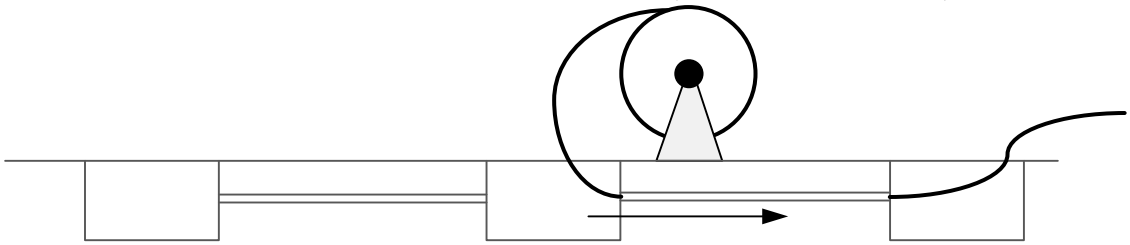
However, on longer runs it may be necessary to pull the cable at intermediate points if the pulling force to be applied on the cable, to pull it in one go through the duct, would exceed the max pulling force allowed by the manufacturer.

For long runs the pulling operation must be accomplished in two or more stages.

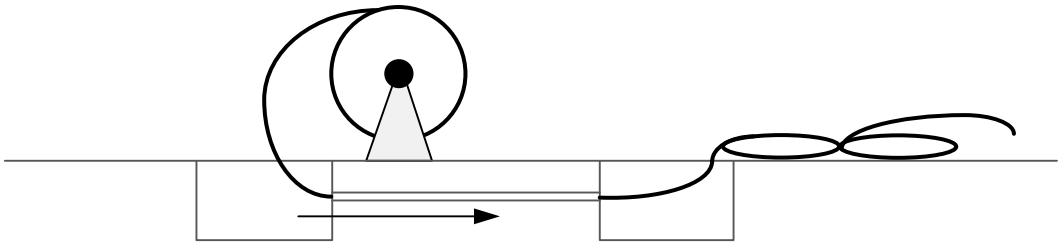
For pulling in stages the following method is recommended.

The pulling can be started at the middle of the run where a maintenance hole is located. The cable pulling will be undertaken in both directions.

The cable is first pulled through the duct in one direction (directly from the reel).



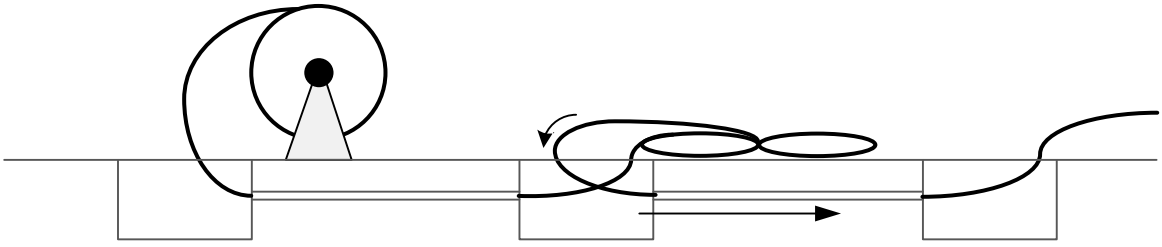
If several pulls are required to reach the full length of the path in that direction, enough cable shall be pulled out of the maintenance hole and coil on the ground in a figure of "8" pattern to prevent twisting of the cable.



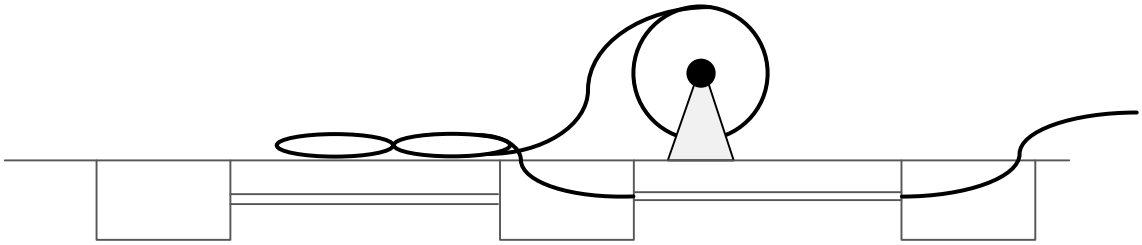
At all times the minimum bending radius of the cable must be maintained.

It is not recommended to lay the cable directly on the ground. A protection layer should be installed to protect the cable as shown on the picture.

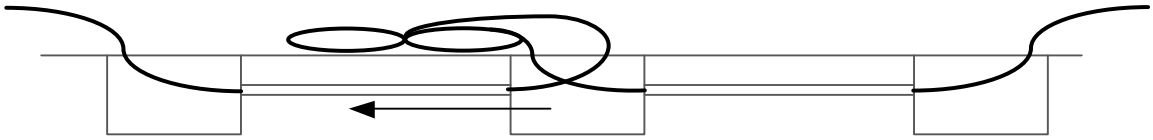
Now the end of the cable is against the ground. Before pulling the cable to the next location the cable roll shall be picked up (using several workers) and flip over so the end to be pulled is on the top (ensure correct manual handling procedure are used).



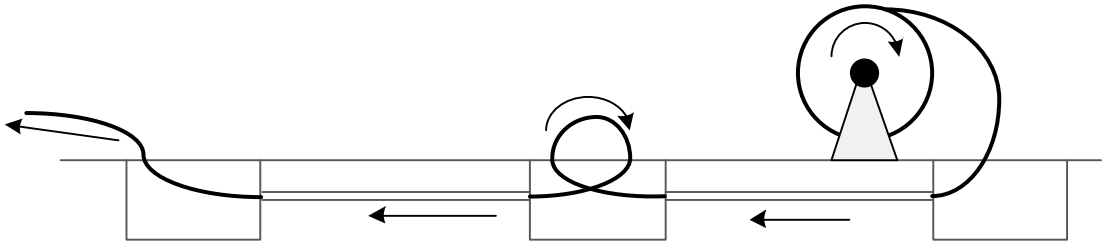
When the pull in the first direction is completed the remaining required cable shall be reeled off the drum and then placed on the ground in a figure of "8" pattern.
This time the end of the cable will be on the top of the figure of "8" and the cable roll must not be flip over.



The other end of the cable should then be pulled through the duct using the procedure described for the first end.



Note
When pulling cables through intermediate maintenance holes a continuous pull method is sometimes used with workers pulling the cable at different locations at the same time.
This method can only be applied to Loose Tube cable.



**Continuous pull method**

This way of proceeding eliminate the need for storing the cable to the ground and can speed-up the process.
However, pulling directly on the outer jacket with an excessive force will cause a compression of the fibre and create significant loss increase.
This process can only be applied if the force to be applied on the cable by the hands of the workers does not cause any deformation of the outer jacket.

# 4. Cable stripping

For any fibre count or cable type, some of the cable outer jacket will have to be removed to expose the fibres for the termination process.

Outside plant cables that will be terminated in trays may need 2m of jacket to be removed.

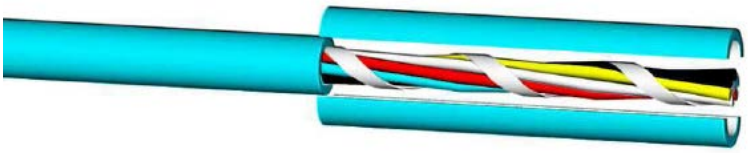
*Recommended length are provided in the Nexans patch panel installation guides available from our website*

Loose Tube outer jacket stripping tool
Various cable strippers can be used to remove the outer jacket of an OF cable.

Nexans recommend the use of the following specific tool:

- Uni-tube loose cables with overall diameter of less than 9mm **PGO/1113**
- Other Loose Tubes cables (uni-tube & multi-tube) **FIBOP/B/R**

The recommended tools are designed to cut the jacket longitudinally and around as shown below.



The stripping tool shall be set according to the diameter of the cable to avoid any damage of the tubes containing the fibres.

**Loose Tube cable stripping tool – PGO/1113**

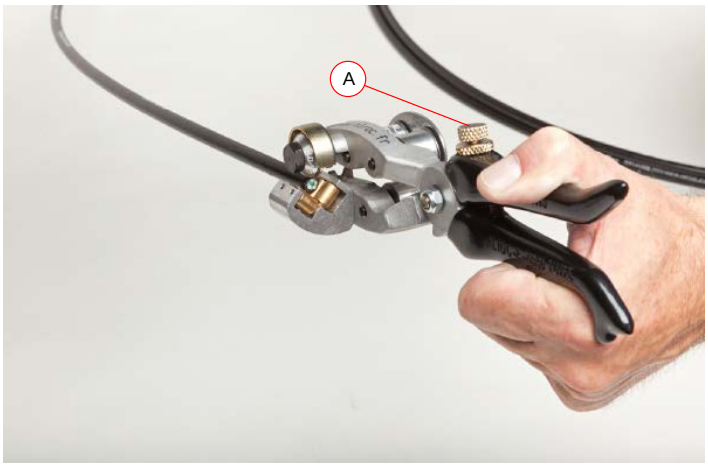

**Loose Tube cable stripping tool – FIBOP/B/R**

Please note that Nexans Cabling Solutions sells this recommended tool.

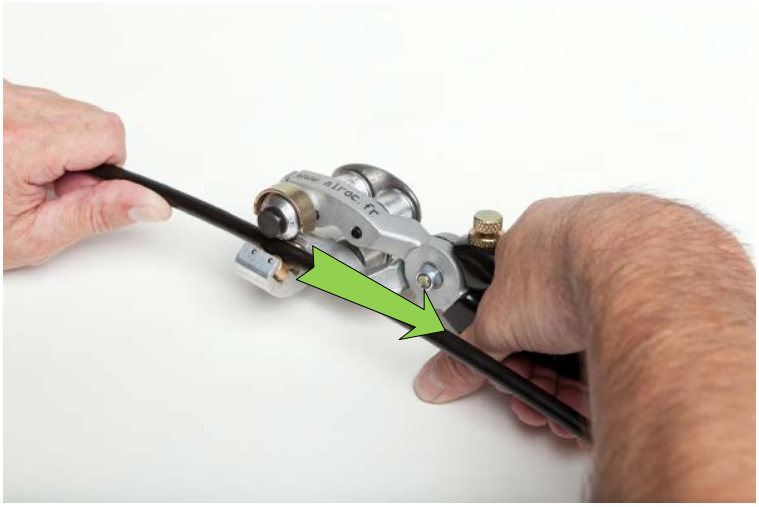
## 4.1. UD Cable Jacket removal process

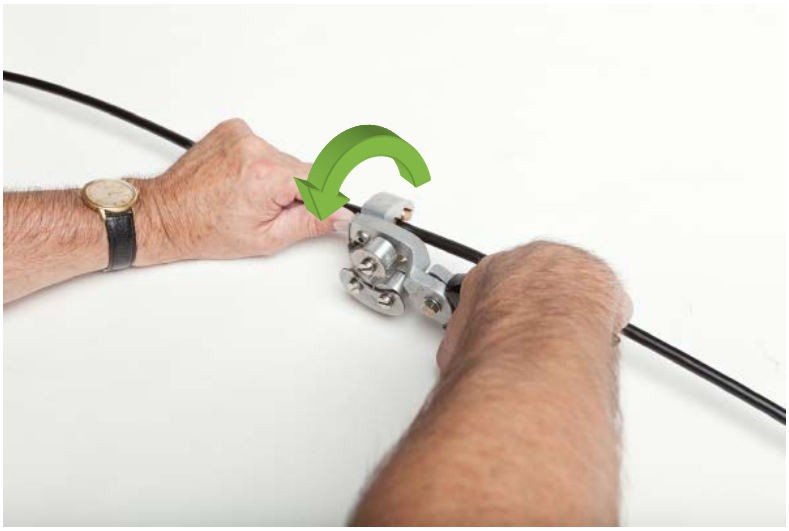
We recommend removing lengths of maximum 1metre – repeat the process for longer lengths.

1. Adjust the blade of the tool according to the thickness of the cable sheath using A
   We recommend first testing the tool setting on a spare piece of cable




2. Cut the jacket longitudinally using the part of the tool dedicated to this operation
   Note: This operation has to be performed twice to cut the jacket on both sides (180° apart)





3. Cut the jacket around using the part of the tool dedicated to this operation

4. Remove the jacket using the front part of the tool

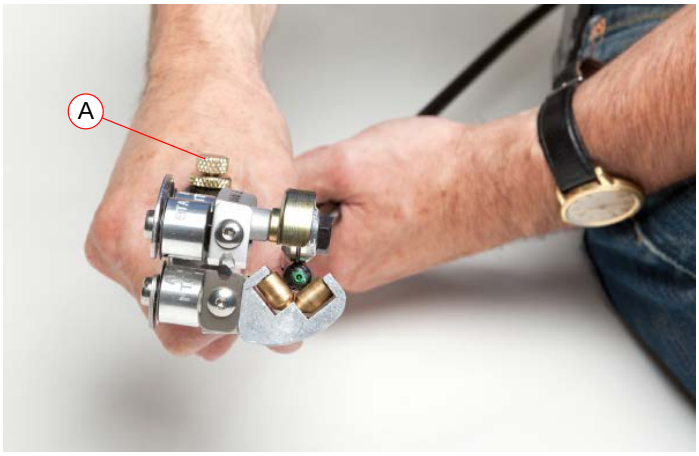
5. Cut the reinforcing elements and use the appropriate scissors to remove aramid or glass yarns

## 4.2. UC Cable Jacket removal process

We recommend removing lengths of maximum 400 mm. – Repeat the process for longer lengths.

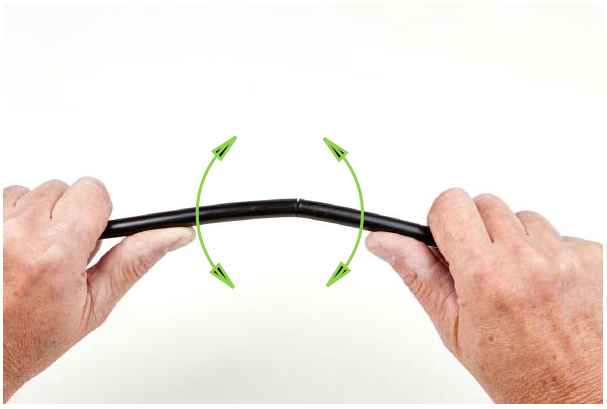
1. To aid jacket removal (step 5) ensure the end face of the cable has all the cable elements cleanly cut to the same length

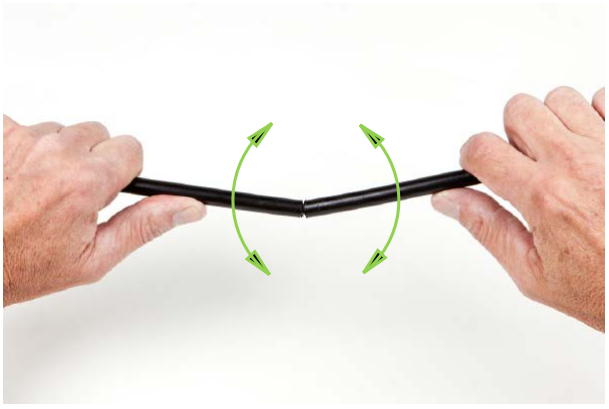
6. Adjust the blade of the tool according to the thickness of the cable sheath using A
   We recommend first testing the tool setting on a spare piece of cable



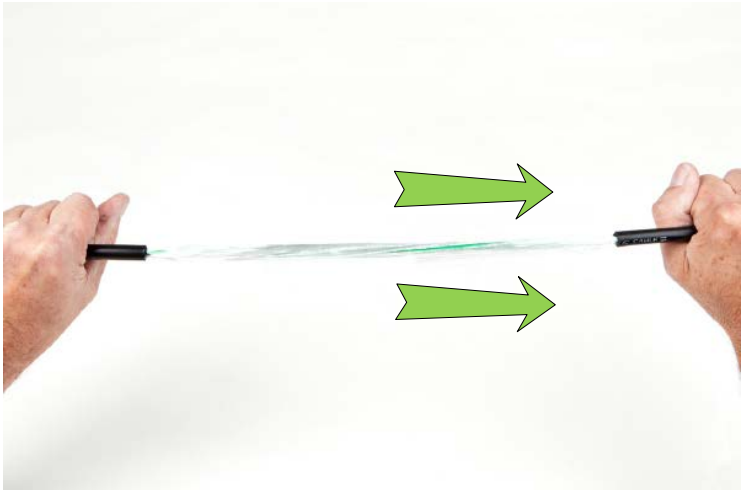

2. Cut the jacket around using the part of the tool dedicated to this operation. Ensure that the corrugated steel armour has been at least partially cut

3. Bend the cable up, down, back and forth to break the corrugated steel armour until it is cut all around the central tube





4. Remove the cut part of jacket and corrugated steel armour together



5. Use the appropriate tool to remove aramid or glass yarns

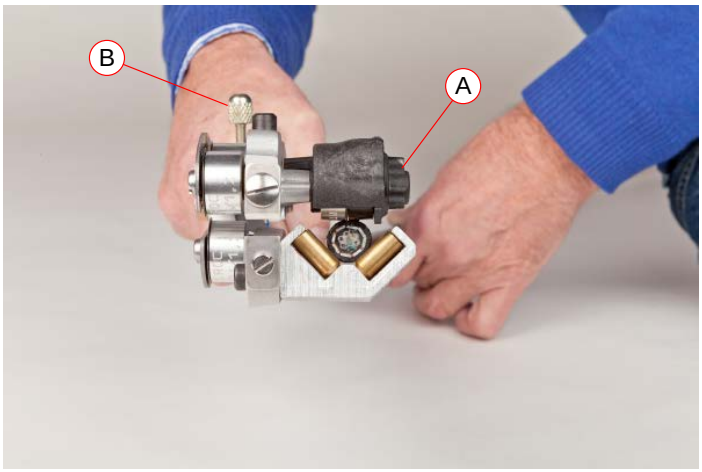
6. Repeat the process until the desired stripped length has been reached

Note: Always cut the aramid yarns as close as possible to the cable sheath before repeating the process – removal of the yarns will make removal of the next jacket section that much easier.

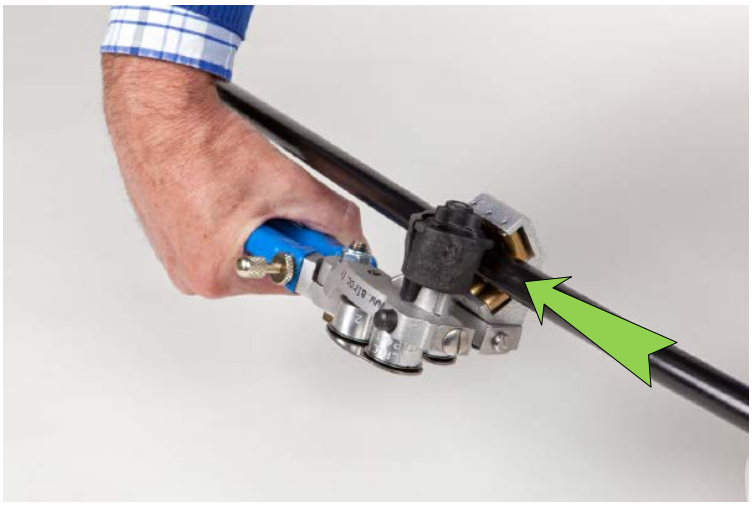
## 4.3. MD Cable Jacket removal process

We recommend removing lengths of maximum 1metre – repeat the process for longer lengths.

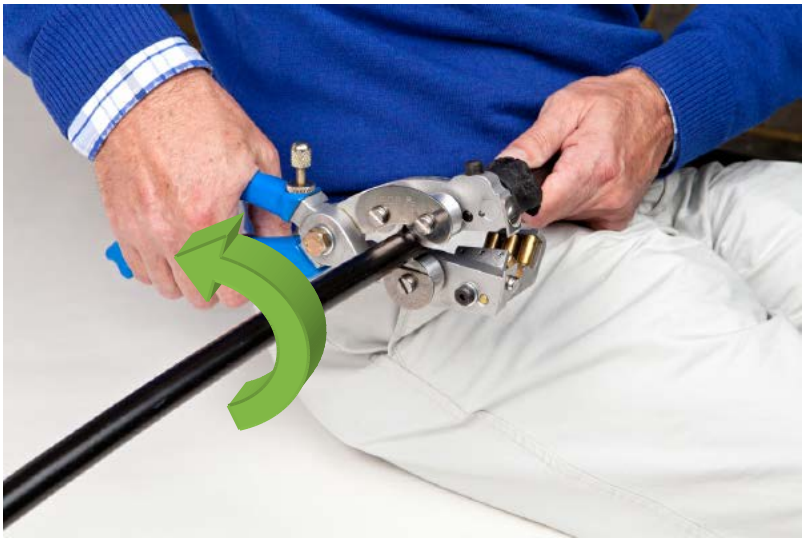
1. Adjust the blade of the tool according to the thickness of the outer sheath of the cable using A and to the diameter of the cable using B
   We recommend first testing the tool setting on a spare piece of cable




2. Cut the jacket longitudinally using the part of the tool dedicated to this operation
   Note: This operation has to be performed twice to cut the jacket on both sides (180° apart)



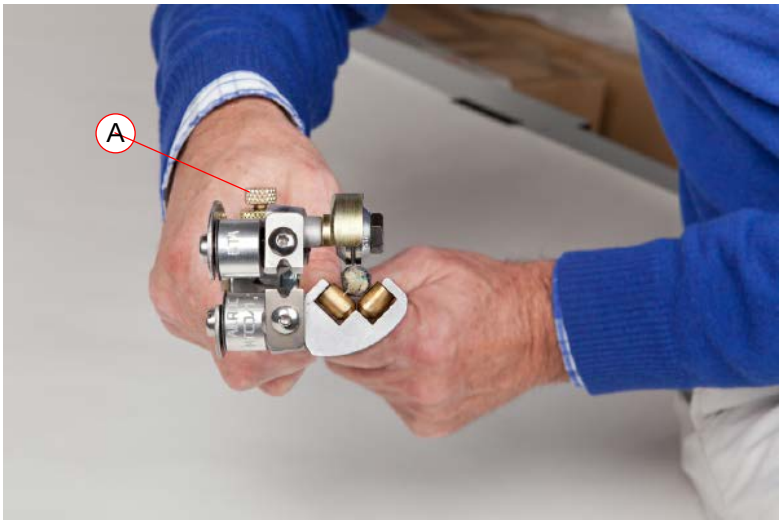
3. Cut the jacket around using the part of the tool dedicated to this operation



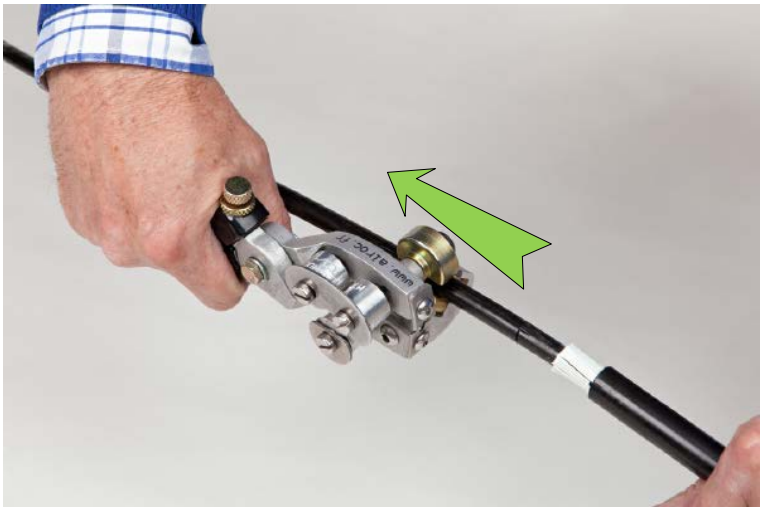
4. Remove the jacket using the front part of the tool

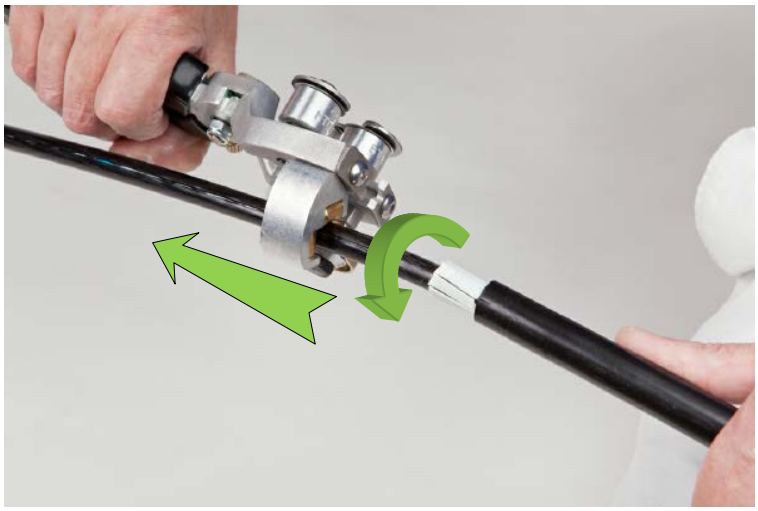
5. Cut the reinforcing elements

6. Adjust the blade of the tool according to the thickness of the inner sheath of the cable using A
We recommend first testing the tool setting on a spare piece of cable

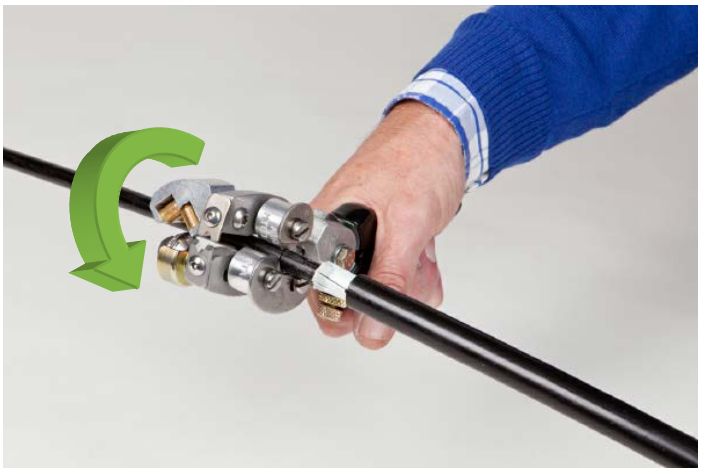



7. Cut the inner jacket longitudinally using the part of the tool dedicated to this operation
Note: This operation has to be performed twice to cut the jacket on both sides (180° apart)





8. Cut the jacket around using the part of the tool dedicated to this operation



9. Remove the inner jacket

10. Carefully clean the jelly from the tubes / modules using an appropriate degreaser (**LANmark-OF degreaser 0,5l – N890.123** or equivalent) – see note page 25

    Impregnate the cleaning paper with the degreaser and wipe the group of tubes from end to end – wiping in the direction away from the jacket

11. Split the tubes and repeat the cleaning process until each tube is perfectly clean

12. For multi-tube cable structure the central strength members will also need to be trimmed

Note: Sometimes they are cut back to the jacket so they will not interfere with termination, other applications will call for the central strength member to be cut to a specific length and incorporated in termination (i.e. with some break-out kits).
Central strength members made with fibre glass rods can be cut using almost any cutting tool.

## 4.4. MC Cable Jacket removal process

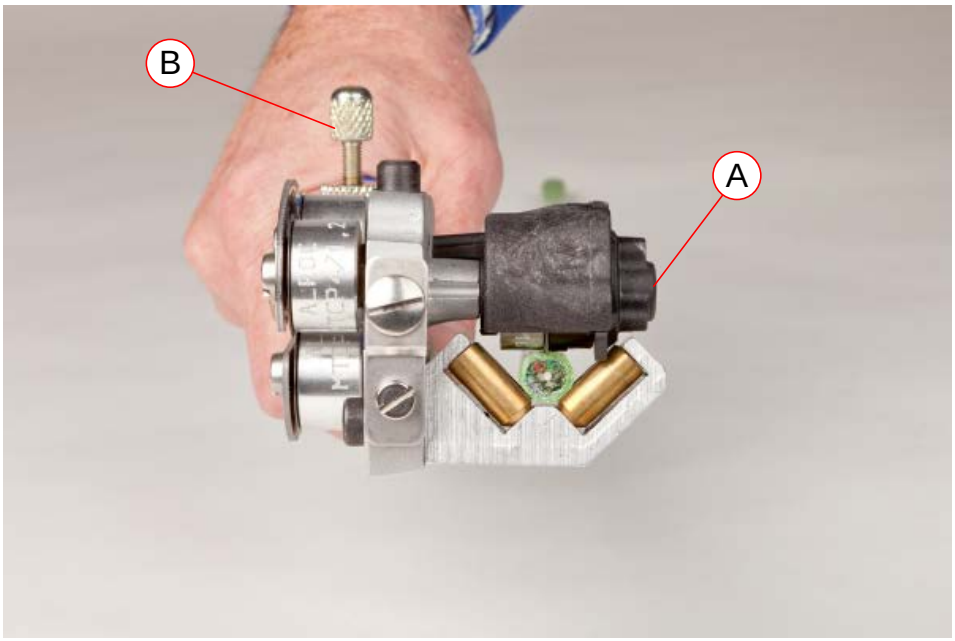
Two methods can be applied to remove the jacket of an MC cable.

### 4.4.1. MC jacket removal process method 1

We recommend removing lengths of maximum 400 mm – repeat the process for longer lengths.

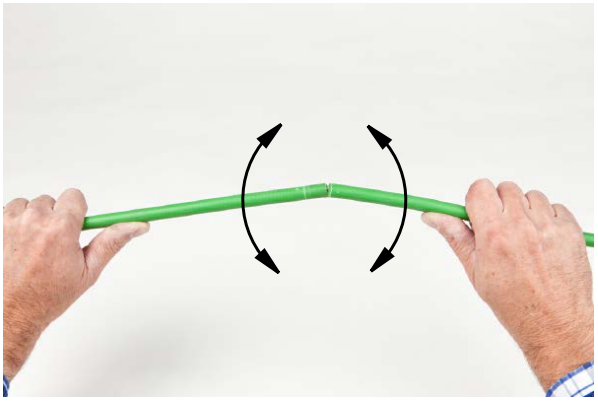
1. To aid jacket removal (step 5) ensure the end face of the cable has all the cable elements cleanly cut to the same length

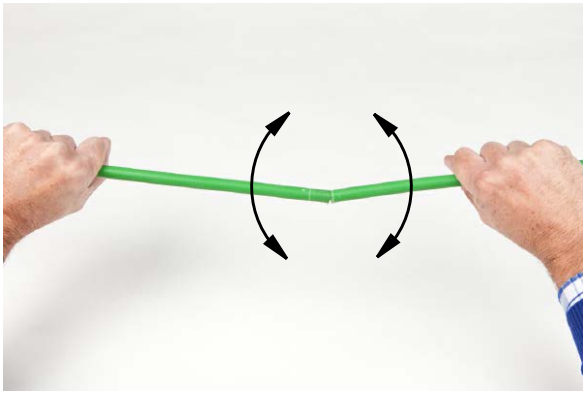
2. Adjust the blade of the tool according to the thickness of the outer sheath of the cable using A and to the diameter of the cable using B
   We recommend first testing the tool setting on a spare piece of cable



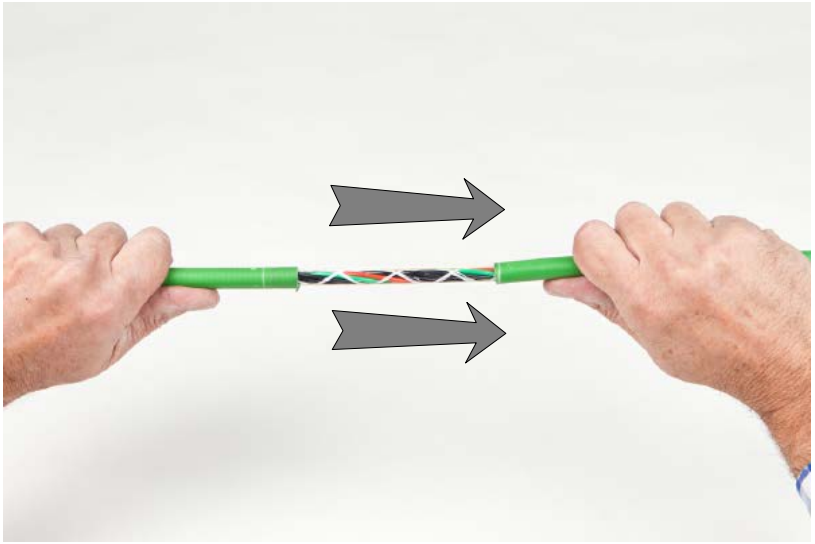
3. Cut the jacket around using the part of the tool dedicated to this operation. Ensure that the corrugated steel armour has been at least partially cut

4. Bend the cable up, down, back and forth to break the corrugated steel armour until the armour is broken all around the central tube





5. Remove the cut part of jacket and corrugated steel armour



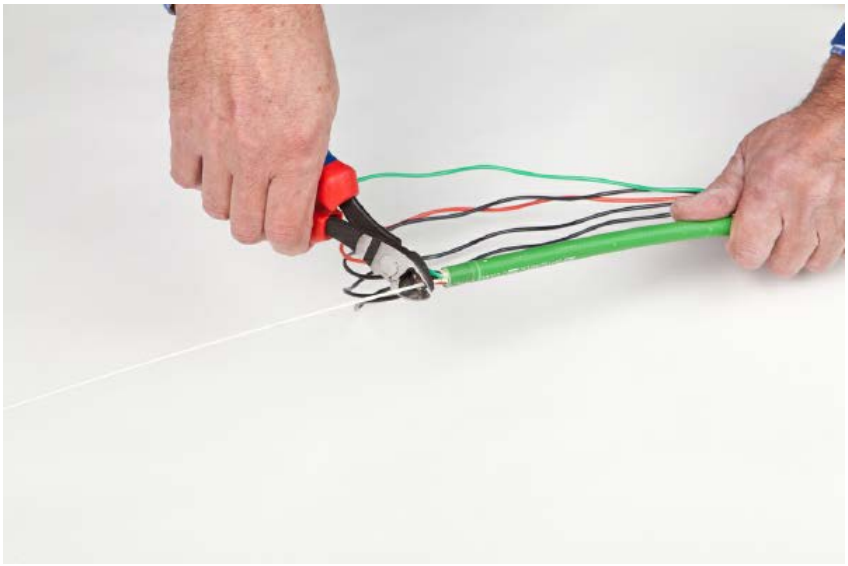
6. Use the appropriate tool to cut the binder elements and the rip cords

7. Repeat the process until the desired stripped length has been reached

   Note: Always cut the binder elements and the rip cords as close as possible to the cable sheath before repeating the process – removal of the binder and the rip cords will make removal of the next jacket section that much easier.

8. For multi-tube cable structure the central strength members will also need to be trimmed

   Note: Sometimes they are cut back to the jacket so they will not interfere with termination, other applications will call for the central strength member to be cut to a specific length and incorporated in termination (i.e. with some break-out kits).
   Central strength members made with fibre glass rods can be cut using almost any cutting tool.

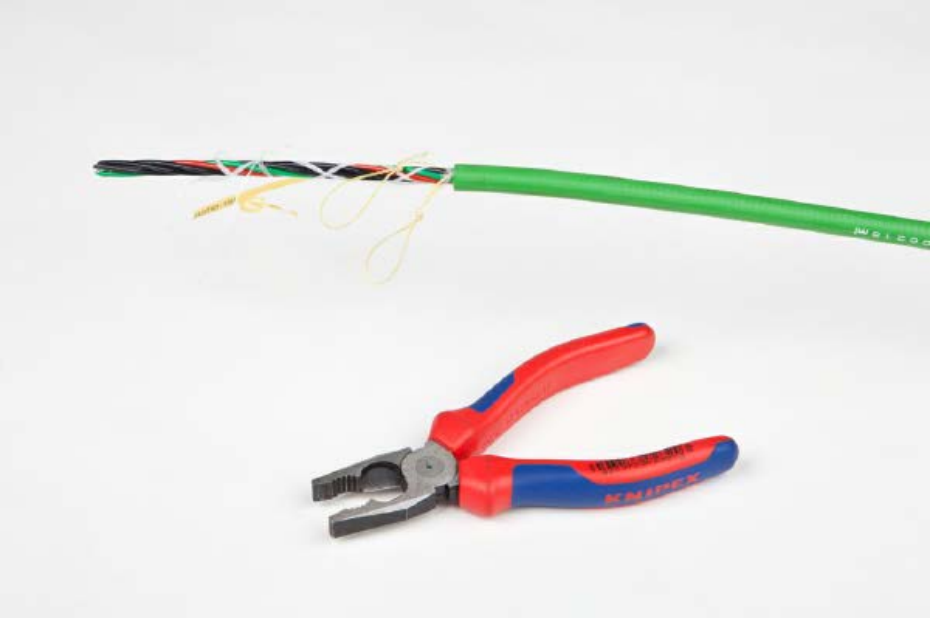


### 4.4.2. MC jacket removal process method 2

We recommend removing lengths of maximum 1 metre – repeat the process for longer lengths.
2 rip cords are integrated inside the MC cable structure.
These elements can be used to strip the jacket.

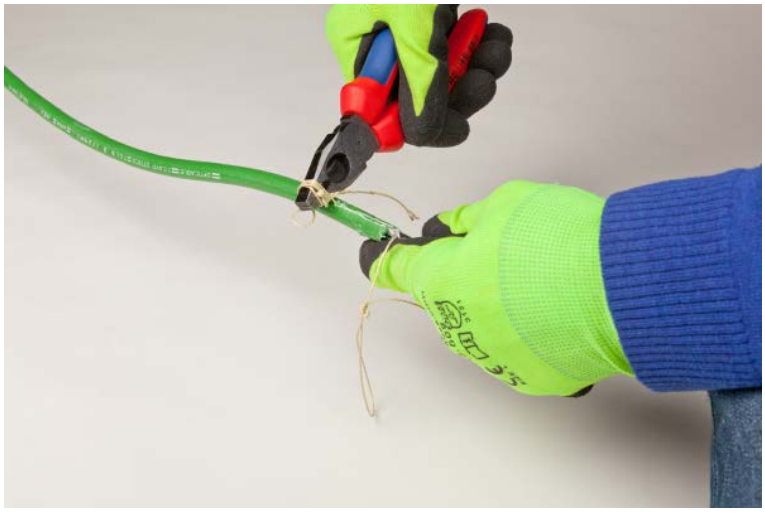
1. Remove a small piece of the jacket
   Note: The removal method 1 can be used for instance.

2. Create a loop at the end of both rip cords (see also option in step 4)
   Note: The knots shall be strong enough to support the effort that will be applied to rip the jacket and the corrugated steel armour.

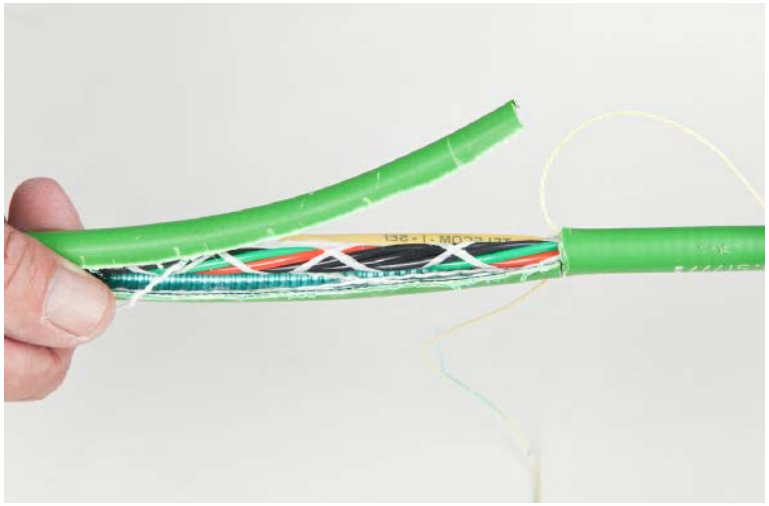


3. Using pliers pull the first cord to rip the jacket and the armour

4. Pull the second cord to rip the jacket and the armour on the other side of the cable
   Note: To ease the process the cord can be wound around the pliers as shown on the following picture



5. Cut the jacket all around the cable and remove it



## 4.5. Core Components

In Loose Tube cables the fibres are contained in a tube having a diameter of 2mm.
Loose Tubes are jelly filled. The fibres shall be carefully cleaned using an appropriate degreaser before termination.
The process is the same for all Loose Tube cable structures (UD, UC, MD or MC)

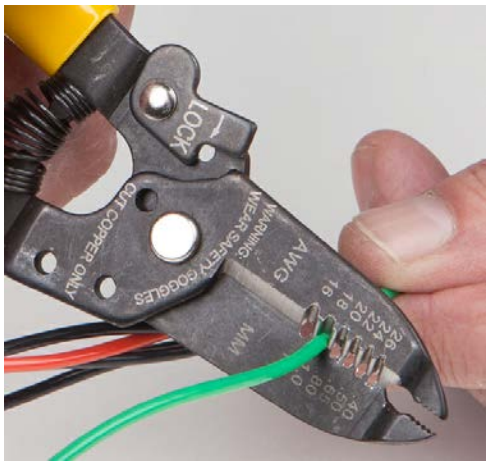

**Recommended materials**

- Stripper tool (**Multi-Wire stripper 821 - Ripley / Miller** or equivalent)
- Low-lint paper (**LANmark-OF Wipes for Anaerobic Toolkit – N102.226** or equivalent)
- Fibre degreaser (**LANmark-OF degreaser 0,5l – N890.123** or equivalent)

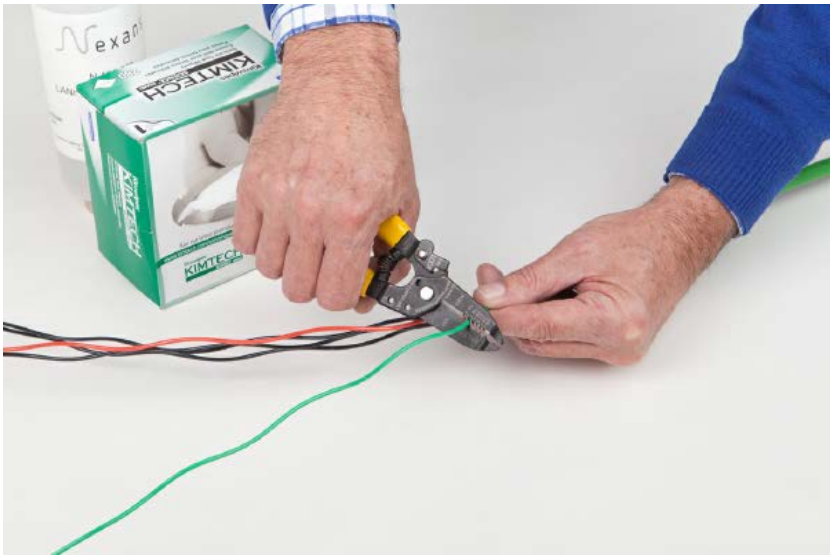
Note
The recommended material has been selected according to their good performance.
For instance the Nexans high performance degreaser is a natural biodegradable and non-toxic solvent that perfectly cleans the coated fibres but doesn't remove the color of the fibre coating and doesn't affect the fibre and its coating.
An appropriate equivalent product could be used but the use of a non specific fibre degreaser is not recommended as it could damage the fibres and therefore invalidate the guarantee.

**Stripping and fibre preparation process**

1. Insert the tube into the position 18AWG / 1.0 mm of the tool

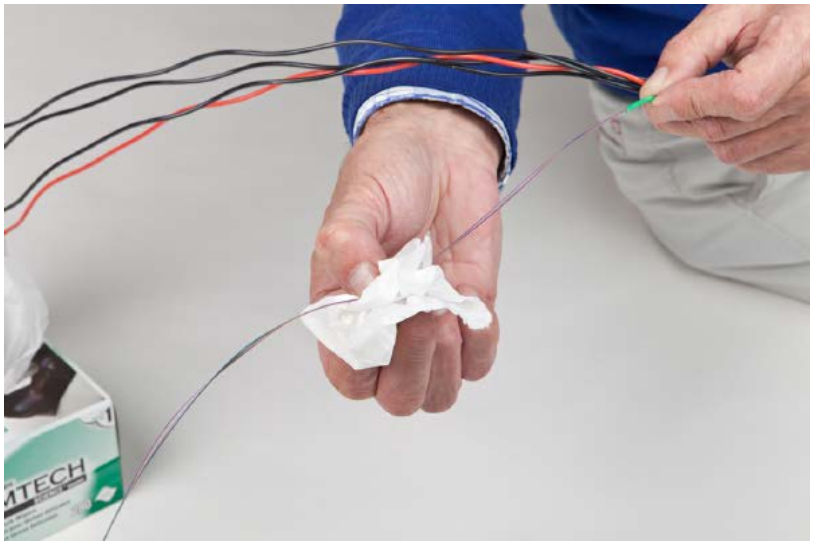


2. Cut and strip the tube





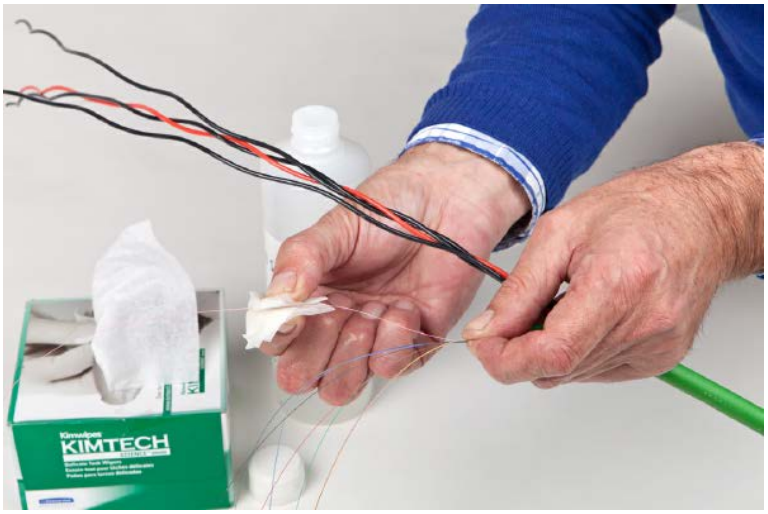
3. Remove the excess of degreaser from around the fibres

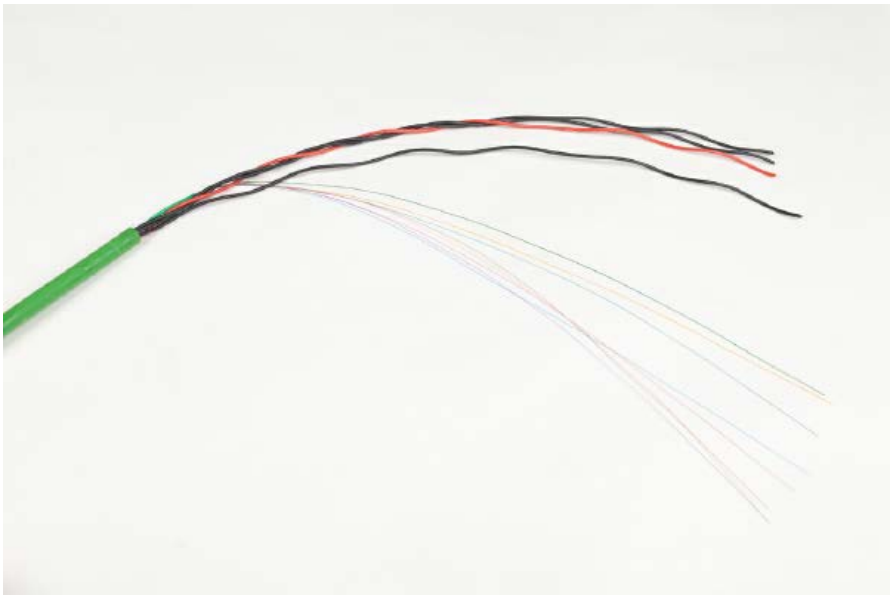


4. Impregnate the cleaning paper with the degreaser and wipe the group of fibres from end to end – wiping in the direction away from the jacket



5. Split the fibres and repeat the cleaning process until each fibre is perfectly clean





Perfectly clean fibres ready for termination

## 4.6. Fibre termination

In Loose Tube cable structures the fibres are only protected by a 250µm coating.

Direct termination with anaerobic field installable connectors is not recommended on these types of fibres.
Pigtail splicing is preferred.

Please refer to the pigtail splicing recommendations contained in the General "Installation Guide For Optical Fibre Cable" document.

# 5. Fibre identification

## 5.1. Uni-tube cables (UD / UC) – up to 24 fibres

| Fibre | Colour | |
|---|---|---|
| 1 | Blue | |
| 2 | Orange | |
| 3 | Green | |
| 4 | Brown | |
| 5 | Grey | |
| 6 | White | |
| 7 | Red | |
| 8 | Black | |
| 9 | Yellow | |
| 10 | Violet | |
| 11 | Pink | |
| 12 | Turquoise | |
| 13 | Blue + 1 ring | I |
| 14 | Orange + 1 ring | I |
| 15 | Green + 1 ring | I |
| 16 | Brown + 1 ring | I |
| 17 | Grey + 1 ring | I |
| 18 | White + 1 ring | I |
| 19 | Blue + 2 rings | II |
| 20 | Orange + 2 rings | II |
| 21 | Green + 2 rings | II |
| 22 | Brown + 2 rings | II |
| 23 | Grey + 2 rings | II |
| 24 | White + 2 rings | II |

## 5.2. Multi-tube cables (MD / MC) – up to 12 fibres per tube

EIA FIBRE COLOUR CODING-12-M

| EIA Fibre Colour Coding | | |
|---|---|---|
| Fibre | Colour | |
| 1 | Blue | |
| 2 | Orange | |
| 3 | Green | |
| 4 | Brown | |
| 5 | Grey | |
| 6 | White | |
| 7 | Red | |
| 8 | Black | |
| 9 | Yellow | |
| 10 | Violet | |
| 11 | Pink | |
| 12 | Turquoise | |
| EIA Tube Colour Coding (Tubes are numbered) | | |
| Fibre type | Colour | |
| MM62.5 | Blue | |
| MM50 | Green | |
| SM | Yellow | |

## Disclaimer

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