10 STEPS

TO TERMINATE YOUR FIBRE PROFESSIONALLY

DATWYLER

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INTRODUCTION

These procedures detail the steps to be taken in order to prepare the ends of fibre optic cables for splicing.

Personnel who are trained and familiar with handling fibre optic cables, cabling components and splicing accessories must perform cable end preparation and splicing.

Mishandling of fibre optic cables can cause damage to the fibres and result in cable length cuts or system degradation.

STEP 1: PLAN YOUR TOOLS

Proper safety requirements should always be followed and local practices maintained.

It is recommended that the installer wear protective eye gear and gloves during many of the installation steps to avoid the possibility of injuries.

Ensure all required materials are on hand prior to start.

It is recommended that the processes of cable end preparation, fibre splicing and splice closure assembly be performed from beginning to end with minimal interruption.

Note: *If for any reason your actions are interrupted ensure fibre optic cable ends and fibres are adequately protected. In the below figure most of the required tools for FOC preparation are listed.*

1. Tape measure	8. Fibre tube scorer
2. Cable marker for marking cable jacket	9. Hook-blade razor knife
3. Aramid shears	10. Lint-free wipes *(for gel-filled cables)*
4. Diagonal cutters	11. Alcohol or gel cleaner
5. Needle nose pliers *(preferably with rounded side edges)*	12. Safety glasses
6. Cable snips	13. Protective cotton gloves
7. Rotary cable slitter	

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STEP 2: MARKING AND CUTTING CABLE

1. Use adhesive tape to mark the cutting point.
2. 2 to 2.5 meters is sufficient length for splicing.
3. Wipe the cable with a dry cloth.
4. Secure the loose fibres and/or tubes to their slots using adhesive tape.

STEP 3: ACCESSING THE FIBRES

Usually cables have many layers before reaching the fibre core. In order to access the fibres, the outer layers need to be removed in a manner which does not harm the fibres.

1. Use a cable ring cutter with adjustable blade level for proper preparation.
2. After cutting the cable the preparation will start by removing the outer sheath (jacket) material and the glass reinforced armour part, the inner sheath and the dry core.

STEP 4: PREPARING THE LOOSE TUBES

1. When reaching the loose tubes, the core tube remover or "blue tool" will be used to remove the coating of each tube.
2. The blue tool is an ideal fibre tool with the blade depth set so that it cuts through approximately 90% of the tube jacket wall leaving a small amount which is thin enough to break when pulled – this ensures that the fibre coating underneath is not damaged.
3. The tubes will be removed for around 1 to 1.2 meters.

STEP 5: NUMBERING THE FIBRES

1. Following cable types, you have to consider the numbering of fibres according to the cable network scheme / splicing schedule which is showing the number of correspondent fibres to be connected to each other from both sides of the cable end.
2. For example in case of multi-tube cable, identify the first fibre in tube 1 of the first cable and store it in the organizer (cassette). The same will be done for the adjoining fibre of the second cable. This activity will be repeated for all fibres in the same tube and then for all in the other tubes.
3. Put the final labeling as per design for the patch panels, splice cassette, adapter panel, etc.

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Fibre colour code (in accordance with IEC 60304)

(up to 12 fibres)

Fibre no.	colour
1	red
2	green
3	blue
4	yellow
5	white
6	grey
7	brown
8	violet
9	turquoise
10	black
11	orange
12	pink

Fibre colour code with ring signature (Datwyler)

(up to 24 fibres)

Fibre no.	colour
13	red/black
14	green/black
15	blue/black
16	yellow/black
17	white/black
18	grey/black
19	brown/black
20	violet/black
21	turquoise/black
22	transparent/black
23	orange/black
24	pink/black

Tube colour code

Tube type	Colour	RAL No.	Fibre types
1st tube	red	3020	all types
2nd tube	green	6018	all types
add. tubes	white	9016	E9/125
	light green	6019	G50/125
	blue	5015	G62/125
dummy elements	black	9005	

STEP 6: FIBRE COATING REMOVAL

1. Fibre coatings are used over the glass fibre to provide a buffer against sources of damage and also to build the fibre up to a larger size that is stronger and easier to handle.
2. A coating stripper is used to remove the coating(s) from the fibre. There are two typical tools:
   - A pliers stripping tool with a mechanical stop that prevents the tool from closing too small and causing unwanted scratches on the fibre.
   - A three-hole fibre stripper tool that can strip different sizes of coated fibres.
3. Do not strip a fibre with a tool designed for different coating size as this can result incomplete removal of the coating or damage the fibre that may reduce its strength.
4. The length of coating to be removed varies according to how the fibre is to be terminated – fusion splice, mechanical splice or connectors.

5. It is normal to remove an excess of 30 to 40 mm of coating even if only as little as 8 mm of fibre is required after cleaving.

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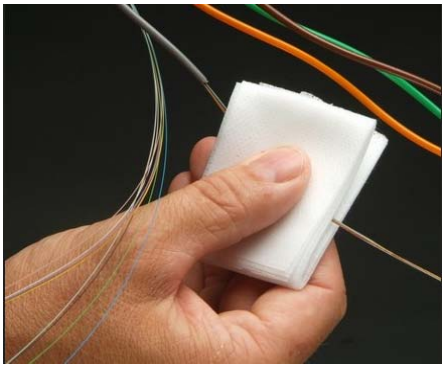
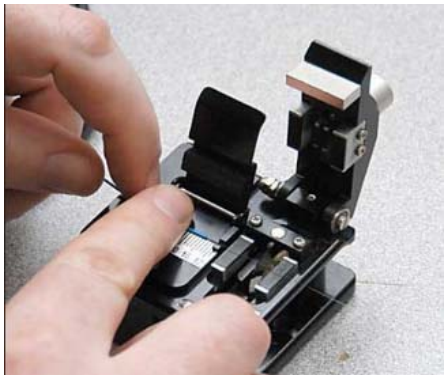
STEP 7: CLEANING PRIOR TO CLEAVING

1. Fibre cleaning is achieved by wiping the fibre with a gauze or paper wipe moistened with isopropyl alcohol.
2. The wiping action is from the end of the remaining coating towards the end of the fibre. This ensures that any coating debris or contaminants on the fibre are wiped towards the end.
3. Do not overclean the fibre because its strength is reduced every time the fibre is wiped.



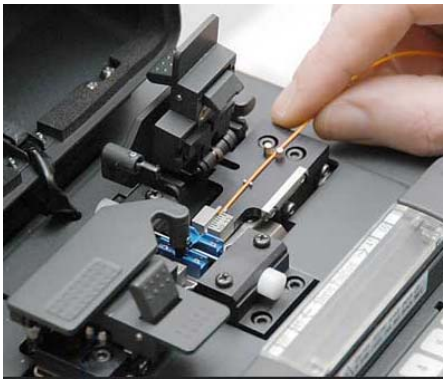
STEP 8: CLEAVING

1. Cleaving is the process of cutting the end of the fibre to form a straight cut across the end rather than an angled cut, chipped end, or shattered end.
2. The principle of cleaving is similar to the cutting of sheet glass: hold, scribe and then bend.



STEP 9: FUSION SPLICING

1. Fibre optic splicing is one of the fibre optic terminations which create a permanent joint between the two fibres.
2. With the benefits of low light loss and back reflection, fibre optic splicing is a preferred method when the cable runs are too long for a single length of fibre or when joining two different types of cables together.
3. There are two methods of splicing: **fusion splicing** *(details are below)* and **mechanical splicing** *(not covered in this document)*.
4. In fusion splicing a machine is used to precisely align the two fibre ends; the glass ends are "fused" or "welded" together using heat or an electric arc.



5. This produces a continuous connection between the fibres enabling very low-loss light transmission (typical loss: 0.1 dB).
6. Fusion splicing has the best return loss performance of all the mating and splicing techniques.

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FOR BETTER SPLICING:

- Frequently clean your splicing tools. When working with fibre, keep in mind that particles not visible to the naked eye could cause tremendous problems when working with fibre optics. "Proper" cleaning of your fibre and tools will save your time and money down the road.
- Properly maintain and operate your cleaver. The cleaver is your most valuable tool in fibre splicing. For fusion splicing you need an even more precise cleaver to achieve exceptional low loss (0.05 dB and less). If you have a poor cleave the fibre ends might not melt together properly causing light loss and high reflection problems. Maintaining your cleaver by following manufacturer instructions for cleaning as well as using the tool properly will provide you with a long lasting piece of equipment and ensuring the job is done right the first time.
- Fusion parameters must be adjusted minimally and methodically (fusion splicing only). If you start changing the fusion parameters on the splicer as soon as there is a hint of a problem you might lose your desired setting. Dirty equipment should be your first check, and they continue with the parameters. Fusion time and fusion current are the two key factors for splicing. Different variables of these two factors can produce the same splice results. High time and low current result in the same outcome as high current and low time. Make sure to change one variable at a time and keep checking until you have found the right fusion parameters for your fibre type.
- Fusion splicing machine should be calibrated as per manufacturer recommendation.

FUSION SPLICING STEPS:

1. **Prepare the fibre.**

   Strip the protective coatings, jackets, tubes, strength members, etc. and leave bare fibre only. Please pay attention to keep the fibre clean.

2. **Cleave the fibre.**

   Choose a good fibre cleaver. The cleaved end must be mirror-smooth and perpendicular to the fibre axis to obtain a proper splice. But the cleaver is not used to cut the fibre. It is only used to produce a cleaved end that is as perpendicular as possible.

3. **Fuse the fibre.**

   Align the fusion splicer unit and use an electrical arc to melt the fibres, permanently welding the two fibre ends together. Alignment can be manual or automatic.

4. **Protect the fibre.**

   To ensure that the splice does not break during normal handling you must protect the fibre from bending and tensile forces. A typical fusion splice has a tensile strength between 0.5 and 1.5 lbs and will not break during normal handling; but it still requires protection from excessive bending and pulling forces.

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STEP 10: FIBRE CLEANING

1. Contamination is the number 1 reason for trouble on optical networks.
2. A single particle mated into the core of a fibre can cause significant back reflection, insertion loss, and/or equipment damage. That is why cleaning and inspection are critical.
3. Microscopic dust particles can cause loss and back reflection problems, and potentially damage the fibre.
   - A 1 µm dust particle on a SM core can block 1% of the light (0.05 dB loss).
   - A 9 µm speck is invisible to the eye, but can completely block the fibre core – a human hair may be 75 µm wide, 8 times larger.
   - Other contaminants include:
     - oils, frequently from human hands
     - film residues condensed from vapours in the air
     - powdery deposits from water/solvents evaporation
4. Different types of fibre optic cleaning kits are available for field cleaning of connector end-faces and splicer v-grooves.

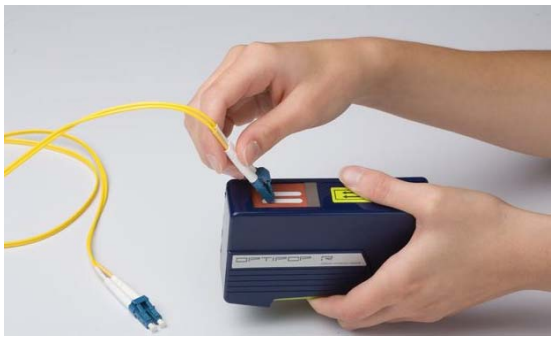

Image Credit: AFL

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