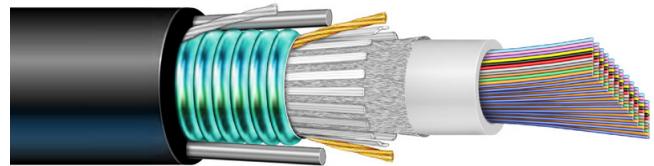


FusionLink™ Central Tube Ribbon

Preparation & handling procedure

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2.4 DO NOT use magnifiers in the presence of laser radiation. Diffused laser light can cause eye damage if focused with optical instruments. Should accidental eye exposure be suspected, arrange for an eye exam immediately.

1.0 Scope

These instructions explain key installation and cable handling considerations for gel tube or gel-free central tube ribbon cable. Ribbon in loose tube cable considerations are provided in other documents. When this cable is used in conjunction closures, cabinets, pedestals, hardware, etc, the user must obtain installation procedures from the appropriate component manufacturer. Failure to adhere to preparation and handling procedures may void the cable warranty.

2.0 Safety

- 2.1** Prysmian recommends the use of approved personal protective equipment in this procedure.
- 2.2** Wear safety glasses and gloves, and use solvents in well-ventilated areas.
- 2.3** Never look directly into the end of a fiber that may be carrying laser light. Laser light may be invisible and can damage your eyes. Viewing it directly does not cause pain. The iris of the eye will not close involuntarily as when viewing a bright light. Consequently, serious damage to the retina of the eye is possible. Should accidental eye exposure to laser light be suspected, arrange for an eye examination immediately.

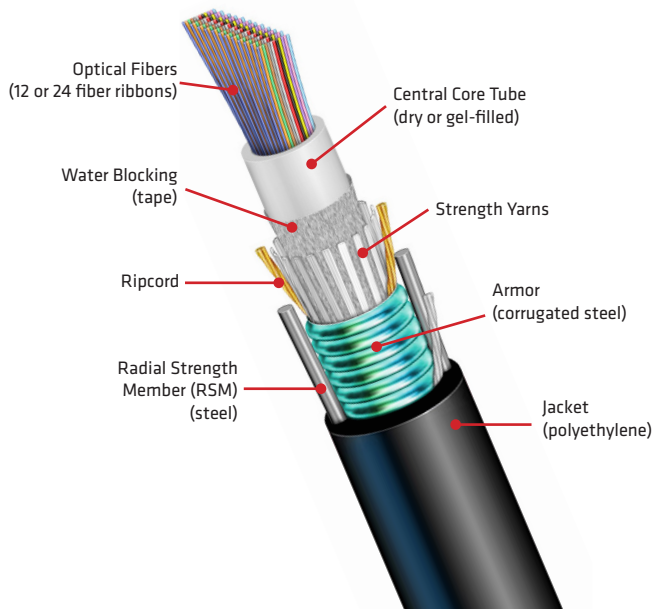
3.0 General Installation Considerations

- 3.1** Cable tension should not exceed 600 lbf.
- 3.2** The dynamic bend radius must be kept larger than 20 times the cable diameter. The static bend radius must be kept larger than 10 times the cable diameter. It should be at least 15 times for cable in storage coils.
- 3.3 DO NOT** bend the central tube at sharp angles while removing the jacket, armor, tapes or strength members. The core tube shall not be routed inside closures or pedestals due to bending restrictions of the core tube. Prysmian recommends the use of the buffer tube splitter to open up the central tube. **Use Prysmian's UniShaver on ONLY Draka's legacy ribbon cables.**
- 3.4** Properly set the blade depth on ring cutters. A shallow blade using multiple rotations is recommended.
- 3.5** Armor cable shall be bonded and grounded in accordance with customer requirements. Prysmian recommends all metallic components be bonded and grounded at each cable end.
- 3.6** When storing cable in a coil, the reverse figure 8 hand coiling method should be used to minimize cable twisting.
- 3.7** Figure 8 machines are not permitted.

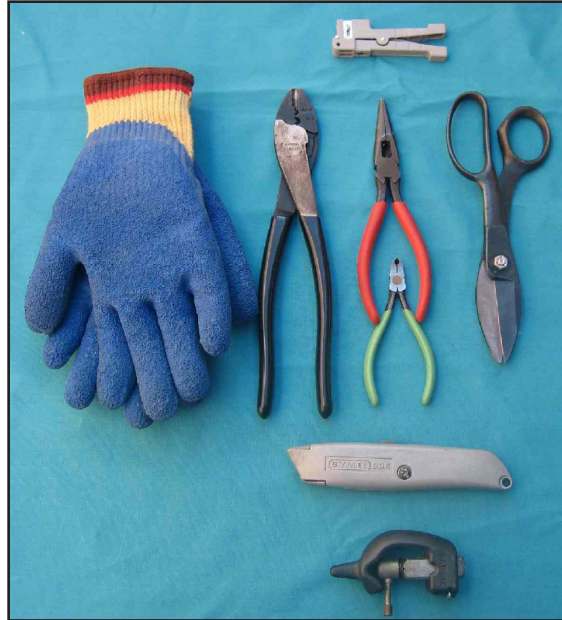
FusionLink™ Central Tube Ribbon Procedure

- 3.8** When blowing, a crash test should be performed for each cable to determine the maximum push force that can be applied. This force will vary for different cable sizes and duct inside diameters.
- 3.9** Radial Strength Members (RSMs) should be secured at termination points. The cable jacket must also be secured.
- 3.10** **NOTE:** Water swellable materials used by the industry do not block water mixed with low levels of salt water. In applications where the cable or termination points are exposed to salt water, a gel filled cable is recommended.
- 3.11** The dry uncoupled cable design (RCU) requires coupling coils in aerial applications at termination points to prevent ribbon retraction; see Sections 10 & II. 25 to 50 ft. of extra cable length should be allocated for the coupling coil on each side of the splice point (50 to 75 ft. total for both coils). When slack loops are left for aerial mid sheath entry splice points, 75 to 100 ft. of cable should be stored to accommodate coupling coil and closure routing requirements. (Refer to product datasheet for specific coupling requirements)
- 3.12** The dry uncoupled cable design (RCU) used in pulling applications should have pulling grips installed per section 13.0 to prevent fiber retraction.
- 3.13** **DO NOT** allow blades or sharp edges to contact the ribbons or fibers.

4.0 Reference Drawing



5.0 Tools & Material Needed for Cable Access



- [+] Utility knife, or cable ring cutter
- [+] Central tube access tools (Prysmian's mid-span access tool and coaxial ring cutter)
- [+] Pliers: needle nose, linesman, diagonal cutter
- [+] Scissors or snips
- [+] D'Gel or cable cleaning solution
- [+] Lint free wipes
- [+] 99% isopropyl alcohol
- [+] Flat-tip screwdriver
- [+] Disposable rags
- [+] Procedure from the closure, cabinet, pedestal, hardware manufacturer.

FusionLink™ Central Tube Ribbon Procedure

6.0 End of Cable Access Procedure

6.1 Measure and Ring Cut #1

Refer to the procedure of the closure, cabinet, pedestal, or hardware manufacturer to determine the length of cable needed to access. At this distance from the end of the cable, make a ring cut. (Ring Cut #1)

CAUTION: Cutting too deeply through the jacket could result in unintentional damage to the ripcords, armor or central tube. Only a shallow cut is necessary to allow the jacket to be removed.

NOTE: For non-armored designs with optional tone-wires, care should be taken not to cut the insulated tone-wire located next to the radial strength member.

6.2 Ring Cut #2

Make Ring Cut #2 six (6) inches from the end of the cable.

6.3 Locate RSMs

Look at the end of the cable to locate the Radial Strength Members (RSM). The RSMs are located on opposite sides of the cable.

6.4 Beginning 6 inches from the end of the cable (Ring Cut #2), use a utility or sheath knife to shave off the jacket/sheath over each RSM. Shave in the direction towards the end of the cable. Peel back the jacket.

NOTE: In the all-dielectric gel design, the RSMs are not embedded in the jacket, but are located under the swellable tape.

6.5 Cut RSMs, Open Armor, Locate Ripcords

- Bend back the RSMs and cut off both RSMs.
- Open up the armor at the seam. Pry open. (if applicable)
- Cut away the armor.
- Locate the 2 yellow ripcords.

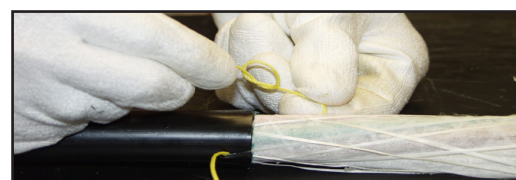
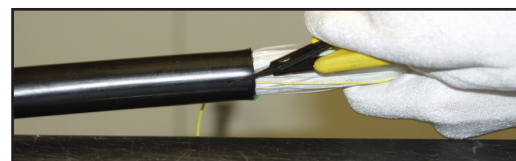
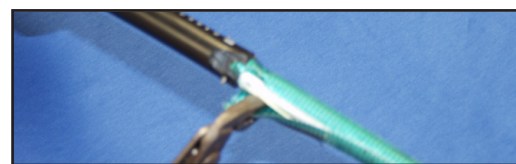
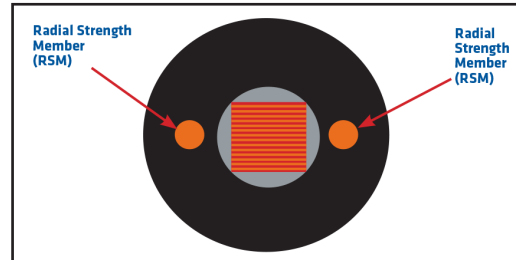
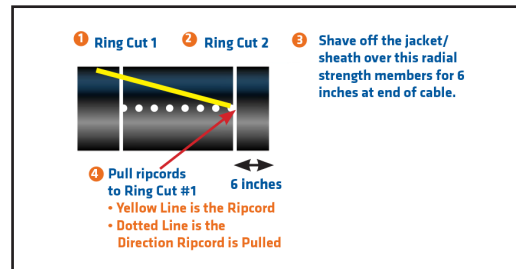
6.6 Ripcord Notches

Use diagonal cutters to notch the jacket (and armor, if applicable) near the ripcords.

NOTE: This helps start the pull of the ripcords and prevents breaking ripcord.

6.7 Knot the Ripcords

Tie a knot in the end of each ripcord. This will help hold the ripcord in the jaws of the pliers.

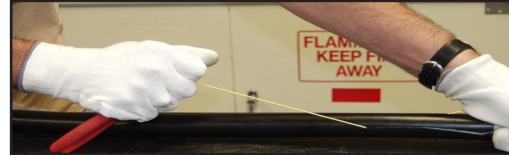
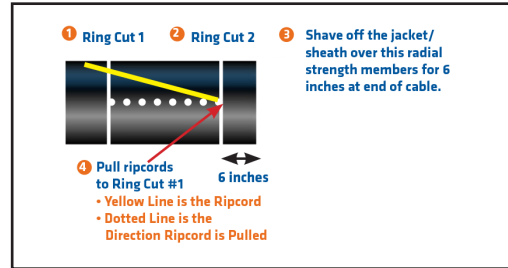


FusionLink™ Central Tube Ribbon Procedure

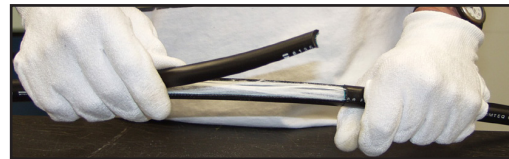
6.8 Pull Ripcords

Grasp one end of a ripcord in the jaws of needle nose pliers. Twist the pliers to wrap the ripcord around them, pull the ripcord through the jacket to Ring Cut #1. Cut the ripcords, leaving 1" exposed.

NOTE: For Armored Cable, consult the closure, pedestal, cabinets, or hardware manufacturer procedure and make sure to leave enough armor in front of the ring-cut to be used for grounding. You may need to pull the ripcord several more inches to leave adequate armor for grounding.

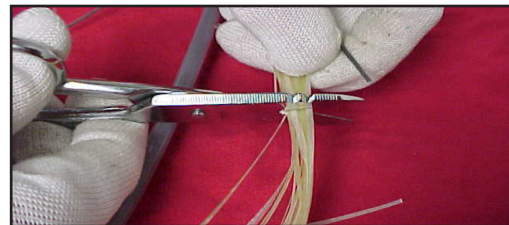
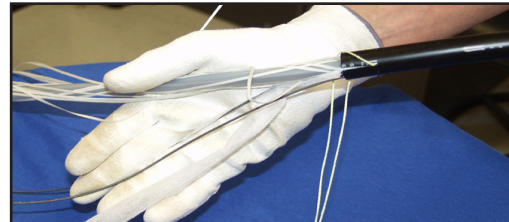


- 6.9 a. Peel the sheath and armor away from the cable core.
b. Cut and discard.
c. You may need to score the armor with a utility knife at Ring Cut #1.



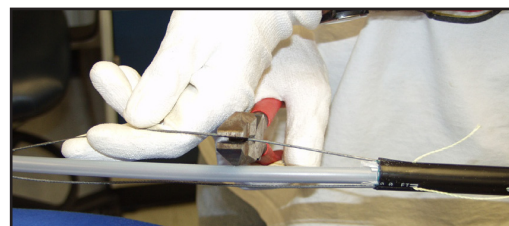
- 6.10 Determine the required length of yarns that need to be left for anchoring. Refer to the closure, cabinet, pedestal manufacturer procedure. Use snips to cut and remove all excess length of yarns and tape from the cable core.

NOTE: It is **CRITICAL** to tightly secure the radial strength members inside the closure, cabinet, pedestal or hardware. This prevents retraction, piston effect, and attenuation increases.



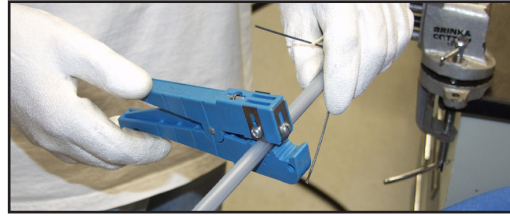
6.11 Radial Strength Members

- a. Determine the required length of Radial Strength Members (RSM) that need to be left for anchoring.
b. Refer to the closure, cabinet, or pedestal manufacturer procedure.
c. Cut and remove excess length. When in doubt, leave 12" of RSMs.

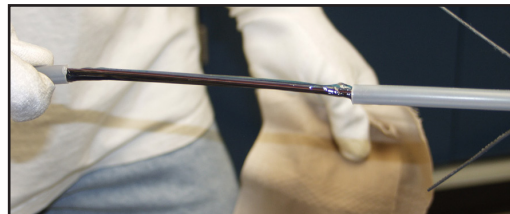
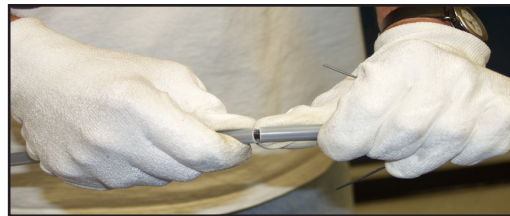


FusionLink™ Central Tube Ribbon Procedure

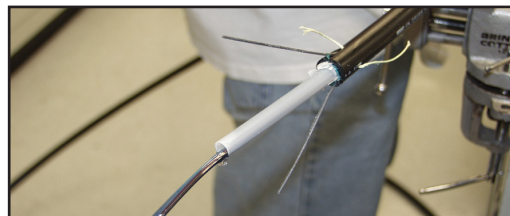
- 6.12** Clean the exposed buffer tube.
- 6.13** Determine the length of central tube that is required. *Refer to the procedure from the closure, cabinet, pedestal manufacturer.* Do not expose more central tube than necessary.
- CAUTION:** Do not route the tube inside the closure. Bending the tube inside the closure may kink the tube causing fiber damage.
- CAUTION:** Calibrate or test the depth of your coaxial ring cutter before performing step 14. Failure to do so could result in cutting too deep an inadvertent cutting of fibers.
- 6.14** To remove the tube, score the buffer tube with rotation(s) of the coaxial ring cutter. *Do not remove more than 48" at a time.*



- 6.15**
- Grasp the tube on each side of the score.
 - Flex the central tube in all directions to separate the tube at the score mark.
 - Pull the tube off of the fibers.
 - Repeat removal of tubes in 48" sections until the desired length of fiber is exposed.



- 6.16 For Gel Free (dry) Cable:**
- Cut away the water swellable tape inside the core tube.
 - Clean the ribbons with isopropyl alcohol and lint free wipes.
- 6.17 For Gel Filled Tubes:**
- Clean the ribbons with isopropyl alcohol & lint free wipes.
 - Remove gel filling compound at the open end of the central tube using a Q-tip or similar swabbing tool.
 - Remove gel from 1 inch inside the central tube.
 - Apply B-sealants, RTV sealants, etc. to seal off the end of the buffer tube to contain future leakage of gel from filling compound.



END OF CABLE ACCESS PROCEDURE

FusionLink™ Central Tube Ribbon Procedure

7.0 Mid span Access Procedure

7.1 Refer to the procedure of the closure, cabinet, pedestal, or hardware manufacturer to determine the length of cable needed to access (the “open window”).

7.2 Ring Cut #2

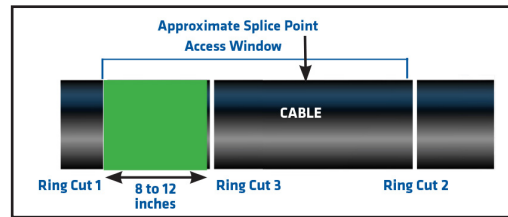
- Make two ring cuts the recommended distance apart (Ring Cut #1 and #2).
- Ensure your splice point is centered between the ring cuts.
- Measure twice and cut once.

CAUTION: Cutting too deeply through the jacket could result in unintentional damage to the ripcords, armor or buffer tube.

For non-armored designs with optional tone-wires, **care should be taken not to cut the insulated tone-wire** located next to the RSM.

7.3 Ring Cut #3

Make a third ring cut (Ring Cut #3) 8” to 12” from Ring Cut #1. (Located in the access window zone)



7.4 Ripcord Notches

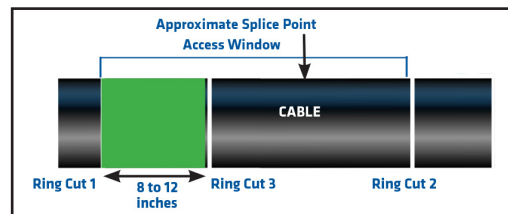
Locate the radial strength members (RSM) inside of the cable. You will be able to find the RSMs by looking at the ring cut locations. The RSMs will be on opposite sides (180 degrees apart). Using a sheath or utility knife, shave off the jacket over both the RSMs in the eight inch section between ring cut #1 and #3.

NOTE: An alternative method is to carefully slit the jacket using a utility knife. This is recommended for the all-dielectric gel-filled design since the strength members are not embedded in the jacket, but are located under the swellable tape.



7.5 Remove the Jacket

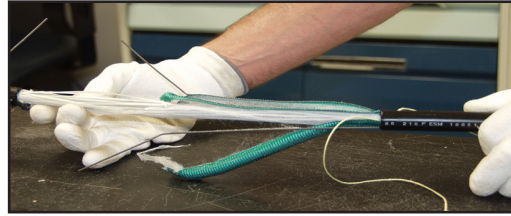
Between ring cuts 1 and 3. Use linesman pliers. Cut the RSMs at Ring Cut #3 and bend back.



FusionLink™ Central Tube Ribbon Procedure

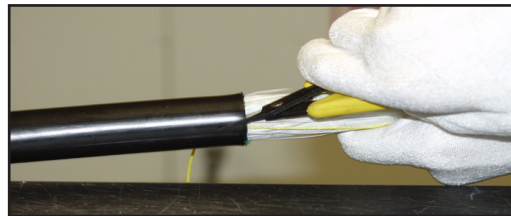
7.6 Open Armor & Locate Ripcords

Open up the armor (if applicable) between Ring Cut #1 and #3 and locate the yellow ripcords.



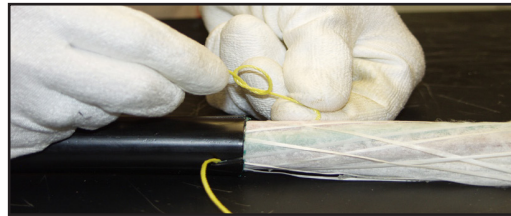
7.7 Ripcord Preparation

Using diagonal cutters, cut a small notch into the sheath and armor (if applicable) near the two ripcords to help start the pull of the ripcords. This prevents breaking of the ripcord.

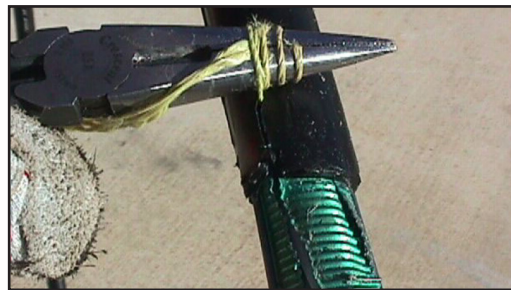


7.8 Cut the ripcords equally between Ring Cut #1 and #3. Tie a knot at the end of both ripcords.

NOTE: This knot prevents the ripcord from slipping through the plier jaws.



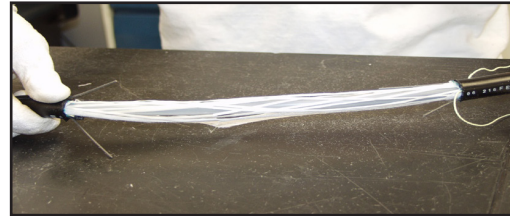
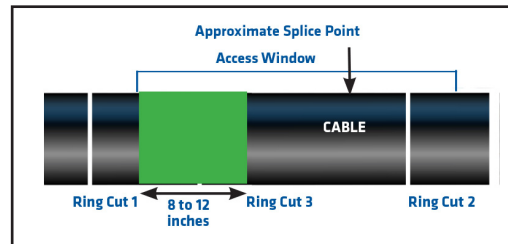
- 7.9
- Grasp the end of the ripcord in the jaws of needle nose pliers.
 - Turn the closed pliers to wrap the ripcord around them.
 - This will be the ripcord located nearest the center of the desired access window.



FusionLink™ Central Tube Ribbon Procedure

7.10 Pull Ripcord to Ring Cut #2

- Pull ripcords and open the jacket to ring cut #2.
- Peel the jacket and armor (if applicable) away from the cable core, then discard it.



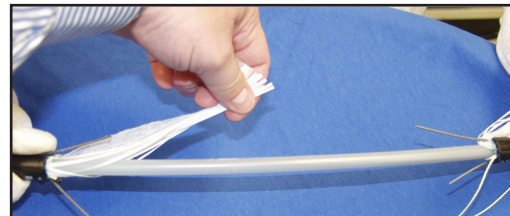
7.11 Use snips to cut all yarns and tapes from the cable core.

CAUTION: Refer to the - closure, cabinet, pedestal, or hardware manufacture's procedure to determine how much strength yarn or RMS to leave exposure for anchoring. Cut the yarns and RSM sat those locations.

NOTE: When in doubt, leave 12".



7.12 Thoroughly clean the exposed buffer tube and strength members. Using isopropyl alcohol.



END OF MIDSPAN ACCESS PROCEDURE

FusionLink™ Central Tube Ribbon Procedure

8.0 Prepare to Open The Central Tube

- 8.1 Select the proper mid-span access tool size.
- 8.2 Perform mid-span entry on the core tube per procedure PR17.
- 8.3 For Gel Free Cable
 - a. Cut away the water swellable tape inside the core tube.
 - b. Using lint-free wipes and d-gel, clean the ribbons.
 - c. Wipe again with 99% isopropyl alcohol to clean the ribbons.
- 8.4 For Gel-Filled Ribbon Cable
 - a. Clean the ribbons with d-gel then wipe with 99% isopropylalcohol and lint free wipes.
 - b. Remove gel filling compound at the central tube using a Q-tip or similar swabbing tool.
 - c. Remove gel 1" inside the central tube.
 - d. Apply B -sealants, RTV sealants, etc. to seal off the end of the buffer tube to contain future leakage of gel filling compound.
- 8.5 The cable is now ready for ribbon breakout and/or anchoring. Refer to that procedure.

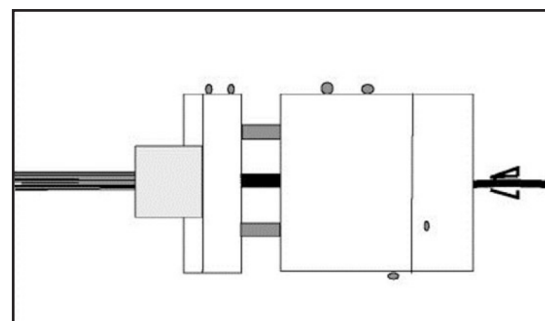
9.0 Ribbon Preparation

Prysmian's ribbon configured fiber consists of an array of color-coded optical fibers edge bonded together with a flexible matrix material. This matrix, along with the ink and fiber secondary coating, is easily removed by a variety of methods. Prysmian ribbon has been successfully stripped using mechanical, thermal, or a combination of these methods.

9.1 End Preparation: Thermal-Mechanical

If 12-fiber fusion splicing is required, use the thermal-mechanical or "Hot Jacket" strippers in conjunction with the mass fusion splicer. Follow the manufacturer's instructions for the unit(s) being used.

- a. Allow the unit to warm up completely on full power, then place the ribbon on the heating surface for 1-2 seconds before stripping.
- b. Follow with a single wipe of an alcohol-dampened cloth to remove any residual debris.
- c. If 12-fiber mechanical splicing is required, use the thermalmechanical "scissors type" strippers, in conjunction with the mass mechanical splicing setup and follow the manufacturer's instructions.
- d. Follow with a single wipe of a 99% isopropyl alcohol-dampened cloth to remove any residual debris.



Thermal-Mechanical (heat-stripping) a ribbon

FusionLink™ Central Tube Ribbon Procedure

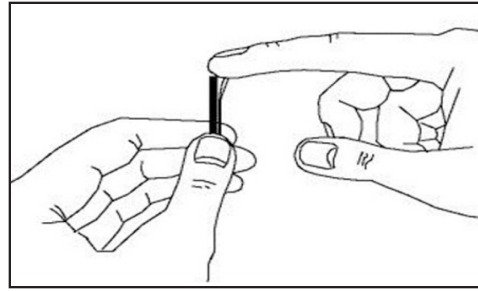
9.2 End Preparation: Mechanical

For applications requiring individual access to the fibers, Prysmian's ribbon can be separated by peeling the fibers away from each other. This method breaks the physical bond between the fibers but allows them to retain their color for identification.

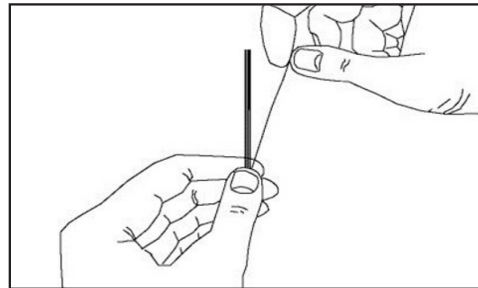
Hold the ribbon to be stripped approximately one quarter of an inch from the end between the thumb and forefinger. Using the forefinger from the other hand, gently brush the fiber ends across the ribbon's major axis starting at one of the edge fibers. This action will separate the fibers at the tip of the ribbon.

To ensure that the fibers do not separate beyond the desired length, wrap a piece of tape around the ribbon at the desired end point.

Hold the ribbon end between the thumb and index finger of one hand. With the thumb and index finger of the other hand, gently pull an edge fiber to slowly separate from the ribbon. Repeat this step for each fiber to be accessed.



Use the forefinger to separate the fibers from each other in the ribbon



Separate a fiber from the ribbon by gently pulling it away from the edge of the ribbon with the thumb and forefinger

10.0 Fiber/Cable Coupling of Ribbon Central Tube Cable

10.1 In central tube ribbon cables, the ribbon stack runs straight down the center of the cable. If cable tensile loads overcome the friction of the ribbon stack in the central core tube, the ribbons can become uncoupled and can move relative to the cable. Cables with enough ribbon stack friction to prevent ribbon movement are called **Coupled Designs** (Prysmian RCD product family), those without enough friction to prevent ribbon stack movement are called **Uncoupled Designs** (Prysmian's RCU products – 12 to 48 and 576 fiber counts).

An uncoupled ribbon stack can cause fibers to retract within the cable when pulling the cable. It can also cause ribbons to pull back into the cable from closures in aerial applications from weather loading.

NOTE: If ribbon movement occurs in closures, fiber damage can occur. The following procedure provides a method for optimizing fiber/cable coupling with central tube designs

Depending on the gel-free central tube design, ribbon coupling may or may not be inherent in the cable. If the design does not provide adequate coupling, coupling coils are required in an aerial application. Prysmian offers both designs, check the datasheet to see if coupling details are required.

FusionLink™ Central Tube Ribbon Procedure

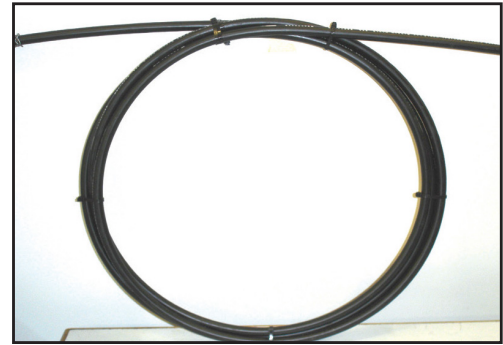
10.2 Aerial Coupling Optimization

Adding coupling coils on each side of a splice closure in aerial applications will couple the ribbon stack with the cable and prevent movement of the ribbons in the closure.

To assure full coupling, each coupling coil must consist of at least 4 cable loops. The loops must have a diameter of at least 30 times the cable diameter.

10.3 Required materials for aerial coupling coils **[+]** 5 or more tie wraps.

10.4 Tie wrap all the loops together at the inlet and exit end as well as a minimum of 3 places evenly spaced around the coil.



EXAMPLE: A 0.97" cable (576f all-dielectric) will need a minimum coil diameter of 29", resulting in a minimum of 91" (7.6 feet) of cable for each loop. With 4 loops for each coupling coil, at least 30.5 feet of cable is needed for each coupling coil.

11.0 Aerial Coupling Coil Slack Loops for Future Splice Points (RCU design)

11.1 When coupling coils are used for optimum fiber and cable coupling, enough cable needs to be stored at future mid sheath aerial splice points to store cable for both coupling coils on each side of the closure and to have enough ribbon and fiber length within the closure for storage and splicing. Since the cable coiling diameter (30 times the cable OD) varies with cable size, the minimum cable length for slack loop storage will vary.

Closure routing length: This length will vary depending on closure manufacturer recommendations. It will also vary depending on where the fiber will be entered. If the fiber opening is in the center of the fiber routed in the closure, more storage length will likely be needed.

11.2 Based on the variability in slack loop diameters and closure routing needs, at least 75 feet of cable is recommended for slack loop storage. A longer length maybe needed if it is desired to splice the fibers on the ground.

11.3 When coiling the cable in the slack loop, the "Reverse Figure 8 Method" is recommended (see section 12).

EXAMPLE: A 0.97" diameter cable will require a minimum of 91" (7.6 feet) of cable in each loop. With a minimum of 4 loops per coil, a minimum of 30.5 feet of cable is required in each coupling loop. Two coupling loops will require a minimum of 61 feet. When accounting for the ribbon and fiber routing within a closure (follow the closure manufacturer recommendations), an additional length of 12 feet can easily be required resulting in a total needed storage length of 73 feet.

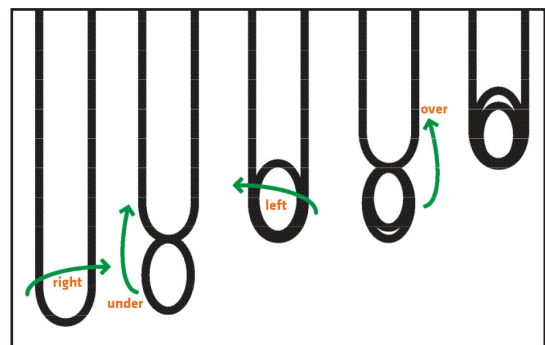
Fiber Count	Cable OD (in)	Coiling Diameter (in)	1 Cable Loop Length (in)	1 Coil Length (4 loops) (ft)	2 Coils (ft)	Cable Length for Closure Routing (ft)	Minimum Slack Loop Length (ft)
All-Dielectric (RCU1JKT)							
12 to 48	0.50	15	47	15.7	31.4	12	43
576	0.97	29.1	91	30.5	60.9	12	73
Armored (RCU1A1J)							
12 to 48	0.50	15	47	15.7	31.4	12	43
576	1.09	32.7	103	34.2	68.5	12	80
All-Dielectric FlexRibbon (RCF1JKT)							
96 to 144	0.50	16	50	16.8	33.5	12	46
288	0.59	18	57	18.8	37.7	12	50
Armored FlexRibbon (RCF1A1J)							
96 to 144	0.50	15	47	15.7	31.4	12	43
288	0.64	20	63	20.9	41.9	12	54

FusionLink™ Central Tube Ribbon Procedure

- 11.4 Tie wrap all of the loops together at the inlet and exit end as well as a minimum of 3 places evenly spaced around the coil.
 - 11.5 When a mid sheath splice point is inserted into this loop, the splice point should be placed in the center of the cable slack loop. Coupling coils as described in Section 10 shall be placed on each side of the closure.
- NOTE:** A butt splice closure, the two cables exiting the end of the closure can be coiled together.

12.0 “Reverse Figure 8 Method” for Cable Storing

- 12.1 This is a method that allows coiling the cable without accumulating twist in the cable
- 12.2 Step By Step
 - a. Cross the cable to make a figure 8 shape, cross left over right.
 - b. Tuck/fold the coil under.
 - c. Cross the cable in the opposite direction, right over left.
 - d. Fold the cable over the top.
 - e. Repeat this process until a minimum of 4 loops of cable is coiled and stored.
 - f. Secure coil with tie wraps.

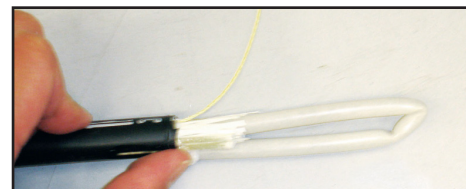
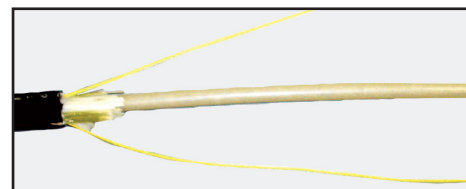


13.0 Gel Free Ribbon Pulling installation Blocking Procedure (RCU design)

This procedure is recommended if no ribbon retraction is desired during pulled installations of the RCU uncoupled design.

- 13.1 Required Materials for Aerial Coupling
 - [+] Vinyl tape
 - [+] Pulling Grip
- 13.2 Expose 8” of buffer tube from the end of the cable. Cut away strength members, tape and yarns. It is recommended to keep the ripcords for future cable access.
- 13.3 Fold over half of the buffer tube (4”) such that the end of the tube is flush with the end of the jacket.
- 13.4 Use vinyl tape to secure the folded over tube to the rest of the cable.

The transition between the cable and folded tube should be flush such that a pulling grip can be applied over the cable end.
- 13.5 Place pulling grip over the end of the folded tube and cable for installation requiring the cable to be pulled.



END OF THE PROCEDURE

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITIES

The practices contained herein are designed as a guide. Since there are numerous practices which may be utilized, Prysmian has tested and determined that the practices described herein are effective & efficient. The recommended practices are based on average conditions.

In addition, the materials and hardware referenced herein appear as examples, but in no way reflect the only tools and materials available to perform these evaluations.

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