Sheath Removal and Mid-Span Access for Light Armored and Armored Loose Tube Optical Fiber Cables

Contents **Section**

1. General

1.1 This installation practice describes sheath removal and mid-span access for OFS light armored and armored loose tube cables. It is intended for personnel with prior cable splicing experience. A working familiarity with cable access tools, splicing equipment, and splice closures is necessary as this guide does not cover all aspects of cable splicing.

1.2 This practice applies to standard loose tube, Option1™, and AccuTube® cables. *Option1* cables are riser-rated and used for indoor/outdoor applications. *AccuTube* cables contain fiber-ribbons and are available in fiber counts from 288 to 864.

1.3 Mid-span access is used in distribution applications where one or more fibers are spliced to a branch cable and the remaining fibers are left continuous through the splice closure.

2. Precautions

2.1 OFS optical fiber cables are designed to meet the rigors of aerial, direct buried, and underground duct environments. During cable installation, care should be taken to ensure that the minimum cable bend diameter is not violated and the maximum rated cable load is not exceeded.

2.2 Minimum bend diameters for fiber optic cable are typically expressed as a multiple of the outside diameter (OD) for both static and dynamic conditions. The static condition represents an installed cable that is subjected to long-term residual load. The dynamic condition represents a cable during installation that may be subjected to the maximum rated cable load (MRCL). For standard loose tube and *Option1* cables, the minimum bend diameter under dynamic conditions (during installation) is 30 × OD. The minimum bend diameter under static conditions (installed) is 20 × OD.

2.3 For *AccuTube* cables, the minimum bend radius for both static (installed) and dynamic conditions (during installation) is 30 × OD.

2.4 Cable tensile load ratings are specified for both short-term and long-term conditions. The short-term condition represents a cable during installation. The long-term condition represents an installed cable that may be subjected to a permanent residual load for the life of the cable. For short-term conditions, the MRCL for standard OFS optical fiber cable is

600 pounds[1] (2700N). For long-term conditions, the maximum tensile load is 200 pounds (890N). For *AccuTube* cable, the MRCL is 1000 pounds and the maximum long-term load is 200 pounds.

2.5 To assure that the MRCL is not exceeded during installation, breakaway pulling swivels and/or calibrated pulling winches are recommended for use during cable installation. Cable lubricants are effective in minimizing installation loads by reducing the coefficient of friction. Contact OFS or a cable lubricant manufacturer for guidance on the proper lubricant to be used with optical fiber cables.

3. Required Tools

1. Cable sheath knife
2. Buffer tube cutting tool
3. OFS Quick Split tool (mid-span access only)
4. Splicer's scissors
5. Diagonal cutters (side cutters)
6. Needle nose pliers
7. Round cable slitter (optional)
8. Tape measure
9. Electrical tape
10. Approved optical fiber cable cleaner
11. Isopropyl Alcohol
12. Paper towels
13. Lint free wipes
14. Gloves
15. Safety glasses

Caution: Gloves and safety glasses should always be worn during the sheath removal process.

4. Sheath Removal for Light Armored and Armored Cables

4.1 Measure and mark the cable at the appropriate stripping length (Figure 1). Consult the closure instructions for the required length of cable jacket to be removed.

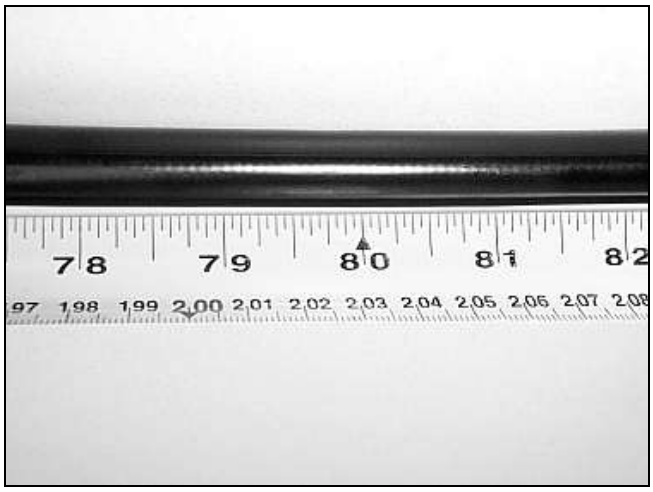

Figure 1 - Measure and mark the cable.

[1] Some OFS cable designs, e.g., self-supporting, micro-cable, and drop cable, have different MRCLs. Please contact OFS Customer Support at 1-888-FIBER-HELP (1-888-342-3743) from inside the USA or 1-770-798-5555 from outside the USA for information regarding these cables.

4.2 Using a cable sheath knife, lightly ring cut the cable at the measured mark and score the steel armor below the polyethylene (Figure 2).

Figure 2 – Ring cut the cable sheath.

4.3 Using a circular motion, gently flex the cable at the ring cut. Be careful not to violate the minimum bend radius of the cable. The polyethylene sheath and steel armor will separate at the ring cut (Figure 3).

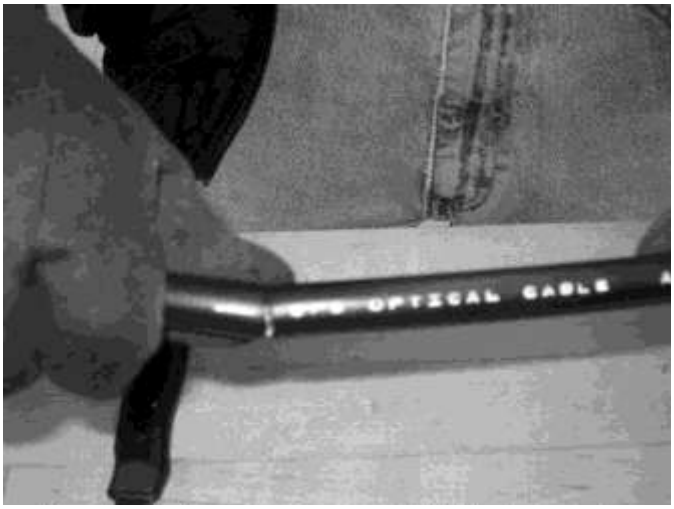

Figure 3 - Separate the cable sheath at the ring cut.

4.4 Make a second ring cut, scoring the armor, approximately 5 inches from the cable end. Gently flex the cable in a circular motion until the polyethylene sheath and armor separate.

4.5 Use a sheath knife to make two longitudinal cuts between the second ring cut and the end of the cable (Figure 4). Cut through the outer sheath to the underlying armor. Make sure the armor overlap is between the longitudinal cuts. (NOTE: A Round Cable Slitting Tool can be used to make the longitudinal cut as well as the ring cuts. The blade depth can also be adjusted to lessen the possibility of fiber damage. Contact OFS for more information.)

Figure 4 – Make two longitudinal cuts at the cable end.

4.6 Use a pair of pliers to remove the outer sheath and expose the armor overlap (Figure 5).

Figure 5 - Remove the outer sheath from the armor.

4.7 Use a sheath knife to lift and separate the armor at the overlap (Figure 6).

Figure 6 - Lift and separate the armor at overlap.

4.8 Remove the 5-inch section of outer sheath and armor exposing the core of the cable (Figure 7). (**Note:** An inner polyethylene jacket will be exposed on armored cables.)

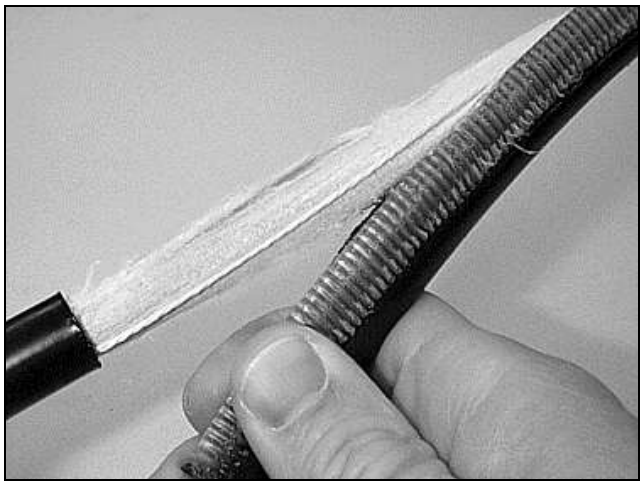

Figure 7 – Remove the outer sheath and armor layer.

4.9 Armored Cable: Skip ahead to Section 4.13.

4.10 Light Armored Cable: Light armored cable has two ripcords below the armor layer. It is necessary to use both ripcords and remove the cable jacket in two lengthwise pieces. Failure to remove the cable jacket in two pieces may cause buffer tube damage if the cable core is pulled through a narrow slit in the jacket.

4.11 Cut a small starting slit adjacent to the first ripcord. Grip the ripcord with needle nose pliers and pull it through the jacket, approximately 90° away from the armor overlap, to the measured mark (Figure 8). Do not pull the ripcord through the armor overlap as this may cut the ripcord. Repeat with the second ripcord pulling it through the jacket approximately 180° away from the first ripcord. Remove the two sections of outer jacket to expose the cable core (Figure 9).

Figure 8 – Pull the ripcord through the jacket.

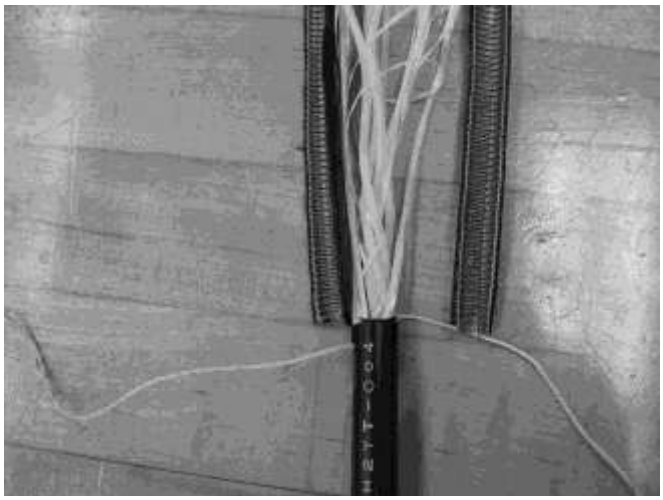

Figure 9 – Remove the cable jacket in two lengthwise sections.

4.12 Skip ahead to Section 4.18.

4.13 Armored Cable: Armored cable has an inner jacket over the core of the cable and has only one ripcord below the armor layer. Cut a small starting slit adjacent to the ripcord. Grip the ripcord with needle nose pliers and pull it through the armor, approximately 180° away from the armor overlap, to the first measured mark (Figure 10). Do not pull the ripcord through the armor overlap as this may cut the ripcord. Remove the outer jacket from the cable core. The inner jacket will protect the buffer tubes as the armor is removed from the cable core. After removing the outer jacket, the inner cable sheath will be exposed.

Figure 10 – Pull the ripcord through the armor and outer jacket.

4.14 Ring cut the inner sheath adjacent to the first measured mark (Figure 11). Gently flex the cable in a circular motion until the polyethylene sheath separates.

Figure 11 - Ring cut the inner sheath.

4.15 Make a second ring cut about 5 inches from the cable end. Gently flex the cable in a circular motion until the polyethylene sheath separates. Pull the 5-inch section of inner jacket off end of the cable to expose the cable core.

4.16 Locate and pull the inner ripcord to the first measured mark (Figure 12). A small starting slit and pliers can be used to help facilitate the pull.

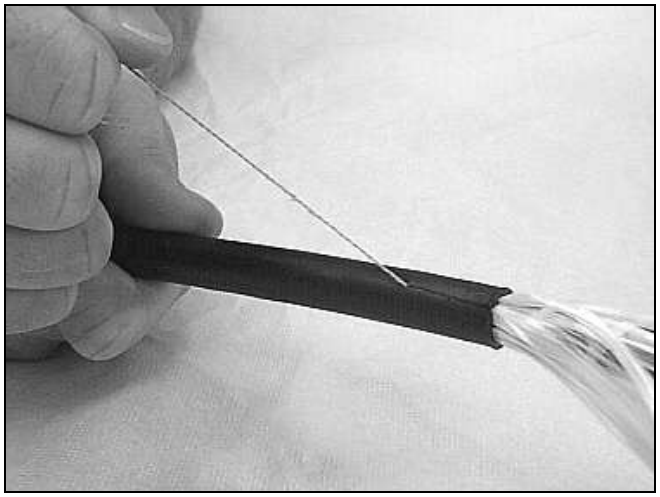

Figure 12 – Pull the ripcord through the inner jacket.

4.17 Remove the inner sheath to expose the core of the cable (Figure 13).

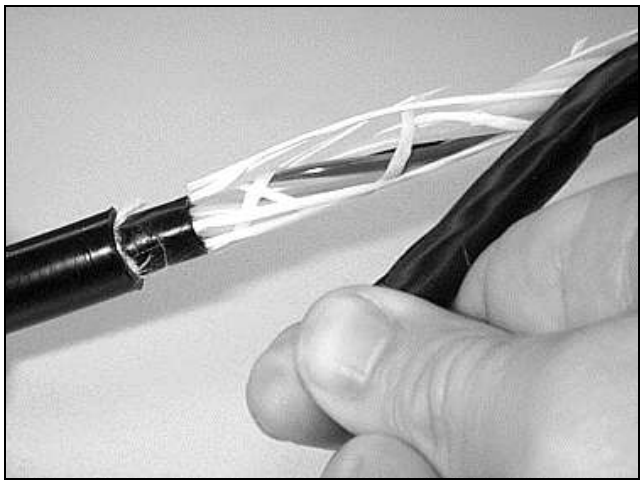

Figure 13 - Remove the inner sheath from the cable core.

4.18 Consult the splice closure instructions to determine the length of the dielectric strength elements that is required for strain relief. Cut and remove the dielectric strength elements as required (Figure 14).

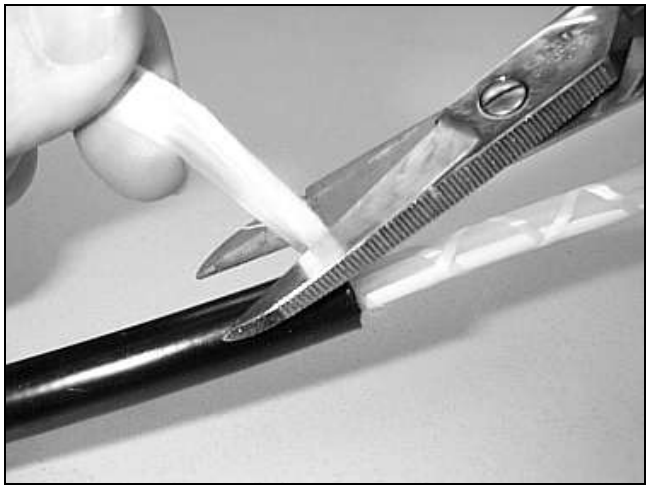

Figure 14 – Cut and remove the dielectric strength elements.

4.19 For grounding purposes, make a ring cut 1 inch beyond the end of the cable jacket. Be careful not to score the armor when making this ring cut.

4.20 Make a longitudinal cut and remove the 1-inch section of outer jacket as shown in Figure 15.

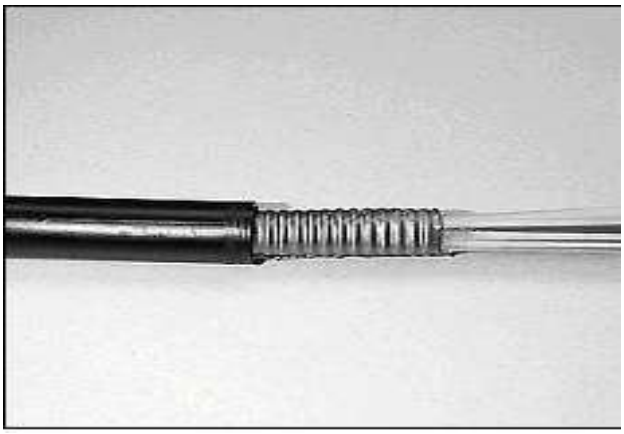

Figure 15 – Expose 1 inch of armor for grounding.

4.21 Cut and remove the binder thread from the cable core (Figure 16).

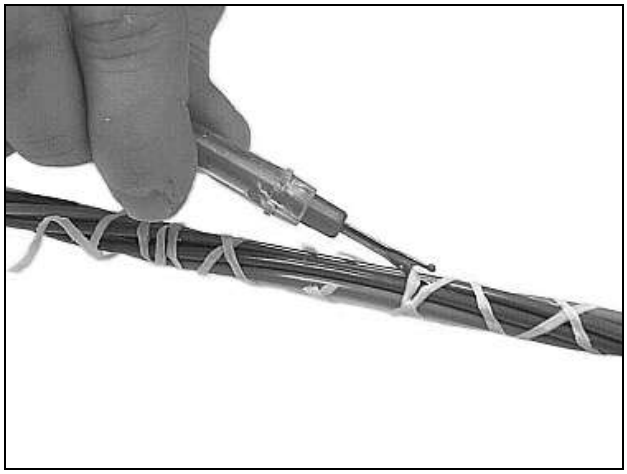

Figure 16 – Cut and remove the binder threads.

4.22 Carefully unwrap the buffer tubes to expose the central strength member (Figure 17).

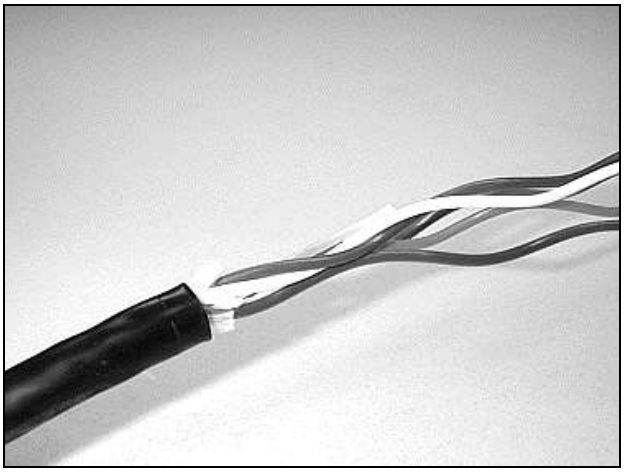

Figure 17 – Unwrap the buffer tubes.

4.23 Consult the splice closure instructions for the length of strength member that is needed to clamp the cable in the closure. Cut the central member to the required length. (Figure 18).

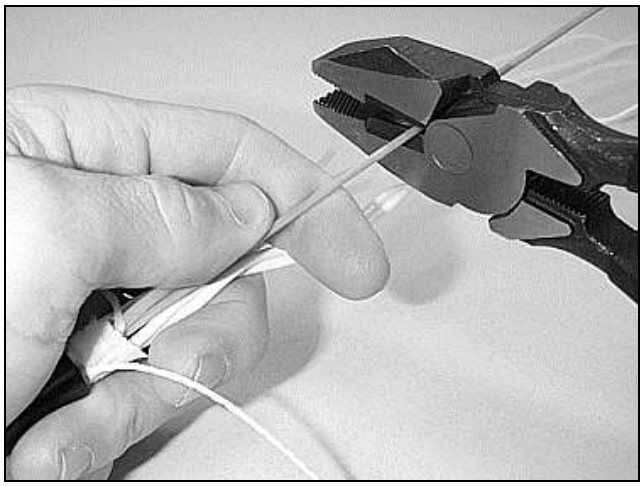

Figure 18 - Cut the central member as required.

4.24 The cable can now be fastened into the splice closure.

4.25 Consult the closure instructions to determine the required fiber and buffer tube lengths. Trim the buffer tubes to the required length.

4.26 Use a buffer tube removal tool to expose the optical fibers. Ring cut the buffer tube at the required length (Figure 19), then bend and snap the tube at the ring cut to separate it. Remove the buffer tube from the fibers. If a long length of fiber must be exposed, it is recommended that the buffer tube be removed in approximately 16-inch lengths.

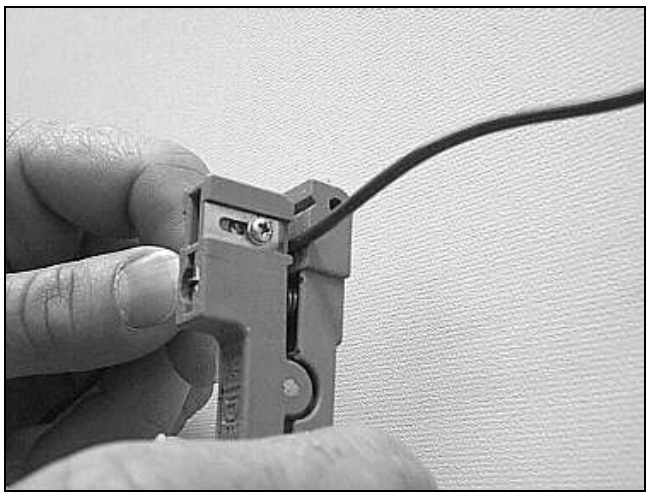

Figure 19 – Score the buffer tube with a buffer tube removal tool.

4.27 Clean the exposed fibers with a lint free wipe (Figure 20) and fasten the tube(s) to their corresponding splice organizing tray.

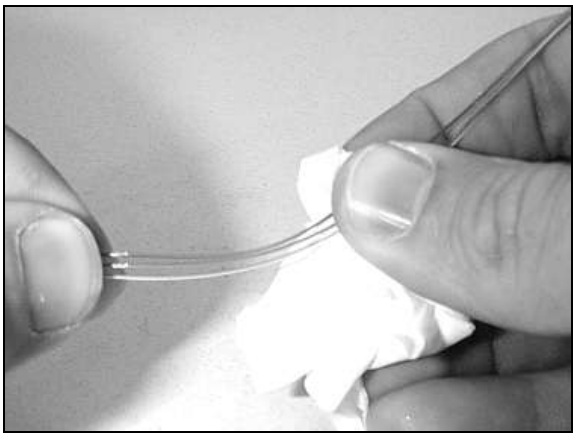

Figure 20 - Clean the optical fibers.

4.28 The fibers are now ready for splicing.

5. Sheath Removal for *AccuTube* Cables

5.1 *AccuTube* cables are manufactured using 12-fiber ribbons rather than single fibers. These cables contain either 6.0 mm or 7.2 mm diameter buffer tubes and are available in fiber counts of 288 up to 864.

5.2 The sheath preparation procedures for light armored and armored *AccuTube* cables are the same as those described in Section 4 except for ribbon access which is described below.

5.3 An OFS Quick Split RT tool is required to access the fiber ribbons in the buffer tubes. The Quick Split RT tool is used to both ring cut and slit 6.0 mm and 7.2 mm buffer tubes. Refer to OFS IP-31A, *Use and Care of the OFS Quick Split RT Tool*, for further details regarding the tool.

5.4 Using the appropriate grooves on the tool, ring cut the tubes and remove them from the ribbons.

5.5 Clean and dry the ribbons using the methods described in OFS IP-041, *AccuRibbon® Cleaning Procedure*.

6. Mid-Span Access for Light Armored and Armored Cables

6.1 Consult the closure instructions to determine the length of cable jacket that must be removed for mid-span access. Use electrical tape to make two marks 10 inches apart in the center of the cable section that will be opened for mid-span access (Figure 21).

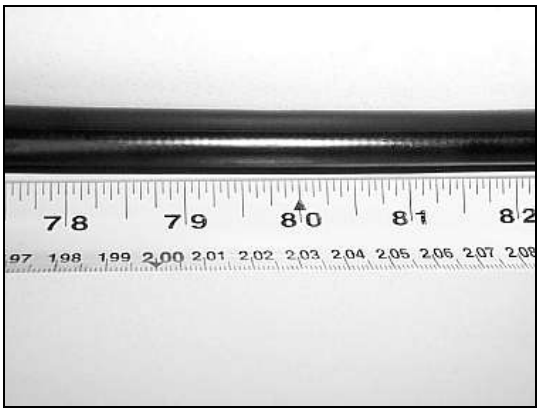

Figure 21 – Measure and mark the cable jacket.

6.2 Use a cable sheath knife to ring cut the cable and score the steel armor at both of the measured marks (Figure 22).

Figure 22 – Ring cut the cable jacket.

6.3 Using a circular motion, gently flex the cable at the score marks being careful not to violate the minimum bend radius of the cable. The polyethylene sheath and steel armor will separate at the score marks (Figure 23).

Figure 23 – Flex the cable at the score marks to separate the sheath.

6.4 Make a third ring cut approximately 1/2 inch from the first ring cut. Do not score the armor or flex the cable.

6.5 Use a sheath knife to make a longitudinal cut through the outer sheath to the underlying armor between the two closely spaced ring cuts (Figure 24).

NOTE: *A Round Cable Slitting Tool can be use to make the longitudinal cut as well as the ring cuts. The blade depth can also be adjusted to lessen the possibility of fiber damage. This is especially important for mid-span access on "live" working systems. Contact OFS for more information.*

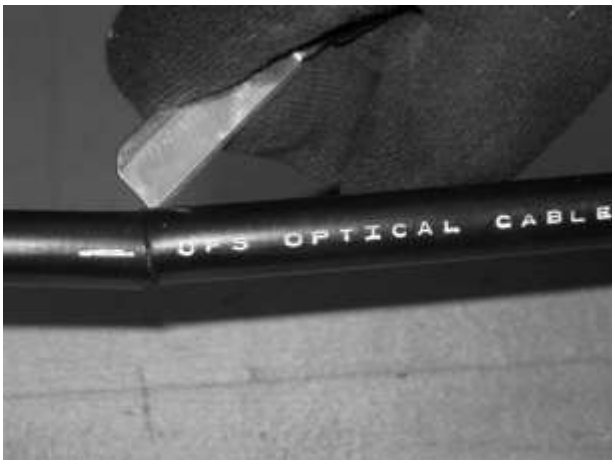

Figure 24 - Make a longitudinal cut between the two closely spaced ring marks.

6.6 Remove the 1/2-inch section of outer jacket to expose the armor (Figure 25).

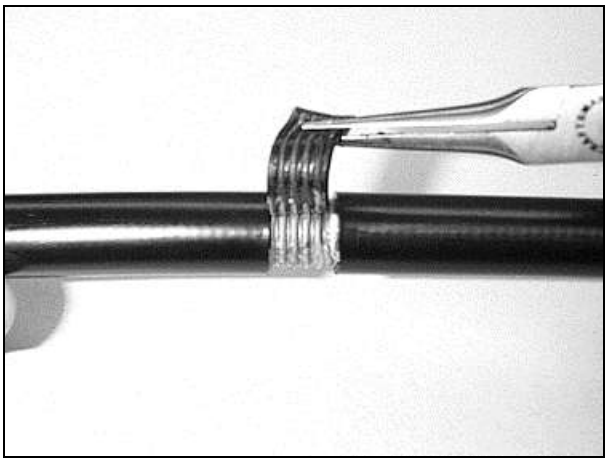

Figure 25 – Remove the ½-inch section of outer jacket.

6.7 Locate the overlap in the steel armor. Make two longitudinal cuts approximately ¼ inch on each side of the overlap (Figure 26). The longitudinal cuts should span the 10-inch section of cable between the ring cuts.

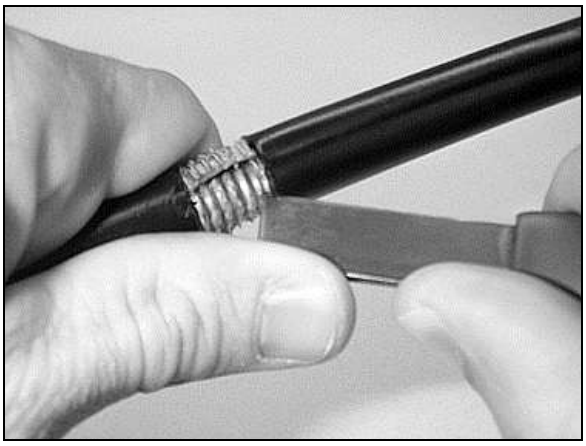

Figure 26 - Make two longitudinal cuts between the ring marks.

6.8 Use a pair of pliers to remove the strip of outer sheath and expose the armor overlap (Figure 27).

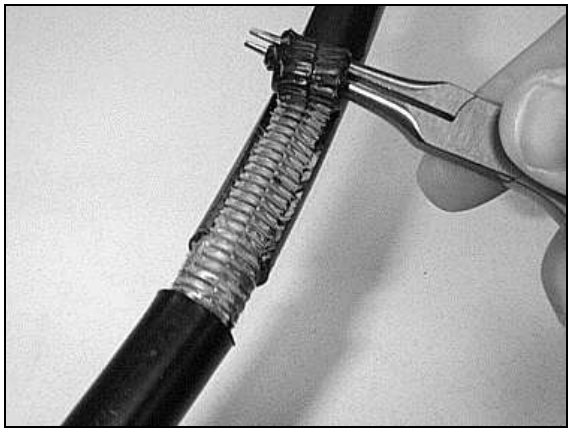

Figure 27 – Expose the armor overlap.

6.9 Use a sheath knife to lift the armor overlap to ease the removal of the armor and outer sheath (Figure 28).

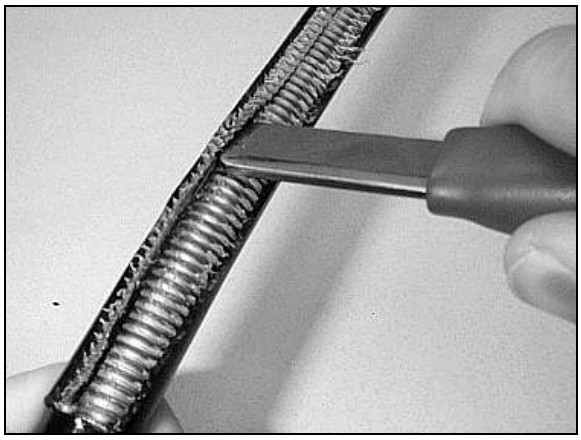

Figure 28 - Lift the armor at the overlap point.

6.10 Carefully remove the 10-inch section of outer sheath and armor from the cable core (Figure 29). Be careful not to scratch or nick the buffer tubes on the edge of the armor. Cut the ripcords at the mid-point. (Note: An inner polyethylene jacket will be exposed on armored cables.)

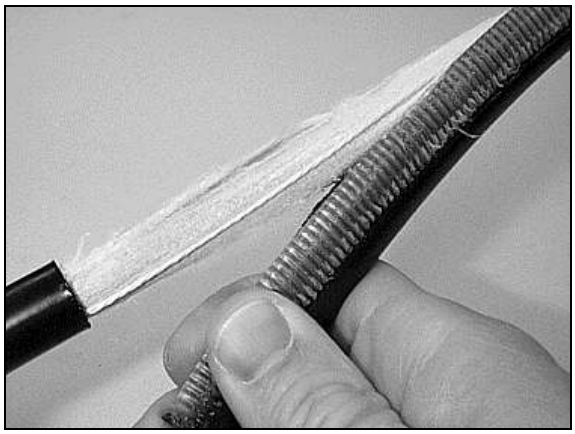

Figure 29 – Carefully remove the outer sheath and armor.

6.11 Light Armored Cables: Skip to Section 6.15.

6.12 Armored Cables: Ring cut the inner jacket at each end of the 10" sheath opening (Figure 30).

Figure 30 - Ring cut the inner sheath.

6.13 Use a circular motion and gently flex the cable at both ring cuts. Be careful not to violate the minimum bend radius of the cable. The polyethylene sheath will separate at this point.

6.14 Use a sheath knife to make a longitudinal cut through the inner jacket between the two ring cuts. Remove the inner jacket (Figure 31).

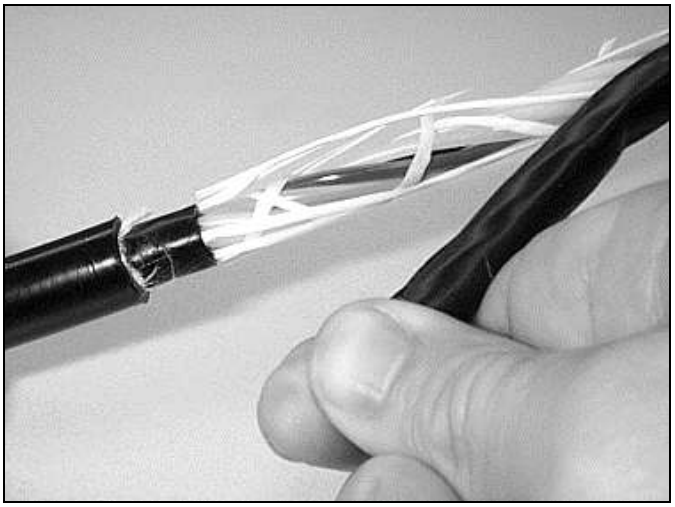

Figure 31 - Remove the inner jacket.

6.15 Cut the ripcord in the middle of the sheath opening (Figure 32). Cut and remove the aramid strength members and water blocking threads.

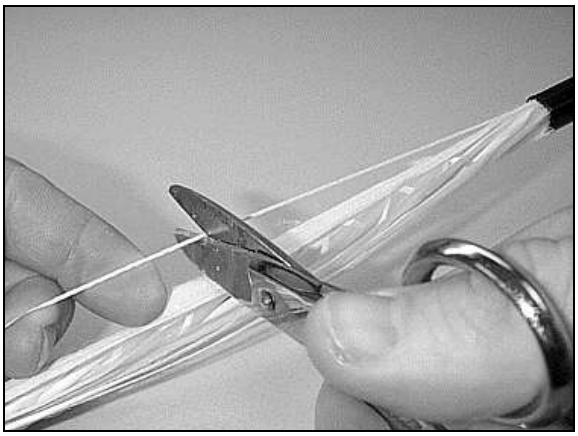

Figure 32 – Cut the ripcord at the midpoint.

6.16 Locate the reversal point of the buffer tubes (Figure 33). The reversal point is the location where the twist of the buffer tubes changes direction. If the reversal point cannot be seen, use the ripcords to expose an additional 12-inch length of the cable core. Repeat this process on alternating sides of the jacket opening until the reversal point is located.

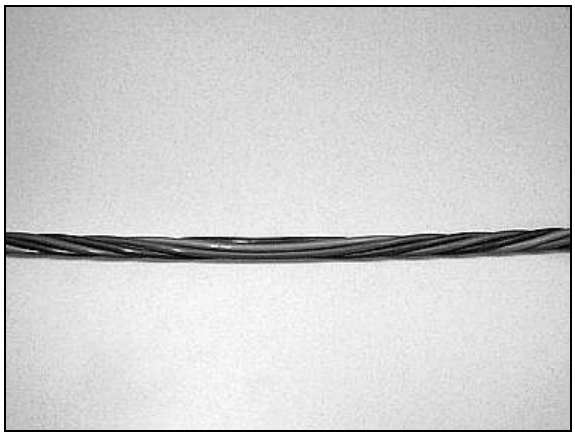

Figure 33 – Locate the buffer tube reversal point.

6.17 Consult the splice closure instructions to determine the length of cable jacket that must be removed. Using the buffer tube reversal point as the middle of the jacket opening, measure equal distances on each side of the reversal point and mark the cable with electrical tape (Figure 34).

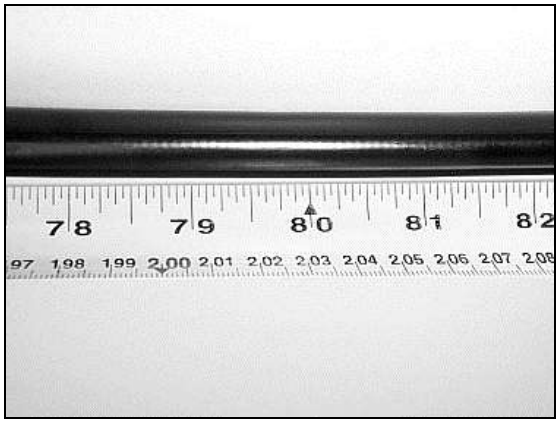

Figure 34 – Measure and mark the sheath opening.

6.18 Use a cable sheath knife to ring cut the outer sheath at both marks.

6.19 Armored Cable: Skip to Section 6.23

6.20 Light Armored Cable: Light armored cable has two ripcords below the armor layer. It is necessary to use both ripcords and remove the cable jacket in two lengthwise pieces. Failure to remove the cable jacket in two pieces may cause buffer tube damage if the cable core is pulled through a narrow slit in the jacket.

6.21 Cut a small starting slit adjacent to the first ripcord. Grip the ripcord with needle nose pliers and pull it through the jacket, approximately 90° away from the armor overlap, to the first measured mark. Do not pull the ripcord through the armor overlap as this may cut the ripcord. Repeat with the second ripcord pulling it through the jacket approximately 180° away from the first ripcord. Remove the two sections of outer jacket to expose the cable core (Figure 35). Repeat for the opposite side of the mid-span sheath opening.

6.22 Skip to Section 6.25.

Figure 35 – Use both ripcords to remove the outer jacket.

6.23 Armored Cable: Locate the ripcord below the armor layer. Pull the ripcord through the armor and outer jacket. Remove the armor and outer jacket to expose the inner sheath. Remove the armor and outer jacket in both directions.

6.24 Open a short window in the inner jacket and locate the ripcord. Pull the ripcord through the inner jacket. Remove the inner jacket to expose the cable core. Repeat in both directions (Figure 36).

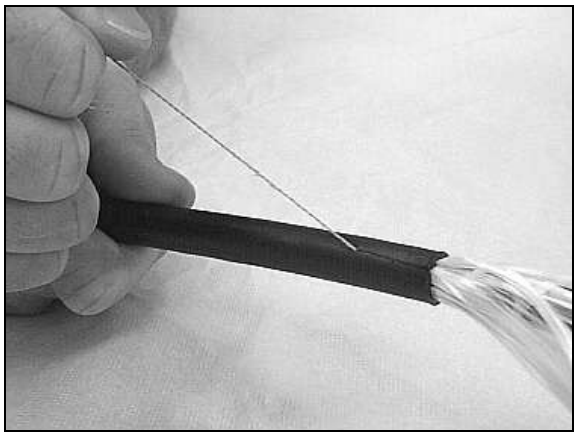

Figure 36 – Pull the ripcord through the inner jacket.

6.25 Consult the splice closure instructions to determine the length of dielectric strength elements required for strain relief. Cut and remove the dielectric strength elements as required. Cut the water blocking tape flush with the cable jacket (Figure 37).

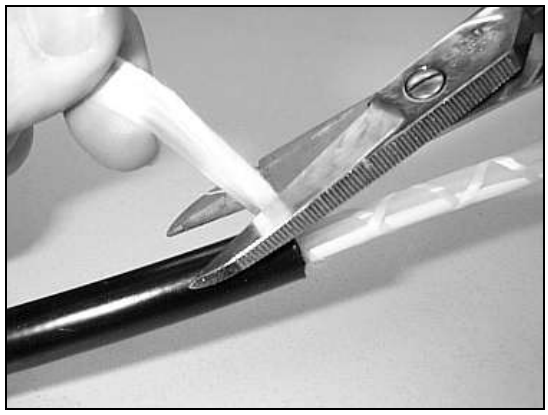

Figure 37 – Cut and remove the dielectric strength members and water blocking tape.

6.21 For grounding purposes, ring cut the cable jacket 1-inch beyond the sheath opening. Be careful not to score the armor when making this ring cut.

6.22 Make a longitudinal cut and remove the 1-inch section of outer jacket (Figure 38). Repeat on the opposite side of the sheath opening.

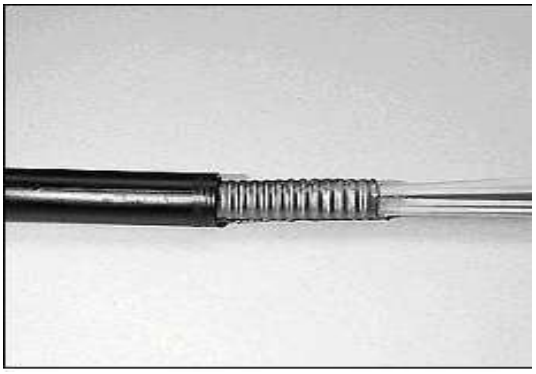

Figure 38 – Expose a 1-inch section of armor for grounding.

6.23 Cut and remove the binder threads from the cable core (Figure 39).

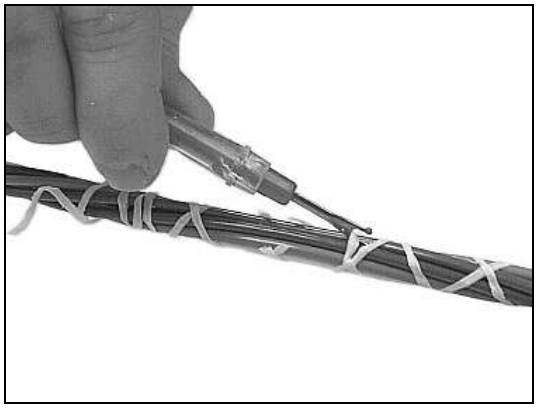

Figure 39 – Cut and remove the binder threads.

6.24 Carefully unwind the buffer tubes from one another (Figure 40).

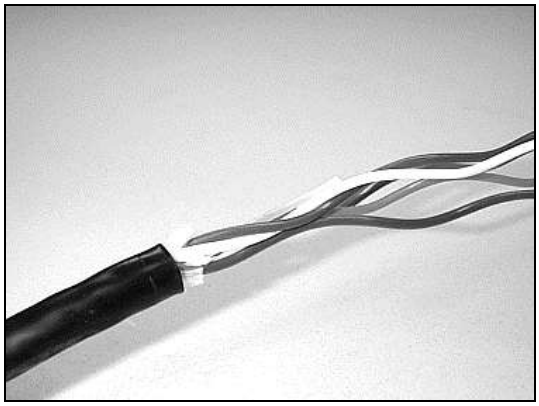

Figure 40 – Unwind the buffer tubes.

6.25 Consult the splice closure instructions for the length of strength member required for strain relief. Trim the central member as required at both ends of the sheath opening (Figure 41).

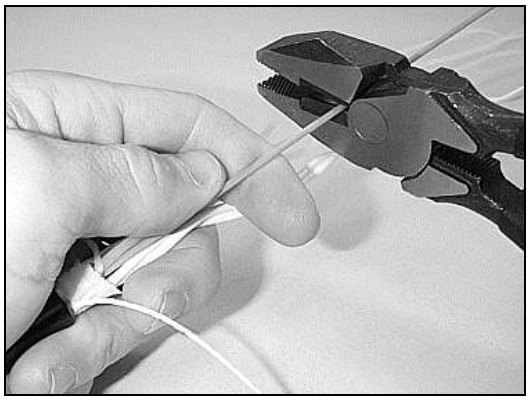

Figure 41 - Cut the central strength member to the required length.

6.26 The cable can now be fastened into the splice closure.

6.27 If all fibers in a tube are to be spliced, the tube and fibers can be cut at the appropriate location. Consult the closure instructions to determine the required fiber and tube lengths. Use a buffer tube cutting tool to ring cut the tube and remove the tube from the fibers (Figure 42). When removing a long length of tube it is recommended to remove the tube in approximately 16-inch sections.

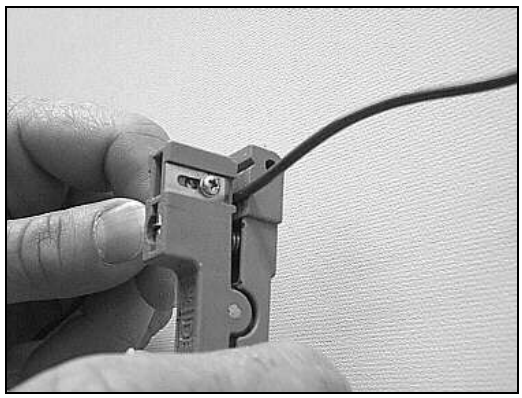

Figure 42 – Ring cut the buffer tube.

6.29 Clean the exposed fibers with a lint free wipe (Figure 43) and fasten the tube(s) to the splice organizing tray(s).

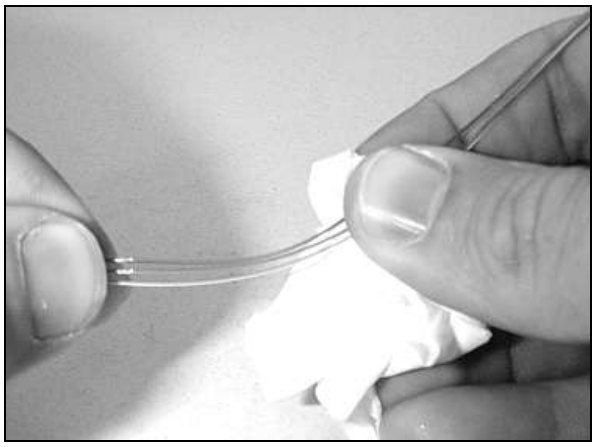

Figure 43 - Clean the optical fibers.

6.30 The fibers are now ready for splicing.

6.31 If select fibers from a buffer tube will be spliced to a branch cable, and the remaining fibers in the same tube will be expressed through the closure, an OFS Quick Split Tool is required to open the tube and access the fibers (Figure 44). The Quick Split tool is used with 2.5- or 3.0-mm OD buffer tubes. Refer to OFS IP-31, *Use and Care of the OFS Quick Split Tool*, for a description of the tool.

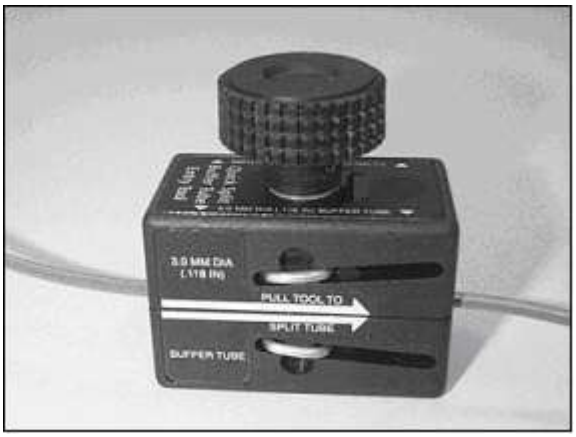

Figure 44 – 2.5/3.0 mm OFS Quick Split Tool

7. Mid-Span Access of Dual-Layer Cables

7.1 Figure 45 shows a dual layer cable after the outer jacket, armor layer, aramid strength members, and binder threads have been removed to expose the outer layer of buffer tubes. This step corresponds to the completion of Section 6.23 described above. For a dual layer cable, the distance between the reverse-oscillating-lay (ROL) locations in the outer layer is typically about 45". Therefore, about 96" of cable jacket should be removed to expose three ROL locations as shown in Figure 45.

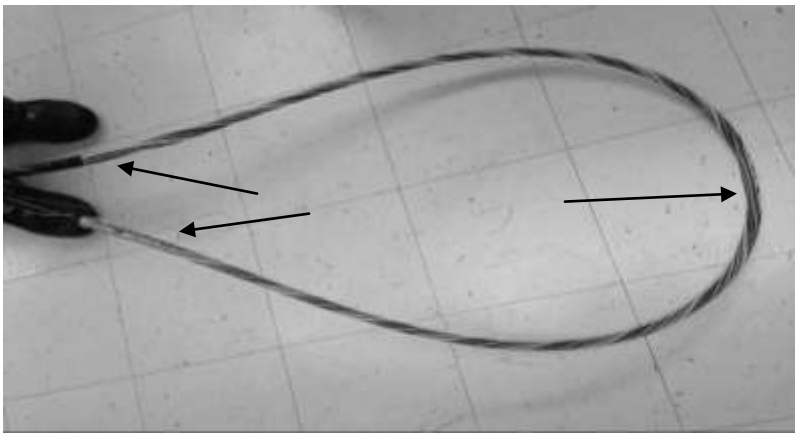

Figure 45 – Remove about 96" of cable jacket to expose three ROL locations indicated by the arrows.

7.2 Begin removal of the outer buffer tube layer at the middle ROL location. Wrap a small piece of vinyl tape around the outer buffer tubes before they are completely unwound (Figure 46). This will help maintain the tubes in a bundle while they are unwound and reduce clutter in the splice closure. Continue to unwind the outer buffer tube layer until it is completely separated from the inner layer as shown in Figure 47. Note that the outer layer of buffer tubes has retained a stranded shape.

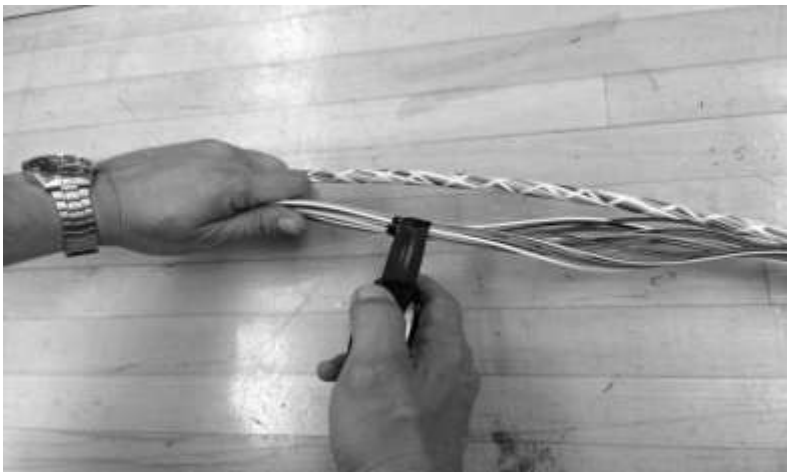

Figure 46 – Wrap a piece of vinyl tape around the outer buffer tubes to keep them in a bundle.

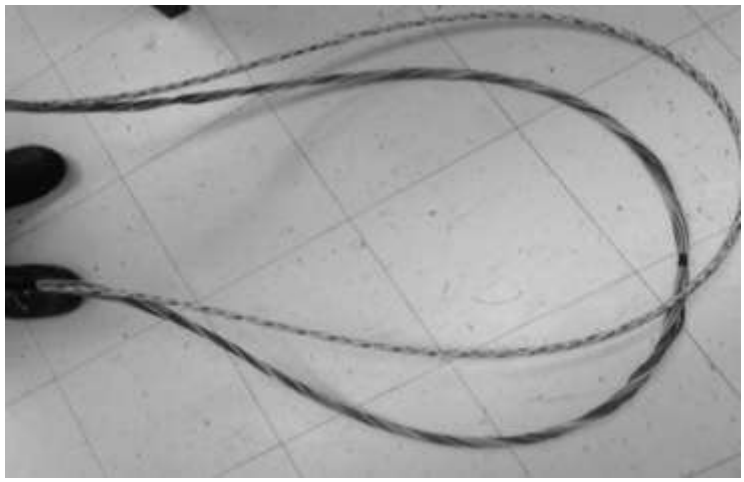

Figure 47 – Unwind the outer tube buffer layer from the inner layer.

7.3 Remove the binder threads from the inner layer and unwind the buffer tube(s) that will be routed to the splice tray for splicing (Figure 48). The tube(s) should be unwound as far as possible towards the ends of the jacket opening (Figure 49). Due to the different locations of the ROLs in the inner and outer layers, it may not be possible to completely unwind the tube(s).

Figure 48 – Unwind the buffer tube(s) that will be routed to the splice tray.

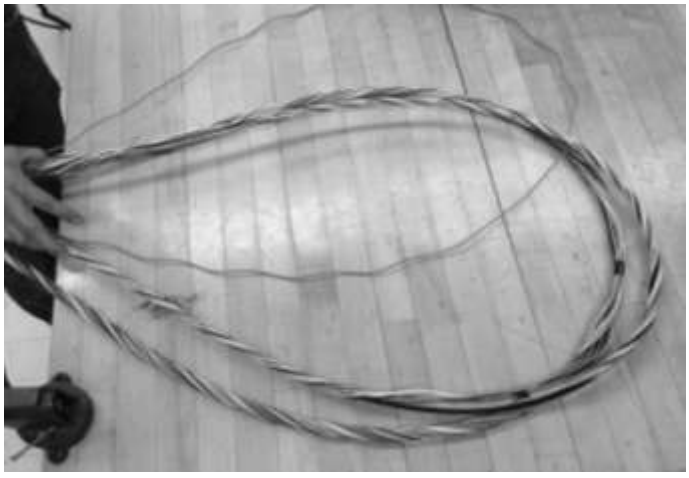

Figure 49 – Unwind the buffer tube(s) as far as possible as towards the end of the jacket opening.

7.4 Begin unwinding the remaining buffer tubes to expose the central strength member. Wrap a length of vinyl tape around the tubes at the centermost ROL location (Figure 50). Continue unwinding the buffer tubes as far as possible as allowed by the location of the ROLs (Figure 51).

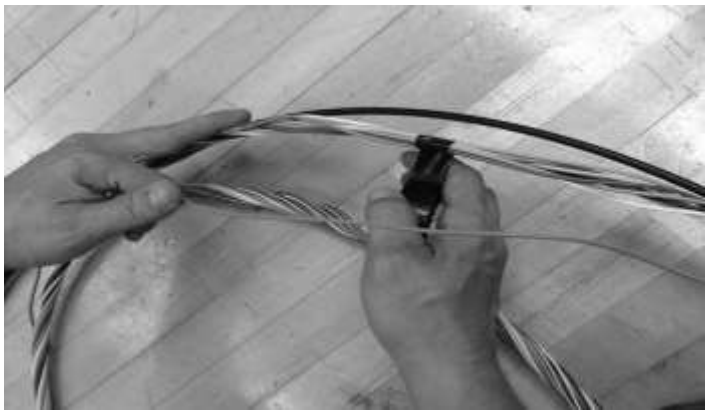

Figure 50 – Wrap a length of vinyl tape around the tubes at the ROL location.

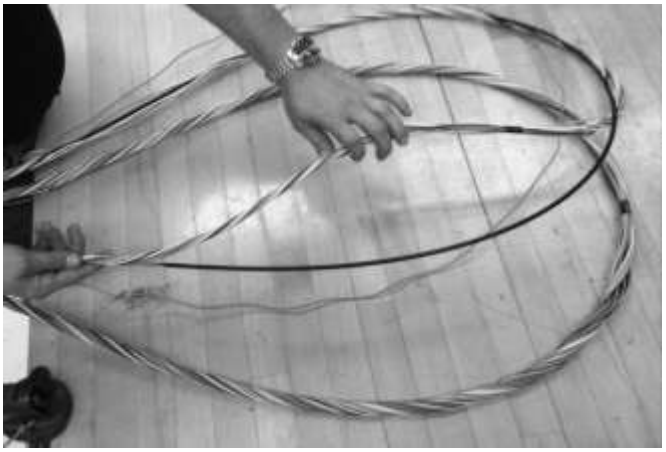

Figure 51 – Unwind the inner layer of buffer tubes to expose the central strength member.

7.5 After exposing the central strength member, cut it to length as required to clamp the cable in the closure. Refer to the closure instructions to determine the recommended length. The strength member can be cut in multiple steps to simplify unwinding the inner layer of buffer tubes (Figure 52 and 53).

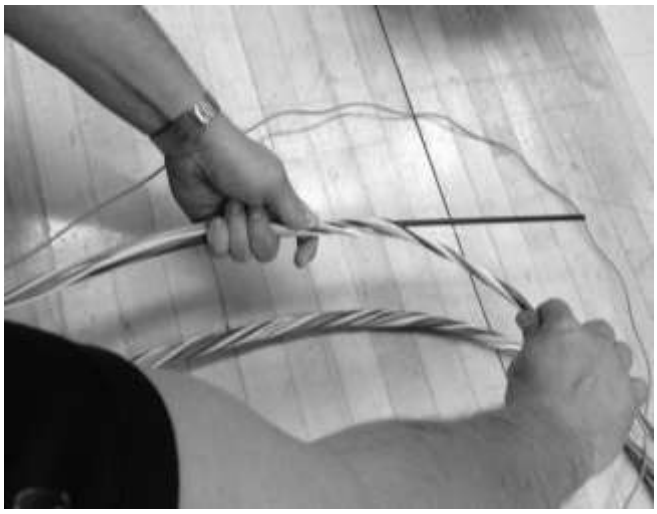

Figure 52 – Cut the central strength member in multiple steps while unwinding the buffer tubes.

Figure 53 – Cut the central strength member to length as required for clamping in the closure.

7.6 Figure 54 shows the completed mid-span opening prior to installing the cable into the splice closure. The buffer tube intended for splicing can be routed through the storage basket and into to the splice tray. The remaining express tubes, i.e., the buffer tubes which will not be accessed for splicing, should be stored in the splice closure storage basket.

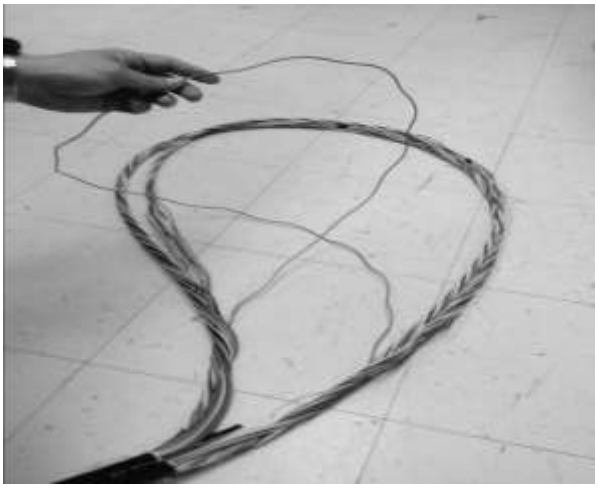

Figure 54 – Completed mid-span access of dual-layer cable.

7.7 Return to Section 6.31 for instructions regarding cutting and slitting the buffer tubes and accessing the optical fibers.

8. Mid-Span Sheath Removal for Light Armored and Armored *AccuTube* Cables

8.1 Light armored and armored *AccuTube* cables are manufactured using 12 fiber ribbons in the place of single fibers. The *AccuRibbon* fibers are contained in either 6.0 mm or 7.2 mm buffer tubes. *AccuTube* cables are available with fiber counts from 288 to 864.

8.2 The procedures for mid-span access of light armor and armored *AccuTube* cables are the same as those outlined in Section 6 for standard loose tube cables. Ribbon access is described below.

8.3 In order to access the ribbons within the buffer tubes, it is necessary to use the OFS Quick Split RT Tool. The Quick Split RT Tool is used to both ring cut and slit 6.0 mm and 7.2 mm OD buffer tubes.

8.4 Please refer to OFS IP-031A, *Use & Care of OFS Quick Split RT Tool*, for detailed instructions on the tool.

8.5 Use the appropriate grooves on the Quick Split RT tool to slit and ring cut the ribbon tubes. Remove the tubes from the ribbon fibers.

8.6 Clean and dry the ribbons using the guidelines outlined in OFS IP-041, *AccuRibbon® Cleaning Procedure.*

For additional information please contact your sales representative. You can also visit our website at www.ofsoptics.com or call 1-888-FIBER-HELP (1-888-342-3743) from inside the USA or 1-770-798-5555 from outside the USA.

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