



SUMITOMO RECOMMENDED PROCEDURE

SRP SP-F04-016

FutureFLEX®

TUBE CABLE SPLICE KIT INSTALLATION PROCEDURE

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1.0 General

1.1 This procedure describes the standard techniques for installing Tube Cable Splice Kits on FutureFLEX dielectric (non-metallic) tube cables.

1.2 Tube Cable Splice Kits provide a permanent, in-line tube cable splice with a waterproof protective barrier by collapsing a rubber shrink sleeve around the coupled tubes and tube cable jacket ends.

1.3 Once installed, a Tube Cable Splice Kit is not re-enterable compared to a TDU enclosure or Splice Case.

1.3.1 Before the tube cable splice is waterproofed / closed, the tube span must be Pressure and Obstruction tested in accordance with Sumitomo Recommended Procedures SRP SP-F04-003 and SRP SP-F04-004.

1.3.2 After the tube cable splice is waterproofed / closed, re-entry is only possible by cutting the rubber shrink sleeve from around the bare tubes. This action introduces the strong possibility of damaging the tubes.

1.4 Tube Cable Splice Kits are primarily used in outdoor applications wherever two (2) tube cables of the same tube count must be coupled / spliced together. Typical installation locations are inside Maintenance Holes, Vaults, Hand Holes, and so forth.

1.5 Tube Cable Splice Kits are not indoor fire-rated. However, they can be used in a Building Entrance Facility area (within the first 50' of building entry) to splice an outside plant tube cable to an indoor rated tube cable (with the same tube count) provided a re-enterable enclosure is not required by project specifications. Once installed, the Tube Cable Splice Kit will provide an effective protective barrier around the outdoor-to-indoor tube cable splice.

1.6 Tube cables joined with a Tube Cable Splice Kit should not be pulled. The Splice Kit does not provide any tensile strength to the splice point and severe tube damage could result.

2.0 Safety Precautions

2.1 The use of personnel safety equipment is strongly recommended while cutting and stripping tube cable ends. This includes the use of cut-resistant Kevlar gloves and eye wear.

3.0 Reference Documents

3.1 Sumitomo Recommended Procedure, *FutureFLEX Tube Pressure Testing Procedure*, SRP SP-F04-003.

3.2 Sumitomo Recommended Procedure, *FutureFLEX Tube Obstruction Testing Procedure*, SRP SP-F04-004.

3.3 Sumitomo Recommended Procedure, *FutureFLEX Tube Cable Installation Procedures*, SRP SP-F04-008.

3.4 Sumitomo Recommended Procedure, *FutureFLEX Tube Cable Splicing Procedures*, SRP SP-F04-031.

4.0 Equipment / Tools Required

The following equipment, tools, and materials are required to complete this procedure:

- 4.1. Tube Cable Splice Kit:
- DE00SPL for 2- and 4-tube cables
 - DE01SPL for 7-tube cables
 - DE02SPL for 19-tube cables

Note: *Splice Kits include Tube Couplings, water-blocking tape, mastic tape, and a rubber shrink sleeve. The rubber shrink sleeve is also known as a Cold Shrink Boot because no heating is required to shrink or collapse the sleeve around the splice point.*

4.2 Vinyl Electricians Tape

4.3 Felt Tip Pen / Marker

4.4 Tape Measure

4.5 Utility Knife with Hook Blade

4.6 Tube Cable Cutter (BETL01)

4.7 Tubing Cutter (BETC001)

5.0 Equipment Layout

5.1 See Fig. 1 for a typical Tube Cable Splice Kit layout and kit component details.

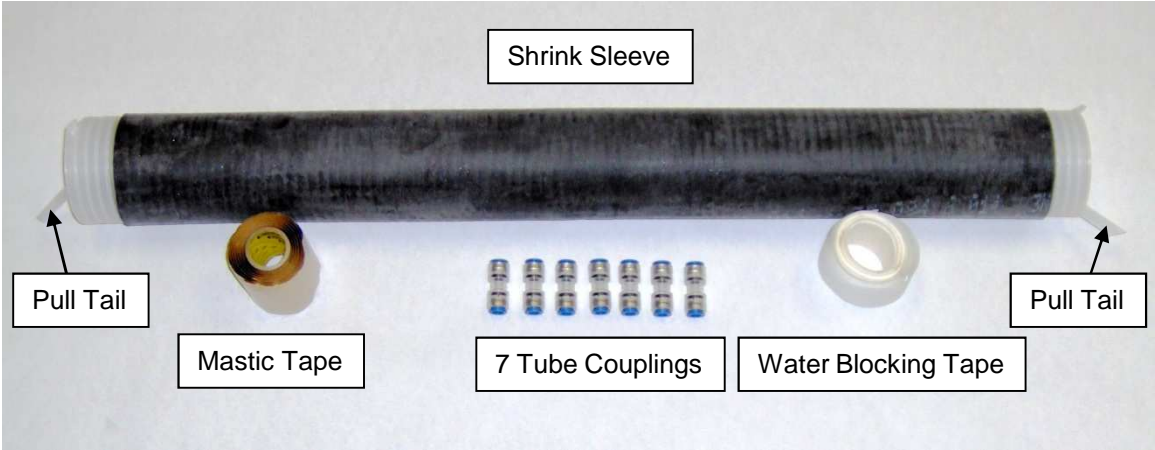


Figure 1
Tube Cable Splice Kit
(7-Tube Cable Kit shown)

DE00SPL Tube Cable Splice Kit

- For Dielectric 2- & 4-Tube Cables; TC02TRX, TC02TOX, TC02MSOS, TC04TRX, TC04TOD, & TC04MSOS only
- Shrink Sleeve 1-1/2" open dia. x 15-1/4" L
- (4) Tube Couplings (DE08MC2)
- Water Blocking Tape
- Mastic Tape

DE01SPL Tube Cable Splice Kit

- For Dielectric 7-Tube Cables; TC07TRX, TC07TOX, & TC07MSOS only
- Shrink Sleeve 3" open dia. x 26" L
- (7) Tube Couplings (DE08MC2)
- Water Blocking Tape
- Mastic Tape

DE02SPL Tube Cable Splice Kit

- For Dielectric 19-Tube Cables; TC19TRX, TC19TOX, & TC19MSOS only
- Shrink Sleeve 4" open dia. x 33" L
- (19) Tube Couplings (DE08MC2)
- Water Blocking Tape
- Mastic Tape

6.0 Preparing the Tube Cables

6.1 **Key Step.** Before installing a Tube Cable Splice Kit, verify that both tube cable ends will mate properly so that their tubes will not be crossed / twisted when coupled. See Sumitomo Recommended Procedure SRP SP-F04-008.

6.2 Determine final installed location of shrink sleeve. Shrink sleeves should be installed in a straight section of the tube cable route; not in a bend / curve.

6.3 Position both tube cables and shrink sleeve side-by-side and hold in place. Ensure tube cables overlap each other.

6.4 Mark both tube cable jackets to coincide with left and right ends of shrink sleeve. **See Fig. 2.**

6.5 Use Tube Cable Cutter (BETL01) and cut each tube cable to length at its First Mark.

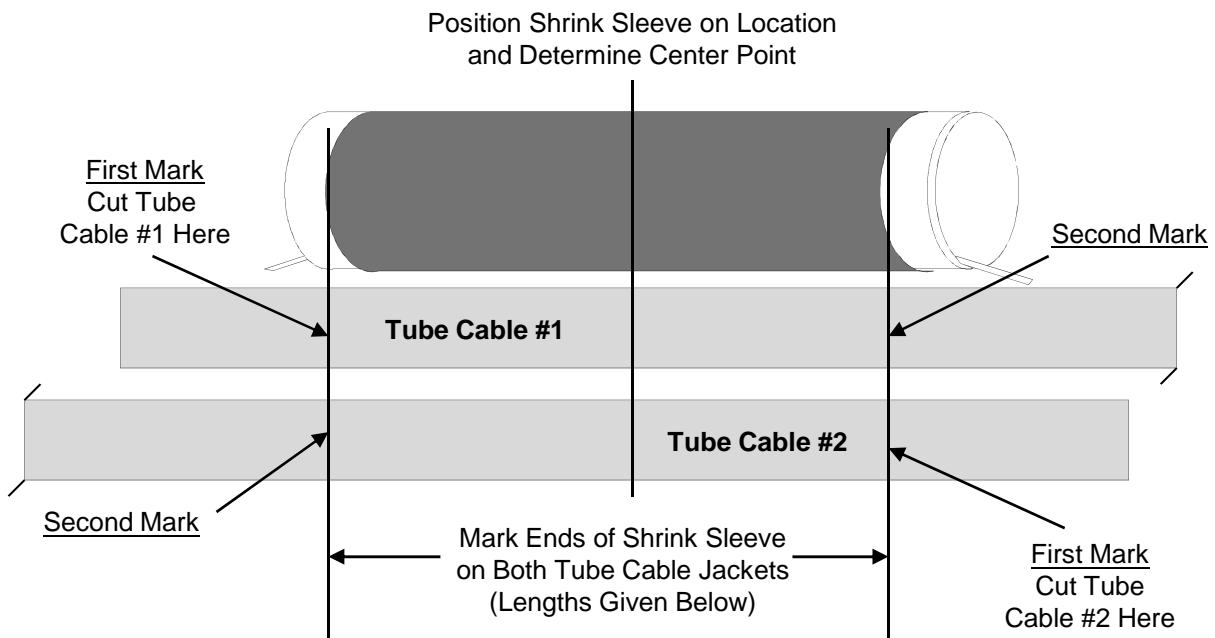


Figure 2
Preparing Tube Cables

Notes:

Approximate Shrink Sleeve Dimensions are:

- For 2- & 4-Tube Cables = 1-1/2" D x 15-1/4" L
- For 7-Tube Cables = 3" D x 26" L
- For 19-Tube Cables = 4" D x 33" L

6.6 To achieve an effective watertight seal, shrink sleeves must overlap tube cable jacket ends.

6.6.1 For 2- & 4-tube cables, measure at least 2" forward from Second Mark and make a Third Mark on each tube cable jacket. **See Fig. 3.**

6.6.2 For 7-tube cables, measure at least 6" forward from Second Mark and make a Third Mark on each tube cable jacket. **Refer to Fig. 3.**

6.6.3 For 19-tube cables, measure at least 5" forward from Second Mark and make a Third Mark on each tube cable jacket. **Refer to Fig. 3.**

6.7 Use Hook Blade Knife to lightly score each tube cable jacket at its Third Mark. Pull ripcord and strip jackets away to expose individual tubes.

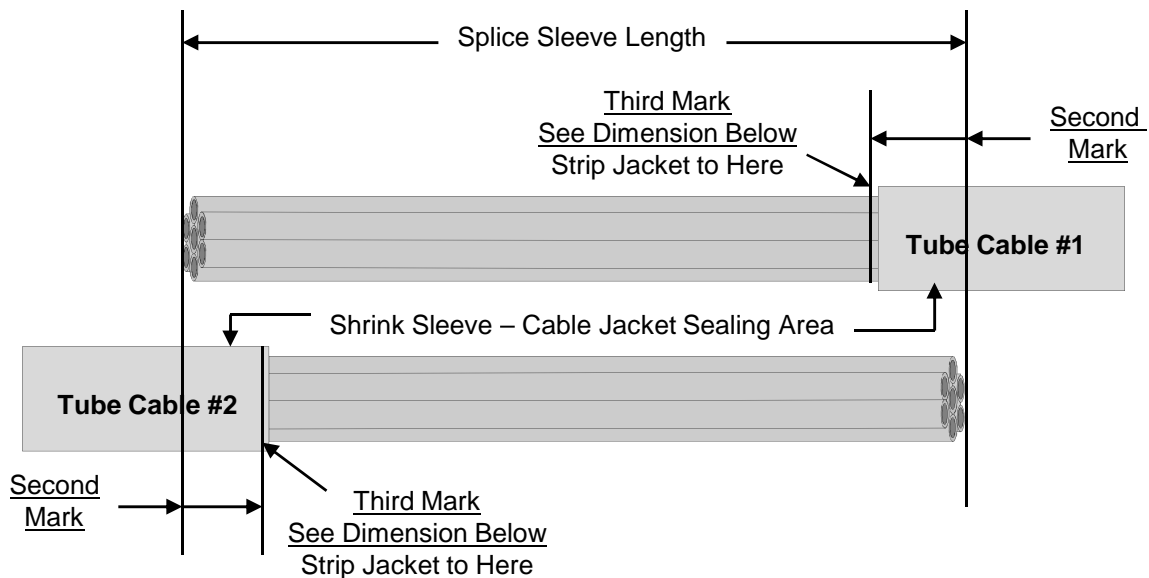


Figure 3
Stripping Tube Cables to Proper Length

Notes:

Approximate Second-to-Third Mark Dimensions are:

- For 2- & 4-Tube Cables = 2" Each End Approx.
- For 7-Tube Cables = 6" Each End Approx.
- For 19-Tube Cables = 5" Each End Approx.

7.0 Cutting the Tubes

7.1 **Key Step.** When installed, shrink sleeves collapse very tightly over the coupled splices. If the Tube Coupling pattern is not accomplished per this procedure, Tube Couplings may be compressed into adjacent bare tubes and damage them. A unique Tube Coupling stagger-arrangement is required.

Note: The below procedure assumes a 7-tube cable is being prepared.

7.2 On first tube cable, locate Tube #1. Measure 4" in from stripped end of tube cable jacket and mark Tube #1. Use Tubing Cutter (BETC001) to cut Tube #1 at this mark. **See Fig. 4.**

7.3 Locate Tube #2. Measure 1-1/8" from the previous cut tube (Tube #1) and mark Tube #2. Use Tubing Cutter (BETC001) to cut Tube #2 at this mark. **Refer to Fig. 4.**

7.4 Repeat above step for remaining Tubes #3 through #7.

7.5 **Important Step.** The tubes of the first tube cable must be cut as described in **ascending numerical sequence** in order to correctly stagger individual Tube Couplings.

7.6 On second tube cable, locate Tube #7. Measure 4" in from stripped end of tube cable jacket and mark Tube #7. Use Tubing Cutter (BETC001) to cut Tube #7 at this mark. **Refer to Fig. 4.**

7.7 Locate Tube #6. Measure 1-1/8" from the previous cut tube (Tube #7) and mark Tube #6. Use Tubing Cutter (BETC001) to cut Tube #6 at this mark. **Refer to Fig. 4.**

7.8 Repeat above step for remaining Tubes #5 through #1.

7.9 **Important Step.** The tubes of the second tube cable must be cut as described in **descending numerical sequence** in order to correctly stagger individual Tube Couplings.

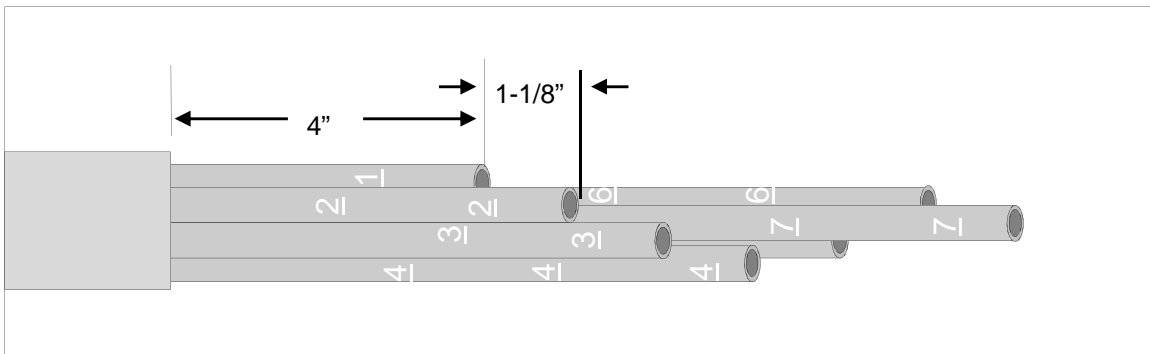


Figure 4

Correct Technique for Cutting Tubes

First Tube Cable = Cut Tubes in Ascending Order from Tube #1 to Tube #7

Second Tube Cable = Cut Tubes in Descending Order from Tube #7 to Tube #1

Note: For a 19-tube cable splice, cut tubes of first tube cable starting with Tube #1 and, in ascending numerical sequence, end with Tube #19. Cut tubes of second tube cable starting with Tube #19 and, in descending numerical sequence, end with Tube #1.

Tip: Make a "Measuring Aid" to help measure the 1-1/8" dimension. Wrap tape around the end of a scrap piece of tubing and trim to 1-1/8" length to create an easy to use and accurate measuring aid. **See Fig. 5.**

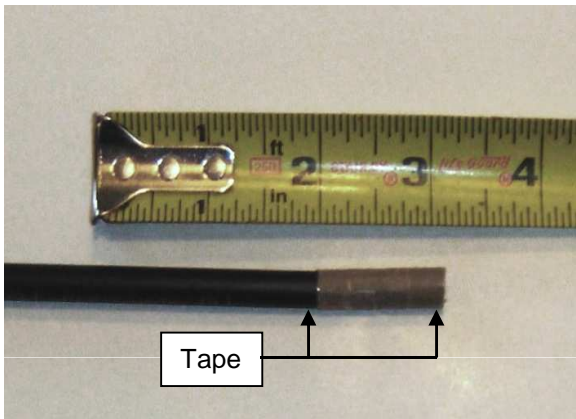


Figure 5
 "Measuring Aid"

8.0 Installing the Tube Couplings

8.1 Slide shrink sleeve over one tube cable end and past exposed tubes. Be sure that one pull tail of the sleeve's plastic core inner wrapping is exposed at each end of the sleeve. **See Fig. 6.**

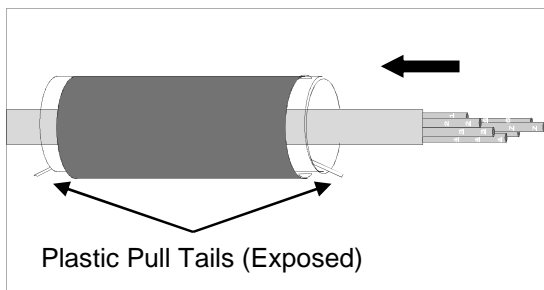


Figure 6
 Shrink Sleeve Installed Over Tube Cable
 (Before Tube Cables are Coupled)

Note: Shrink sleeves for 7- and 19-tube cables have two (2) pull tails. Shrink sleeve for 2- & 4-tube cables has only one (1) pull tail.

8.2 Choose either tube cable and install a Tube Coupling on each tube. Be sure each tube is pushed all the way into its coupling and fully and firmly seated. **See Fig. 7.**

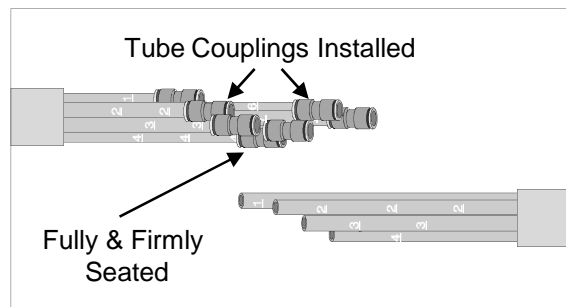


Figure 7
 All Tube Couplings Installed
 on One Tube Cable

8.3 Connect tube cable ends together by first coupling tube with highest number to its mate. Then continue coupling tubes in descending numerical sequence. Be sure each tube is pushed all the way into its coupling and fully and firmly seated. **See Fig. 8.**

8.4 Tube Coupling stagger arrangement places plastic shoulder of one Tube Coupling against the plastic shoulder of an adjacent Tube Coupling. This arrangement is necessary to prevent a Tube Coupling from being pressed into and possibly compressing / kinking an adjacent bare tube when shrink sleeve is collapsed.

8.5 **Important Step.** Once all the tubes are coupled together, each tube in the span must be tested before shrink sleeve is collapsed. While the Tube Couplings are still exposed and accessible, perform Pressure Test and Obstruction Test Procedures per Sumitomo Recommended Procedures SRP SP-F04-003 and SRP SP-F04-004.

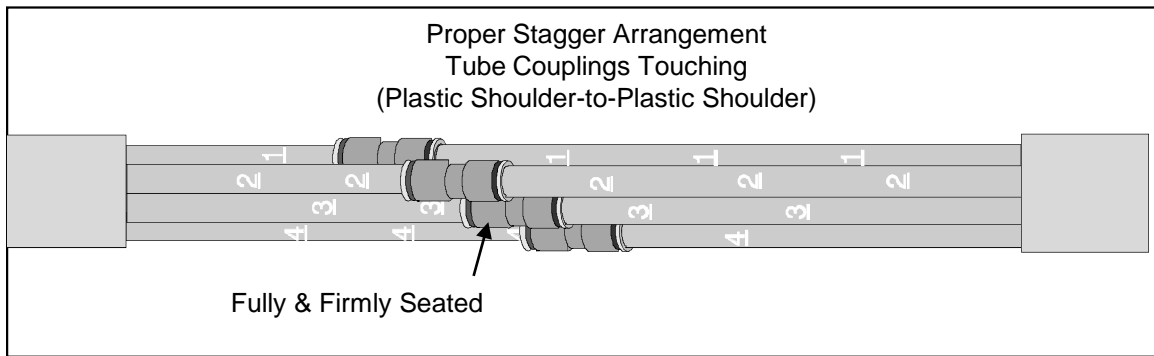


Figure 8
 All Tubes Coupled in Proper Stagger Arrangement

9.0 Sealing the Splice

9.1 After tube testing is complete and any problems corrected, the exposed splice must be waterproofed before the shrink sleeve is collapsed.

9.2 Use water blocking tape provided in Tube Cable Splice Kit and apply a helically-wrapped layer over tube splice area. Start and end water blocking tape wrap just inside jacket ends. Overlap adjoining wraps by 30-50 percent. **See Fig. 9.**

9.3 Use Vinyl Electricians Tape (Installer provided) and apply a helically-wrapped layer over the water-blocking tape. This secures both

ends of the water blocking tape to the cable and keeps it from tearing when the shrink sleeve is collapsed. Overlap adjoining wraps by 30-50 percent. **Refer to Fig. 9.**

9.4 Clean and dry any foreign material from both tube cable jacket ends. Clean all areas where the shrink sleeve will come in contact with the jacket.

9.5 Use mastic tape provided in Tube Cable Splice Kit to wrap two (2) layers around each tube cable jacket end. Apply mastic tape about 1/4" in from end of jacket. Be sure to apply mastic tape with its adhesive side directly on the cable jacket and wrap it tightly to avoid air voids. **Refer to Fig. 9.**

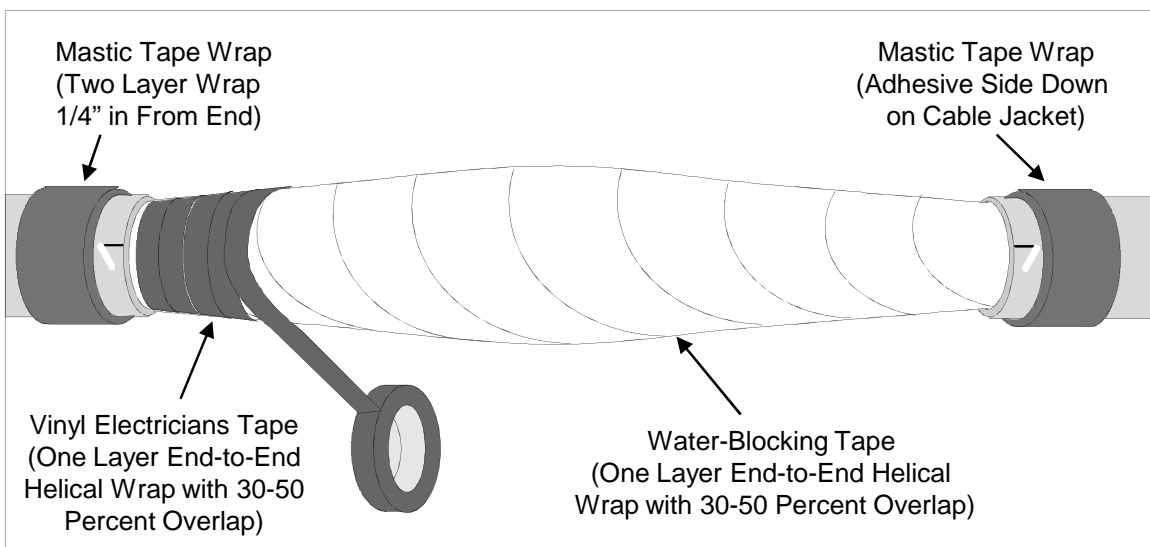


Figure 9
 Waterproofing the Splice

10.0 Collapsing the Shrink Sleeve

Note: Shrink Sleeves for 7- and 19-tube cables have two (2) pull tails. They must be pulled one at a time (not together). Shrink sleeve will collapse from the center outward, one half or side at a time.

10.1 Center shrink sleeve over coupled splice area. Confirm that one pull tail of the sleeve's plastic core inner wrapping is accessible at each end of the sleeve. **See Fig. 10.**

10.2 Hold shrink sleeve in place and grasp one pull tail. Gently pull and sleeve will begin collapsing onto center of splice area. Unwind pull tail as progress is made.

10.2.1 **Key Step.** As shrink sleeve starts to collapse, it must be pulled to guide the collapsing rubber from the splice center outward.

10.2.2 If sleeve is not pulled, the collapsing rubber will tend to build layers on top of itself instead of collapsing along the splice.

10.3 Repeat process with other pull tail for other half of shrink sleeve.

Note: Shrink sleeve for 2- & 4-tube cables only has one (1) pull tail. When pulled, sleeve collapses from one end only.

10.4 Center shrink sleeve over coupled splice area. Confirm that pull tail of the sleeve's plastic core inner wrapping is accessible.

10.5 Hold shrink sleeve in place and grasp pull tail. Gently pull and sleeve will begin collapsing onto end of splice area. Unwind pull tail as progress is made.

10.5.1 **Key Step.** As shrink sleeve starts to collapse, it must be pulled to guide the collapsing rubber.

10.5.2 If sleeve is not pulled, the collapsing rubber will tend to build layers on top of itself instead of collapsing along the splice.

10.6 This completes the basic Tube Cable Splice Kit installation procedure.

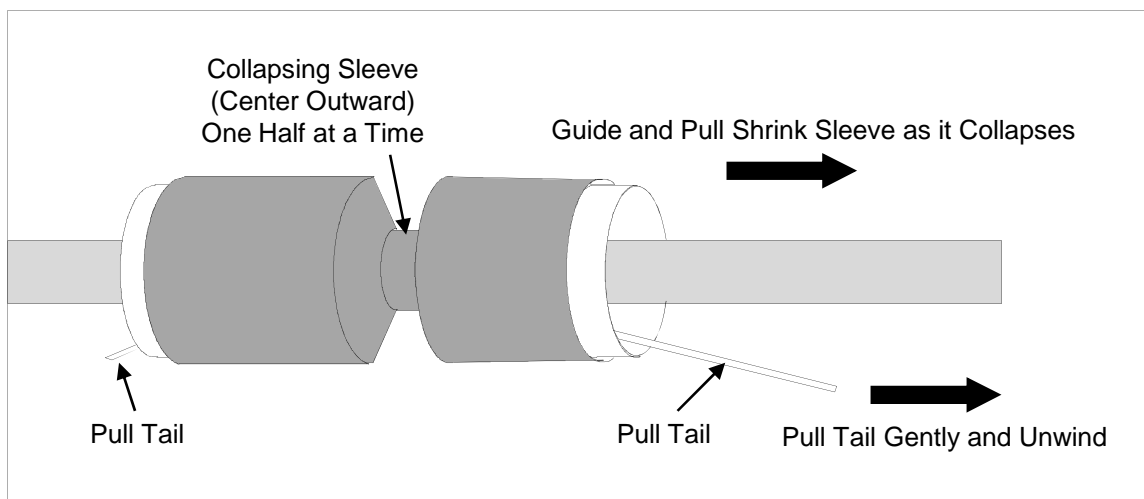


Figure 10
Collapsing Shrink Sleeve for 7- and 19-Tube Cables

11.0 Special Technique for Central Strength Members

Potentially this movement could damage tubes or Tube Couplings inside the splice.

11.1 For tube cables containing a Central Strength Member, an extra step is required when installing a Tube Cable Splice Kit.

11.2 Cut each strength member so that there will be at least a 4" overlap between them when the tubes are coupled.

Note: Currently only TC04TOD and TC04MSOS tube cable designs contain a dielectric Fiber Reinforced Plastic Strength Member.

11.3 Use Vinyl Electricians Tape to thoroughly wrap the pair of strength members together. **See Fig. 11.**

11.2 Strength members must be joined / taped together rather than being cut off. This technique guards against the strength members moving or "pistoning" inside the spliced area when the tube cable segments move.

CAUTION: Tube cables joined with a Tube Cable Splice Kit should not be pulled. This also applies to tube cables with Central Strength Members. The taped strength members do not provide any tensile strength to the splice point and severe tube damage could result.

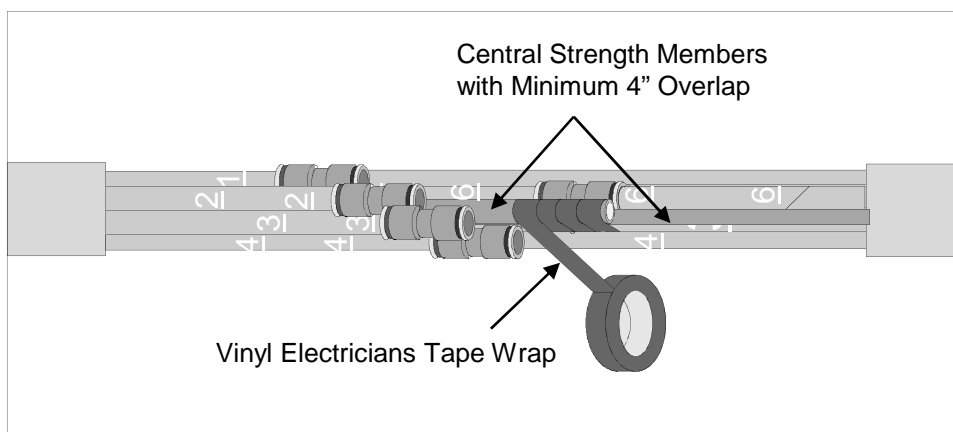


Figure 11

Taping Central Strength Members Inside an Inline Tube Cable Splice

12.0 Tube Cable Splice Kits for Metallic Tube Cable Types

12.3 The potential problem is that the protruding bonding hardware could penetrate or wear through the rubber shrink sleeve. This would negate the waterproof sealing of the splice.

12.1 The use of a Tube Cable Splice Kit to provide a permanent, in-line splice with a waterproof protective barrier around metallic tube cable types is not recommended.

12.4 In-line splices of metallic tube cable types are best accomplished inside properly rated outdoor enclosures such as a NEMA-4, -4X, -6, or -6P enclosure (box) or inside a Splice Case where the above problem will not be encountered.

12.2 The metallic elements of such tube cables must be bonded with appropriate Shield Connector Assemblies and Bonding Strap hardware. Refer to Sumitomo Recommended Procedure SRP SP-F04-030.