

SUMITOMO RECOMMENDED PROCEDURE**SRP SP-F04-011****RESTORATION PROCEDURE
DIELECTRIC TUBE CABLES & TUBE CABLE SPLICE KITS**

<u>PARA.</u>	<u>CONTENTS</u>
1.0	General
2.0	Safety Precautions
3.0	Reference Documents
4.0	Equipment / Tools Required
5.0	Removing the Fiber Bundle
6.0	Preparing the Tube Cable
7.0	Making the Tube Cable Splices
8.0	Installing the Fiber Bundle

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1.0 General

1.1 This procedure describes the standard techniques for making a permanent repair to a damaged FutureFLEX dielectric (non-metallic) outdoor tube cable using Tube Cable Splice Kits.

1.2 If a tube cable has been damaged, chances are that some or all of its inner tubes will no longer accept fiber bundle. **See Fig. 1.**



Figure 1
Badly Kinked Tube Cable

1.3 If the tube cable's outer jacket is no longer intact, contamination (water) can enter the interior tube area and cause further damage.

1.4 The scope of this SRP is to provide the steps and procedures necessary to restore the tube cable span and all its tubes to a 100-percent re-usable condition.

1.5 Restoration efforts begin by first removing any installed fiber bundles from the damaged span.

1.6 The damaged tube cable section is then cut out and a replacement segment of the same tube cable type is spliced into the existing span. Tube Cable Splice Kits are used to provide a permanent, in-line tube cable splice with a waterproof protective barrier around the coupled tubes.

1.7 After the individual tube splices are completed and before the tube cable splice is waterproofed / closed, the tube span must be pressure and obstruction tested.

1.8 Fiber bundles are then re-installed to complete the restoration effort.

2.0 Safety Precautions

2.1 The use of safety equipment is strongly recommended while cutting and stripping the tube cable ends. This includes the use of protective gloves and eye wear.

3.0 Reference Documents

3.1 Sumitomo Recommended Procedure, *FutureFLEX Fiber Bundle Removal Procedure*, SRP SP-F04-025.

3.2 Sumitomo Recommended Procedure, *FutureFLEX Tube & Tube Cable Sealing Procedures*, SRP SP-F04-019.

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

3.4 Sumitomo Recommended Procedure, *FutureFLEX Tube Cable Splice Kit Installation Procedure*, SRP SP-F04-016.

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

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

3.7 Sumitomo Recommended Procedure, *FutureFLEX Blowing Equipment Set-up Procedure*, SRP SP-F04-001.

4.0 Equipment / Tools Required

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

4.1 To remove fiber bundle from tube cable span, see SRP SP-F04-025.

4.2 To install Tube Cable Splice Kits, see SRP SP-F04-016.

4.3 To perform Tube Pressure Tests, see SRP SP-F04-003.

4.4 To perform Tube Obstruction Tests, see SRP SP-F04-004.

4.5 To set up Blowing Head Equipment Kit, see SRP SP-F04-001.

4.6 To install fiber bundle, see SRP SP-F04-002.

4.7 Replacement tube cable section; length to suit. Obtain from authorized FutureFLEX Distributors.

4.8 Replacement fiber bundle (if necessary); length to suit. Obtain from authorized FutureFLEX Distributors.

5.0 Removing the Fiber Bundle

5.1 Before a tube cable splice can be accomplished, the degree of damage to the installed fiber bundle must be determined.

5.2 If the fiber bundle is undamaged, it can be blown out of the tube span and reused. Perform fiber bundle removal procedures as explained in SRP SP-F04-025.

5.2.1 Set up a Gas Supply bottle at entry point Fiber Termination Unit (FTU) and a Blowing Head with empty fiber bundle reel at exit point FTU.

5.2.2 Blow fiber bundle out of tube and neatly guide onto reel. **See Fig. 2.**



Figure 2

Blow Fiber Bundle Out of Damaged Tube and onto Empty Reel

5.3 If the fiber bundle is damaged (some or all of the fiber optic strands inoperative), it should be scrapped and replaced. **See Fig. 3.**

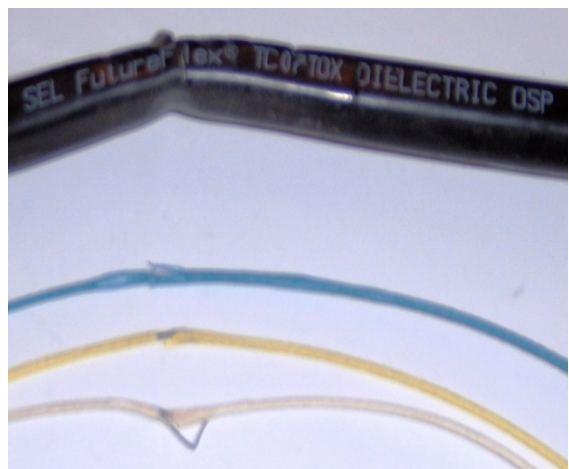


Figure 3

Jacket Cut and Fiber Bundles Damaged

5.4 Set up a Gas Supply bottle at entry point FTU and carefully blow fiber bundle out of tube directly into an appropriate trash container.

Note: *If the tube span is intact, the fiber bundle may be able to be blown out of the entire tube span length. If not, the fiber bundle may have to be cut and blown out in sections.*

6.0 Preparing the Tube Cable

6.1 After the fiber bundle has been removed from the tube span, tube cable restoration efforts can begin.

6.2 The recommended repair method is similar to that of conventional fiber optic cable types. The tube cable must be cut 10' - 20' back on both sides of the central damage point. Then a new section of tube cable is spliced in to reconnect the open tube cable ends.

Note: *On-site conditions must be evaluated. It may be advantageous to make tube cable repairs from within accessible Manholes or Pull Boxes. If so, cut tube cable at these points and use a longer replacement section.*

6.3 Use Tube Cable Cutter (BETL64) to cut the tube cable on both sides of the damaged area.

6.4 Depending on when and where the tube cable sustained damage, water or other forms of contamination may have entered some or all of the individual tubes. It is recommended to clean and dry out the tubes at this time.

6.4.1 Set up a Gas Supply bottle at one end of tube span. Apply a low pressure (about 40-50 psi) through each tube for about 20-30 minutes to dry out its interior. Adjust amount of pressure to suit tube span length and conditions.

6.4.2 If more severe forms of tube contamination have occurred, contact Sumitomo Electric Lightwave for additional advice.

6.5 After the tube interiors have been cleaned, immediately seal the open tube cable ends. Heat Shrink End Caps are the recommended sealing device. Refer to Sumitomo Recommended Procedure SRP SP-F04-019.

7.0 Making the Tube Cable Splices

7.1 Bring in replacement tube cable section and cut to desired length using Tube Cable Cutter (BETL64).

7.2 **Key Step.** Before installing Tube Cable Splice Kits, verify that 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.

7.3 At both repair points, install Tube Cable Splice Kits in accordance with Sumitomo Recommended Procedure SRP SP-F04-016. **See Fig. 4.**

7.4 Be sure to accomplish Tube Coupling "Unique" stagger arrangement at each splice point as described in SRP SP-F04-016. This arrangement places the 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 the shrink sleeve is collapsed. **See Fig. 5.**

7.5 **Important Step.** Once all the tubes are coupled together, each tube in the span must be tested before the shrink sleeves are 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.

7.6 After the tubes are tested, waterproof each splice point by wrapping the exposed tubes with water blocking tape and applying mastic tape wraps on the tube cable jacket ends. **See Fig. 6.**

7.7 Collapse the shrink sleeves over the coupled tubes by carefully pulling on the sleeve's Pull Tails. **See Fig. 7.**

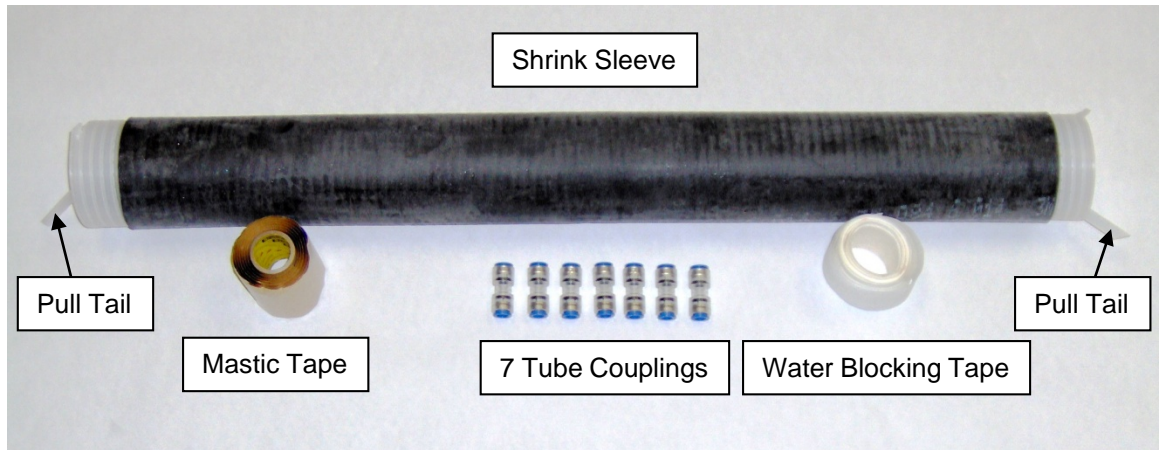


Figure 4
Tube Cable Splice Kit
(7-Tube Cable Kit Shown)

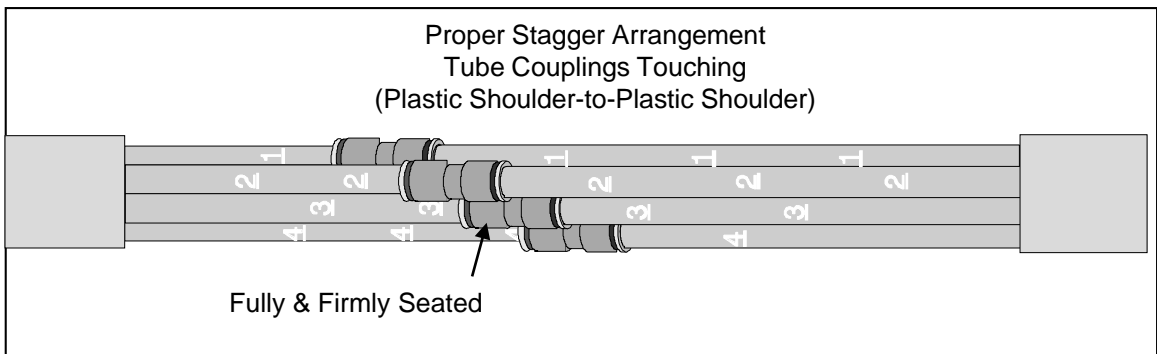


Figure 5
Tubes Coupled in Proper Stagger Arrangement

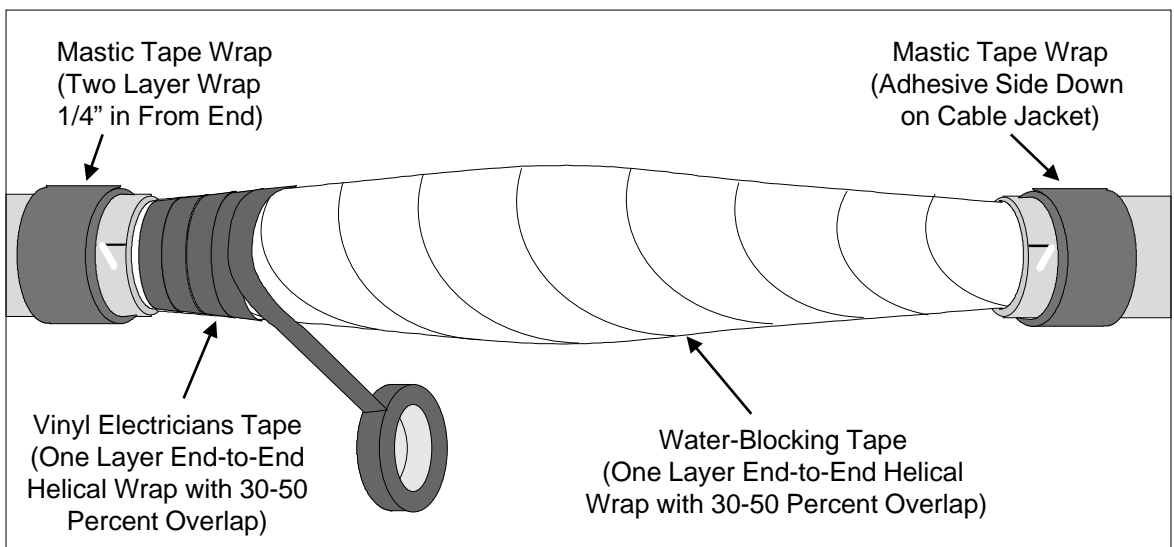
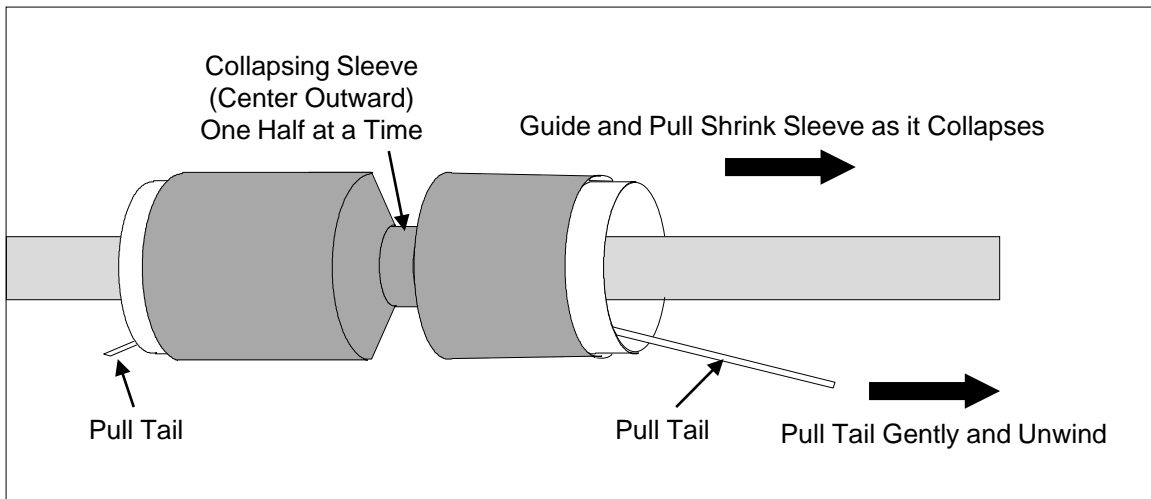


Figure 6
Waterproofing the Splice

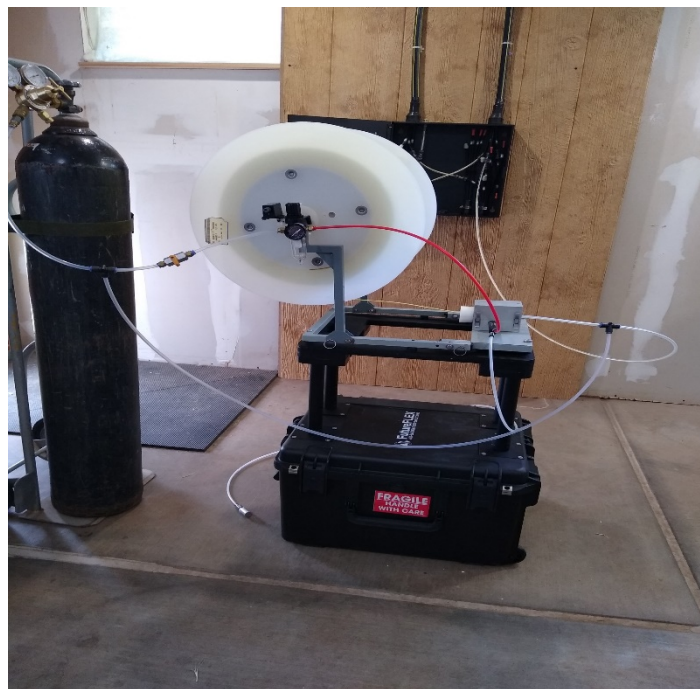
**Figure 7**

Collapsing Shrink Sleeve for 7- and 19-Tube Cables

8.0 Installing the Fiber Bundle

8.1 At this point in the restoration effort, the tube cable splice points have been tested and permanently repaired with waterproof Tube Cable Splice Kits.

8.2 Refer to Sumitomo Recommended Procedures SRP SP-F04-001 and SRP SP-F04-002 to set up the Blowing Head Equipment and install replacement fiber bundle. **See Fig. 8.**

**Figure 8**

Blowing Head Set Up and Ready to Install Replacement Fiber Bundle