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SUMITOMO RECOMMENDED PROCEDURE

SRP SP-F04-012

FutureFLEX®

RESTORATION PROCEDURE
METALLIC TUBE CABLES & SPLICE CASE KITS

SUMITOMO ELECTRIC LIGHTWAVE CORP.
78 TW Alexander Drive, Research Triangle Park, NC 27709
(919) 541-8100 or 1-800-358-7378
www.futureflex.com
SEL is a Member of the Sumitomo Electric Industries, Ltd. Group

1.0 General

1.1 This procedure describes the standard techniques for making a permanent repair to a damaged FutureFLEX metallic outdoor tube cables using PLP Splice Case 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. Splice Case 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 Splice Case Kits are 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 Splice Case Kit Installation Procedures*, SRP SP-F04-015.

3.5 Sumitomo Recommended Procedure, *FutureFlex Grounding & Bonding Metallic Tube Cable Procedures,* SRP SP-F04-030.

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

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

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

3.9 Sumitomo Recommended Procedure, *FutureFLEX Fiber Bundle Installation Procedure*, SRP SP-F04-016.

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 Splice Case Kits, see SRP SP-F04-015.

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 nitrogen 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.**

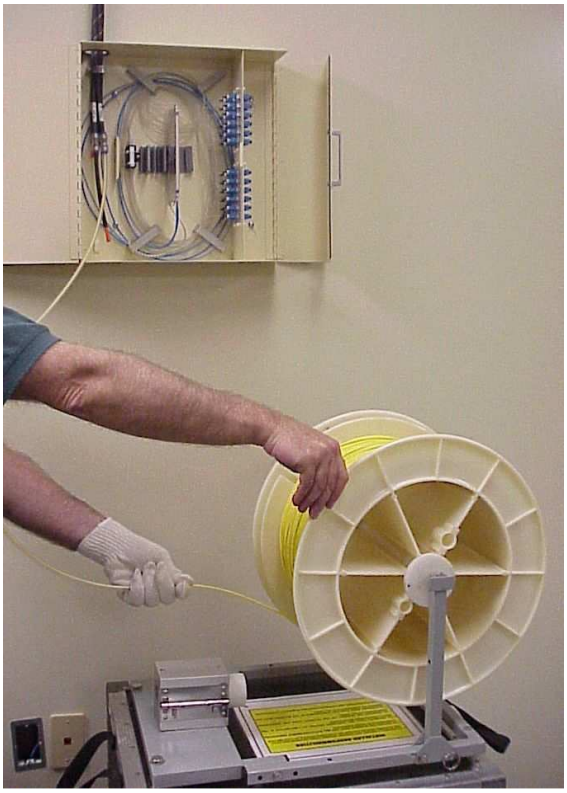

Figure 2
Blow Fiber Bundle Out of Damaged Tube and onto Empty Reel

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.**

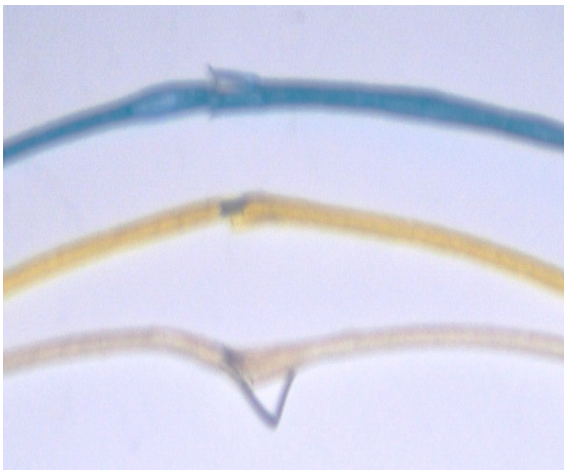

Figure 3
Fiber Bundles Damaged

5.4 Set up a nitrogen 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 (BETL01) or hacksaw 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 nitrogen 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 (BETL01) or hacksaw.

7.2 **Key Step.** Before installing Splice Case Kits, verify that tube cable ends will mate properly so that their tubes will not be crossed or twisted when coupled. See Sumitomo Recommended Procedure SRP SP-F04-008.

7.3 At both repair points, install Splice Case Kits in accordance with Sumitomo Recommended Procedure SRP SP-F04-015. **See Fig. 4.**

7.4 Metallic tube cables must be grounded and bonded. Be sure to prepare tube cable ends in accordance with Sumitomo Recommended Procedure SRP SP-F04-015.

7.5 Be sure to accomplish Tube Coupling stagger arrangement at each splice point as described in SRP SP-F04-015. This arrangement places the plastic shoulder of one Tube Coupling against the plastic shoulder of an adjacent Tube Coupling. This is necessary to prevent a Tube Coupling from being pressed into and possibly compressing / kinking an adjacent bare tube. **See Fig. 5.**

7.6 Assemble the End Plates per PLP standard recommended procedures. However, there are special sealing techniques that must used when installing LAP / TLW tube cable types. Be sure to follow Sumitomo Recommended Procedure SRP SP-F04-015 instructions carefully.

7.7 **Important Step.** Once all the tubes are coupled together and the cables installed in the assembled End Plate sections, each tube in the span must be tested before the Splice Case is waterproofed and closed. 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.

7.8 After the tubes are tested, perform Grounding & Bonding procedures per Sumitomo Recommended Procedures SRP SP-F04-015 and SRP SP-F04-030.

7.9 Install the two (2) Shell Halves together per PLP standard recommended procedures. Follow Lockbar tightening instructions carefully as lockbar nuts must be tightened in a specific sequence and torqued to specific values.

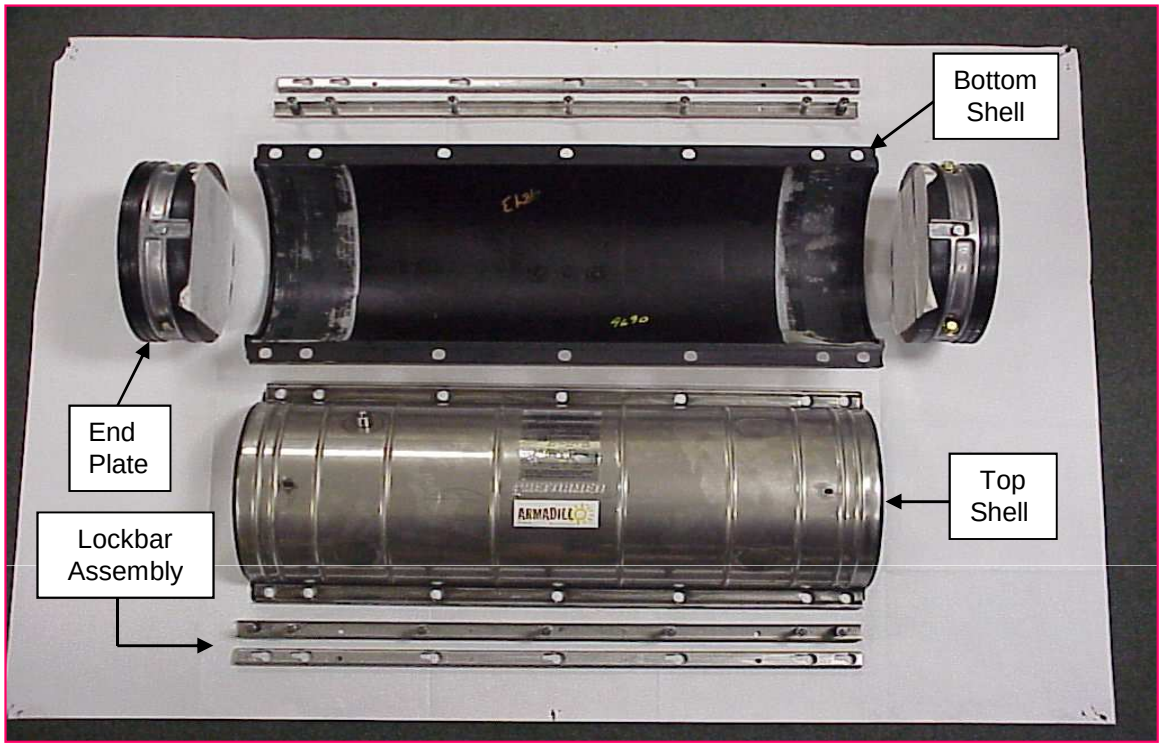

Figure 4
Splice Case Kit

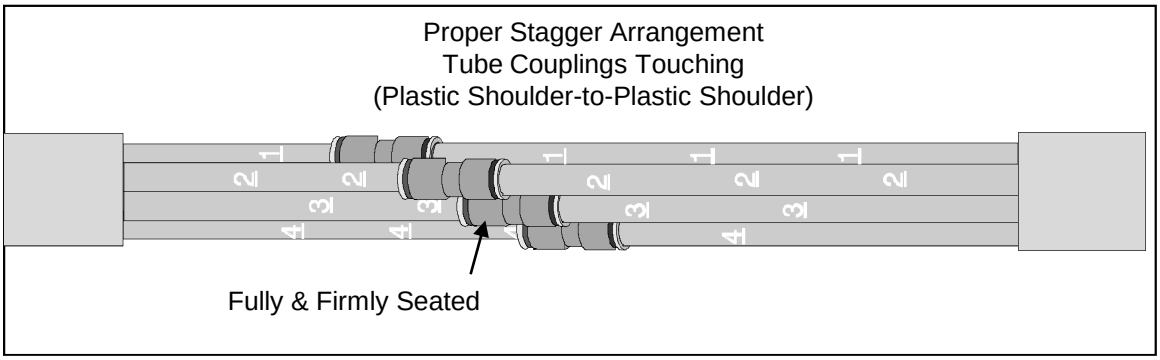

Figure 5
Tubes Coupled in Proper Stagger Arrangement

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 Splice Case 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.**

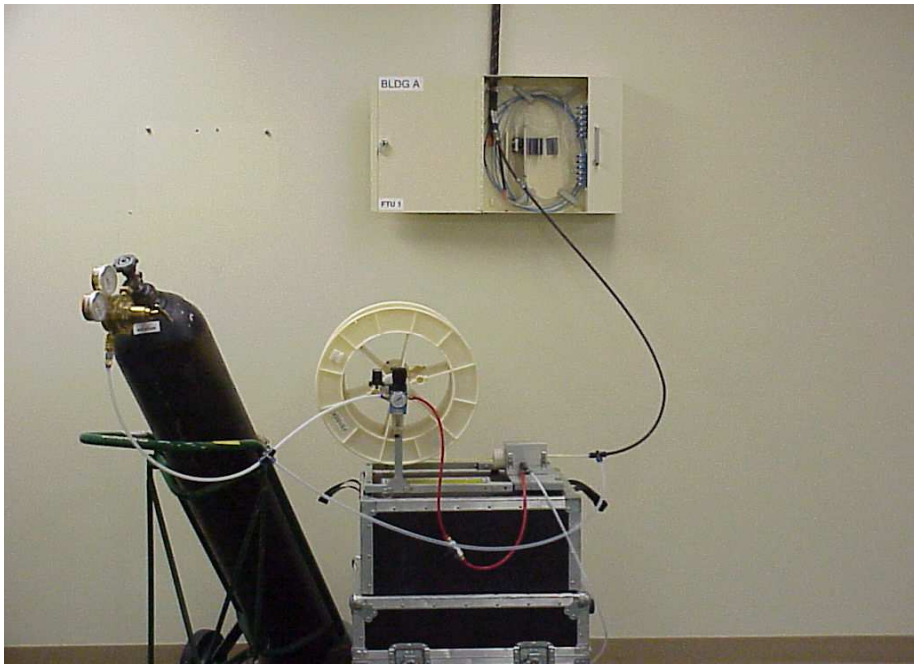

Figure 8
Blowing Head Set Up and Ready to
Install Replacement Fiber Bundle