SUMITOMO RECOMMENDED PROCEDURE

SRP SP-F04-019

TUBE & TUBE CABLE SEALING PROCEDURES

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1.0 General

1.1 This procedure describes the standard techniques for sealing FutureFLEX Air-Blown Fiber (ABF) tube cables and tubes. Actual on-site techniques may vary depending on the installation and local code requirements.

1.2 Sealing open tube cable and tube ends will prevent the intrusion of contamination before, during, and after tube cable installation. Protecting the integrity of the tubes is paramount.

1.3 Sealing (waterproofing) tube cables as they enter a building will prevent the passage of water, ground gases, insects / rodents, and so forth.

1.4 Sealing (firestopping) tube cables as they pass through building walls and floors will prevent the passage of fire, smoke, and so forth.

Note: *Special tube cable and tube sealing techniques are to be performed in Class I, Division 1 & 2 environments. These procedures are described in Sumitomo Recommended Procedures SRP SP-F04-032 Sealing Procedures for FutureFLEX Tube Cables Located in Class I, Division 1 & 2 Environments and SRP SP-F04-033 Sealing Procedures for FutureFLEX Tubes Located in Class I, Division 1 & 2 Environments.*

2.0 Safety Precautions

2.1 Some of the sealing materials discussed in this procedure do emit unpleasant smells and can cause the eyes to water. In some cases, free hydrogen gas is evolved during the curing process.

2.2 Adequate ventilation is required in confined spaces. Read and follow the precautions listed on the container being used.

3.0 Equipment / Tools Required

The equipment, tools, and materials required to complete these procedures are described within the appropriate sections.

4.0 Sealing Tube Cable Ends

4.1 The recommended device to seal open tube cable ends is a Heat Shrink End Cap. When properly applied, it will prevent all forms of contamination from entering the open tube cable end. Do not remove Heat Shrink End Caps until after the tube cable has been installed and ready to be coupled or terminated inside a TDU enclosure.

4.2 Heat Shrink End Caps are available in four (4) sizes to fit various tube cable designs / sizes. **See Fig. 1.**

#1 = Heat Shrink End Cap (DE19HS2) is for all 19-armored tube cables and 24 tube cables
#2 = Heat Shrink End Cap (DE19HS1) is for all 12- and 19-unarmored tube cables.
#3 = Heat Shrink End Cap (DE07HS1) is for all 2- and 4- armored tube cables, all 7-armored tube cables, all 7-unarmored tube cables, and all 12-unarmored tube cables.
#4 = Heat Shrink End Cap (DE04HS1) is for all 2- to 4-unarmored tube cables

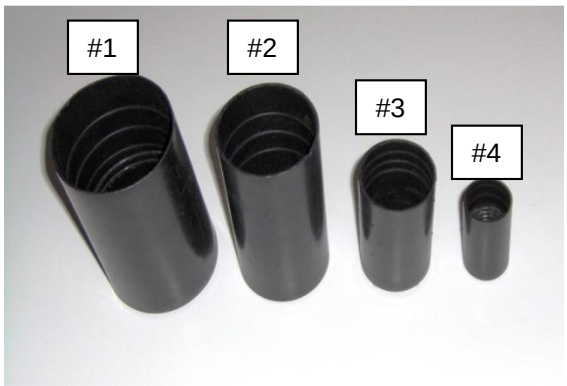

Figure 1
Heat Shrink End Caps Sizes

4.3 Use Tube Cable Cutter (BETL03) or similar to flush-cut end of tube cables. Use a hacksaw or similar metal-cutting device to flush-cut end of armored tube cables.

4.4 Slide Heat Shrink End Cap over tube cable end and use a standard heat gun (preferred method) or mini-torch to collapse Heat Shrink End Cap. Verify tightness after cooling.

Figure 2
Heat Shrink End Caps Installed

4.5 In the event a Heat Shrink End Cap is not available, alternative methods can be used to seal open tube cable ends.

4.5.1 For outdoor (wet, muddy, etc.) installations, apply a liberal coating of a Silicone caulk (such as RTV or similar) into the open ends of the tubes and into the open areas between the tubes. Then wrap the tube cable end with an appropriate tape (duct tape is recommended for its better holding power).

4.5.2 For indoor (dry) installations (not going through wet environments), wrap the tube cable end with an appropriate tape (duct tape is recommended for its better holding power).

5.0 Sealing Individual Tube Ends

5.1 There are several recommended devices available to seal open tube ends that, when properly installed, will prevent contamination such as water, dirt, dust, insects, and so forth from entering the open end of an empty or filled (with fiber bundle) tube.

5.2 Use Tubing Cutter (BETC001) to flush-cut the end of the tube.

5.3 Tube Plug (DE06MP) Use an orange-colored DE06MP Tube Plug to seal an empty 8mm OD / 6mm ID tube in indoor applications only. The stem of the orange Tube Plug is 6.35mm OD. Use finger-pressure only and insert Tube Plug until it is firmly seated inside the tube. Do not "jam" Tube Plug into tube or it will be difficult to remove later. The DE06MP Tube Plug is not a push-fit device and can be blown out of the tube if pressure is inadvertently applied. Exercise caution. **See Fig. 3.**

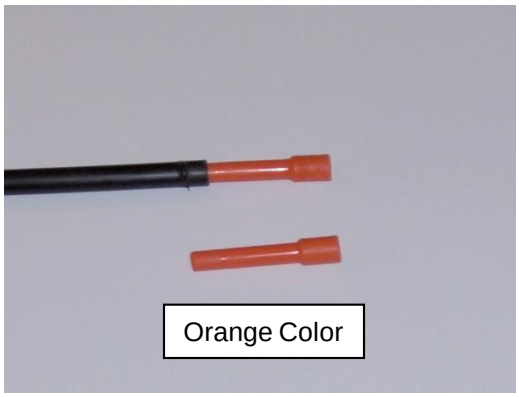

Figure 3
DE06MP Tube Plug to Seal
Empty 8mm OD / 6mm ID Tubes

5.4 Tube Plug (DE55MP) Use a blue-colored DE55MP Tube Plug to seal an empty 8mm OD / 5.5mm ID TP2 plenum-rated tube in indoor applications only. The stem of the blue Tube Plug is 6.00mm OD. Use finger-pressure only and insert Tube Plug until it is firmly seated inside the tube. Do not "jam" Tube Plug into tube or it will be difficult to remove later. The DE06MP Tube Plug is not a push-fit device and can be blown out of the tube if pressure is inadvertently applied. Exercise caution. **See Fig. 4.**

5.4.1 Do not use an Orange DE06MP Tube Plug to seal a 5.5mm ID TP2 plenum-rate tube. The over-sized plug is difficult to install and causes the end of the TP2 tube to flare out. **See Fig. 5.**

5.4.2 Refer to Sumitomo Recommended Procedure, Plenum-Rated Jacketed Tube Cable TCxxTP2 Installation Procedures, SRP SP-F04-029.

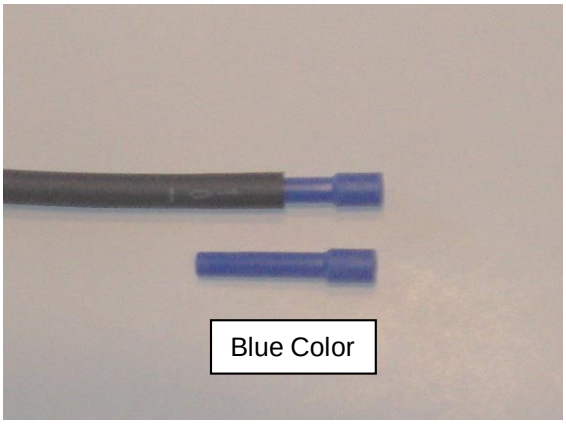

Figure 4
DE55MP Tube Plug to Seal
Empty 8mm OD / 5.5mm ID Tubes

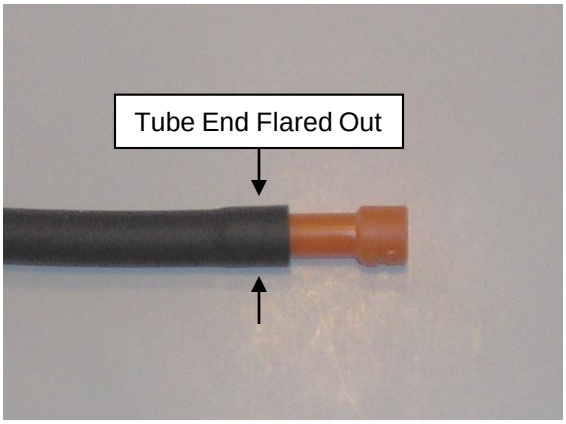

Figure 5
Result of Using Wrong Tube Plug
in TP2 Plenum-Rated Tube

5.5 Tube Cap (DE08MA) Use a slate-colored DE08MA Tube Cap to seal an empty tube in both indoor and outdoor applications. Because it is a push-fit device, the Tube Cap is especially effective in the harsher outdoor applications and cannot be blown off the end of a tube if pressure is applied. Ensure the Tube Cap is firmly attached to the tube end. **See Fig. 6.**

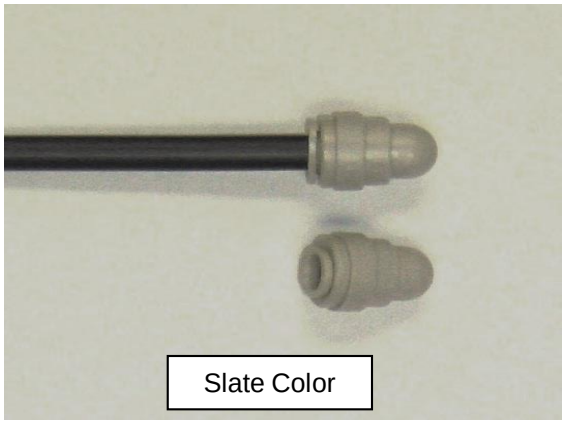

Figure 6
DE08MA Tube Cap to Seal
Empty Tubes

Note: *Special tube cable and tube sealing techniques are to be performed in Class I, Division 1 & 2 environments. These procedures are described in Sumitomo Recommended Procedures SRP SP-F04-032 Sealing FutureFLEX Tube Cables in Class I – Divisions 1 and 2 Environments and SRP SP-F04-033 FutureFLEX Class I – Divisions 1 and 2 Gas Block Tube Coupling Installation Procedures.*

6.0 Sealing at Building Entrance
Whenever tube cables enter a building, the penetration method must be sealed to prevent the intrusion of contamination such as water, ground gases, insects / rodents, etc.

6.1 If tube cable enters a building via conduit, the conduit opening must be sealed. Depending on local code requirements, rubber conduit plugs, water plugs, duct sealer, or similar materials should be used. Always follow specific manufacturer's recommended installation instructions.

Note: *In the event that the conduit must be re-opened for access, it must always be re-sealed / waterproofed prior to job completion.*

6.2 If tube cable enters a building via cutting or drilling / boring, proper sealing (waterproofing) of inner and outer building walls must be accomplished in accordance with local code requirements. Depending on local code requirements, foams, caulks, or similar materials should be used. Always follow specific manufacturer's recommended installation instructions.

7.0 Sealing / Firestopping Within Building

Whenever tube cables pass through interior walls or floors (such as in a Riser application), the penetration must be sealed with an approved firestopping material to create a fire and smoke barrier.

7.1 Mechanical firestop systems are typically pre-manufactured elastomeric components shaped to fit around standard cables, tubes, or conduits. Mechanical systems require some means of applying compression to the sides of the opening, conduit, or tube cable to establish a tight seal. There are many types of approved devices on the market. Use a method that complies with local code requirements and always follow specific manufacturer's recommended installation instructions.

7.2 Non-mechanical firestop systems come in a variety of forms and each has a desirable property for specific situations. All share the common benefit of adapting to irregular openings and off-center tube cable or conduit placement. Non-mechanical firestop materials are available in the following forms:

- Silicone foams
- Caulks
- Puttys
- Cementitious materials
- Intumescent sheets
- Pre-manufactured pillows

7.3 The most practical method for sealing tube cables is by the use of Silicone foams or caulks. They are available in tubes and cans that allow for easy application. Puttys are available in bars and sticks. Cementitious materials require mixing. Intumescent materials and pillows are available in pre-manufactured sheets. Use a method that complies with local code requirements and always follow specific manufacturer's recommended installation instructions.

Note: *In the event that the penetration must be re-opened for access, it must always be re-sealed / firestopped prior to job completion.*

8.0 Sealing Between Tubes

8.1 In addition to using an approved waterproofing or firestopping method to seal around the outside of a tube cable jacket, the open spaces between the tubes must also be sealed to prevent the intrusion of water, smoke, ground gases, etc. whenever a open tube cable end is exposed to such elements. **See Fig. 9.**

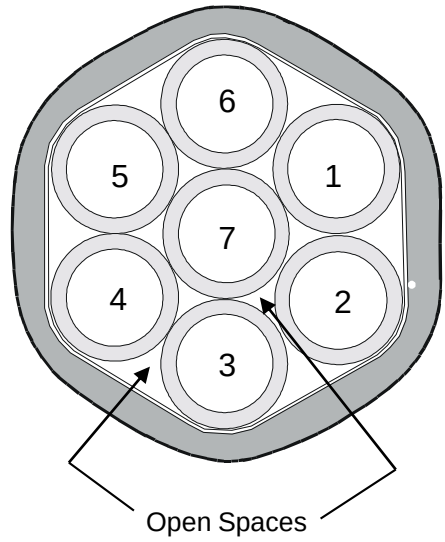

Figure 9
Open Spaces Between Tubes
Must Also Be Waterproofed / Sealed

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8.2 To prevent the intrusion of water, smoke, ground gases, and the like, sealing between tubes can be accomplished using approved silicone sealants, foams or caulks. Use a method that complies with local code requirements and always follow specific manufacturer's recommended installation instructions.

8.3 After the tube cable jacket has been removed and the tubes exposed, spread the tubes apart being careful not to kink them.

8.4 Fill the gaps between the tubes with an approved sealant. Make sure that all the spaces between each tube receive the material being used.

8.5 When an ample quantity of sealant has been applied, release the tubes and lightly squeeze them together into their natural position. Apply a temporary tape wrap around the tubes to hold them together.

8.6 Apply additional sealant around the outer edge of the tubes and around the outer jacket to complete the sealing process. **See Fig. 10.**

8.7 Allow the sealant to cure fully without disturbing the tubes.

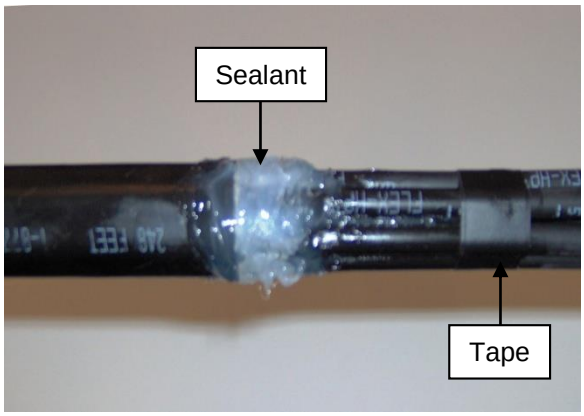

Figure 10
Waterproofing / Sealing Between Tubes and Tube / Jacket Interface