SUMITOMO RECOMMENDED PROCEDURE

SRP SP-F04-039

ARMORED TUBE CABLE INSTALLATION PROCEDURES

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1.0 General

1.1 This procedure describes the special techniques required to install FutureFLEX Air-Blown Fiber (ABF) Interlocked Galvanized Steel armored tube cables in typical indoor and outdoor (duct and direct buried) applications.

1.2 A spiral-wrapped Interlocked Galvanized Steel armoring surrounding a core cable provides an extremely rugged, high crush resistance tube cable design and is available in two (2) configurations.

1.2.1 Dash -1 tube cable Part Numbers identify a tube cable with a ruggedized Interlocked Galvanized Steel wrap without a Polyethylene (PE) outer jacket. The Dash -1 designs are typically used in indoor applications with General Purpose-, Riser-, or Plenum-rated tube cables. **See Fig. 1.**

Figure 1
A Dash -1 Plenum-Rated Tube Cable
(TC07TP2-1 Shown)

1.2.2 Dash -2 tube cable Part Numbers identify a tube cable with a ruggedized Interlocked Galvanized Steel wrap with a Polyethylene (PE) outer jacket. The Dash -2 designs are typically used in outdoor applications with all Dielectric and Metallic tube cable designs. **See Fig. 2.**

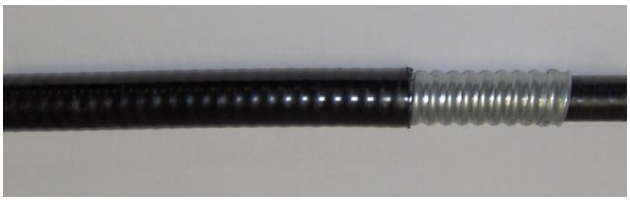

Figure 2
A Dash -2 Outdoor Tube Cable
(TC07TOX-2 Shown)

1.3 The ID of the spiral-wrapped Interlocked Galvanized Steel wrap is slightly larger than the OD of the core tube cable. This results in a somewhat “loose fit” between the armor and core cable and allows the core cable to move if, for example, subjected to thermal expansions / contractions.

1.3.1 When the tube cable is placed under tension as it is being pulled in with standard pulling grips, tapes, or ropes, the Interlocked steel coils tend to expand or stretch.

1.3.2 Consequentially, when the end of the tube cable reaches its splice location and / or Tube Distribution Unit (TDU) entry point, the Interlocked Steel can be longer than its core cable.

1.4 The required technique for installing Dash -1 and Dash-2 Interlocked Galvanized Steel armored tube cables is that the outer armor and the inner core cable must be pulled together.

2.0 Safety Precautions

2.1 The use of safety equipment (safety glasses, safety shoes, gloves) is recommended during this installation procedure.

3.0 Reference Documents

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

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

4.0 Equipment / Tools Required

4.1 Standard cable installation hardware, equipment, and tools. No specialized equipment is required.

4.2 Vinyl Electricians Tape or Duct Tape

4.3 Tape Measure

4.4 Utility Knife with Hook Blade

4.5 Tube Cable Cutter (BETL03)

4.6 Safety glasses

4.7 Kevlar gloves

4.8 Hacksaw or similar

4.9 Heat Shrink End Caps (DE04HS1, DE07HS1, DE19HS1, or DE19HS2)

5.0 Installation Procedures for Dash -1 Armored Tube Cables

5.1 Refer to Sumitomo Recommended Procedure *FutureFLEX Tube Cable Installation Procedures,* SRP SP-F04-008 for standard tube cable reel handling and storage requirements.

5.2 Refer to Sumitomo Recommended Procedure, *FutureFLEX Tube & Tube Cable Sealing Procedures, S*RP SP-F04-019. Ensure the head end of the tube cable is properly sealed to keep all forms of contamination out of the tubes during installation. Heat Shrink End Caps are the preferred sealing devices. **See Fig. 3.** However, for indoor runs where the tube cable is typically not being pulled through a wet environment, an appropriate tape wrap (duct or electrical tape) over the end of the cable is sufficient.

Figure 3
Heat Shrink End Caps

5.3 During the installation effort, do **not** exceed the maximum tensile load limit (maximum allowable pulling force) of the tube cable. **See TABLE I.**

Tube Cable Part Number	Maximum Tensile Load
TC02TGX-1	500 lbs
TC07TGX-1	600 lbs
TC02TRC-1	500 lbs
TC04TRC-1	500 lbs
TC07TRC-1	600 lbs
TC19TRC-1	600 lbs
TC02TP2-1	500 lbs
TC04TP2-1	500 lbs
TC07TP2-1	600 lbs
TC19TP2-1	600 lbs

TABLE I
Maximum Tensile Loads for
Dash -1 Armored Tube Cables

5.4 Every ABF tube cable installation must be installed with some slack footage in the run.

5.4.1 Normal Slack Footage - Just as with conventional cabling, normal slack footage must be installed in every tube cable run following standard practices and procedures.

5.4.2 Thermal Slack Footage - To compensate for any thermal expansions and contractions, additional tube cable length (thermal slack footage) must be calculated and installed. Refer to Sumitomo Recommended Procedure *FutureFLEX Tube Cable Installation Procedures,* SRP SP-F04-008.

5.4.3 Extra Slack Footage - It is recommended to provide at least an additional 3-feet of tube cable length at each splice location and / or Tube Distribution Unit (TDU) entry point. This extra length typically provides enough material to work with when make tube connections inside the enclosure.

5.5 Set the reel up so the tube cable pays from the top of the reel.

5.6 Proceed with normal cable installation practices and procedures.

5.7 ***IMPORTANT STEP*** – As the tube cable is being pulled off the reel, manually turn the reel to minimize / reduce tension on the cable.

WARNING: ***Do <u>not</u> cut the tube cable from the reel until the following steps have been performed.***

5.8 When the head end of the tube cable reaches its final destination <u>and</u> sufficient slack footage has been made available, remove the pulling force. Observe the end of the tube cable for a few minutes and watch for any movement. Once the tube cable is no longer under tension, it will tend to "relax." The expanded armor may contract a bit. Additionally, the core cable may have been elongated during the installation and now, no longer under tension, it may retract a bit. These conditions are normal.

5.9 When no more tube cable movement can be detected, remove the tube cable end seal (e.g.: Heat Shrink End Cap) and inspect the end of the cable. Determine exactly where the core cable is in relationship to the end of the armor.

5.9.1 If the core cable is even with or <u>slightly</u> extended beyond / retracted into the armor, these conditions are normal. Proceed with normal installation procedures. **See Fig. 4.**

Figure 4
Core Cable Even With or Very Close to the End of the Armor

5.10 If the core cable *appears* to have "retracted" into the armor and the head end cannot be seen, insert a tape measure into the armor to determine where the core cable's head end is located. **See Fig. 5.**

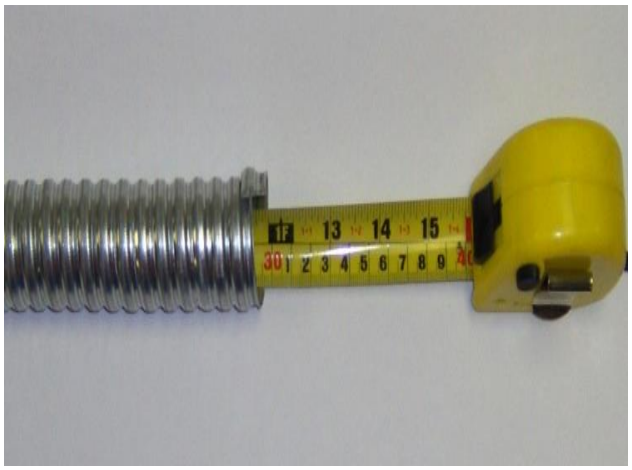

Figure 5
Core Cable has "Retracted" into the Armor

5.10.1 Unravel the Interlock Galvanized Steel wrap until the armor is even with the head end of the core cable. Bend the steel wrap back and forth until it breaks and remove it from around the core cable.

5.10.2 If required, pull in <u>more</u> tube cable until a sufficient slack footage length is made available at the splice point or TDU location.

5.11 When the tube cable head end installation is complete, pull more tube cable off the reel until sufficient slack footage length is made available at the tail end of the run. Then cut the tube cable from the reel.

6.0 Installation Procedures for Dash -2 Armored Tube Cables using Standard Pulling Grips

6.1 If a standard wire-mesh basket-weave style Pulling Grip will be used to pull in the tube cable, ensure the Grip meets or exceeds the following requirements.

6.1.1 The *Cable Diameter Range* of the Pulling Grip's wire-mesh basket must provide the tightest fit onto the Outside Diameter (OD) of the tube cable's armor.

6.1.2 The *Approximate Breaking Strength* rating of the Pulling Grip must exceed the Maximum Tensile Load rating of the tube cable being installed.

6.1.3 The *Basket Length* of the Pulling Grip must be as long as possible. Typically, Pulling Grips come in a "Short" length and a "Standard" length configuration. Select the longer "Standard" length.

6.1.4 *Pulling Grips with a Rotating Eye* are preferred over Pulling Grips with a Flexible (wire loop) Eye. Although both style grips are very acceptable, the Rotating Eye allows for easier attachment of Pulling Swivels. **See Fig. 6.**

Pulling Grip with Rotating Eye

Pulling Grip with Flexible Eye

Figure 6
Different Types of Pulling Grips

6.1.5 The use of a *Pulling Swivel* during a tube cable installation is highly recommended as it helps avoid spiraling and twisting of the tube cable that can potentially result in tube damage. **See Fig. 7.**

Figure 7
A Typical Pulling Swivel

6.2 Refer to Sumitomo Recommended Procedure *FutureFLEX Tube Cable Installation Procedures,* SRP SP-F04-008 for standard tube cable reel handling and storage requirements.

6.3 Set the reel up so the tube cable pays from the top of the reel. Pull a short length of tube cable off the reel and remove the Heat Shrink End Cap from the head end of the tube cable.

6.4 Measure the Pulling Grip's Basket Length. With a Utility Knife, **cut the cable's Polyethylene outer jacket and remove a length of jacket equal to one half of the Basket Length**. Expose the Interlocked Galvanized Steel wrap. For example, if the Basket Length is 36" long, cut and remove at least 18" of the tube cable's outer jacket.

6.5 Unravel the Interlock Galvanized Steel wrap back to where the Polyethylene outer jacket was removed. Bend the steel wrap back and forth until it breaks and remove it from around the core cable. These steps expose a length of core cable beyond the armor. **See Fig. 8.**

6.6 Refer to Sumitomo Recommended Procedure, *FutureFLEX Tube & Tube Cable Sealing Procedures, S*RP SP-F04-019. Re-seal the head end of the core cable to keep all forms of contamination out of the tubes during installation. Heat Shrink End Caps are the preferred sealing devices. **Refer to Fig. 3.** In wet, muddy, etc. installations, an alternative sealing method is to 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 core cable end with an appropriate tape (electrical, duct, etc.).

6.7 Apply a tape wrap around the end of the armor and over the core cable to keep water, mud, etc. from getting under the armor during the pull-in operation. **See Fig. 9.**

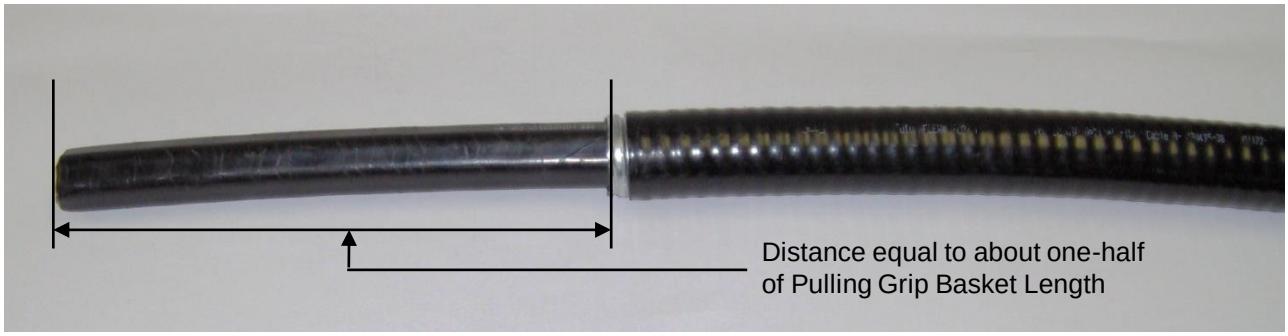

Figure 8
Polyethylene Outer Jacket and Armor Removed and Core Cable Exposed

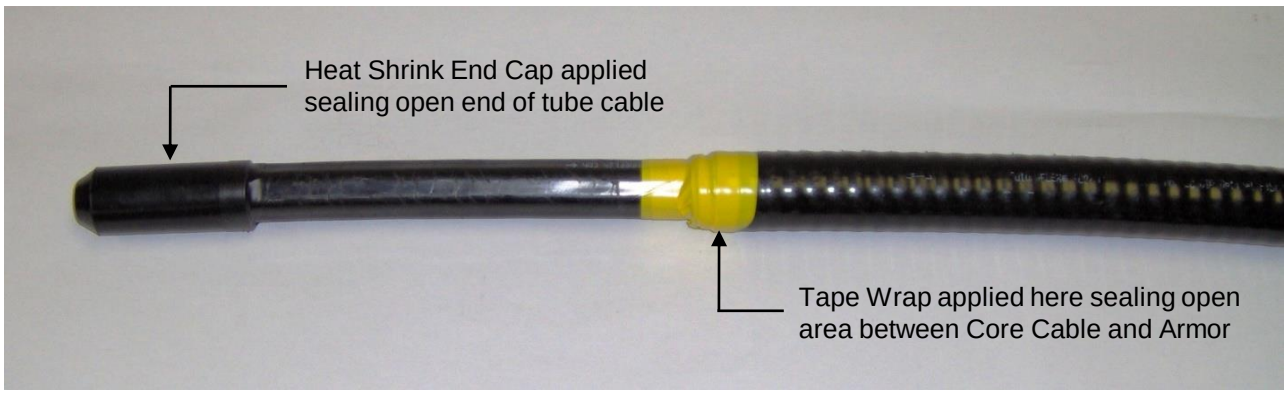

Figure 9
Open Ends and Areas of Tube Cable Sealed

6.8 Compress the Pulling Grip's Basket and install it fully and firmly over the core cable and armor. Smooth out the wire mesh to ensure the best possible fit. Ensure the tail end of the Grip engages the armor and the head end of the Grip engages the core cable equally. **See Fig. 10.**

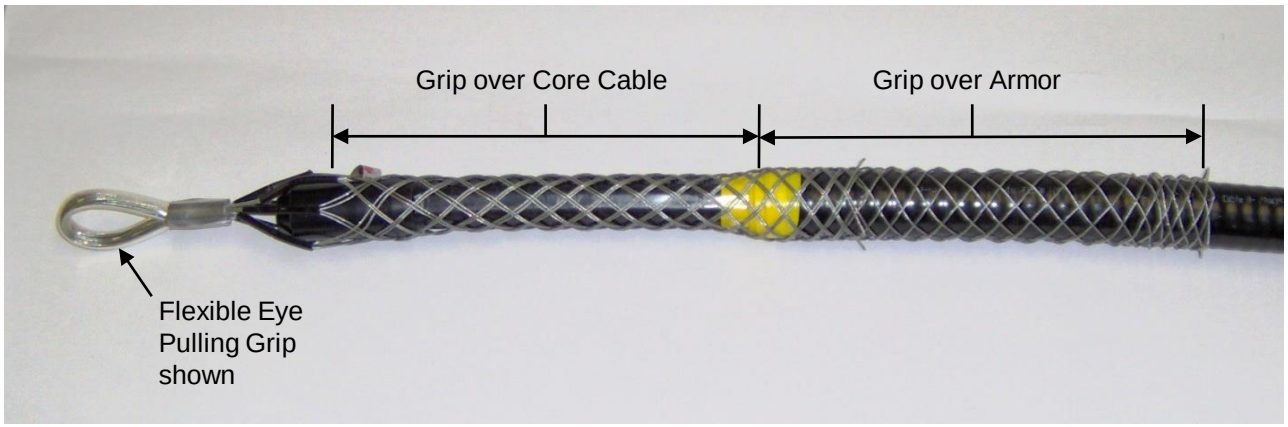

Figure 10
Pulling Grip Installed Equally over Armor and Core Cable

6.9 Apply Vinyl Electricians or Duct Tape over the entire length of the Pulling Grip's basket. Start the wrap on the Polyethylene outer jacket of the cable and move to the head end of the cable. Apply one layer of tape end-to-end with a Helical wrap and a 30-50 percent overlap. **See Fig. 11.**

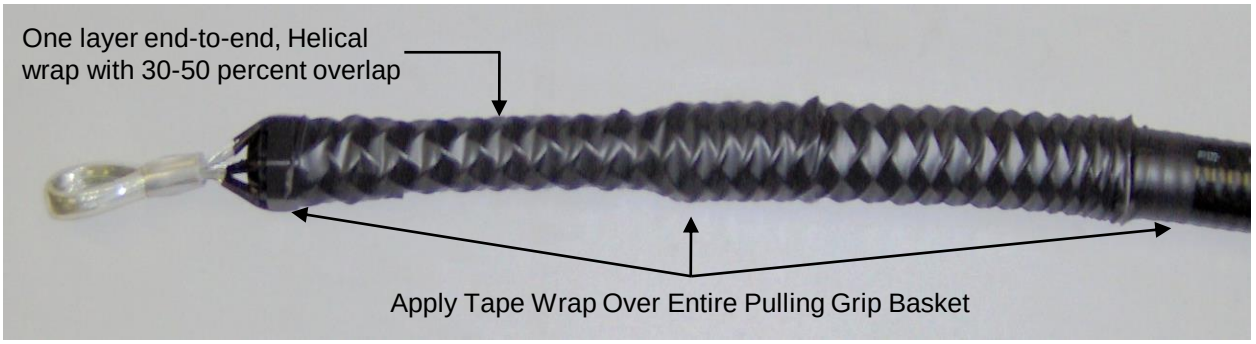

Figure 11
Tape Over Pulling Grip Basket

6.10 During the installation effort, do **not** exceed the maximum tensile load limit (maximum allowable pulling force) of the tube cable. **See TABLE II.**

Tube Cable Part Number	Maximum Tensile Load
TC02MSOS-2	500 lbs.
TC04MSOS-2	500 lbs.
TC07MSOS-2	600 lbs.
TC19MSOS-2	600 lbs.
TC02TOX-2	500 lbs.
TC04TOD-2	500 lbs.
TC07TOX-2	600 lbs.
TC19TOX-2	600 lbs.

TABLE II
Maximum Tensile Loads for
Dash -2 Armored Tube Cables

6.11 Every ABF tube cable installation must be installed with some slack footage in the run.

6.11.1 Normal Slack Footage - Just as with conventional cabling, normal slack footage must be installed in every tube cable run following standard practices and procedures.

6.11.2 Thermal Slack Footage - To compensate for any thermal expansions and contractions, additional tube cable length (thermal slack footage) must be calculated and installed. Refer to Sumitomo Recommended Procedure *FutureFLEX Tube Cable Installation Procedures,* SRP SP-F04-008.

6.11.3 Extra Slack Footage - It is recommended to provide at least an additional 3-feet of tube cable length at each splice location and / or Tube Distribution Unit (TDU) entry point. This extra length typically provides enough material to work with when make tube connections inside the enclosure.

6.12 Proceed with normal cable installation practices and procedures.

6.13 ***IMPORTANT STEP*** – As the tube cable is being pulled off the reel, manually turn the reel to minimize / reduce tension on the cable.

WARNING: ***Do not cut the tube cable from the reel until the following steps have been performed.***

6.14 When the head end of the tube cable reaches its final destination and sufficient slack footage has been made available, remove the pulling force / slack the pulling line. Do not remove the Pulling Grip yet.

6.15 Observe the end of the tube cable for a few minutes. Once the tube cable is no longer under tension, it will tend to "relax." The expanded armor may contract a bit. Additionally, the core cable may have been elongated during the installation and now, no longer under tension, it may retract a bit. These conditions are normal.

6.16 When no more tube cable movement can be detected, remove the Pulling Grip and proceed with normal installation procedures.

6.17 Back at the reel, pull more tube cable off until sufficient slack footage length is made available at the tail end of the run. Then cut the tube cable from the reel.

7.0 Installation Procedures for Dash -2 Armored Tube Cables using Standard Pulling Tapes or Ropes

7.1 If standard Pulling Tapes or Ropes will be used to pull in the tube cable, ensure The *Approximate Breaking Strength* or *Tensile Load* rating of the tape or rope exceeds the Maximum Tensile Load rating of the tube cable being installed.

7.2 Refer to Sumitomo Recommended Procedure *FutureFLEX Tube Cable Installation Procedures,* SRP SP-F04-008 for standard tube cable reel handling and storage requirements.

7.3 Set the reel up so the tube cable pays from the top of the reel. Pull a short length of tube cable off the reel and remove the Heat Shrink End Cap from the head end of the tube cable.

7.4 With a Utility Knife, **cut and remove at least 3-feet of the tube cable's Polyethylene outer jacket.** Expose the Interlocked Galvanized Steel wrap.

7.5 Unravel the Interlock Galvanized Steel wrap back to where the Polyethylene outer jacket was removed. Bend the steel wrap back and forth until it breaks and remove it from around the core cable. These steps expose approximately 3-feet of the core cable beyond the armor. **See Fig. 12.**

7.6 Refer to Sumitomo Recommended Procedure, *FutureFLEX Tube & Tube Cable Sealing Procedures, S*RP SP-F04-019. Re-seal the head end of the core cable to keep all forms of contamination out of the tubes during installation. Heat Shrink End Caps are the preferred sealing devices. **Refer to Fig. 3.** In wet, muddy, etc. environments, an alternative sealing method is to 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 core cable end with an appropriate tape (electric, duct, etc.).

7.7 Apply a tape wrap around the end of the armor and over the core cable to keep water, mud, etc. from getting under the armor during the pull-in operation. **See Fig. 13.**

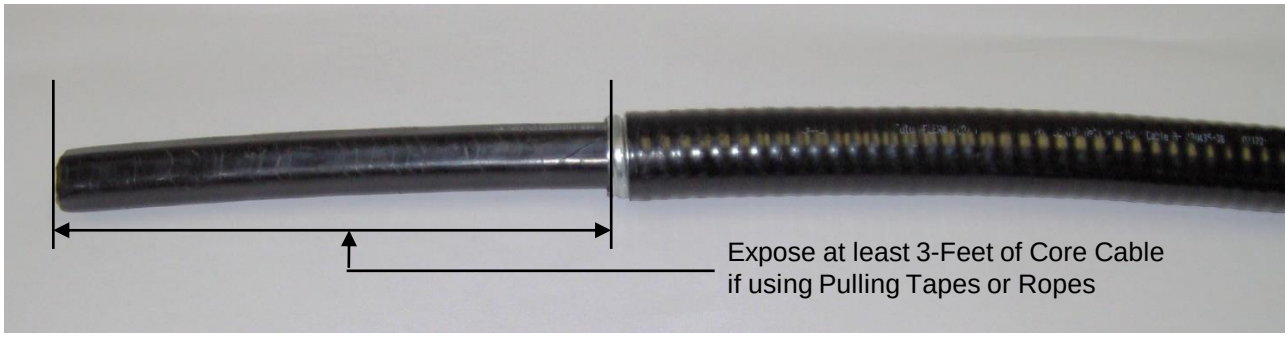

Figure 12
Polyethylene Outer Jacket and Armor Removed and Core Cable Exposed

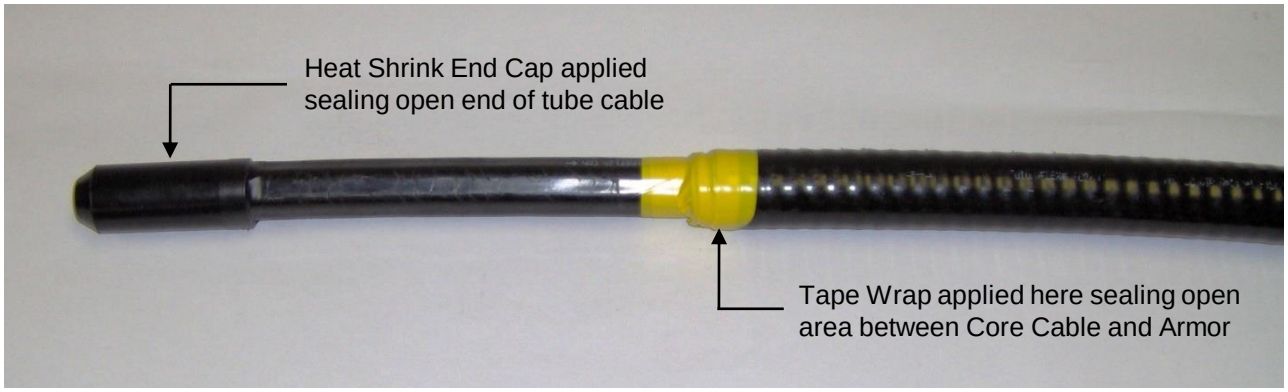

Figure 13
Open Ends and Areas of Tube Cable Sealed

7.8 Install the Pulling Tape or Rope around the armor and exposed core cable with a series of half hitches. **See Fig. 14.**

7.9 Apply Vinyl Electricians or Duct Tape over the entire length of the Pulling Tape or Rope. Start the wrap on the Polyethylene outer jacket of the cable. Apply one layer of tape end-to-end with a Helical wrap and a 30-50 percent overlap. **See Fig. 15.**

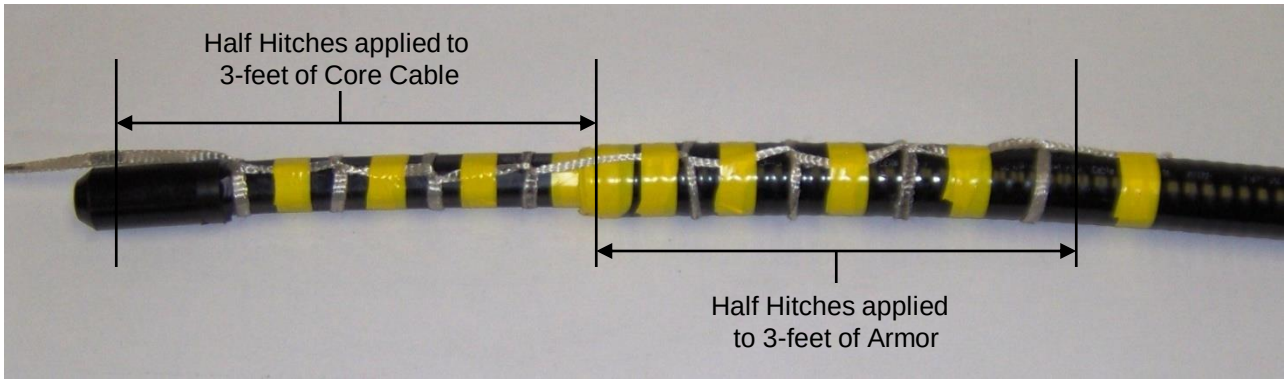

Figure 14
Pulling Tape or Rope Half-Hitched to Armor and Core Cable Equally

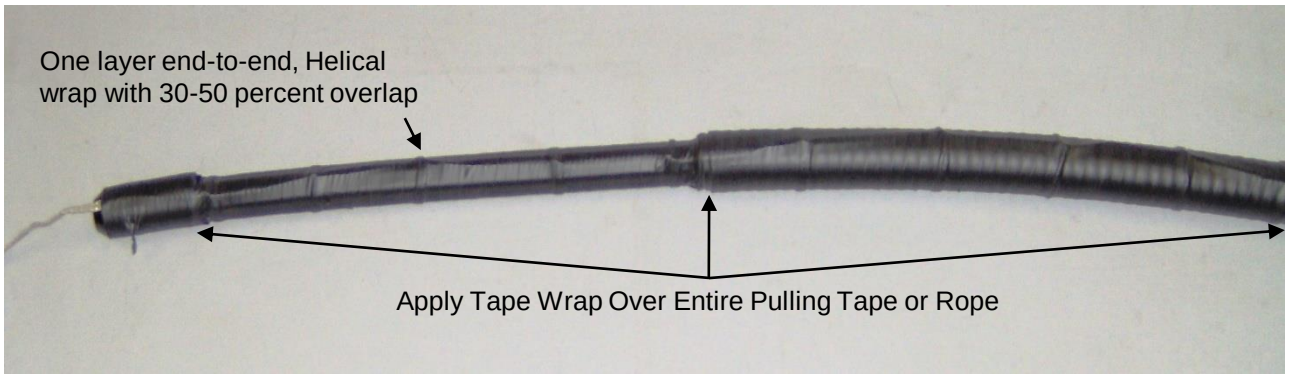

Figure 15
Tape Over Pulling Tape or Rope

7.10 During the installation effort, do **not** exceed the maximum tensile load limit (maximum allowable pulling force) of the tube cable. **Refer to TABLE II.**

7.11 Every ABF tube cable installation must be installed with some slack footage in the run.

7.11.1 Normal Slack Footage - Just as with conventional cabling, normal slack footage must be installed in every tube cable run following standard practices and procedures.

7.11.2 Thermal Slack Footage - To compensate for any thermal expansions and contractions, additional tube cable length (thermal slack footage) must be calculated and installed. Refer to Sumitomo Recommended Procedure *FutureFLEX Tube Cable Installation Procedures,* SRP SP-F04-008.

7.11.3 Extra Slack Footage - It is recommended to provide at least an additional 3-feet of tube cable length at each splice location and / or Tube Distribution Unit (TDU) entry point. This extra length typically provides enough material to work with when make tube connections inside the enclosure.

7.12 Proceed with normal cable installation practices and procedures.

7.13 ***IMPORTANT STEP*** – As the tube cable is being pulled off the reel, manually turn the reel to minimize / reduce tension on the cable.

WARNING: ***Do not cut the tube cable from the reel until the following steps have been performed.***

7.14 When the head end of the tube cable reaches its final destination and sufficient slack footage has been made available, remove the pulling force / slack the pulling line. Do not remove the Pulling Tape or Rope yet.

7.15 Observe the end of the tube cable for a few minutes. Once the tube cable is no longer under tension, it will tend to "relax." The expanded armor may contract a bit. Additionally, the core cable may have been elongated during the installation and now, no longer under tension, it may retract a bit. These conditions are normal.

7.16 When no more tube cable movement can be detected, remove the Pulling Tape or Rope and proceed with normal installation procedures.

7.17 Back at the reel, pull more tube cable off until sufficient slack footage length is made available at the tail end of the run. Then cut the tube cable from the reel.