SUMITOMO RECOMMENDED PROCEDURE

SRP SP-F04-002

FutureFLEX® AIR-BLOWN FIBER® SOLUTIONS

FIBER BUNDLE INSTALLATION PROCEDURE

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1.0 General

1.1 This procedure describes the steps necessary to set the initial tube span and Blowing Head Air Motor operating pressures and to perform the operating techniques required to install FutureFLEX Air Blown Fiber (ABF) fiber bundles in FutureFLEX tube cables. This single installation procedure is for both a BE200 and B200 LR.

1.2 A pressure source (Nitrogen Cylinder, Compressed Air Cylinder, or Air Compressor), a Blowing Head Equipment Kit, and a reel of ABF fiber bundle must be set up at one end of a tube span (see Sumitomo Recommended Procedure SRP SP-F04-001).

1.2.1 When activated, the Blowing Head "pulls" the fiber bundle from the reel and feeds it into the tube span at the fiber bundle entry point Fiber Termination Unit (FTU).

1.2.2 The Air Flow pressure blowing through the tube propels the fiber bundle to the other end of the tube span or fiber bundle exit point FTU.

1.3 Before installing a fiber bundle, the tube span must successfully pass the Tube Pressure and Tube Obstruction Tests (see SRP SP-F04-003 and SRP SP-F04-004).

NOTE: IF installing FP48PVS or FP72PVS, please refer to SRP SP-F04-053 for lubrication procedures before fiber bundle installation.

2.0 Safety Precautions

2.1 Pressurized Nitrogen – The use of inert (nonflammable) pressurized Nitrogen (N_2) gas presents several safety concerns.

2.1.1 N_2 is a simple asphyxiate. If large amounts of nitrogen are released into a confined area, the nitrogen can displace the amount of oxygen in air necessary to support life. This can result in a loss of balance, dizziness, rapid reduction in the ability to perform movements, reduced consciousness of surroundings, as well as other symptoms that are included in the MSDS (Material Safety Data Sheet) available upon request from the Gas Supplier. It is recommended that pressurized nitrogen only be released into a well-ventilated area.

2.1.2 When using pressurized nitrogen, there are no risks related to fire, reactivity, or other special hazards. Nitrogen is not listed as a carcinogen by NTP, IARC, or OSHA.

2.2 Compressed Air – The use of nonflammable pressurized compressed air (Atmospheric Air), either from a cylinder / bottle or air compressor, presents no safety concerns.

2.2.1 Air is nontoxic and necessary to support life. There are no ventilation concerns.

2.2.2 Compressed Air at high pressures does present an unusual fire and explosive hazard in that it will accelerate the burning of materials to a greater rate than they would burn at normal atmospheric pressure.

2.2.3 When using pressurized air, there are no risks related to fire, reactivity, or other special hazards. Air is not listed as a carcinogen by NTP, IARC, or OSHA. An MSDS (Material Safety Data Sheet) is available upon request from the Gas Supplier.

2.3 Pressurized Gas Cylinders / Bottles – Transporting and handling pressurized gas cylinders presents several safety concerns.

2.3.1 Any pressurized gas cylinder is dangerous if damaged. Gas bottles must be properly capped when being transported and stored. Gas bottles must be secured in a stable bottle dolly or chained to structure when uncapped for use.

2.3.2 A full size 300 cubic foot volume gas bottle weighs approximately 160 lbs. Two personnel should accomplish any manual lifting or moving of a bottle. Exercise care and use proper lifting techniques.

2.4 Blowing Head Equipment Transit Case – Transporting and handling the Blowing Head Equipment Transit Case presents several safety concerns.

2.4.1 The Blowing Head Equipment Transit Case weighs approximately 55 lbs. Normal transport is accomplished by pushing / pulling the Transit Case using its retractable handle and built-in wheels.

2.4.2 It is recommended that two personnel accomplish any manual lifting or moving of the Transit Case. Exercise care and use proper lifting techniques.

1.Reference Documents

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

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

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

4.0 Equipment / Tools Required
The following equipment and tools are required to complete this procedure.

4.1 Nitrogen Cylinder (Installer provided)
•Industrial Grade Nitrogen; preferred pressure source
•Inert (nonflammable) gas
•Dry or with no more than 4 ppm moisture content (H_2O)
•Oil / contaminant free output
•300 cu. ft. (approx.) volume bottle size recommended
•2200-to-2500 psi (approx.) pressure charge

Note: Typically, one 300 cu. ft. bottle of nitrogen will be required to install (approx.) 3000' - 4000' of fiber bundle and will last about 35-45 minutes. This "conservative estimate" can vary depending upon tube route orientation, fiber bundle size, tube cable type, and operating practices.

4.2 One Blowing Head Equipment Kit (BE200LRM, BE200LRS, or BE200LRY). See Sumitomo Recommended Procedure SRP SP-F04-001 for details.

4.3 Large Adjustable Wrench (Installer provided); 10" suggested.

4.4 8mm tubing (any type) for miscellaneous connections (Installer provided).

4.5 Reel of ABF Fiber Bundle.

4.6 Tube Couplings (DE08MC2) (Installer provided).

4.7 Cylinder Adapter (BEREGCA) (Installer provided); required if using Compressed Air Cylinders as pressure source.

4.8 Means of communicating across tube span (e.g.: two-way radios or similar).

4.9 Alternate Pressure Source – Although bottled Nitrogen is the preferred pressure source because of its cleanliness, general convenience, inexpensive cost, and ease of portability, compressed air from either a Compressed Air Cylinder or an Air Compressor can be used as an alternate pressure source.

4.10 Compressed Air Cylinder (Installer provided)
•"Dry Grade" Compressed Air
•Nonflammable gas (atmospheric air)
•Dry or with no more than 10 ppm moisture content (H_2O)
•Oil / contaminant free
•300 cu. ft. (approx.) volume bottle size recommended
•2200-to-2500 psi (approx.) pressure charge

Note: *Different types or "grades" of Compressed Air are available. The "purer" grades with such names as Zero Grade, Vehicle Emission Grade, Scientific Grade, and Accurate Grade undergo additional refining processes so they contain fewer impurities (hydrocarbons) and have less moisture content. It is <u>not</u> necessary to use these "purer" more costly grades of air for blowing operations.*

Note: *Performance-wise, Compressed Air supplied in a Cylinder performs the same as Nitrogen. There are no differences in the blowability of fiber bundle nor operation of the Blowing Head.*

Note: *Typically, one 300 cu. ft. bottle of will be Compressed Air required to install (approx.) 3000' - 4000' of fiber bundle and last about 35-45 minutes. This "conservative" estimate" can vary depending upon tube route orientation, fiber bundle size, tube cable type, and operating practices.*

Important Note: *Compressed Air Cylinders are supplied with a Female left-hand thread Bottle fitting (CGA-590). Pressure Regulators BEREG01 or BEREG02 supplied in the Blowing*

Head Equipment Kit have a Male right-hand thread Nut (CGA-580). A CGA-590 Industrial Air Cylinder-to-CGA-580 Nitrogen Regulator Cylinder Adapter is therefore required to connect the Pressure Regulators to the Bottle fitting. One (1) Cylinder Adapter is required for each Pressure Regulator used. ***See Fig. 1.***

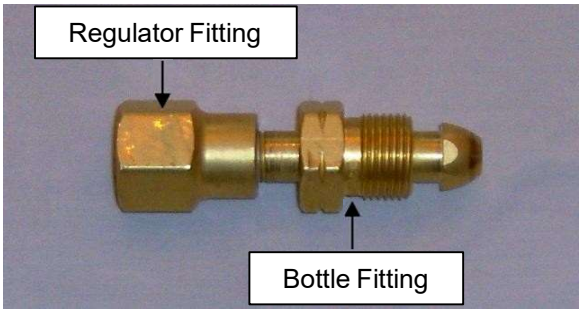

Figure 1
CGA-590 Industrial Air Cylinder-to-CGA-580 Nitrogen Regulator Cylinder Adapter

4.11 Air Compressor (Installer provided)
•Output dry or with no more than 10 ppm moisture content (H_2O); often requires use of a Secondary Dryer
- Output oil / contaminant free
- Output flow rate (capacity) at least 12 scfm
- Output pressure at least 200 psi

Note: *If an Air Compressor is to be used, additional Air and Coalescer Filters and a secondary Desiccant-type Dryer are strongly recommended and must be of compatible output flow and pressure ratings with the Air Compressor. Also consider the following potential issues first. Power source / requirements? Physical size of Compressor? Portability? Distance Compressor must be set up from Blowing Head? Fittings necessary to connect Compressor output to a Pressure Regulator? Noise if use indoors?*

5.0 Equipment Layout

5.1 **See Fig. 2** for Blowing Head Equipment layout. Also refer to Sumitomo Recommended Procedure SP-F04-001 for detailed set-up procedures.

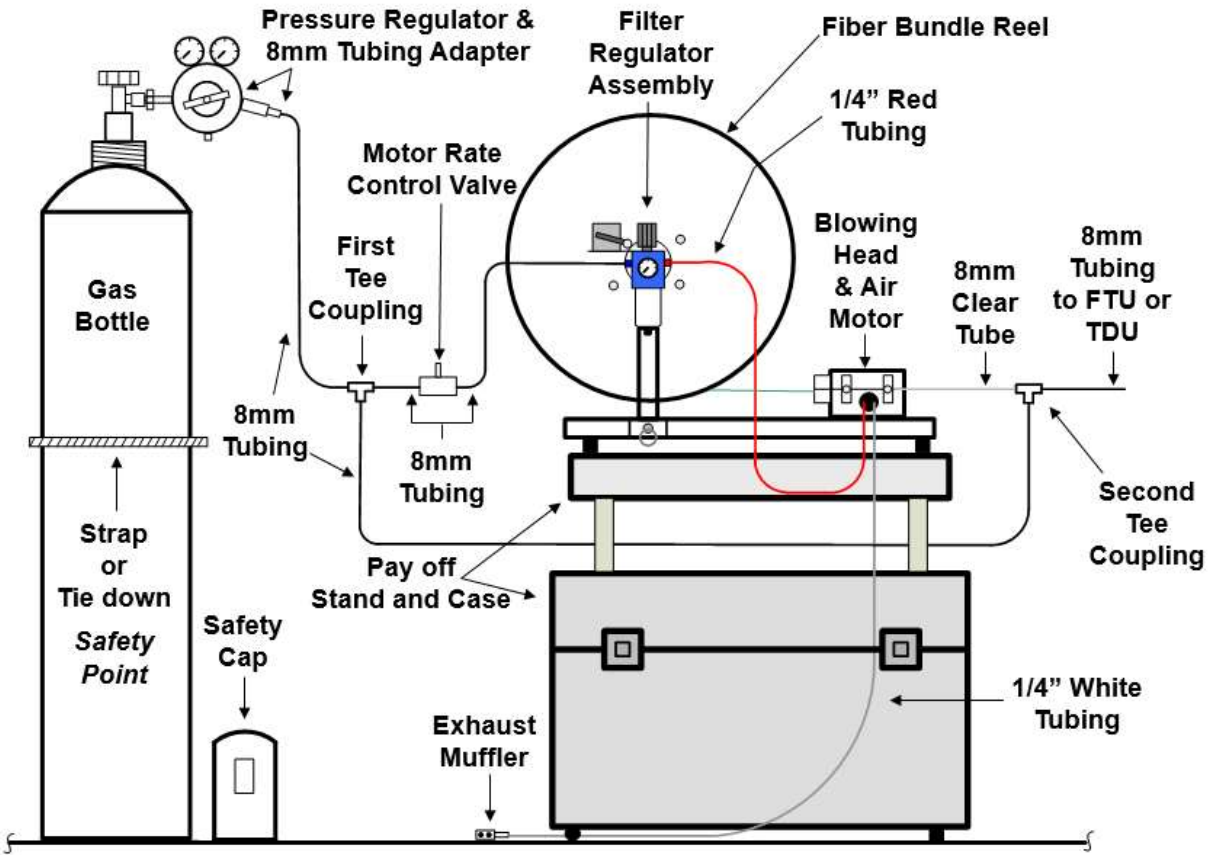

Figure 2
Blowing Head Equipment Layout

Best Practice … always set up Blowing Head Equipment in a neat, organized, and correct manner each and every time

6.0 Installation Preparations

CAUTION: *Before installing fiber bundle, verify tube span Pressure Test and Obstruction Test Procedures (Sumitomo Recommended Procedures SRP SP-F04-003 and SRP SP-F04-004) have been successfully accomplished.*

6.1 Complete Blowing Equipment Set-up procedures identified in Sumitomo Recommended Procedure SRP SP-F04-001 to ensure proper set-up of the equipment and loading of the fiber bundle.

6.2 Establish communications between Installers located at both ends of tube span.

6.3 Evaluate fiber bundle entry and exit point locations. Ensure they are well ventilated to disperse nitrogen gas released during installation operations. If necessary, relocate Blowing Equipment to a ventilated area and use jumper tubing to reach entry point FTU. If necessary, use jumper tubing at exit point FTU and extend tube span to a ventilated area. If required, provide auxiliary means of ventilation.

6.4 At entry and exit point FTUs, locate and identify correct tube cable and tube scheduled for fiber bundle installation.

6.5 Verify Payoff Counter is set to zero reading by turning Reset Knob. **See Fig 3.**

Note: *Payoff Counter indicates fiber bundle payoff distance in "meters" not "feet." This measurement is an approximate value and should be used for reference only. To convert the Counter reading to feet, simply multiple displayed number by three (3) and average out.*

7.0 Set Initial Operating Pressures

7.1 Verify Motor Rate Control Valve is closed and open Bottle Supply Valve.

Note: *Initial operating pressures listed are recommended starting values based on typical*

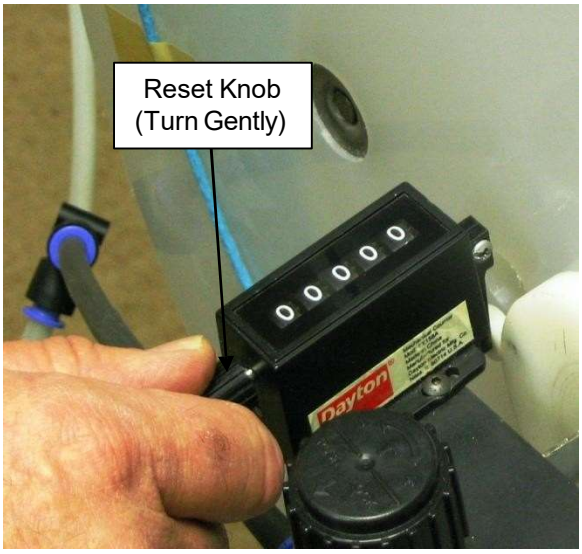

Figure 3
Set Payoff Counter to Zero
(Reads in Meters)

conditions. They can and should be changed to suit various installations. For example, if tube span length is short and tube route orientation fairly straight, lower operating pressures are quite acceptable.

7.2 **Air Flow Pressure.** Air Flow Pressure is defined as the air pressure applied to the tube span and actually blows in the fiber bundle.

7.2.1 For tube span runs greater than 500 feet in length, adjust Pressure Regulator Valve to supply 60 psi Air Flow pressure to the tube span.

7.2.2 For tube span runs less than 500 feet in length, adjust Pressure Regulator Valve to supply something less than 60 psi Air Flow pressure to the tube span; suggest starting with 50, or 60 psi. Short tube span runs typically do not need high Air Flow Pressures to blow in the fiber bundle. Additionally, using lower pressures helps save the gas supply. **See Fig. 4.**

CAUTION: *Maximum Safe Working Pressure Rating is 200 psi.*

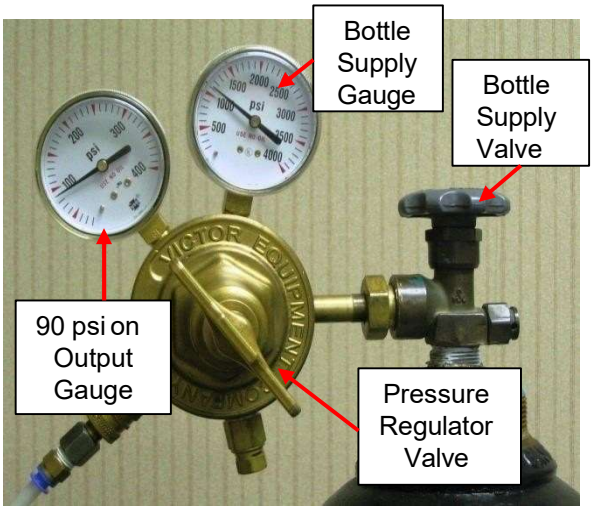

Figure 4
Set Initial Air Flow Pressure at 90 psi

7.3 **Important Step.** With Bottle Supply Valve open and Pressure Regulator set to desired output pressure pressurizing the tube span, wait and obtain verification that good airflow exists at exit point FTU before opening Motor Rate Control Valve.

7.4 While pressurizing the tube span, listen for air leakage at the Blowing Head. Minor air leakage will not degrade fiber bundle installation performance. If significant air leakage *(loud hissing sound)* is detected, stop operations, and close Bottle Supply Valve. The typical problem is a poor seating of the Fiber Bundle Air Seal and 8mm Clear Tube inside the Blowing Head. Allow tube span to de-pressurize. Open Blowing Head and reseat Fiber Bundle Air Seal and 8mm Clear Tube to stop or minimize leakage. (See Sumitomo Recommended Procedure SRP SP- F04-001.)

8.0 Start Installation

8.1 When ready, slowly open Motor Rate Control Valve to apply air pressure to the Air Motor to start the fiber bundle installation. *As the fiber bundle begins to move, look and listen for two (2) things.*

- Air Motor Cleaner Fluid Discharge
- Air Motor Pressure

8.2 Blowing Head Air Motor Cleaner Discharge**.** The key Preventative Maintenance action for the Air Motor is to apply 3-4 drops of Air Motor Cleaner fluid into the motor's Red Input Line *Before Every Use*. (See Sumitomo Recommended Procedure SRP SP-F04-001.)

When the Motor Rate Control Valve is opened to apply air pressure to the Air Motor, the Cleaner Fluid is blown into the Air Motor and any dirt or debris in the unit will be flushed out and discharged through the Exhaust Muffler tube.

8.2.1 If this discharge is fairly clear and clean, continue the blow.

8.2.2 If this discharge appears to be excessively dirty / black, shut off the Air Motor and stop blowing operations. Apply *another* 3-4 drops of Cleaner Fluid into the Air Motor's Red Input Line. Repeat these procedures until the discharge is fairly clear and clean.

8.3 Air Motor Pressure**.** Air pressure to the Air Motor is filtered and regulated by the Filter / Regulator Assembly and applied to the Air Motor only after the Motor Rate Control Valve is opened. The Motor Regulator Valve (black knob) atop the Filter / Regulator Assembly is pre-set to provide about 85-90 psi pressure to the Air Motor which is the motor's most efficient operating range.

8.3.1 When the Motor Rate Control Valve is fully opened, observe the pressure reading on the Filter / Regulator's Pressure Gauge. It should indicate between 60-65 psi. Also, occasionally monitor this pressure reading during blowing operations to ensure it stays around the 85-90 psi range.

8.3.2 Sometimes the Air Motor Pressure will begin to decline during a blowing operation. The Motor Regulator Valve can be adjusted to return to the 60-65 psi range. To make this adjustment, carefully lift valve handle to unlock it, turn until desired pressure is observed on adjacent pressure gauge, and then push down valve handle to lock. This adjustment can be made during blowing operations while the Air Motor is running. **See Fig. 5.**

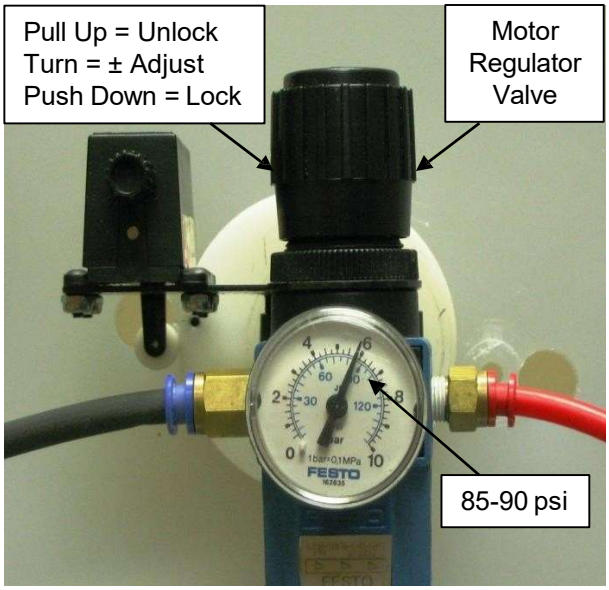

Figure 5
Set / Reset Air Motor Pressure at 85-90 psi

Figure 6
Waving & Snaking in the Clear Tube

9.0 During Installation

A fiber bundle installation is a dynamic event and the Blowing Head Operator must remain alert to ever-changing conditions. Always practice good Blowing Head Operator techniques described below.

9.1 Hold Motor Rate Control Valve
Keep two (2) hands on the Motor Rate Control Valve during fiber bundle installation operations. In the event the Air Motor must be secured quickly, the Blowing Head Operator must have positive control of valve / valve handle.

9.2 Monitor Clear Tube
Constantly monitor fiber bundle performance by watching condition of bundle moving through 8mm Clear Tube at front of Blowing Head. Best performance is achieved when fiber bundle is traveling through the center of the 8mm Clear Tube.

9.2.1 If fiber bundle begins to “wave and snake" inside 8mm Clear Tube, adjust Air Flow pressure to smooth out bundle performance. **See Fig. 6.**

9.2.2 Important Step**.** If fiber bundle stops moving in 8mm Clear Tube, quickly close Motor Rate Control Valve. *Repeat ... quickly close the Motor Rate Control Valve.* Allow tube span pressure to stabilize and attempt to re-start blowing operations by *slowly* opening Motor Rate Control Valve. If the bundle begins to move, continue to slowly increase the speed of the Air Motor. If the bundle does not want to move, stop. Do not try to “force” it to move or damage may result.

CAUTION: *If fiber bundle stops moving, failure to quickly close Motor Rate Control Valve and stop Air Motor and Fiber Bundle Drive Wheels from rotating can result in damage to fiber bundle.*

9.3 Listen to Air Motor / Exhaust Muffler
Listen to the sound of the Air Motor during fiber bundle installation operations. When operations are going smoothly, the Air Motor emits a nice, steady pitch; similar to a Dentist’s drill. If the Air Motor pitch changes and begins to labor, adjust / increase Air Flow pressure to improve motor performance.

Note: *Listening to the Air Motor is a key operating tip.*

9.4 Adjust Air Flow Pressure
During fiber bundle installation, be prepared to increase / decrease Air Flow pressure by adjusting the Pressure Regulator Valve. Make all pressure adjustments in small increments (about 10 psi at a time). **Refer to Fig. 4.**

CAUTION: *Maximum Safe Working Pressure Rating is 200 psi.*

9.4.1 Become familiar with tube span route and watch fiber bundle payoff distance progress on Payoff Counter. Anticipate when a change in Air Flow pressure will benefit installation operations. Be prepared to increase Air Flow pressure as fiber bundle travels further into tube span, begins going uphill, or enters a series of tight bends.

9.4.2 If installation operations are proceeding smoothly, try decreasing Air Flow pressure to conserve gas supply.

9.5 Monitor Bottle Supply Pressure
When Bottle Supply pressure drops below 400 psi, it indicates the bottle is getting near empty. Keep installing fiber bundle but watch for a noticeable slowdown in fiber bundle installation speed and listen to the Air Motor.

9.5.1 If using one Bottle, be prepared to stop blowing operations when bottle pressure is no longer effective / goes to zero. Secure Motor Rate Control and Bottle Supply Valve. Replace empty bottle with new one.

9.5.2 If using a Dual-Tank Gas Bottle Set-up, be prepared to switch over to the second bottle.

10.0 Completing Installation – At Exit Point FTU

10.1 Installer at exit point FTU informs Blowing Head Operator when fiber bundle reaches exit point FTU.

10.2 Blowing Head Operator adjusts Motor Rate Control Valve to slow fiber bundle movement.

10.3 A 10' - 15' exposed length of fiber bundle is recommended for fiber termination purposes; more or less length if required / desired. Instruct Blowing Head Operator to either stop or continue until the desired fiber bundle length is available.

10.4 When enough fiber bundle length is available at exit point FTU, instruct Blowing Head Operator to close Motor Rate Control and Bottle Supply Valves.

10.5 Allow tube span to de-pressurize / vent.

10.6. Remove and retain reusable Fiber Bundle Blowing Tip. **See Fig. 7.**

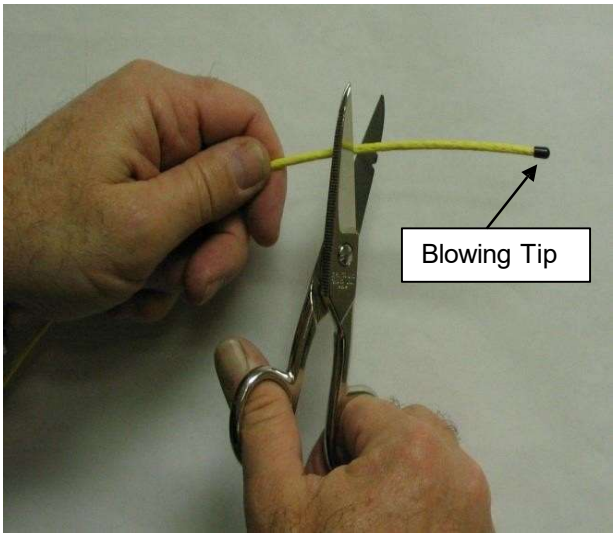

Figure 7
Do Not Remove Blowing Tip
Cut 2"-3" Off End of Fiber Bundle

Note: *It is recommended to leave Blowing Tip installed on fiber bundle and cut off first 2" - 3" of fiber bundle. This technique will help prevent the small Blowing Tip from being "misplaced."*

10.7 Coil and organize fiber bundle and protect it from accidental damage by storing inside FTU.

11.0 Completing Installation – At Entry Point FTU

11.1 After Motor Rate Control and Bottle Supply Valves have been closed to stop blowing operations, allow tube span to de-pressurize / vent.

***CAUTION**: When securing from blowing operations, always de-pressurize / vent the Pressure Regulator (Supply and Output Pressure Gauges to read zero). Then turn Pressure Regulator Valve's Tee Handle out / counterclockwise to relieve physical pressure on internal diaphragm. This step is vital to prolong the life of and prevent damage to the Regulator's internal diaphragm.*

11.2 Leave fiber bundle installed in Blowing Head for additional protection.

11.3 Carefully manually pay off recommended 10'- 15' of fiber bundle length from the reel for fiber termination purposes; more or less length if required / desired. When enough length is available, cut fiber bundle from reel. **See Fig. 8.**

11.4 When tube span has de-pressurized, open Blowing Head and carefully remove Fiber Bundle Air Seal from around fiber bundle. **See Fig. 9.**

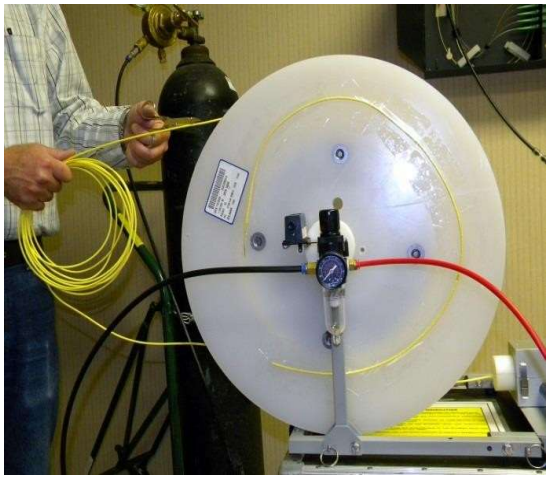

Figure 8
Fiber Bundle Still in Blowing Head (Protected)
Termination Length Removed from Reel
Cut Fiber Bundle from Reel

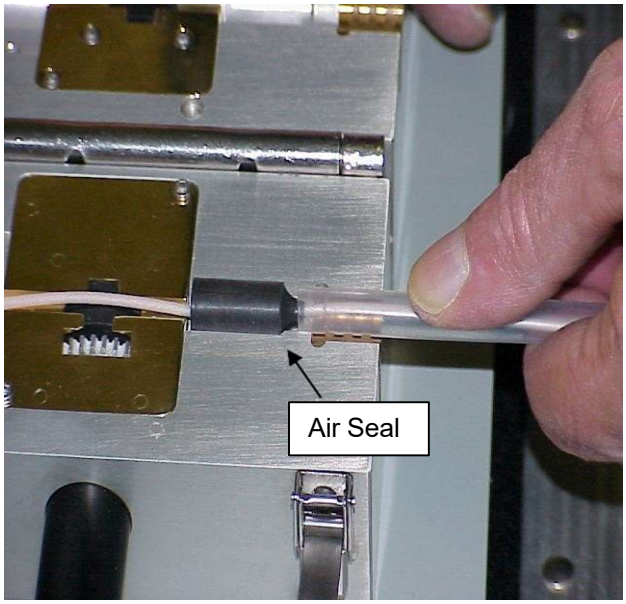

Figure 9
Open Blowing Head and
Carefully Remove Fiber Bundle Air Seal

11.5 Carefully uncouple Gas Supply Tubing from Branch Leg of Second Tee Coupling. **See Fig. 10.**

11.6 Carefully uncouple Second Tee Coupling and 8mm Clear Tube from tube span. **See Fig. 10.**

11.7 Carefully slide Second Tee Coupling and 8mm Clear Tube off cut end of fiber bundle and retain. **See Fig. 10.**

11.10 This completes the basic fiber bundle installation process.

11.11 If storing Blowing Head Equipment, re-install Plugs and Caps (removed during Set-up Procedures) in the Air Motor and Filter / Regulator Fittings and on 1/4" Red Tubing Ends. This is a very important step to prevent an excessive debris build-up in these components during storage. **See Fig. 11.**

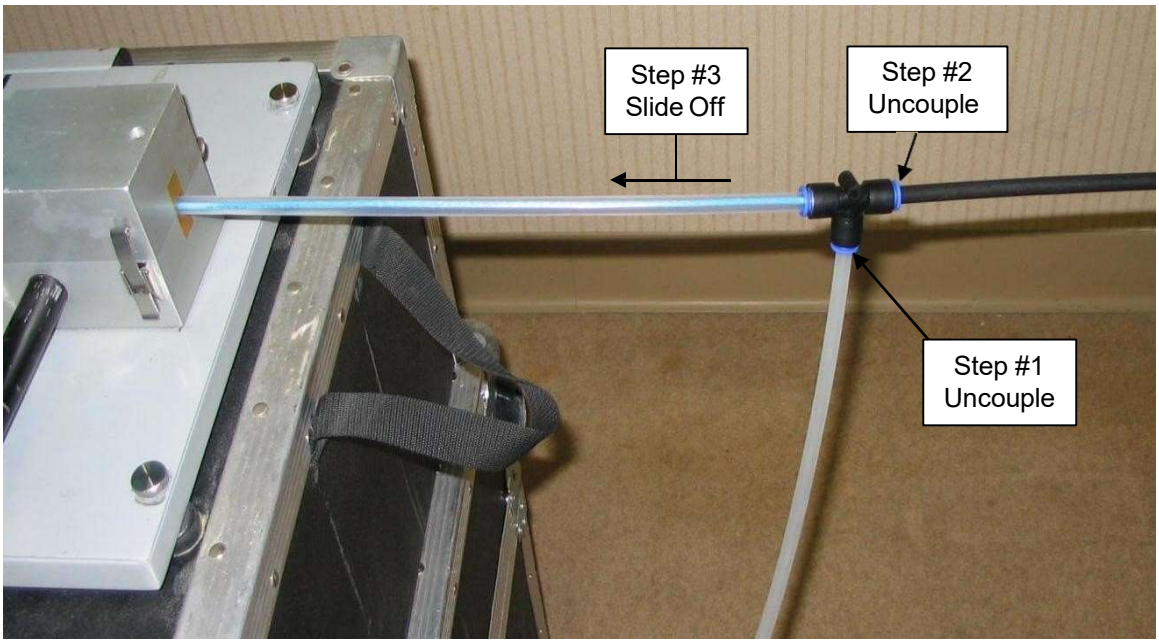

Figure 10
Step #1 = Uncouple Supply Tubing from Branch Leg of Second Tee Coupling
Step #2 = Uncouple Second Tee Coupling and Clear Tube from Tube Span
Step #3 = Slide Second Tee Coupling and Clear Tube off Cut End of Fiber Bundle

11.8 Coil and organize fiber bundle and protect it from accidental damage by storing inside FTU.

11.9 Secure loose end of fiber bundle to reel. As required, remove fiber bundle reel from Payoff Stand and install reel's protective cover (Clamshell).

Figure 11
Plugs and Caps

12.0 Installation Recommendations

12.1 Install from the Easy End
Begin a fiber bundle installation at the end of the tube span that has the fewest bends. This approach allows the moving fiber bundle to gain forward momentum and helps it overcome the resistance caused by downstream bends.

12.2 Blow Down Instead of Up
Begin a fiber bundle installation at the highest end of the tube span. This approach allows the moving fiber bundle to overcome the resistance caused by going uphill in a vertical route.

12.3 Adjust Operating Pressures
Do not hesitate to adjust Air Flow and Air Motor pressures to optimize the installation process. Make all adjustments in small increments.

12.4 Blowing Head Components
Make sure the Fiber Bundle Drive Wheels and Air Seals are the correct types / sizes for the fiber bundle being installed. Inspect the centerline grooves in the Drive Wheels for wear. Install new Drive Wheels if unsure of wear and before starting a long distance fiber bundle installation. Have extra sets of Drive Wheels on hand.

12.5 Fiber Bundle Blowing Tips
Always install a Fiber Bundle Blowing Tip on the end of the fiber bundle before installation operations begin. The Blowing Tip will help the fiber bundle pass through Tube Couplings installed along the tube span route.

12.6 Bottle Pressure
Check Bottle supply pressure before starting a fiber bundle installation. Make sure there is enough pressure in the bottle to complete the installation. Also make sure there are enough bottles on hand should more than one be required to complete the installation.

Note: *Typically, one 300 cu. ft. bottle of gas (nitrogen or compressed air) will be required to install (approx.) 3000' - 4000' of fiber bundle and last about 35-45 minutes. This "conservative estimate" can vary depending upon tube route orientation, fiber bundle size, and tube cable type.*

13.0 Installation Problems

13.1 Direction of Installation
If having problems installing fiber bundle from one direction, stop. Remove any installed fiber bundle (see Sumitomo Recommended Procedure SRP SP-F04-025). Disassemble Blowing Head Equipment and relocate to other end of tube span. Set-up Blowing Head Equipment (see Sumitomo Recommended Procedure SRP SP-F04-001) and install fiber bundle from opposite direction.

13.2 Installation Temperatures
Usually it is better to install fiber bundle when temperatures are near room temperature (e.g.: 60° – 80° F). During extremely hot or extremely cold conditions, installation performance may degrade.

13.3 Back Pressure Build-up
If a moving fiber bundle starts to slow down or stops moving, a Back Pressure condition could be developing inside the tube span. This can occur if the open end of the tube is suddenly blocked or restricted. It can also occur if too much Air Flow pressure is applied to the tube span. In either case, pressure cannot escape from the exit end of the tube fast enough to keep the fiber bundle moving efficiently.

Note: *"Back Pressure" is the term used to describe an airflow condition within a tube span that opposes Air Flow pressure.*

13.3.1 To relieve a minor Back Pressure condition, try decreasing Air Flow pressure by adjusting the Pressure Regulator Valve.

13.3.2 To relieve a major Back Pressure condition, stop operations and secure Air Flow pressure. Allow tube span to de-pressurize / vent. Slowly re-start installation operations using less Air Flow pressure.

13.4 Worn Drive Wheels
If a moving fiber bundle starts to slow down and stops moving, the Fiber Bundle Drive Wheels may be worn out. Stop blowing operations, allow tube span to de-pressurize / vent, open Blowing Head, and inspect grooves in Drive Wheels for excessive wear.

13.4.1 Red Drive Wheels (small groove) are used to install 2mm OD 2-, 4-, 6- and 12-fiber bundles. One pair installs approximately 10,000 feet of 2mm OD fiber bundle.

13.4.2 Black Drive Wheels (large groove) are used to install 3mm OD 24-, 3.75mm OD 48- and 4.0mm OD 72-fiber bundles. One pair installs approximately 3,000 feet of 3.75mm and 4.00mm OD fiber bundle.

13.4.3 Replace Drive Wheels as required (see Sumitomo Recommended Procedure SRP SP-F04-001).

13.5 Long or Difficult Tube Cable Routes
Table I provides information on *Standard Blowing Distances Using One (1) Blowing Head.* This data can be very helpful in determining if an Extended Blowing technique will be required or should be considered. Extended Blowing procedures are described in Sumitomo Recommended Procedures SRPs SP-F04-026, SP-F04-027, and SP-F04-028.

14.0 Change Gas Bottle (One Bottle)

14.1 When Bottle supply pressure drops below 400 psi, watch for a noticeable slowdown in fiber bundle installation speed. Stay alert and close Motor Rate Control Valve to stop fiber bundle movement when forward progress declines.

14.2 Close Bottle Supply Valve and allow tube span to de-pressurize. Do not proceed until Bottle Supply Gauge reads zero.

14.3 Disconnect 8mm tubing from 8mm Tubing Adapter and use large adjustable wrench to remove Pressure Regulator from empty bottle.

14.4 Install valve cap, release securing chain, and remove empty bottle.

14.5 Install new bottle, ensure it is securely chained in place, and remove valve cap.

14.6 Thread Pressure Regulator fitting onto bottle valve housing and tighten with large adjustable wrench.

7.Open Bottle Supply Valve and check for leakage around fitting. If leakage is detected, close Bottle Supply Valve and see Sumitomo Recommended Procedure SRP SP-F04-001.

8.Verify Pressure Regulator's output pressure is unchanged. Adjust if necessary.

14.9 Allow tube span to re-pressurize and obtain verification that airflow exists at exit point FTU before opening Motor Rate Control Valve.

14.10 **Very Important Step.** Slowly open Motor Rate Control Valve.

14.10.1 If fiber bundle begins moving in 8mm Clear Tube, slowly increase speed and resume normal installation operations.

14.10.2 However, if fiber bundle does not move or if any movement is very slow and labored, stop by immediately closing Motor Rate Control Valve. Allow more time for Air Flow pressure to fully re-charge tube span.

14.10.3 Carefully try again until the fiber bundle begins to move easily. Do not be in a hurry as fiber bundle damage may result.

15.0 Dual Tank Operations (Two Bottles)

15.1 If a Dual-Tank Set-Up (described in Sumitomo Recommended Procedure SRP SP-F04-001) is being used, begin fiber bundle installation operations as follows.

Note: *It is recommended to operate the Dual-Tank Set-up one bottle at a time; i.e.: Bottle #1 on and Bottle #2 off.*

15.2 Ensure Bottle Supply Valve #2 and Isolation Valve #2 are closed.

15.3 Open Bottle Supply Valve #1 and set Pressure Regulator #1 to desired Air Flow pressure.

15.4 When ready to begin fiber bundle installation operations, open Isolation Valve #1. Perform normal installation procedures as described in this SRP. **See Fig. 13.**

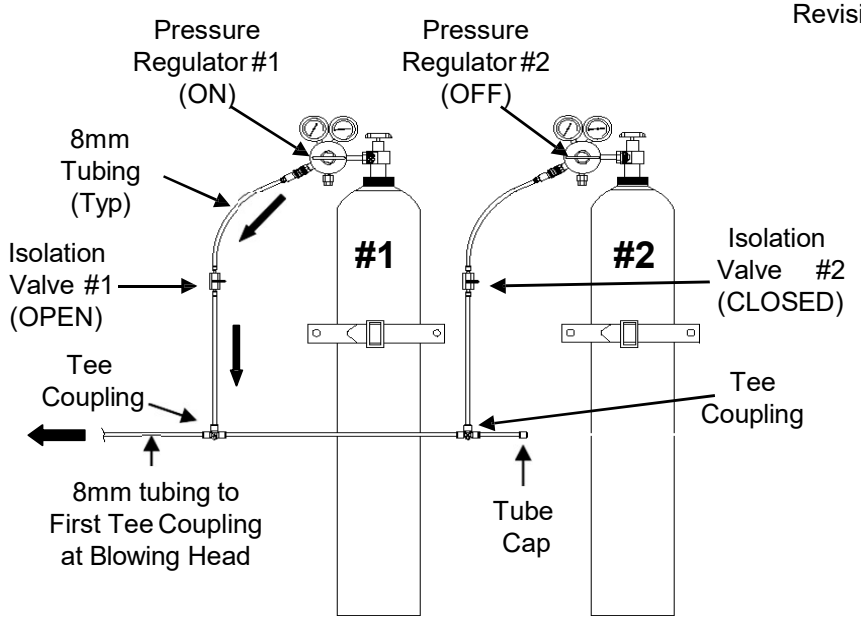

Figure 13
Dual Tank Operation; Tank #1 ON

15.5 When Bottle #1 supply pressure drops below 400 psi, watch for a noticeable slowdown in fiber bundle installation speed. At this time also open Bottle #2 and adjust Pressure Regulator #2 to match Air Flow pressure currently being supplied by Pressure Regulator #1.

15.6 When fiber bundle forward progress begins to decline, quickly and simultaneously close Isolation Valve #1 and open Isolation Valve #2. This action switches the tanks and keeps a constant supply of gas supplied to the Blowing Head Air Motor and tube span through the "First" Tee Coupling. **See Fig. 14.**

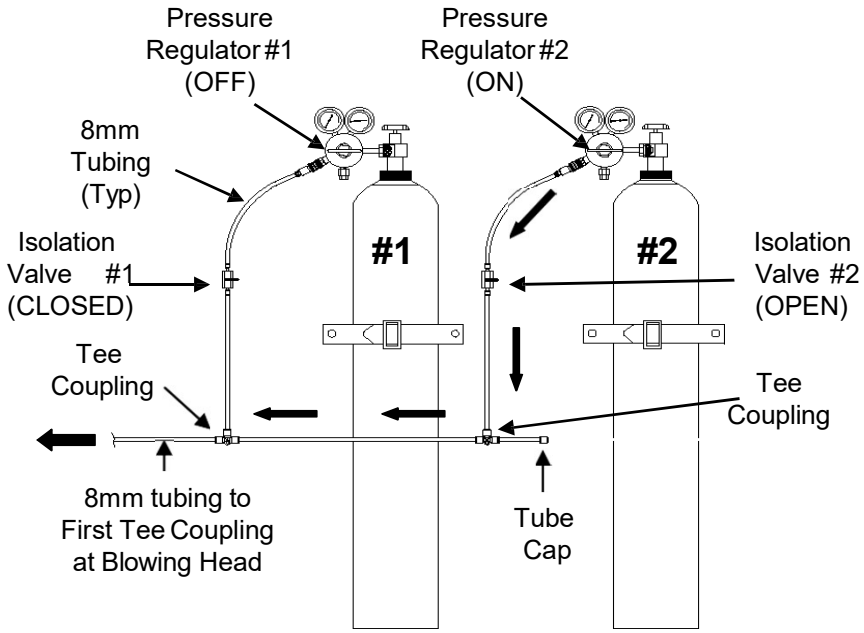

Figure 14
Dual Tank Operation; Tank #2 ON

15.7 Since Air Flow pressure readings between the two Pressure Regulators may not be exactly the same, be prepared to adjust Pressure Regulator #2's output as necessary to continue good fiber bundle installation operations.

Note: *If necessary, a third bottle may be made ready during on-going fiber bundle installation operations. Ensure Isolation Valve #1 remains closed. Disconnect and remove Bottle #1, position and connect Bottle #3 using the same procedures described in Sumitomo Recommended Procedure SRP SP-F04-001.*

TABLE 1

STANDARD FIBER BUNDLE BLOWING DISTANCES USING ONE (1) BLOWING HEAD

2, 4, 6 and 12 Fiber Bundles (2mm OD)	**APPROX. BLOWING DISTANCE**
All OSP tube cables All MTIO tube cable	1500 meters or 5000 feet
TRC (Riser) tube cables	1000 meters or 3300 feet
TGX (General Purpose),TPX (Plenum) single tube cables, and TP2 (Plenum) tube cables	500 meters or 1650 feet
24-Fiber Bundles (3mm OD)	**APPROX. BLOWING DISTANCE**
All OSP tube cables MTIO tube cables	1500 meters or 5000 feet 1500 meters or 5000 feet
TRC (Riser) tube cables	750 meters or 2500 feet
TGX (General Purpose),TPX (Plenum) single tube cables, and TP2 (Plenum) tube cables	300 meters or 1000 feet
48-Fiber PEF Bundles (3.7mm OD)	**APPROX. BLOWING DISTANCE**
All OSP tube cables & MTIO tube cables	1400 meters or 4,000 feet
TRC (Riser) tube cables	1000 meters or 2,500 feet
TGX (General Purpose),TPX (Plenum) single tube cables, and TP2 (Plenum) tube cables	228 meters or 750 feet
48 & 72-Fiber PVDF Bundles (4.0mm OD)	**APPROX. BLOWING DISTANCE**
OSP tube cables (without lubricant)	450 meters or 1500 feet
OSP tube cables (with lubricant)	1220 meters or 3500 feet
TRC (Riser) tube cables	610 meters or 2,000 feet

ADDENDUM A
Fiber Bundle Installation Checklist

Notes:
1. All distances given are approximate values.
2. Several factors heavily influence actual blowing distances:
   - The location, number, and severity of bends in a tube cable run
   - The fiber bundle size installed (2mm OD,3mm OD or 4mm OD)
   - The tube cable type or types being blown through
3. Since 24- and 48-fiber Bundles contain four (4) nylon Sub Units and a Central Member, they are stiffer than and not as flexible as 12-Fiber Bundles. Consequently, 24-, 48- and 72-fiber bundle blowing distances may be slightly less than the approximate distances noted above if installed in tube cable routes with numerous tight bends.

The following checklist is intended to assist an Installing Activity prepare for a FutureFLEX® ABF fiber bundle installation. Every installation is different and must be evaluated separately. Use this checklist as a "basic guideline" only and add to it as necessary.

TUBE CABLE ROUTE	√
Where are the "Sending" and "Receiving" Ends of the tube span located?	
What are the tube span or segment distances?	
What are the distances between TDUs?	
What are the tube cable types? (Plenum, Riser, Outside Plant)	
Where are the TDUs located along the tube span route?	
What is tube route orientation? (Straight, sweeping bends, sharp bends, verticals, etc.)	
Where are the "worst" bends located in the tube route? (Blow from the "easy" end)	
Does the tube span route contain any vertical sections? (Blow down instead of up)	
What is the tube routing like inside the TDUs? (Avoid tight bends inside a TDU)	

FIBER BUNDLE	√
What size fiber bundle is being installed? (2mm OD, 3mm OD, or 3.5mm OD)	
Does fiber bundle to be installed match the Project Plan? (Install to the Plan)	
Which tube is being used? (Tube numbers at Sending and Receiving ends)	
How much fiber bundle needs to blown out for termination purposes? (10' - 15' recommended)	

TDUs and FTUs	√
Have the best fiber bundle entry / exit points been determined?	
Are Tube Plugs and Fiber Bushings on hand? (To seal tube ends)	
How will Gas Bottles be secured / chained in place? (Bottle Safety)	
Have ventilation issues been considered at both ends of the tube span? (Ventilation Safety)	

BLOWING EQUIPMENT	√
Are the correct size Fiber Bundle Drive Wheels and Air Seals on hand?	
Are extra Fiber Bundle Drive Wheels on hand?	
Are the correct size and number of Fiber Bundle Blowing Tips on hand? (Red 2mm, Black 3mm, and Blue 4mm)	
Are tube jumpers and extra Tube Couplings on hand?	
Have the appropriate SRPs been reviewed? (SRPs SP-F04-001 & SP-F04-002)	
Is the Blowing Head clean? (Dry or damp / denatured alcohol wipe down)	
How many bottles of gas are required? (Estimate about 3000' - 4000' per bottle)	
Is a suitable adjustable wrench on hand to install the Pressure Regulator to the Bottle?	

MISCELLANEOUS. ITEMS	√
Are enough radios / phones on hand and in good working order? Are the batteries charged?	
Is a Tube Test Kit on hand?	
Is an extra Pressure Regulator Assembly with 8mm Tubing Adapter on hand?	
Is a Dual-Tank Isolation Valve Kit on hand?	
If using Compressed Air Cylinders, is a Cylinder Adapter(s) on hand?	
Have Pressure and Obstruction Tests been performed and results documented?	

EXTENDED BLOWING TECHNIQUES	√
If required, which Extended Blowing Technique will be used? (Tandem, Mid-Span, Segment Blowing or combinations.)	
If required, can TDUs be opened along the tube span route for access to Tube Couplings?	
Are clean drop cloths / traffic cones available to protect the fiber bundle if a Figure 8 is required?	
Extra T couplings on hand extended blowing set up?	
Will the Blowing Head be used on the Payoff Stand or removed from the Payoff Stand?	