

SUMITOMO RECOMMENDED PROCEDURE

SRP SP-F04-009



BE300 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.

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-F04-007**).

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.

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.

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 (N₂) gas presents several safety concerns.

2.1.1 N₂ 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 detailed in the MSDS.

MSDS “Material Safety Data Sheet is 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 / Tank 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 / Tanks - Transporting and handling pressurized gas cylinders presents several safety concerns.

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

2.3.2 A full size 300 cubic foot volume gas Tank weighs approximately 160 lbs. Two personnel should accomplish any manual lifting or moving of a Tank. 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.

3. Reference Documents

3.1 Sumitomo Recommended Procedure, *FutureFLEX Fiber Bundle Blowing Equipment Set-up Procedure*, **SRP SP-F04-007**.

3.2 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 (H₂O)
 - Oil / contaminant free output
 - 300 cu. ft. (approx.) volume Tank size recommended
 - 2200-to-2500 Psi (approx.) pressure charge

Note: Typically, one 300 cu. ft. Tank 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 (BE300). See Sumitomo Recommended Procedure **SRP SP- F04-007** 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.

Important Note: Except during an active Blowing Operation the Fiber Bundle should always be protected from Dust and Debris by using the Clamshell. More Importantly the Fiber Bundle must always be secured to the Reel so that it cannot become wrapped or tangled during transit. Never transit or store the Fiber Bundle reel-side down.

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 Tank 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 (H₂O)
 - Oil / contaminant free
 - 300 cu. ft. (approx.) volume Tank 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 not 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. Tank of 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, tube cable type, and operating practices.

Important Note: Compressed Air Cylinders are supplied with a Female left-hand threaded Tank fitting (CGA-590). Pressure Regulator BEREG02 supplied in the Blowing Head Equipment Kit has a Male right-hand threaded 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 Tank fitting. One (1) Cylinder Adapter is required for each Pressure Regulator used. **See Fig. 1**

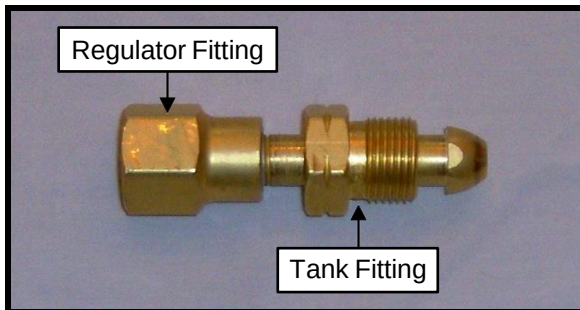


Figure 1.

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 compatible in both the output flow and the pressure ratings with the selected Air Compressor.

Also consider the following potential issues:

- Portability?
- Power Source Requirements?
- Physical size of Compressor?
- Noise "Decibels" if use indoors?
- Distance between Compressor and BE300?
- Fittings Compressor to Pressure Regulator?

5.0 Equipment Layout

5.1 See Fig. 2 for Blowing Head Equipment layout. Also refer to Sumitomo Recommended Procedure **SRP: SP-F04-007** for detailed set-up procedures.

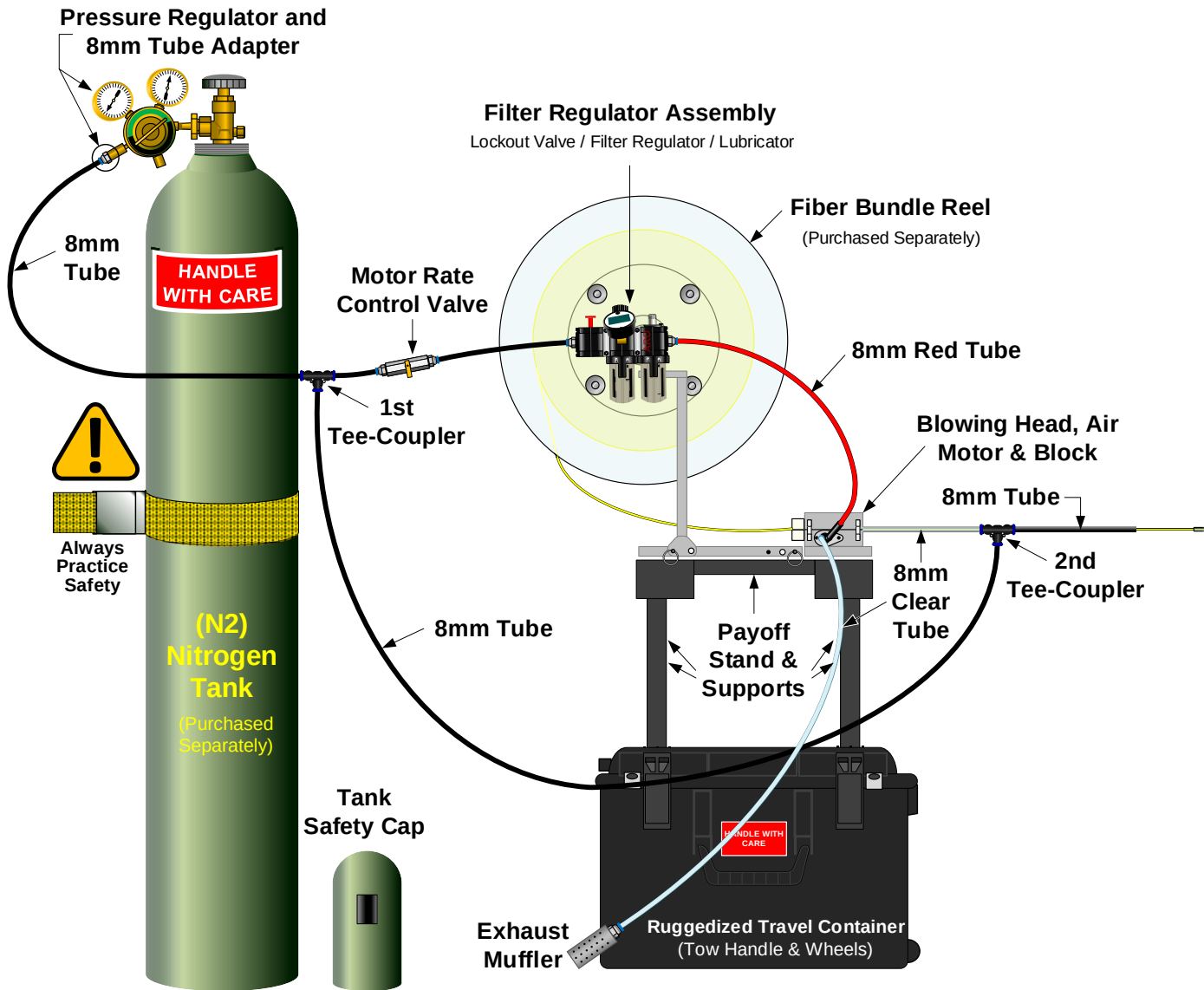


Figure 2
Blowing Head Equipment Layout

Best Practice: always set up the 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-F04-007** to ensure proper set-up of the equipment and loading of the Fiber Bundle.

Important Note: Before attempting to load the Fiber Bundle into the Blowing Head it is very important to make sure that the Fiber Bundle has not overlapped itself and is wound evenly across the spool. If the Fiber Bundle is overlapped prior to starting the blowing operations, the overlap can cause the Fiber Bundle to become tangled on the Reel and at some point during the blow may create a binding condition that could prevent the Fiber Bundle from freely feeding off the Reel. For this reason the Blowing Head Operator must ensure the Fiber Bundle has not become looped around itself. Failure to perform this step could result in Damage to the Fiber Bundle, Halting the Blowing Operations and impacting the cost of materials and labor while creating delays to the project schedule. Do not begin blowing operations without ensuring the Fiber Bundle has not overlapped onto itself.

This same rule must be adhered to when blowing operations have stopped “for any reason” in the event that the reel continues to spin and the Fiber Bundle continues to feed off the Reel. This scenario can cause the slack Fiber Bundle to become overlapped or tangled in itself.

For this reason, the Operator must pay close attention to the reel at all times to avoid the accumulation of slack. The Blowing Head Operator must always ensure that no overlapping has occurred to the Fiber Bundle before trying to install it.

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 the Blowing Equipment to a ventilated area and use jumper tubing to reach entry point. If necessary, use jumper tubing at the exit point and extend the tube span to a ventilated area. If required, provide auxiliary means of ventilation.

6.4 At entry and exit points, locate and identify correct tube cable and tube scheduled for Fiber Bundle installation.

6.5 Verify the Fiber Bundle Print-String to locate the foot measurement. **See Fig 3.** Always record the Sequential Foot Number printed on the Fiber Bundle to determine the total distance of a span.

6.5.1 By recording the Sequential Marking printed on the Fiber Bundle it allows you to determine an exact span length at the end of a blow or, it can help you diagnose how far a Fiber Bundle traveled if it “stops mid-blow” for any reason. Example: by subtracting the lesser Seq-No from the greater Seq-No the result will be the total lineage distance between the two values or, the distance the Fiber Bundle traveled before encountering problems.

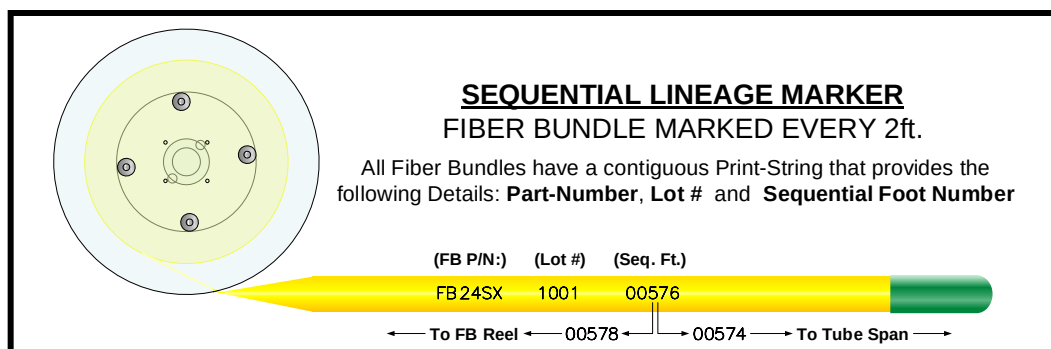


Figure 3 - Print String (Sample) - Always Record Sequential Foot Marker before starting the blow

6.5.2 This procedure can be very helpful when blowing in new fiber and encountering difficulties, (slow or stopped blow). By determining how many feet of Fiber Bundle was blown in before stopping, it allows the installer to trace the span to the point where the Fiber Bundle stopped. i.e. a pinched tube, a loose coupler connection or a technical section with numerous turns and elevations. Knowing this distance helps to isolate the exact section of the span where the stoppage occurred. If a problem is not found, it helps the installer to decide if they should consider performing a Segment, Mid-Span or Tandem Blowing Operation as a work-around procedure.

See Sumitomo Recommended Procedures –

- **SRP: SP-F04-026** for Tandem Blowing
- **SRP: SP-F04-027** for Mid-Span Blowing
- **SRP: SP-F04-028** for Segment Blowing

7.0 Set Initial Operating Pressures

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

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

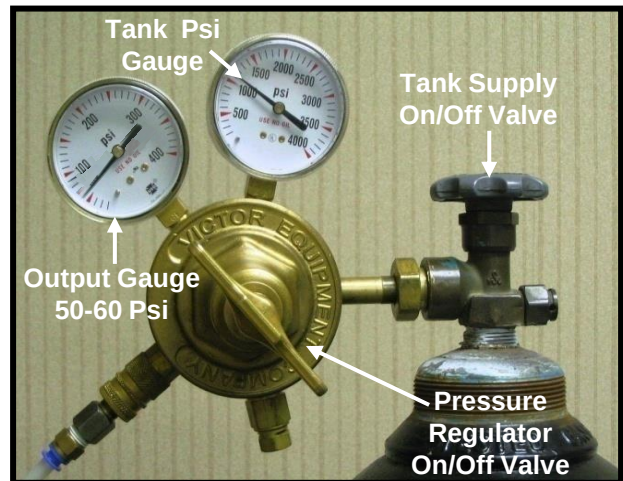


Figure 4

Set Initial Air Flow Pressure at 50-60 Psi

7.3 Important Step. With Tank Supply Valve open and Pressure Regulator set to desired output pressure "pressurizing the tube span" wait and obtain verification that good airflow exists at the exit point before opening the 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 Tank 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 reseal Fiber Bundle Air Seal and 8mm Clear Tube to stop or minimize leakage. (See Sumitomo Recommended Procedure **SRP: SP-F04-007.**)

7.4.1 A leaking Air Seal can be caused while closing the block; This may occur when the inside edge of the block pinches or grabs onto the seal causing it to push inward and down which can misalign the seating of the seal. **See Fig. 5 - (1 & 2)**

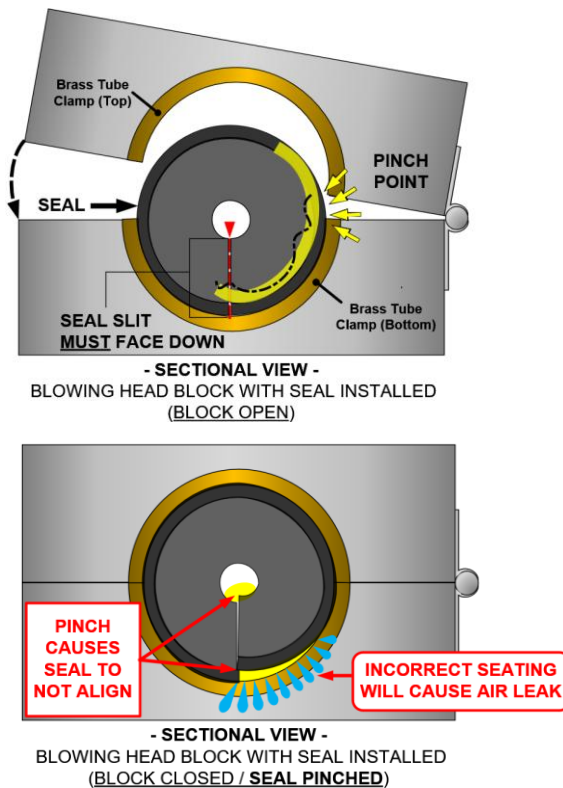


Figure 5 - (Example) - Pinched Air Seal

7.4.2 Always be cautious and careful when installing the seal, additionally and equally important is the placement of the Clear Tube and how it mates to the Air Seal. Always be sure that the end of the Clear Tube that mates to the Air Seal is **Square Cut**: The cut face is at a 90° angle to the length (axis) of the tube. *(This is Important!)*

7.4.3 With the Air Seal “positioned Slit-Down” and placed into the block, the large O.D. end of the Seal should be very close to or, touching the Brass Plate. Next, the Clear Tube should be snugly mated to the smaller O.D. end of the Seal. With both the Air Seal and Clear Tube properly in place you must now slowly and carefully close the Top of the Block “While holding the Clear Tube steady”.

See Fig. 6 - (1 & 2)

Note: *It's not uncommon for a technician to make several attempts at this process to be certain they got it right.*

Always Pay Close Attention to both the Clear Tube and the Air Seal when installing or replacing these items to avoid performance hindering air leaks.

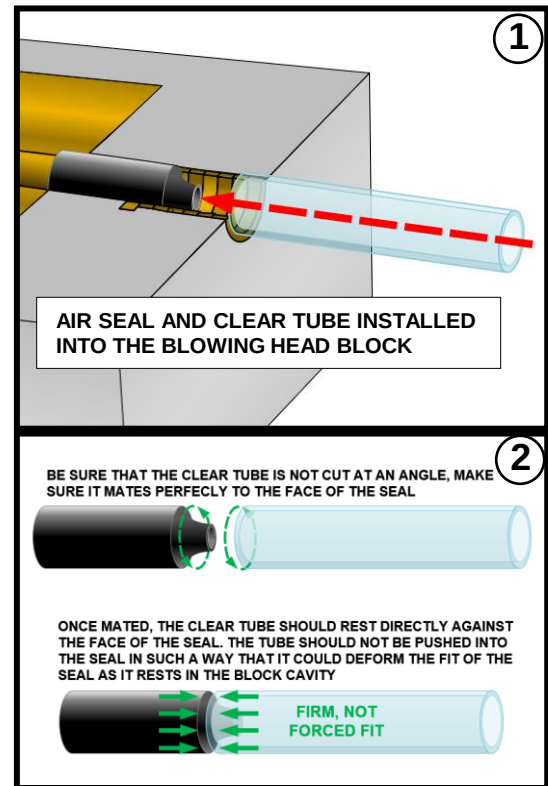


Figure 6 - Air Seal and Clear Tube Mating

8.0 Start Installation

8.1 When ready, slowly open the 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 - (Pay Attention to the Sound)
- Filter Regulator - (Verify Proper Pressure)

8.2 Air Motor Sound - Always pay close attention to the sound of the motor. As with any motor, if you pay attention to the sound that it makes you can tell when it's running optimally, when it's under a load and when it's running poorly/erratically. The best way to describe the motor sound it is when compared to a Dentist's drill that emits a high-pitched whine. Keeping your ears tuned to the sound of the motor will improve the operator's ability to detect and address potential issues before they happen. *(This is Important!)*

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 approximately 40 Psi pressure to the Air Motor which, is the motor's efficient operating pressure in most situations.

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 SEL's pre-set pressure between 35-40 Psi. Also, occasionally monitor this pressure reading during blowing operations to ensure it remains at the 35-40 Psi range.

8.3.2 Sometimes the Air Motor Pressure will begin to decline during a blowing operation. The Regulator Valve can be adjusted to return to the 35-40 Psi range. To make this adjustment, carefully lift the valve knob to unlock it, turn until the desired pressure is observed on adjacent pressure gauge and then push down the valve knob to lock it. This adjustment can be made during blowing operations while the Air Motor is running. **See Fig. 7**

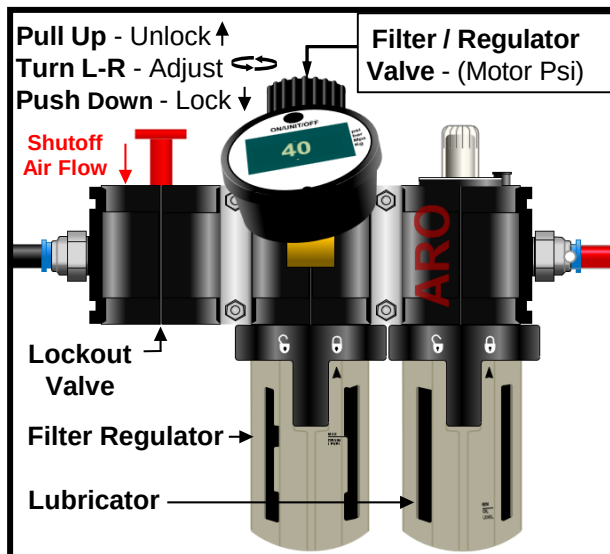


Figure 7

Set / Reset Air Motor Pressure to 35-40 Psi

8.4 Air Motor Lubricator - The BE300 has been fitted with an in-line Lubricator, this ensures continuous lubrication of the air motor, provides optimal performance and minimizes long term wear.

For Lubricator operation and maintenance details, please reference Sumitomo Recommended Procedures **SRP: SP-F04-007** – Blowing Equipment Setup Procedures.

See Fig. 7

8.5 Lockout Valve - The BE300 has also been fitted with a lock out valve **See Fig. 7**, the Lockout Valve when activated cuts all air-flow to the Filter Regulator, Lubricator and Air Motor. The Lockout Valve allows the operator to quickly shutdown a blowing operation in the event it is necessary. Example: If the Fiber Bundle begins to wave, shake and/or bunch up when viewed through the Clear Tube it may be necessary to lower air pressure to the Motor while increasing air to the span. If these adjustments fail to stop all waving and shaking and, fail to restore blowing progress or more importantly, the Fiber Bundle stops moving, SEL recommends that you stop the blow and shutdown air to the Motor using the Lockout Valve to avoid damage to the Fiber Bundle. **See Fig. 8**

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 herein.

9.1 Keep a Finger on the Lockout 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 the Lockout Valve Actuator Button.

9.2 Monitor the Clear Tube; Constantly monitor the condition of the bundle moving through the 8mm Clear Tube (Front of Blowing Head). Optimal performance is achieved when the Fiber Bundle is traveling through the center of the 8mm Clear Tube.

9.2.1 If Fiber Bundle begins to “wave and snake” inside the 8mm Clear Tube, adjust the Air Flow pressure to smooth out the bundles performance.

See Fig. 8

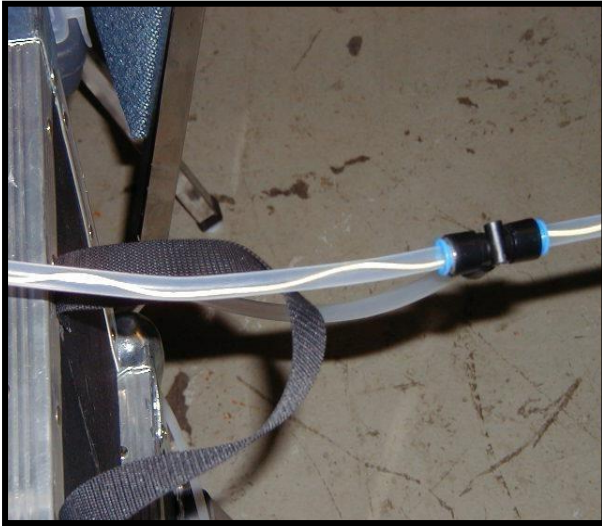


Figure 8

Waving & Snaking in the Clear Tube

9.2.2 Important Step. If Fiber Bundle stops moving inside the 8mm Clear Tube, Quickly Press Down the Lockout Valve Actuator button to shutoff air to the Air Motor. Allow the Tube Span pressure to stabilize and attempt to re-start blowing operations by first closing the Motor Rate Control Valve, next, reset/open the Lockout Valve. Now you may begin slowly opening the 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 the Fiber Bundle stops moving, failure to quickly close the Lockout Valve to stop the Air Motor and Fiber Bundle Drive Wheels from rotating could result in damages to the Fiber Bundle jacket and/or fibers.

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. If the Air Motor pitch changes and begins to labor, adjust / increase the Air Flow pressure to improve motor performance.

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

9.4 Adjust the 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 5 Psi at a time). **Refer to Fig. 4**

CAUTION: Maximum Safe Working Pressure Rating is 200 Psi.

9.4.1 Become familiar with the Tube Span Route, watch / listen to the blowing head to know when you have encountered technical / non-technical tube routes based on how fast the Fiber Bundle is moving and the Pitch of the Motor. 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 it is recommended that no adjustments are made to the air pressure for both Motor and Span.

9.5 Monitor the Tank Supply Pressure when Tank Supply Pressure drops below 400 Psi, this indicates the Tank is getting near empty. Keep installing Fiber Bundle but watch for a noticeable slowdown in Fiber Bundle installation speed and continue listening to the Air Motor.

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

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

10.0 Completing Installation - At Exit Point.

10.1 Installer at the exit point informs Blowing Head Operator when Fiber Bundle reaches exit point.

10.2 Blowing Head Operator adjusts Motor Rate Control Valve to slow the Fiber Bundle Travel.

10.3 A 10'-15' exposed length of Fiber Bundle is recommended for fiber termination purposes; more or less length as 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 the exit point, instruct the Blowing Head Operator to close the Motor Rate Control and Tank Supply Valves.

10.5 Allow Tube Span to de-pressurize / vent.

10.6 Remove and retain reusable Fiber Bundle Blowing Tip. **See Fig. 9**

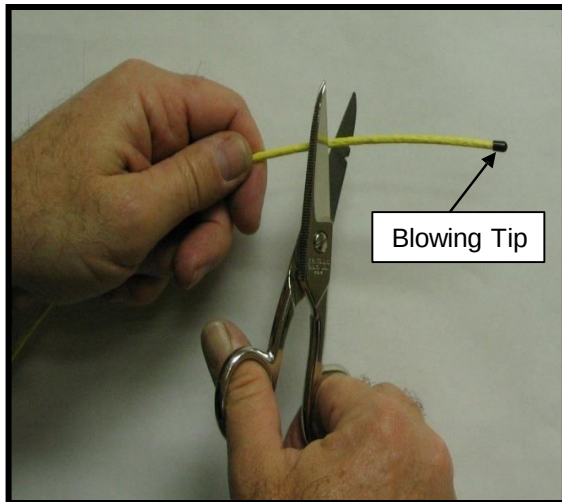


Figure 9

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 the Fiber Bundle to protect it from accidental damage by storing inside the designated enclosure.

11.0 Completing Installation - (Entry Point)

11.1 After Motor Rate Control and Tank 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. 10**

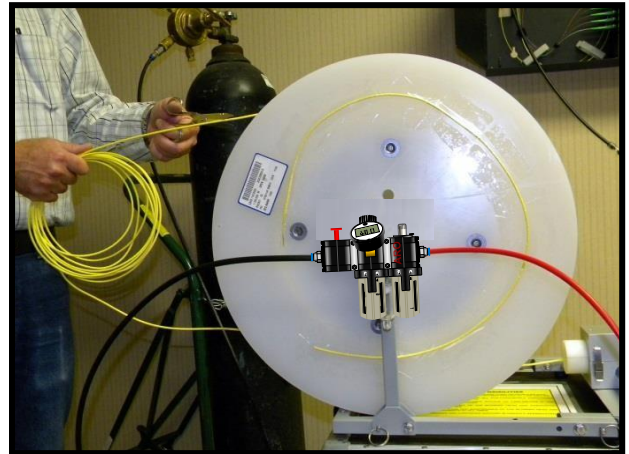


Figure 10

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

11.4 When tube span has de-pressurized, open Blowing Head and carefully remove Fiber Bundle Air Seal from around Fiber Bundle. **See Fig. 11**

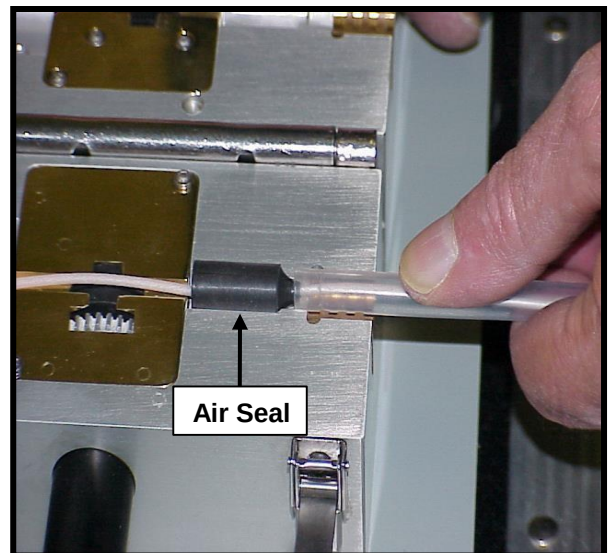


Figure 11

Open Blowing Head and
Carefully Remove Fiber Bundle Air Seal
by separating the slit while moving the
Seal away and off of the Bundle.

11.5 Carefully uncouple Air Supply Tubing from Branch Leg of Second Tee Coupling.

See Fig. 12 - ①

11.6 Carefully uncouple Second Tee Coupling and 8mm Clear Tube from tube span. **See Fig. 10 - ②**

11.7 Carefully slide Second Tee Coupling and 8mm Clear Tube off cut end of Fiber Bundle and retain. **See Fig. 10 - ③**

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 both ends of the 8mm Red Tubing. This is a very important step to prevent any excessive debris and/or build-up in these components during storage.

See Fig. 13

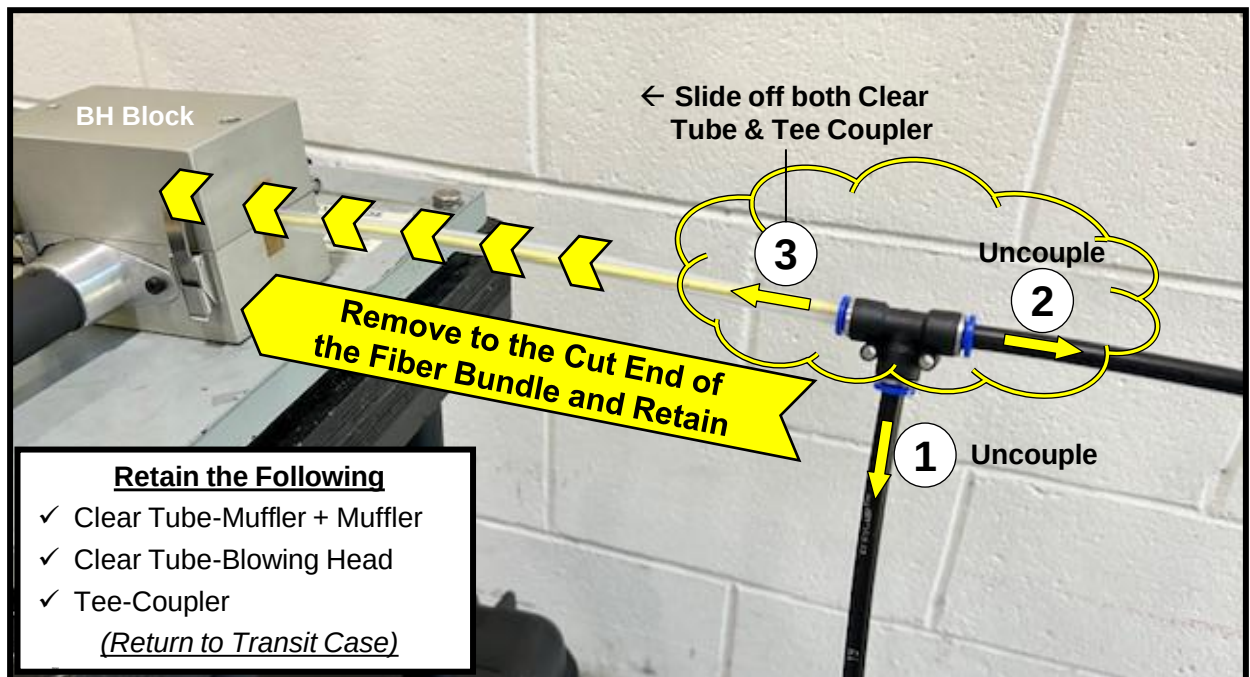


Figure 12

- ✓ **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 it inside an Enclosure.

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



Figure 13
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 Tank Pressure

Check Tank supply pressure before starting a Fiber Bundle installation. Make sure there is enough pressure in the Tank to complete the installation. Also make sure there are enough Tanks on hand should more than one be required to complete the installation.

Note: Typically, one 300 cu. ft. Tank 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-F04-007) 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, stopping and restarting operations using less Air Flow pressure is an option. Alternatively, if you can shorten the blowing distance and perform a Segment Blow this may be the best option. See Sumitomo Recommended Procedures **SRP: SP-F04-028**.

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 6-fiber 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-, 3.7mm OD 48- and 4.0mm or 4.1mm 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-F04-007).

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 Tank (One Tank)

14.1 When Tank 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 Tank Supply Valve and allow tube span to de-pressurize. Do not proceed until Tank Supply Gauge reads zero.

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

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

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

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

14.7 Open Tank Supply Valve and check for leakage around fitting. If leakage is detected, close Tank Supply Valve and see Sumitomo Recommended Procedure SRP SP-F04-007.

14.8 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 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 Tanks)

15.1 If a Dual-Tank Set-Up (described in Sumitomo Recommended Procedure **SRP: SP-F04-007**) is being used, begin Fiber Bundle installation operations as follows.

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

15.2 Ensure Tank Supply Valve #2 and Isolation Valve #2 are closed. **See Fig. 14**

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

15.4 When you are ready to begin the Fiber Bundle installation operations, first open Isolation Valve #1. Perform normal installation procedures as described in this SRP. **See Fig. 15**

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

15.6 When the 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 flowing to the Blowing Head Air Motor and Tube Span through the "First" Tee Coupling. See Fig. 16

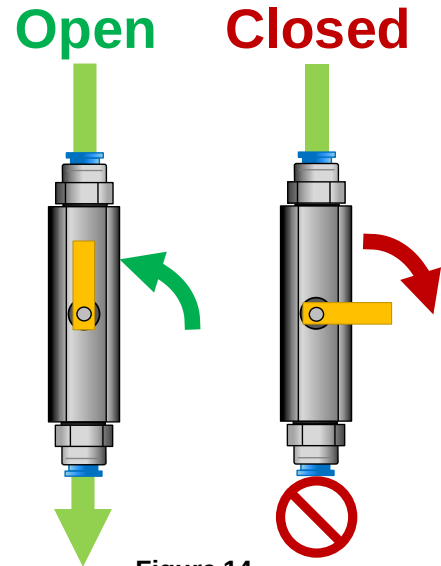


Figure 14
Motor Rate Control Valve - (ON / OFF)

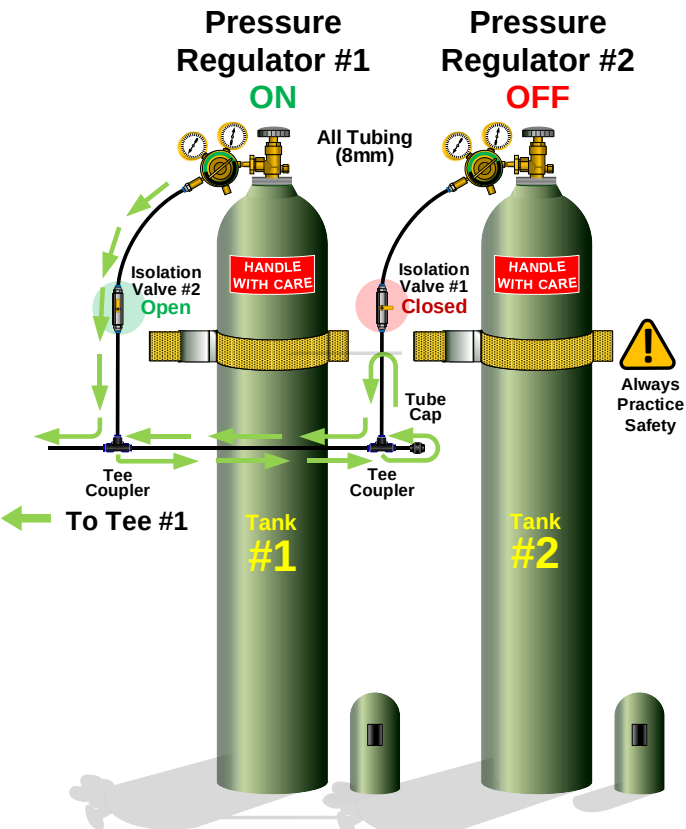


Figure 15
Dual Tank Operation; Tank #1 ON

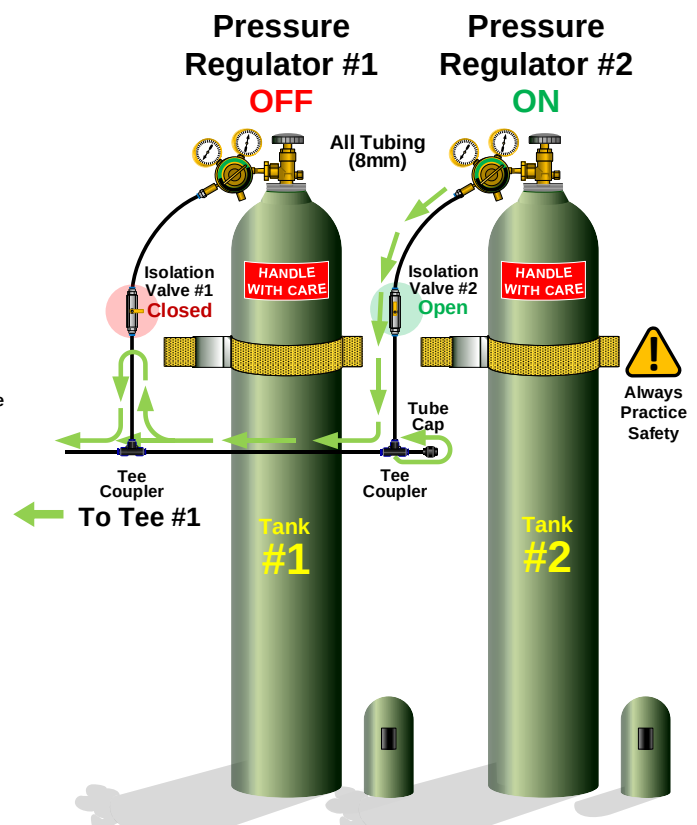


Figure 16
Dual Tank Operation; Tank #2 ON

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 Tank may be made ready during on-going Fiber Bundle installation operations. Ensure Isolation Valve #1 remains closed. Disconnect and remove Tank #1, position and connect Tank #3 using the same procedures described in Sumitomo Recommended Procedure **SRP: SP-F04-007**

TABLE 1 STANDARD FIBER BUNDLE BLOWING DISTANCES

(APPROXIMATE DISTANCES LISTED ARE BASED ON USING ONE (1) BLOWING HEAD)

➤ **Non-Ribbonized Fiber Bundles** - (PEF *Polyethylene Extruded Foam* Jacket)

6 and 12 FIBER BUNDLES (2mm O.D.)	APPROXIMATE BLOWING DISTANCE
All OSP Tube Cables	1500 meters or 5000 feet
All MTIO Tube Cables	1500 meters or 5000 feet
TRC (Riser) Tube Cables	1000 meters or 3300 feet
TGX (General Purpose) Single Tube and TP2 (Plenum) Tube Cables	600 meters or 1950 feet 600 meters or 1950 feet

➤ **Non-Ribbonized Fiber Bundles** - (PEF *Polyethylene Extruded Foam* Jacket)

24-FIBER BUNDLES (3mm O.D.)	APPROXIMATE BLOWING DISTANCE
All OSP Tube Cables	1800 meters or 6000 feet
All MTIO Tube Cables	1800 meters or 6000 feet
TRC (Riser) Tube Cables	1000 meters or 3300 feet
TGX (General Purpose) Single Tube and * TP2 (Plenum) Tube Cables	300 meters or 1000 feet 300 meters or 1000 feet

* **Note:** (24f Bundles in Tube Cables with Seven (7) or Greater Tube Count Only)

➤ **Non-Ribbonized Fiber Bundles** - (PEF *Polyethylene Extruded Foam* Jacket)

48-FIBER BUNDLES (3.7mm O.D.)	APPROXIMATE BLOWING DISTANCE
All OSP Tube Cables	1500 meters or 5000 feet
All MTIO Tube Cables	1500 meters or 5000 feet
TRC (Riser) Tube Cables	1000 meters or 3300 feet
TGX (General Purpose) Single Tube and * TP2 (Plenum) Tube Cables	228 meters or 750 feet 228 meters or 750 feet

* **Note:** (48f Bundles in Tube Cables with Seven (7) or Greater Tube Count Only)

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STANDARD FIBER BUNDLE BLOWING DISTANCES (Cont.)

(APPROXIMATE DISTANCES LISTED ARE BASED ON USING ONE (1) BLOWING HEAD)

➤ **Ribbonized Fiber Bundles** - (PVDF *Polyvinylidene Fluoride* Jacket)

48 & 72PVS - FIBER BUNDLES (3.1 & 3.7mm O.D.)	APPROXIMATE BLOWING DISTANCE
OSP Tube Cables (without lubricant)	700 meters or 2300 feet
OSP Tube Cables (with lubricant)	1220 meters or 4000 feet
TRC (Riser) Tube Cables	800 meters or 2600 feet
TGX (General Purpose) Single Tube and * TP2 (Plenum) Tube Cables	228 meters or 750 feet 228 meters or 750 feet

* **Note:** (48f & 72f Bundles in Tube Cables with Seven (7) or Greater Tube Count Only)➤ **Ribbonized Fiber Bundles** - (PVDF *Polyvinylidene Fluoride* Jacket)

72PV3 and 72PV4 - FIBER BUNDLES (4.1 mm O.D.)	APPROXIMATE BLOWING DISTANCE
OSP Tube Cables (without lubricant)	650 meters or 2100 feet
OSP Tube Cables (with lubricant)	1200 meters or 3900 feet
TRC (Riser) Tube Cables	750 meters or 2450 feet
TGX (General Purpose) Single Tube and * TP2 (Plenum) Tube Cables	200 meters or 650 feet 200 meters or 650 feet

* **Note:** (72f Bundles in Tube Cables with Seven (7) or Greater Tube Count Only)

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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, 3mm, 3.1mm, 3.5mm or 4.1mm 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 be 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 Tanks be secured / chained in place? (Tank 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, Green 3.5mm and Blue 4.1mm)	
Are tube jumpers and extra Tube Couplings on hand?	
Have the appropriate SRPs been reviewed? (SRPs SP-F04-007 & SP-F04-009)	
Is the Blowing Head clean? (Dry or damp / denatured alcohol wipe down)	
How many Tanks of gas are required? (Estimate about 3000' - 4000' per Tank)	
Is a suitable adjustable wrench on hand to install the Pressure Regulator to the Tank?	

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 <u>and</u> 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 and Clear Tube on hand extended blowing set up?	
Will the Blowing Head be used on the Payoff Stand or removed from the Payoff Stand?	