## CONSTRUCTION AND OPERATION

BI-Lok Series D Dual Ferrule Tube Fittings are composed of four precision machined component parts: 1) fitting body, 2) front ferrule, 3) back ferrule, 4) nut. BI-Lok Tube Fittings are shipped fully assembled and individually bagged. Once the tubing has been fully inserted into the fitting, a leak tight seal is achieved through the simple action of tightening the nut against the fitting body. The tightening of the nut provides the axial thrust required to engage the captively held ferrules against the outside diameter of the tubing. The staged swaging action of the ferrules, with minimal torque transfer to the tubing during make-up, provides the key to BI-Lok's high integrity sealing capability and exceptional service life.

# MATERIALS OF CONSTRUCTION

| Comi                                 | ponent    | Fitting Material   |                     |  |  |  |
|--------------------------------------|-----------|--------------------|---------------------|--|--|--|
| Component                            |           | Brass              | 316 Stainless Steel |  |  |  |
| Fitting                              | Forged    | ASTM B124, CDA 377 | ASTM A182           |  |  |  |
| Body                                 | Bar Stock |                    |                     |  |  |  |
| Front Ferrule<br>Back Ferrule<br>Nut |           | ASTM B16, CDA 360  | ASTM A479           |  |  |  |

Stainless Steel Fitting Bodies and Nuts are Heat /Lot code traceable. Stainless steel nuts are silver plated to prevent gauling and reduce make-up torque.

## **QUALITY CONTROL**

BI-Lok Tube Fittings are designed, manufactured and inspected to the rigid quality requirements of our ISO certified production facility. All Stainless Steel Fittings are Heat/Lot code traceable. BI-Lok Tube Fittings have been tested and certified to a variety of Global International Industry standards and regulatory agencies.



\*Swagelok® is a registered trade mark of the Swagelok Company

# **INTERCHANGEABILITY AND GAGEABILITY**

BI-Lok Series D Dual Ferrule Tube Fittings are manufactured to be completely component intermixable with the Swagelok® brand of tube fittings. Independent third party testing concluded that piece by piece intermixing of each manufacturer's component parts, in various combinations, yielded no performance degradation of the fitting connection. BI-Lok Dual Ferrule Tube Fittings are fully compatible for use with the Swagelok® brand Gap Inspection Gauges.

## **TUBING SELECTION AND PREPARATION**

The selection of the proper tubing is essential to both the performance and safety of a tubing system. Careful consideration should be applied to the following variables; system pressure, media, flow, operating temperature and environmental conditions. Tube fittings should always be used with similar tube materials. i.e.; Stainless Steel fittings with Stainless Steel tubing and Brass fittings with copper tubing. In order to achieve proper fitting make-up, the tubing must be softer that the fitting material. For stainless steel tubing, we recommend fully annealed seamless or welded and drawn tubing of ASTM A269, A213 and A249. Tubing hardness should not exceed Rockwell B-90. For copper tubing, seamless or soft annealed ASTM B-75, or seamless soft annealed Type K or Type L water tubing ASTM B-88 is recommended. Care should be taken in tube handling to ensure that tubing is reasonably straight and is cut in a manner to create smooth square ends, free of burrs. Handling practices should consider that surface scratches on the tube OD may be a potential source of leaks.



# PRESSURE RATINGS

The BI-Lok Dual Series D Ferrule Tube Fitting consists of four elements — nut, front ferrule, back ferrule and fitting body. However, the actual sealing function is accomplished with the addition of a fifth element, the tubing itself. Therefore, the pressure rating of the fitting assembly is a direct function of the tubing selected. Proper tube selection is critical and the ultimate responsibility of the system designer/user. The tables listed on page 2 provide the allowable pressure ratings of a variety of commonly used tube sizes and materials.



|       | STAINLESS STEEL TUBING |                              |       |       |       |       |       |       |       |       |             |              |
|-------|------------------------|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------------|--------------|
| Tube  |                        | Tube Wall Thickness (Inches) |       |       |       |       |       |       |       |       |             |              |
| OD    | 0.010                  | 0.012                        | 0.014 | 0.016 | 0.020 | 0.028 | 0.035 | 0.049 | 0.065 | 0.083 | 0.095       | 0.109        |
| 1/16" | 5600                   | 6800                         | 8100  | 9400  | 12000 |       |       |       |       |       |             |              |
| 1/8 " |                        |                              |       |       |       | 8500  | 10900 |       |       |       |             |              |
| 3/16" |                        |                              |       |       |       | 5400  | 7000  | 10200 |       |       |             |              |
| 1/4"  |                        |                              |       |       |       | 4000  | 5100  | 7500  | 10200 |       | Working Pre | essure, PSIG |
| 5/16" |                        |                              |       |       |       |       | 4000  | 5800  | 8000  |       |             |              |
| 3/8"  |                        |                              |       |       |       |       | 3300  | 4800  | 6500  |       |             |              |
| 1/2"  |                        |                              |       |       |       |       | 2600  | 3700  | 5100  | 6700  |             |              |
| 5/8"  |                        |                              |       |       |       |       |       | 2900  | 4000  | 5200  |             |              |
| 3/4"  |                        |                              |       |       |       |       |       | 2400  | 3300  | 4200  | 4900        | 5800         |
| 7/8"  |                        |                              |       |       |       |       |       | 2000  | 2800  | 3600  | 4200        | 4800         |
| 1"    |                        |                              |       |       |       |       |       |       | 2400  | 3100  | 3600        | 4200         |

304 and 316 annealed seamless tubing per ASTM A-269 or equivalent working pressure are based on allowable stress of 20,000 psi between -20° F and 100° F (Reference: ANSI B31.3)

|       | COPPER TUBING |                              |       |       |       |              |             |       |  |  |
|-------|---------------|------------------------------|-------|-------|-------|--------------|-------------|-------|--|--|
| Tube  |               | Tube Wall Thickness (Inches) |       |       |       |              |             |       |  |  |
| OD    | 0.028         | 0.035                        | 0.049 | 0.065 | 0.083 | 0.095        | 0.109       | 0.120 |  |  |
| 1/8 " | 2700          | 3600                         | 5100  |       |       |              |             |       |  |  |
| 3/16" | 1800          | 2300                         | 3400  |       |       |              |             |       |  |  |
| 1/4"  | 1300          | 1600                         | 2500  | 3500  |       |              |             |       |  |  |
| 5/16" |               | 1300                         | 1900  | 2700  |       | Working Pres | ssure, PSIG |       |  |  |
| 3/8"  |               | 1000                         | 1600  | 2200  |       |              |             |       |  |  |
| 1/2"  |               | 800                          | 1100  | 1600  | 2100  |              |             |       |  |  |
| 5/8"  |               |                              | 900   | 1200  | 1600  | 1900         |             |       |  |  |
| 3/4"  |               |                              | 700   | 1000  | 1300  | 1500         | 1800        |       |  |  |
| 7/8"  |               |                              | 600   | 800   | 1100  | 1300         | 1500        |       |  |  |
| 1"    |               |                              | 500   | 700   | 900   | 1100         | 1300        | 1500  |  |  |

Copper tubing per ASTM B-75 or equivalent. Working pressures are based on allowable stress of 6,000 psi between -70°F and 100° F (Reference: ANSI B31.3)

| CARBON STEEL TUBING |       |                               |       |       |       |             |              |       |  |
|---------------------|-------|-------------------------------|-------|-------|-------|-------------|--------------|-------|--|
| Tube                |       | Tube Wall Thickness, (Inches) |       |       |       |             |              |       |  |
| OD                  | 0.028 | 0.035                         | 0.049 | 0.065 | 0.083 | 0.095       | 0.109        | 0.120 |  |
| 1/8"                | 8000  | 10200                         |       |       |       |             |              |       |  |
| 3/16"               | 5100  | 6600                          | 9600  |       |       |             |              |       |  |
| 1/4"                | 3700  | 4800                          | 7000  | 9600  |       |             |              |       |  |
| 5/16"               |       | 3700                          | 5500  | 7500  |       | Working Pre | essure, PSIG |       |  |
| 3/8"                |       | 3100                          | 4500  | 6200  |       |             |              |       |  |
| 1/2"                |       | 2300                          | 3200  | 4500  | 5900  |             |              |       |  |
| 5/8"                |       | 1800                          | 2600  | 3500  | 4600  | 5300        |              |       |  |
| 3/4"                |       |                               | 2100  | 2900  | 3700  | 4300        | 5100         |       |  |
| 7/8"                |       |                               | 1800  | 2400  | 3200  | 3700        | 4300         |       |  |
| 1"                  |       |                               | 1500  | 2100  | 2700  | 3200        | 3700         | 4100  |  |

Carbon steel hydraulic tubing per ASTM A-179 or equivalent. Working pressures are based on allowable stress of 15,700 psi between -70°F and 100° F (Reference: ANSI B31.3)

| CTD | ECC |     | $T \cap$ | DC. |
|-----|-----|-----|----------|-----|
| ЭІП | ESS | ГАС | IU       | пэ  |

Stress Factor used to calculate maximum allowable working pressures at elevated temperatures.

NOTE: To find the maximum allowable working pressures for various tube materials at elevated temperatures, simply multiply the maximum allowable working pressure for the the tube size and wall thickness found in these charts by the correct Stress Factor found in the table below:

|   | Temperature Stress Factor |                        |                        |              |        |  |  |  |  |  |
|---|---------------------------|------------------------|------------------------|--------------|--------|--|--|--|--|--|
| 1 | TEMP (°F)                 | 304<br>Stainless Steel | 316<br>Stainless Steel | Carbon Steel | Copper |  |  |  |  |  |
|   | 200                       | 1.00                   | 1.00                   | .95          | .80    |  |  |  |  |  |
|   | 400                       | .93                    | .96                    | .87          | .50    |  |  |  |  |  |
|   | 600                       | .82                    | .85                    |              |        |  |  |  |  |  |
|   | 800                       | .76                    | .79                    |              |        |  |  |  |  |  |
|   | 1000                      | .69                    | .76                    |              |        |  |  |  |  |  |

| PIPE END PRESSURE RATINGS |             |                      |       |        |  |  |  |  |
|---------------------------|-------------|----------------------|-------|--------|--|--|--|--|
| NPT<br>Pipe Size          |             | nless and<br>n Steel | Brass |        |  |  |  |  |
| i ipo oizo                | Male Female |                      | Male  | Female |  |  |  |  |
| 1/8"                      | 10000       | 6500                 | 5000  | 3200   |  |  |  |  |
| 1/4"                      | 8000        | 6600                 | 4000  | 3300   |  |  |  |  |
| 3/8"                      | 7800        | 5300                 | 3900  | 2600   |  |  |  |  |
| 1/2"                      | 7700        | 4900                 | 3800  | 2400   |  |  |  |  |
| 3/4"                      | 7300        | 4600                 | 3600  | 2300   |  |  |  |  |
| 1"                        | 5300        | 4400                 | 2600  | 2200   |  |  |  |  |

Fittings with both Tube and NPT threaded pipe end connections have different pressure ratings. When specifying these type fittings, please refer to this chart for maximum allowable pressure ratings. A thread sealant is recommended when using NPT connections.

# ASSEMBLY INSTRUCTIONS

### **Assembly Instructions**

The following procedures refer to the proper assembly of the BI-Lok Series D Dual Ferrule Tube Fittings.

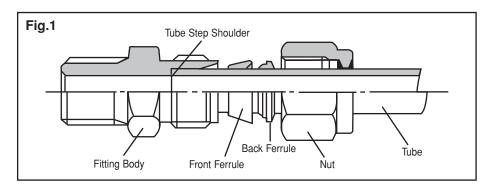
- 1. BI-Lok Tube Fittings are supplied fully assembled and individually bagged, allowing for clean efficient make-up. Should component assembly be required, please note that the order of assembly is the front ferrule into the cone of fitting body, back ferrule and fitting nut as noted in Fig. 1.
- 2. Insert the tubing into the fitting body until it bottoms out against the tube stop shoulder of the fitting. Please note that tubing should be cut squarely and free of burrs.
- 3. Hand tighten the nut as much as possible, bringing the fitting to what is called the "finger tight" position.
- 4. Secure the fitting body with a wrench and tighten the nut with another wrench an additional 3/4 of a turn for tube sizes 1/16" thru 3/16" or for sizes 1/4" and above 1-1/4 turns. (refer to Fig. 2a, 2b, and 2c).

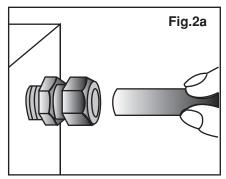
#### **Reassembly Instructions**

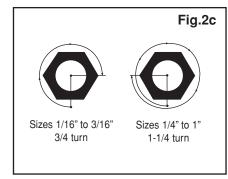
To reassemble a BI-Lok Series D Dual Ferrule Tube Fitting, simply insert the tube assembly (nut, front and back ferrule preswaged on the tube) into the fitting body and hand tighten the nut. Next, using a wrench, rotate the nut approximately 1/4 of a turn (back to the original make-up position) and then tighten the nut slightly.

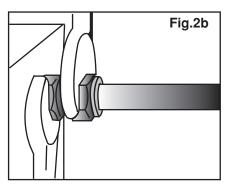
#### **Tube Measuring and Fitting**

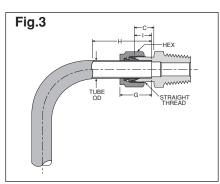
When measuring and bending tubing it is important to be aware of two critical measurements. The first being the tube insertion depth (reference dimension G) into the fitting assembly which must be considered in the determining the over all length of tube required. The other being the minimum length of straight tubing required for a proper tube bend (reference dimension H). Both measurements are dependant on tube OD; please use Fig. 3 for reference purposes.











| Tube Size | <b>A</b><br>Tube OD | Straight<br>Thread | Hex<br>Tube Nut | С    | G    | н                                      | I    |
|-----------|---------------------|--------------------|-----------------|------|------|--|------|
| 1         | 1/16"               | 10-32              | 5/16"           | 0.27 | 0.34 | 1/2"                                   | 0.19 |
| 2         | 1/8"                | 5/16"-20           | 7/16"           | 0.34 | 0.50 | 23/32"                                 | 0.25 |
| 3         | 3/16"               | 3/8"-20            | 1/2"            | 0.37 | 0.54 | 3/4"                                   | 0.28 |
| 4         | 1/4"                | 7/16"-20           | 9/16"           | 0.40 | 0.60 | 13/16"                                 | 0.31 |
| 5         | 5/16"               | 1/2"-20            | 5/8"            | 0.44 | 0.64 | 7/8"                                   | 0.34 |
| 6         | 3/8"                | 9/16"-20           | 11/16"          | 0.47 | 0.66 | 15/16"                                 | 0.37 |
| 8         | 1/2"                | 3/4"-20            | 7/8"            | 0.47 | 0.90 | 1 <sup>3</sup> / <sub>16</sub> "       | 0.50 |
| 10        | 5/8"                | 7/8"-20            | 1"              | 0.47 | 0.96 | <b>1</b> <sup>1</sup> / <sub>4</sub> " | 0.56 |
| 12        | 3/4"                | 1"-20              | <b>1</b> 1/8"   | 0.47 | 0.96 | <b>1</b> <sup>1</sup> / <sub>4</sub> " | 0.56 |
| 14        | 7/8"                | 11/8"-20           | <b>1</b> 1/4"   | 0.47 | 1.02 | 1 <sup>5</sup> / <sub>16</sub> "       | 0.63 |
| 16        | 1"                  | 15/16"-20          | <b>1</b> 1/2"   | 0.56 | 1.23 | <b>1</b> <sup>1</sup> /2"              | 0.75 |