# High Purity Fluoropolymer Tubing

# Series TL/TIL

**Material: Super PFA**

## Series and Specifications

| | | Metric sizes (Series TL) | | | | | | Inch sizes (Series TIL) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tubing model** | | **TL0403** | **TL0604** | **TL0806** | **TL1008** | **TL1210** | **TL1916** | **TIL01** | **TILB01** | **TIL05** | **TIL07** | **TIL11** | **TIL13** | **TIL19** | **TIL25** |
| **Nominal diameter** | | – | – | – | – | – | – | 1/8" | 1/8" | 3/16" | 1/4" | 3/8" | 1/2" | 3/4" | 1" |
| **Tubing size** | | ø4 x ø3 | ø6 x ø4 | ø8 x ø6 | ø10 x ø8 | ø12 x ø10 | ø19 x ø16 | 1/8" x 0.086" | 1/8" x 1/16" | 3/16" x 1/8" | 1/4" x 5/32" | 3/8" x 1/4" | 1/2" x 3/8" | 3/4" x 5/8" | 1" x 7/8" |
| **O.D. (mm)** | **Basic diameter** | 4 | 6 | 8 | 10 | 12 | 19 | 3.18 | 3.18 | 4.75 | 6.35 | 9.53 | 12.7 | 19.05 | 25.4 |
| | **Tolerance** | ±0.1 | | | | +0.2 –0.1 | | ±0.1 | | | | | +0.2 –0.1 | | |
| **Thickness (mm)** | **Basic diameter** | 0.5 | 1 | | | | 1.5 | 0.5 | 0.8 | 0.8 | 1.2 | 1.6 | | | |
| | **Tolerance** | ±0.05 | ±0.1 | | | | ±0.15 | ±0.05 | ±0.08 | ±0.08 | ±0.12 | ±0.15 | | | |
| **Bundle** | **10 m** | – | – | – | ● | ● | ● | – | – | – | – | ● | ● | – | – |
| | **20 m** | ● | ● | ● | ● | ● | ● | ● | – | ● | ● | ● | ● | ● | ● |
| | **50 m** | ● | ● | ● | ● | ● | ● | ● | – | ● | ● | ● | ● | ● | ● |
| | **100 m** | ● | ● | ● | ● | ● | ● | ● | – | ● | ● | ● | ● | ● | – |
| | **50 Ft. (16 m)** | – | – | – | – | – | – | ● | ● | ● | ● | ● | ● | ● | ● |
| | **100 Ft. (33 m)** | – | – | – | – | – | – | ● | ● | ● | ● | ● | ● | ● | ● |
| **Straight pipe** | **2 m** | ● | ● | ● | ● | ● | ● | ● | – | ● | ● | ● | ● | ● | ● |
| **Color** | | Translucent (color of material) | | | | | | | | | | | | | |
| **Applicable fluid** | | Please refer to the applicable fluid in page 41. | | | | | | | | | | | | | |
| **Max. operating pressure (at 20°C)** Note 1) | | 1 MPa | | | 0.9MPa | 0.7 MPa | 0.6 MPa | 1 MPa | | | | | | 0.7 MPa | 0.5 MPa |
| **Burst pressure (at 20°C)** | | 4.9 MPa | 6.9 MPa | 4.7 MPa | 3.6MPa | 2.9 MPa | 2.6 MPa | 6.4 MPa | 9.9 MPa | 6.7 MPa | 7.9 MPa | 6.7 MPa | 4.6 MPa | 2.8 MPa | 2.0 MPa |
| **Min. bending radius (mm)** Note 2) | | 20 | | 40 | 65 | 110 | 160 | 12 | 6 | 20 | | 30 | 60 | 160 | 290 |
| **Max. operating temperature (Fixed use)** | | 260°C | | | | | | | | | | | | | |
| **Material** | | Super PFA | | | | | | | | | | | | | |

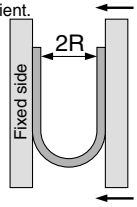
Note 1) • The maximum operating pressure is the value at 20°C. For other temperatures, calculate from the burst pressure drop coefficient. Furthermore, an abnormal temperature increase due to adiabatic compression can cause tubing to burst. To operate at a temperature other than 20°C, the operating pressure must be no more than the value calculated using the equation below: When the value (calculated using the formula below) exceeds 1 MPa, the Max. operating pressure is 1 MPa.

**(Max. operating pressure) = 1/4 x (burst pressure drop coefficient) x (burst pressure at 20°C)**

• When using a fluid in liquid form, the surge pressure must be no more than the maximum operating pressure. A surge pressure higher than the maximum operating pressure can cause breakage of the fitting or bursting of the tubing.

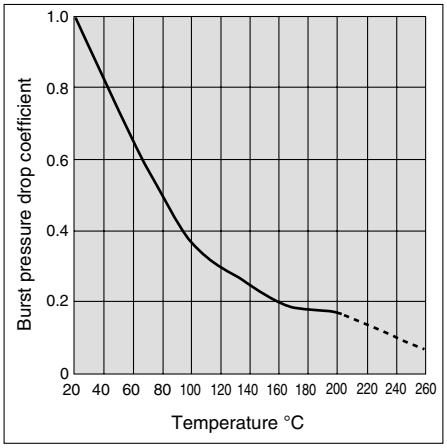
Note 2) The minimum bending radius is measured using the method shown in the figure at the right.

Note 3) It is connectable with LQ Series (3/4"size). As for other commercial items, there are some cases it is not able to connect due to tolerance of dimensions.




At a temperature of 20°C bend the tubing into a U shape. Then with one side fixed, gradually close the other side and measure 2R at the point where the tubing folds or flattens, etc.

## Burst pressure drop curve




## How to Order

**Metric sizes** **TL0604** – **20**

**Inch sizes** **TIL01** – **20**

**Tubing Model**

**Length** **Applicable to both metric and inch size**

| Symbol | Type | Length |
|---|---|---|
| **10** | Roll | 10 m |
| **20** | | 20 m |
| **50** | | 50 m |
| **100** | | 100 m |
| **2S** | Straight | 2 m |

**Length** **Applicable to inch size only**

| Symbol | Type | Length |
|---|---|---|
| **16** | Roll | 50 Ft. (16 m) |
| **33** | | 100 Ft. (33 m) |

Please refer to the "Series and Specifications" above, as the tubing length differs dependant on each size.

Note 4) Figures shown in tables are representative values, not guaranteed values.

Note 4)

## Eluting fluorine ion amount (μg/g)

| Type | Fluorine ion |
|---|---|
| Eluting amount | 0.1 or less |

A 15 g piece of fluororesin tubing is cut off, washed in deionized water and immersed in 15 ml of 25% methyl alcohol extract at room temperature for 24 hours. Then the extract is diluted with deionized water to be subjected to a quantitative analysis of fluorine ions.

Note 4)

## Eluting metal ion amount (ng/cm²)

| Type | Al | Fe | Ni | Na | Ca |
|---|---|---|---|---|---|
| Eluting amount | 4.5 | 0.3 | 0.2 | 7.1 | 1.3 |

The interior of the fluororesin tubing is washed with super deionized water. Approximately 20g of super high purity hydrofluoric acid (48%) is measured and injected into the tubing. The interior wall of the tubing is immersed at normal temperature for one week with both ends of the tubing plugged. Then the extract was diluted with super deionized water to be subjected to a quantitative analysis on Al, Fe, Ni, Na and Ca by the stripping method.

# Applicable Fluids

## Material and fluid compatibility check list for high purity fluoropolymer fittings

| Chemical | | Compatibility |
|---|---|---|
| **Acetic acid** | 100% | ○ |
| **Acetone** | 100% | ○ Note 1) |
| **Ammonium fluoride** | 40% | ○ |
| **Ammonium hydroxide** | 30% | ○ |
| **Butyl acetate** | 100% | ○ |
| **Methylne chloride** | 100% | ○ |
| **Hydrochloric acid** | 38% | ○ |
| **Hydrofluoric acid** | 50% | ○ |
| **Hydrogen peroxide** | 60% | ○ |
| **Methanol** | 100% | ○ |
| **Methyl ethyl Ketone** | — | ○ |
| **Nitric acid** | 70% | ○ |
| **Phosphoric acid** | 86% | ○ |
| **Caustic potash** | 85% | ○ |
| **Sulfuric acid** | 100% | ○ |
| **Toluene** | — | ○ Note 1) |
| **Xylene** | — | ○ |
| **Sodium hydroxide** | 100% | ○ |
| **1.1.1-Trichloroethane** | 100% | ○ |
| **Rhosphorus pentachloride** | — | ○ |
| **Isobutyl alcohol** | — | ○ Note 1) |
| **Isopropyl alcohol** | — | ○ Note 1) |
| **Ozone** | — | ○ |
| **Ethyl acetate** | — | ○ Note 1) |
| **Deionized water** | — | ○ |
| **Nitrogen** | — | ○ |
| **Ultrapure water** | — | ○ |
| **Tmah** | — | ○ |

The material and fluid compatibility check list provides reference values as a guide only.
Note 1) Since static electricity may be generated, implement suitable countermeasures.

Table symbol ○ can be used.

- Compatibility is indicated for fluid temperatures of 200°C or less.
- The material and fluid compatibility check list provides reference values as a guide only, therefore we do not guarantee the application to our product.
- The data above is based on the information presented by the material manufacturers.
- SMC is not responsible for its accuracy and any damage happened because of this data.

# *Series LQ$^{1}_{2}$, LVN, TL/TIL*
# High Purity Fluoropolymer Fittings/ Needle Valve/Tubing Precautions 1

**Be sure to read before handling.**

## Design and Selection

### ⚠ Warning

**1. Confirm the specifications.**

Give careful consideration to operating conditions such as the application, fluid and environment, and use within the operating ranges specified in this catalog.

**2. Fluid**

Operate within the indicated fluid temperature range.

**3. Maintenance space**

Ensure the necessary space for maintenance and inspections.

**4. Fluid pressure range**

Keep the supplied fluid pressure within the operating pressure range shown in the catalog.

**5. Countermeasures for static electricity**

Since static electricity may be generated depending on the fluid being used, implement suitable countermeasures.

## Mounting

### ⚠ Warning

**1. After mounting, perform suitable function and leak tests to confirm that the mounting is correct.**

**2. Instruction manual**

Mount and operate the product after reading the manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

## Piping

### ⚠ Caution

**1. Connect tubing with special tools.**

Refer to pages 17-5-127 through 17-5-129 regarding tubing connection and special tools.

**2. Tighten the nut until it touches the end surface of the body, and then tighten it an addition 1/8 turn. As a guide, refer to the proper tightening torques shown below.**

**Nut tightening torque for piping**

| Body class | Torque (N·m) | |
|---|---|---|
| | LQ1 | LQ2 |
| **2** | 0.3 to 0.4 | 1.5 to 2.0 |
| **3** | 0.8 to 1.0 | 3.0 to 3.5 |
| **4** | 1.0 to 1.2 | 7.5 to 9.0 |
| **5** | 2.5 to 3.0 | 11.0 to 13.0 |
| **6** | 5.5 to 6.0 | — |

**3. Use sealant tape for the piping of taper thread parts such as LQ□H and LQ□L.**

Tape the ridges tightly with the sealant tape, starting one ridge width left from thread end side. 3 to 4 sealant tapes are required.

**Taper thread mounting torque**

| Bore size | Torque (N·m) |
|---|---|
| 1/8 | 0.6 to 0.9 |
| 1/4 | 0.8 to 1.2 |
| 3/8 | 1.0 to 1.6 |
| 1/2 | 1.5 to 2.0 |
| 3/4 | 2.0 to 2.7 |
| 1 | 2.5 to 3.6 |

# *Series LQ$^{1}_{2}$, LVN, TL/TIL*
# High Purity Fluoropolymer Fittings/ Needle Valve/Tubing Precautions 2

**Be sure to read before handling.**

## Operating Environment

### ⚠ Warning

1. **Do not use in locations having an explosive atmosphere.**
2. **Do not operate in locations where vibration or impact occurs.**
3. **In locations near heat sources, block off radiated heat.**

## Maintenance

### ⚠ Warning

1. **Perform maintenance in accordance with the procedures in the instruction manual.**
   Improper handling can cause damage.
2. **When removing or reinstalling fittings, remove any remaining chemicals and carefully replace them with deionized water or air, etc., before beginning work activities.**
3. **Tightening of taper threads for piping**
   Because the taper threads are made of resin, minute leakage may gradually occur due to stress relaxation. Perform periodic inspections, and if leakage is detected correct the problem by additional tightening. If additional tightening becomes ineffective, replace the fitting with a new product.
4. **Check the following during regular maintenance, and replace components as necessary.**
   a) Scratches, gouges, abrasion, corrosion
   b) Twisting, flattening or distortion of tubing
   c) Hardening, deterioration or softening of tubing
5. **Do not repair or patch the replaced tubing or fittings for reuse.**

## Operating Precautions

### ⚠ Warning

1. **Operate within the range of the maximum operating pressure.**

### ⚠ Caution

1. **After a long period of non-use, perform inspections before beginning operation.**
2. **Use sufficient care in the handling of series LQ clean packaging types when their packaging is opened.**
3. **For LVN Series, be careful not to apply any excessive force to the stroke end, which fully opens and closes, to avoid accidental damage or changes in flow characteristics.**

## Installation of Tubing

### ⚠ Caution

1. **Cut the end of the tubing at a right angle and pass it through the fitting nut. After placing the tubing in the holder, push it onto the insert bushing until it stops and clamp it with the knob. As a guide when tightening the tubing with the knob, maintain a uniform gap (approx. 2 mm) on both sides of the holder.**
   - **When the tubing is curved, straighten it out before using it.**
   - **The tubing may slip if there is oil or dust, etc., on the holder. Remove the contamination using alcohol or another suitable cleaner.**

## Use of Tubing

### ⚠ Caution

1. **Refer to the applicable tubing sizes shown below for tubing to be used.**

**Applicable tubing sizes**

| | Connection tubing size | O.D. (mm) | | Internal thickness (mm) | |
|---|---|---|---|---|---|
| | | Standard size | Tolerance | Standard size | Tolerance |
| Metric sizes | ø3 to ø2 | 3.0 | +0.2 −0.1 | 0.5 | ±0.06 |
| | ø4 to ø3 | 4.0 | | | |
| | ø6 to ø4 | 6.0 | | 1.0 | ±0.1 |
| | ø8 to ø6 | 8.0 | | | |
| | ø10 to ø8 | 10.0 | | | |
| | ø12 to ø10 | 12.0 | | | |
| | ø19 to ø16 | 19.0 | +0.3 −0.1 | 1.5 | ±0.15 |
| | ø25 to ø22 | 25.0 | | | |
| Inch sizes | 1/8" to 0.086" | 3.18 | +0.2 −0.1 | 0.5 | ±0.1 |
| | 3/16" to 1/8" | 4.75 | | 0.8 | |
| | 1/4" to 5/32" | 6.35 | | 1.2 | ±0.12 |
| | 3/8" to 1/4" | 9.53 | | 1.6 | ±0.15 |
| | 1/2" to 3/8" | 12.7 | | | |
| | 3/4" to 5/8" | 19.0 | +0.3 −0.1 | | |
| | 1" to 7/8" | 25.4 | | | |