

Special Elastomeric Seal Ring Seal Type "E"

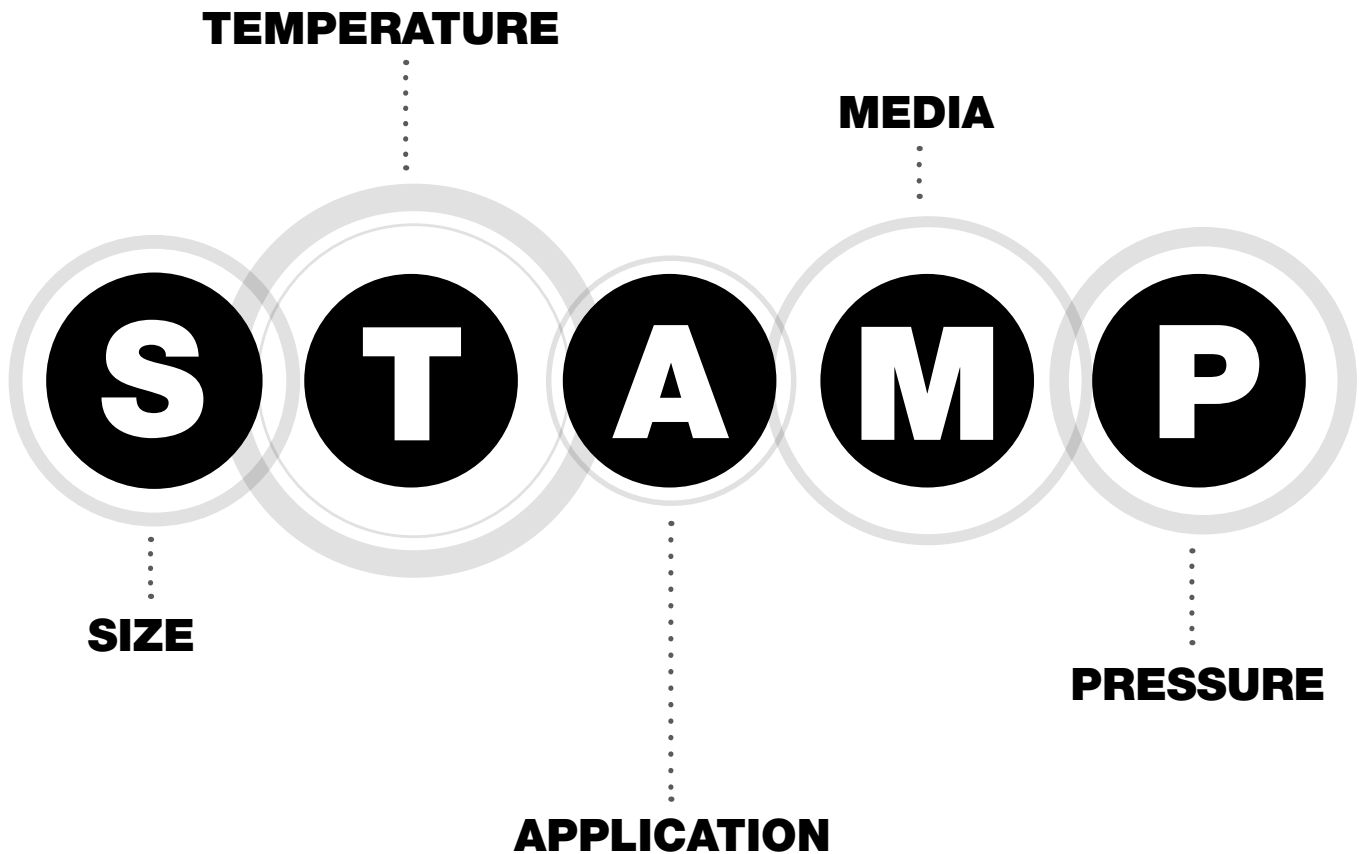
# General Technical

T



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## **Before you spec it STAMP it.**

When you order fittings and adapters from Parker, remember the word “STAMP.” That way you won’t forget important information! Size, Temperature, Application, Media and Pressure “STAMP” is the process for determining the proper fitting or adaptor selection. Selecting the proper fitting for a given application is an important part of system design.



**Size** .....



Proper material, type and size of tubing and fittings for a given application is critical for efficient and trouble free operation of the fluid system. Selection of proper tubing and fittings involves determining the correct flow diameter, then selecting the correct material and the optimum tube size (O.D. and wall thickness).

Proper sizing for various parts of a hydraulic system results in an optimum combination of efficient and cost effective performance. A tube or fitting that is too small causes high fluid velocity, which has many detrimental effects. In suction lines, it causes cavitation which starves and damages pumps. In pressure lines, it causes high friction losses and turbulence, both resulting in high pressure drops and heat generation. High heat accelerates wear in moving parts and rapid aging of seals and hoses, all resulting in reduced component life. High heat generation also means wasted energy, and hence, low efficiency.

Too large of a tube or fitting increases system cost. Thus, optimum sizing is very critical. The following is a simple procedure for sizing of tube and fittings.

**Step 1: Determine Required Flow Diameter**

Use Tables T1 and T2 to determine recommended flow diameter for the required flow rate and type of line.

The table is based on the following recommended flow velocities:

**Pressure lines — 25 ft./sec. or 7.62 meters/sec.**

**Return lines — 10 ft./sec. or 3.05 meters/sec.**

**Suction lines — 4 ft./sec. or 1.22 meters/sec.**

If you desire to use different velocities than the above, use one of the following formulae to determine the required flow diameter.

|                        |   |
|------------------------|---|
| Tube I.D. (in.) = 0.64 | $\frac{\text{Flow in GPM}}{\text{Velocity in ft./sec.}}$                  |
| OR                     |   |
| Tube I.D. (in.) = 4.61 | $\frac{\text{Flow in liters per minute}}{\text{Velocity in meters/sec.}}$ |

The flow diameter will be used in combination with the temperature, application, media and pressure data to determine the proper tube size (O.D. and wall thickness).

NOTE: The tube fitting dash (-) size will be dependent on the tube outside diameter selected based on the S.T.A.M.P. criteria.

**Recommended Flow Diameter – In Inches** ..... 

| Maximum Flow Rate GPM | Recommended Flow Diameter in Inches |              |               |
|-----------------------|-------------------------------------|--------------|---------------|
|                       | Pressure Lines                      | Return Lines | Suction Lines |
| 0.25                  | 0.064                               | 0.101        | 0.160         |
| 0.50                  | 0.091                               | 0.143        | 0.226         |
| 0.75                  | 0.111                               | 0.175        | 0.277         |
| 1.00                  | 0.128                               | 0.202        | 0.320         |
| 1.25                  | 0.143                               | 0.226        | 0.358         |
| 1.50                  | 0.157                               | 0.247        | 0.392         |
| 1.75                  | 0.169                               | 0.267        | 0.423         |
| 2.00                  | 0.181                               | 0.286        | 0.453         |
| 2.50                  | 0.202                               | 0.319        | 0.506         |
| 3.00                  | 0.222                               | 0.350        | 0.554         |
| 3.50                  | 0.239                               | 0.378        | 0.599         |
| 4.00                  | 0.256                               | 0.404        | 0.640         |
| 4.50                  | 0.272                               | 0.429        | 0.679         |
| 5.00                  | 0.286                               | 0.452        | 0.716         |
| 5.50                  | 0.300                               | 0.474        | 0.750         |
| 6.00                  | 0.314                               | 0.495        | 0.784         |
| 6.50                  | 0.326                               | 0.515        | 0.816         |
| 7.00                  | 0.339                               | 0.534        | 0.847         |
| 7.50                  | 0.351                               | 0.553        | 0.876         |
| 8.00                  | 0.362                               | 0.571        | 0.905         |
| 8.50                  | 0.373                               | 0.589        | 0.933         |
| 9.00                  | 0.384                               | 0.606        | 0.960         |
| 9.50                  | 0.395                               | 0.623        | 0.986         |
| 10.00                 | 0.405                               | 0.639        | 1.012         |
| 11.00                 | 0.425                               | 0.670        | 1.061         |
| 12.00                 | 0.443                               | 0.700        | 1.109         |
| 13.00                 | 0.462                               | 0.728        | 1.154         |
| 14.00                 | 0.479                               | 0.756        | 1.197         |
| 15.00                 | 0.496                               | 0.782        | 1.239         |
| 16.00                 | 0.512                               | 0.808        | 1.280         |
| 17.00                 | 0.528                               | 0.833        | 1.319         |
| 18.00                 | 0.543                               | 0.857        | 1.358         |
| 19.00                 | 0.558                               | 0.880        | 1.395         |
| 20.00                 | 0.572                               | 0.903        | 1.431         |
| 22.00                 | 0.600                               | 0.947        | 1.501         |
| 24.00                 | 0.627                               | 0.990        | 1.568         |
| 26.00                 | 0.653                               | 1.030        | 1.632         |
| 28.00                 | 0.677                               | 1.069        | 1.693         |
| 30.00                 | 0.701                               | 1.106        | 1.753         |
| 32.00                 | 0.724                               | 1.143        | 1.810         |
| 34.00                 | 0.746                               | 1.178        | 1.866         |
| 36.00                 | 0.768                               | 1.212        | 1.920         |
| 38.00                 | 0.789                               | 1.245        | 1.973         |
| 40.00                 | 0.810                               | 1.278        | 2.024         |
| 42.00                 | 0.830                               | 1.309        | 2.074         |
| 44.00                 | 0.849                               | 1.340        | 2.123         |
| 46.00                 | 0.868                               | 1.370        | 2.170         |
| 48.00                 | 0.887                               | 1.399        | 2.217         |
| 50.00                 | 0.905                               | 1.428        | 2.263         |
| 55.00                 | 0.949                               | 1.498        | 2.373         |
| 60.00                 | 0.991                               | 1.565        | 2.479         |

| Maximum Flow Rate GPM | Recommended Flow Diameter in Inches |              |               |
|-----------------------|-------------------------------------|--------------|---------------|
|                       | Pressure Lines                      | Return Lines | Suction Lines |
| 65.00                 | 1.032                               | 1.629        | 2.580         |
| 70.00                 | 1.071                               | 1.690        | 2.677         |
| 75.00                 | 1.109                               | 1.749        | 2.771         |
| 80.00                 | 1.145                               | 1.807        | 2.862         |
| 85.00                 | 1.180                               | 1.862        | 2.950         |
| 90.00                 | 1.214                               | 1.916        | 3.036         |
| 95.00                 | 1.248                               | 1.969        | 3.119         |
| 100.00                | 1.280                               | 2.020        | 3.200         |
| 110.00                | 1.342                               | 2.119        | 3.356         |
| 120.00                | 1.402                               | 2.213        | 3.505         |
| 130.00                | 1.459                               | 2.303        | 3.649         |
| 140.00                | 1.515                               | 2.390        | 3.786         |
| 150.00                | 1.568                               | 2.474        | 3.919         |
| 160.00                | 1.619                               | 2.555        | 4.048         |
| 170.00                | 1.669                               | 2.634        | 4.172         |
| 180.00                | 1.717                               | 2.710        | 4.293         |
| 190.00                | 1.764                               | 2.784        | 4.411         |
| 200.00                | 1.810                               | 2.857        | 4.525         |

**Table T1 – Recommended Flow Diameters, in Inches**

Dimensions and pressures for reference only, subject to change.



**Recommended Flow Diameter – In Millimeters** ..... 

| Maximum Flow Rate LPM* | Recommended Flow Diameter in Millimeters |              |               |
|------------------------|--|--------------|---------------|
|                        | Pressure Lines                           | Return Lines | Suction Lines |
| 1                      | 1.670                                    | 2.640        | 4.180         |
| 2                      | 2.362                                    | 3.734        | 5.911         |
| 3                      | 2.893                                    | 4.573        | 7.240         |
| 4                      | 3.340                                    | 5.280        | 8.360         |
| 5                      | 3.734                                    | 5.903        | 9.347         |
| 6                      | 4.091                                    | 6.467        | 10.239        |
| 7                      | 4.418                                    | 6.985        | 11.059        |
| 8                      | 4.723                                    | 7.467        | 11.823        |
| 9                      | 5.010                                    | 7.920        | 12.540        |
| 10                     | 5.281                                    | 8.348        | 13.218        |
| 12                     | 5.785                                    | 9.145        | 14.480        |
| 14                     | 6.249                                    | 9.878        | 15.640        |
| 16                     | 6.680                                    | 10.560       | 16.720        |
| 18                     | 7.085                                    | 11.201       | 17.734        |
| 20                     | 7.468                                    | 11.806       | 18.694        |
| 22                     | 7.833                                    | 12.383       | 19.606        |
| 24                     | 8.181                                    | 12.933       | 20.478        |
| 26                     | 8.515                                    | 13.461       | 21.314        |
| 28                     | 8.837                                    | 13.970       | 22.118        |
| 30                     | 9.147                                    | 14.460       | 22.895        |
| 32                     | 9.447                                    | 14.934       | 23.646        |
| 34                     | 9.738                                    | 15.394       | 24.373        |
| 36                     | 10.020                                   | 15.840       | 25.080        |
| 38                     | 10.295                                   | 16.274       | 25.767        |
| 40                     | 10.562                                   | 16.697       | 26.437        |
| 45                     | 11.203                                   | 17.710       | 28.040        |
| 50                     | 11.809                                   | 18.668       | 29.557        |
| 55                     | 12.385                                   | 19.579       | 31.000        |
| 60                     | 12.936                                   | 20.449       | 32.378        |
| 65                     | 13.464                                   | 21.284       | 33.700        |
| 70                     | 13.972                                   | 22.088       | 34.972        |
| 75                     | 14.463                                   | 22.863       | 36.200        |
| 80                     | 14.937                                   | 23.613       | 37.387        |
| 85                     | 15.397                                   | 24.340       | 38.538        |
| 90                     | 15.843                                   | 25.045       | 39.655        |
| 95                     | 16.277                                   | 25.732       | 40.742        |
| 100                    | 16.700                                   | 26.400       | 41.800        |
| 110                    | 17.515                                   | 27.689       | 43.840        |
| 120                    | 18.294                                   | 28.920       | 45.790        |
| 130                    | 19.041                                   | 30.101       | 47.659        |
| 140                    | 19.760                                   | 31.237       | 49.458        |
| 150                    | 20.453                                   | 32.333       | 51.194        |
| 160                    | 21.124                                   | 33.394       | 52.873        |
| 170                    | 21.774                                   | 34.421       | 54.501        |
| 180                    | 22.405                                   | 35.419       | 56.081        |
| 190                    | 23.019                                   | 36.390       | 57.617        |
| 200                    | 23.617                                   | 37.335       | 59.114        |
| 220                    | 24.770                                   | 39.158       | 61.999        |
| 240                    | 25.872                                   | 40.899       | 64.756        |
| 260                    | 26.928                                   | 42.569       | 67.400        |
| 280                    | 27.944                                   | 44.176       | 69.945        |

| Maximum Flow Rate LPM* | Recommended Flow Diameter in Millimeters |              |               |
|------------------------|--|--------------|---------------|
|                        | Pressure Lines                           | Return Lines | Suction Lines |
| 300                    | 28.925                                   | 45.726       | 72.400        |
| 320                    | 29.874                                   | 47.226       | 74.774        |
| 340                    | 30.793                                   | 48.679       | 77.075        |
| 360                    | 31.686                                   | 50.090       | 79.310        |
| 380                    | 32.554                                   | 51.463       | 81.483        |
| 400                    | 33.400                                   | 52.800       | 83.600        |
| 450                    | 35.426                                   | 56.003       | 88.671        |
| 500                    | 37.342                                   | 59.032       | 93.468        |
| 550                    | 39.165                                   | 61.913       | 98.030        |
| 600                    | 40.906                                   | 64.667       | 102.389       |
| 650                    | 42.577                                   | 67.307       | 106.570       |
| 700                    | 44.184                                   | 69.848       | 110.592       |
| 750                    | 45.735                                   | 72.299       | 114.474       |
| 800                    | 47.235                                   | 74.670       | 118.228       |

**Table T2 – Recommended Flow Diameters, in Millimeters**

\*LPM = Liters Per Minute

Dimensions and pressures for reference only, subject to change.



# Tube Fittings Pressure Drop..... **S**

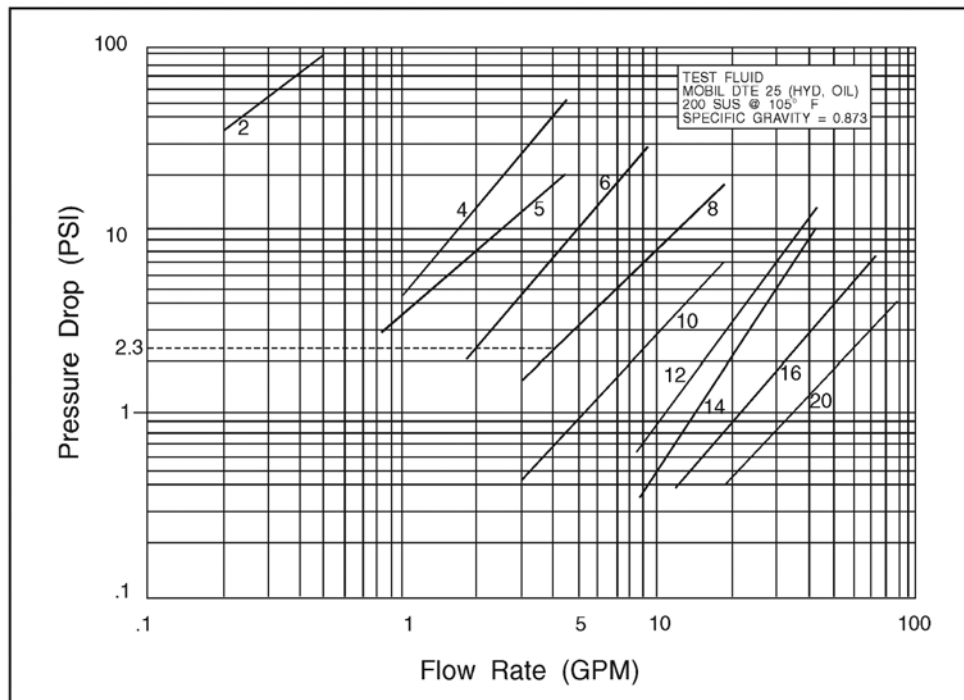
In hydraulic systems, pressure drop represents loss of energy and therefore should be kept to a minimum. Pressure loss in straight tubing and hose is mainly caused by the frictional resistance of the walls, while in fittings it is mainly caused by changes in the magnitude or direction of the fluid velocity. Mathematical analysis of pressure drop, even though possible, may not be exact because of the interrelationship of factors such as fluid density, velocity, flow area and frictional coefficients.

The following pressure drop charts were derived from actual test data and may be used as a guide for determining pressure

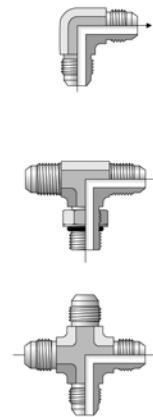
drops at various flow rates through fittings for fluid indicated. To determine pressure drop for a given flow, trace a vertical line up from the flow axis to the desired size line then trace a horizontal line from this intersection over to the pressure drop axis.

**Example:** A size 8 CTX, with oil, similar to the test fluid, flowing through it at 4 gallons per minute, would cause a pressure drop of approximately 2.3 psi. Conversions will have to be made for fluids which are not similar to test fluid.

The Tube Fittings part numbers are listed below the Pressure Drop Chart to which they apply.



Examples:



**Fig. T3 – Pressure Drop Chart for 90° Fittings or Branch Path Through a Tee or Cross Fitting (Triple-Lok)**

### Pressure Drops for Other Fitting:

\*These pressure drop curves were established with Triple-Lok fittings. The pressure drop values can be adjusted for other fittings of the same size by multiplying the value from the chart by the ratio of Triple-Lok flow diameter to that of the other fitting, raised to the 4th power.

**Example:** Find pressure drop for 6 C5L at 5 gallons per minute flow rate:

From the chart, the pressure drop for 6 C5X is 10 psi.

Also, the ratio of 6 C5X to 6 C5L flow diameters is 0.297/0.264, or 1.125.

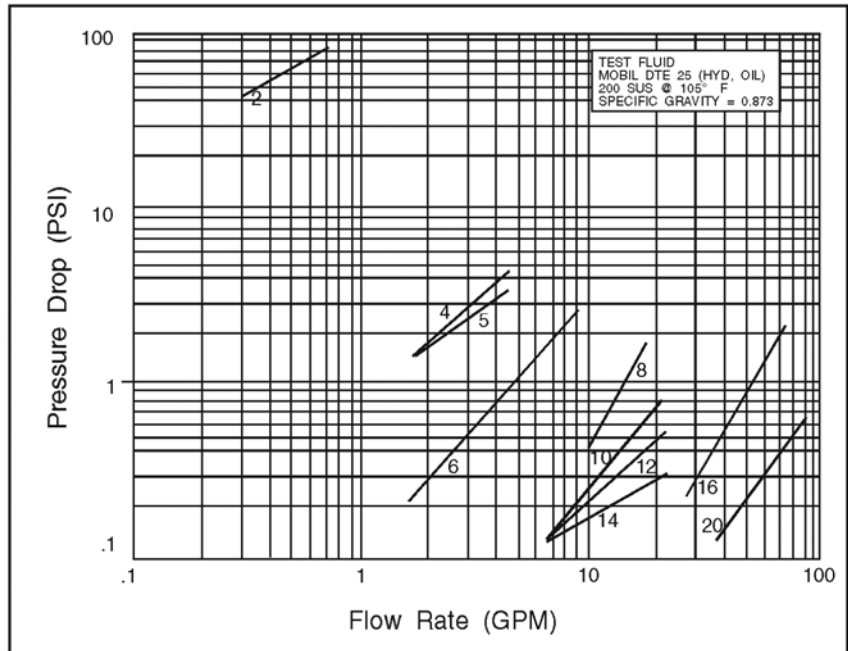
Therefore, the pressure drop for Seal-Lok = 10 x (1.125)<sup>4</sup> = 16 psi.

### Pressure Drops for Other Fluids:

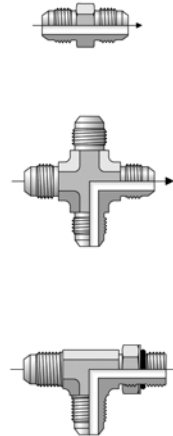
Pressure drop through a fitting is mainly caused by change in direction and velocity of the fluid. Therefore, it is directly proportional to the specific gravity of the fluid. The drop due to friction, which is dependent on the viscosity of the fluid, is so small in this case that it can be ignored. Thus, the pressure drop with a different fluid can be calculated by multiplying the value from the graph above by the ratio of specific gravity of the two fluids, or:

$$\text{New Drop} = \text{Value from the graph} \times \frac{\text{Specific Gravity of New Fluid}}{\text{Specific Gravity of Test Fluid (0.873)}}$$

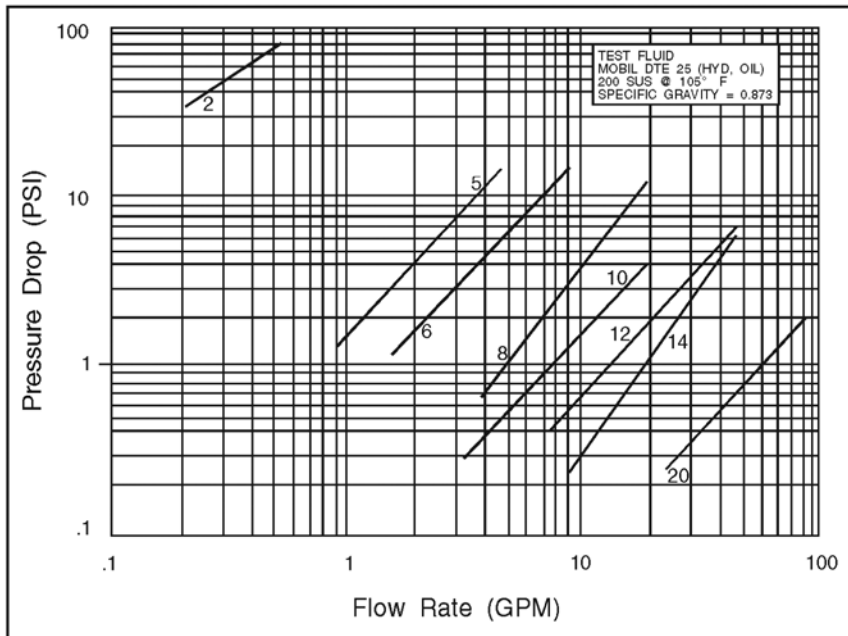
Dimensions and pressures for reference only, subject to change.



Examples:



**Fig. T4 – Pressure Drop Chart for Straight Fittings and Run Legs of Tees and Crosses (Triple-Lok)**



Example:



**Fig. T5 – Pressure Drop Chart for 45° Elbow Fittings (Triple-Lok)**

Dimensions and pressures for reference only, subject to change.



# Temperature..... T

## Temperature Ratings For Common Tube Materials

| Tube Material                               | Specification            | Construction              | Condition                     | Max. Hardness        | Temperature Range (7)                   |
|---|--------------------------|---------------------------|-------------------------------|----------------------|---|
| Carbon Steel C-1010                         | SAE J524 (ASTM A179) (8) | Seamless                  | Fully Annealed                | HRB 72               | -65° to 500°F<br>-55° to 260°C          |
|   | SAE J525 (ASTM A178) (8) | Welded & Drawn            |                               |                      |   |
|   | SAE J356                 | Welded & Flash Controlled |                               |                      |   |
| Carbon Steel C-1021                         | SAE J2467                | Welded & Flash Controlled | Fully Annealed                | HRB 75               | -65° to 500°F<br>-55° to 260°C          |
|   | SAE J2435                | Welded & Drawn            |                               |                      |   |
| Carbon Steel High Strength Low Alloy (HSLA) | SAE 2613                 | Welded & Flash Controlled | Sub-critically annealed       | HRB 90               | -65° to 500°F<br>-55° to 260°C          |
|   | SAE J2614                | Welded & Drawn            |                               |                      |   |
| Alloy Steel 4130                            | ASTM A519                | Seamless                  |                               |                      | -65° to 500°F<br>-55° to 260°C          |
| St 37.4 (Carbon Steel)                      | DIN 2391 Part 2 (Metric) | Seamless                  | Fully Annealed                | HRB 72               | -65° to 500°F<br>-55° to 260°C          |
| Stainless Steel 304 & 316                   | ASTM A213<br>ASTM A269   | Seamless                  | Fully Annealed                | HRB 90               | -425° to 1200°<br>-255° to 650°C<br>(3) |
|   | ASTM A249<br>ASTM A269   | Welded & Drawn            |                               |                      |   |
| 1.4571<br>1.4541<br>Stainless Steel         | DIN 17458 Tab 8 (Metric) | Seamless                  | Fully Annealed                | HRB 90               | -425° to 1200°<br>-255° to 650°C<br>(3) |
| Copper                                      | SAE J528 (ASTM B-75) (8) | Seamless                  | Soft Annealed Temper 0        | 60 Max. Rockwell 15T | -325° to 400°F<br>-200° to 205°C        |
| Aluminum 6061                               | ASTM-B210                | Seamless                  | T6 Temper                     | HRB 56               | -325° to 400°F<br>-200° to 205°C        |
|   |                          |                           | 0 & T4 Temper                 | HRB 30               |   |
| Monel 400                                   | ASTM-B165                | Seamless                  | Fully Annealed                | HRB 70               | -400° to 800°F<br>-240° to 425°C        |
| Nylon                                       |                          | Extruded                  | Flexible & Semi-Rigid         |                      | -60° to 200°F<br>-50° to 95°C           |
| Polyethylene                                | ASTM D-1248              | Extruded                  | Instrument Grade              |                      | -80° to 150°F<br>-60° to 65°C           |
| PVC   |                          | Extruded                  | Instrument & Laboratory Grade |                      | 0° to 140°F<br>-20° to 60°C             |
| PFTE  |                          | Extruded & Cinkered       |                               |                      | -65° to 400°F<br>-55° to 205°C          |

**Table T6 – Temperature Ratios for Common Tube Materials**

### Tube Derating Factors for Temperature

Besides severity of service, high operating temperature also reduces allowable working pressure of the tubing. Temperature derating factors for various tube materials are given in Table T7. Where applicable, derating factors for severity of service and temperature should be applied to the design pressure values in Tables T17 and T18 to arrive at the maximum recommended working pressure.

**Example:** Combined derating factor for 316SS tubing for B (severe) service and 500°F. operation is .67 x .9 = .603

### Tube Selection Example:

\*The derating factors are based on allowable design stress values at various temperatures per ASME B31.1 code for pressure piping (1986).

| Maximum Operating Temperature | Steel C-1010 and C-4130 | Stainless Steel |      | Copper | Aluminum 6061-T6 | Monel Type 4000 |
|-------------------------------|-------------------------|-----------------|------|--------|------------------|-----------------|
|                               |                         | 304             | 316  |        |                  |                 |
| 100                           | 1.00                    | 1.00            | 1.00 | 1.00   | 1.00             | 1.00            |
| 150                           | 1.00                    | 0.91            | 1.00 | 0.85   | 1.00             | 0.97            |
| 200                           | 1.00                    | 0.84            | 1.00 | 0.80   | 1.00             | 0.94            |
| 250                           | 1.00                    | 0.79            | 1.00 | 0.80   | 0.94             | 0.91            |
| 300                           | 1.00                    | 0.75            | 1.00 | 0.78   | 0.80             | 0.88            |
| 350                           | 0.99                    | 0.72            | 0.99 | 0.67   | 0.60             | 0.86            |
| 400                           | 0.98                    | 0.69            | 0.97 | 0.50   | 0.43             | 0.85            |
| 500                           | 0.96                    | 0.65            | 0.90 |        |                  | 0.84            |
| 600                           |                         | 0.61            | 0.85 |        |                  | 0.84            |
| 700                           |                         | 0.59            | 0.82 |        |                  | 0.84            |
| 800                           |                         | 0.57            | 0.80 |        |                  | 0.83            |
| 900                           |                         | 0.54            | 0.78 |        |                  |                 |
| 1000                          |                         | 0.52            | 0.77 |        |                  |                 |
| 1100                          |                         | 0.47            | 0.62 |        |                  |                 |
| 1200                          |                         | 0.32            | 0.37 |        |                  |                 |

**Table T7 – Temperature Derating Factors\* for Tubes**

# O-Ring Material Selection T

Standard O-Rings supplied with Parker tube fittings and adapters are 90 durometer hard nitrile (Buna-N) Parker compound #N0552 or similar. These O-Rings are well suited for most industrial hydraulic and pneumatic systems. They have high extrusion resistance making them suitable for very high pressure static applications. Optional high temperature fluorocarbon, Parker compound #V0894, is also available for higher temperature specifications.

O-Rings for other than normal hydraulic media or higher temperature applications can be selected from the following chart. The chart should be used only as a general guide. Before making final selection for a given application, it is recommended that appropriate tests be conducted to assure compatibility with the fluid, temperature, pressure and other environmental conditions.

For fluids not shown in the chart, please contact the Tube Fittings Division.

| Polymer                                 | Abbreviated Name               | Parker Compound No.     | Color   | SAE j515 Type              | Hardness Shore "A" <sup>7)</sup> | Temperature Range (°F)                       | Recommended For  | Not Recommended For  |
|---|--------------------------------|-------------------------|---|----------------------------|----------------------------------|--|--|--|
| Nitrile-Butadiene                       | NBR                            | N0552                   | Black   | CH <sup>2)</sup>           | 90 <sup>6)</sup>                 | -30° to 250°                                 | Petroleum base oils and fluids, mineral oils, ethylene glycol base fluids, silicone and di-ester base lubricants, air, water under 150°F, and natural gas.                   | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons, and methanol.    |
| Nitrile-Butadiene                       | NBR                            | N0674                   | Black   | —                          | 70                               | -30° to 250°                                 |  |  |
| Nitrile-Butadiene                       | NBR                            | N0103                   | Black   | —                          | 70                               | -65° to 225°                                 |  |  |
| Nitrile-Butadiene (Low compression set) | NBR                            | N1059                   | Black   | CH <sup>2)</sup>           | 90                               | -30° to 275°                                 | Hydrogen fuel cells.<br>Hydrogen fuel cells.<br>Meets FDA requirements for food products.<br>CNG Applications  |  |
| Nitrile-Butadiene                       | NBR                            | N0507                   | Black   | —                          | 90                               | -65° to 180°                                 |  |  |
| Nitrile-Butadiene                       | NBR                            | N0304                   | Black   | —                          | 75                               | -65° to 225°                                 |  |  |
| Nitrile-Butadiene                       | NBR                            | N0508                   | Black   | —                          | —                                | -35° to 250°                                 |  |  |
| Nitrile-Butadiene                       | NBR                            | N0756                   | Black   | —                          | 75 <sup>6)</sup>                 | -65° to 275°                                 | Phosphate ester base hydraulic fluids, hot water, steam to 400°F, silicone oils and greases, dilute acids and alkalis, ketones, alcohols and automotive brake fluids.        | Petroleum base oils and di-ester base lubricants.  |
| Ethylene-Propylene                      | EPDM                           | E0540                   | Black   | CA <sup>3)</sup>           | 80                               | -65° to 275°                                 |  |  |
| Ethylene-Propylene                      | EPDM                           | E0893                   | Purple <sup>1)</sup>                                    | CA <sup>3)</sup>           | 80                               | -65° to 275°                                 | CO2 climate control systems.   |  |
| Ethylene-Propylene                      | EPDM                           | E0962                   | Black   | —                          | 90                               | -65° to 275°                                 |  |  |
| Neoprene                                | CR                             | C0873                   | Black   | —                          | 70                               | -45° to 250°                                 | Refrigerants (freons, ammonia), high aniline point<br>petroleum oils, mild acids, and silicate ester lubricants.   | Phosphate ester fluids and ketones.  |
| Neoprene                                | CR                             | C0944                   | Red <sup>1)</sup>                                       | —                          | 70                               | -45° to 250°                                 |  |  |
| Fluorocarbon                            | FKM <sup>5)</sup><br>or<br>FPM | V0747<br>V0884<br>V0894 | Black<br>Brown <sup>1)</sup><br>Brown <sup>1), 5)</sup> | —<br>—<br>HK <sup>4)</sup> | 75<br>75<br>90 <sup>6)</sup>     | -15° to 400°<br>-15° to 400°<br>-15° to 400° | Petroleum base oils and fluids, some phosphate ester base fluids, silicone and silicate ester base lubricants, di-ester base lubricants, acids and halogenated hydrocarbons. | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, and hot hydrofluoric or chlorosulfonic acids. |
|   |                                |                         |   |                            |                                  |  |  |  |
| Silicone                                | Si                             | S0604                   | Rust <sup>1)</sup>                                      | —                          | 70                               | -65° to 450°                                 | Dry heat (air to 400°F) and high aniline point oils.   | Most petroleum fluids, ketones, water and steam.   |

**Table T8 – O-Ring Selection**

- 1) These Parker "Chromasure" color assurance O-Rings are available from the Parker Hannifin O-Ring Division. They help eliminate assembly errors, reduce warranty costs and liability risks, and assure safety in aftermarket business.
- 2) Formerly SAE Type I.
- 3) Formerly SAE Type II.
- 4) Formerly SAE Type III.
- 5) "FKM" is the ASTM designation for fluorocarbon. Its ISO designation is "FPM". For "DIN" Fittings, color is green.
- 6) Standard compounds available from stock.
- 7) Use 90 durometer hard O-Rings for applications with 1500 psi or higher pressures.

Dimensions and pressures for reference only, subject to change.



# Application A

## Connector Proliferation

Today many different types of connectors are being used around the world. Most of these have come about through historical use and local preference for a certain design concept. Some connections of the North American origin such as four bolt flange, SAE straight thread and 37° Flare have found some degree of acceptance and use in Europe and Japan as a result of the exports of U.S. machinery to the regions after World War II. But, large majority of usage is made up of a variety of indigenous port and tube connections. A quick review of the commonly used connections around the world reveals that there are eight different port connections and eleven different tube/hose connections.

### Port Connections

|                              |   |
|------------------------------|---|
| NPTF                         | ISO 6149 (Metric Straight Thread O-Ring Port) |
| SAE Straight Thread (UN/UNF) | JIS-PT (BSPT)                                 |
| 4-Bolt Flange                | JIS-B2351 (BSPP similar to SAE)               |
| ISO 1179 (BSPP)              |   |
| ISO 9974 (Metric)            |   |

### Tube/Hose Connections:

|                                   |                             |
|-----------------------------------|-----------------------------|
| 37° Flare (SAE)                   | 30° Flare, BSPP (JIS)       |
| 24° Flareless, Inch Threads (SAE) | 24° Flareless, Metric (JIS) |
| 60° Cone Swivel, NPSM (SAE)       | 60° Cone, BSPP (JIS)        |
| O-Ring Face Seal (SAE)            | 60° Cone, Metric (JIS)      |
| 24° Cone, Metric (DIN)            | 37° Flare, Metric (Russia)  |
| 60° Cone, BSPP (BSi)              |                             |

### The Challenge

Leakage is no longer acceptable in world class products. Above proliferation, besides limiting availability and increasing cost, increases leakage potential through misapplications. Therefore, the challenge facing the fluid power industry is two fold — eliminate leakage and minimize proliferation.

### Meeting The Challenge

This challenge has been met through a very intensive and cooperative effort by the member nations of

sub-committee 4 of the ISO Technical Committee 131 (ISO/TC131) The sub-committee started this effort in 1989 and has completed development of performance based standards for the most widely used ports and tube/hose connections to limit proliferation, and strongly endorsing those with elastomeric seals to eliminate leakage in hydraulic systems.

Ten ports, eight threaded and two four bolt flange, and four tube/hose connections as shown on page T12 have been standardized. The threaded ports and tube/hose connections are paired in the ISO 8434 series of fitting standards as defined in the table below.

To minimize proliferation in port usage and promote leak free connections, the sub-committee strongly endorses use of ISO 6149 port for all new designs by including the following statement in all port standards:

*“For threaded ports and stud ends specified in new designs in hydraulic fluid power applications, only ISO 6149 shall be used. Threaded ports and stud ends in accordance with ISO 1179, ISO 9974 and ISO 11926 shall not be used for new designs in hydraulic fluid power applications.”*

On the tube/hose connection side, only ISO 8434-3 (O-Ring Face Seal) and ISO 8434-4 (24° cone with weld nipple) feature elastomeric seal for zero leak performance. Combining these with the ISO 6149 for the port connection leads to two (2) combinations (complete fittings) for use in leak-free world class products. They are:

|            |   |
|------------|---|
| ISO 8434-3 | O-Ring Face Seal and ISO 6149 Port        |
| ISO 8434-4 | 24° Cone With Soft Seal and ISO 6149 Port |

For large port connections, the four bolt flange connection per ISO 6162 (SAE J518 is included in ISO 6162) remains widely used and the recommended connection.

| Application                                  | Port                               | Tube/Hose Connection                 |                          |            |                      |
|--|------------------------------------|--------------------------------------|--------------------------|------------|----------------------|
|  |                                    | 24° Cone Flareless (DIN) (Bite Type) | 37° Flare (Inch Threads) | ORFS       | 24° Cone Weld Nipple |
| For All Designs                              | Metric<br>ISO 6149<br>(SAE J2244)  | ISO 8434-1                           | ISO 8434-2               | ISO 8434-3 | ISO 8434-4*          |
| Not for New Designs in Hydraulic Fluid Power | Metric<br>ISO 1179<br>(DIN 3852-2) | ISO 8434-1                           | ISO 8434-2               | --         | ISO 8434-4*          |
|  | Metric<br>ISO 9974<br>(DIN 3852-1) | ISO 8434-1                           | --                       | --         | ISO 8434-4*          |
|  | UN/UNF<br>ISO 11926<br>(SAE J1926) | --                                   | ISO 8434-2               | --         | --                   |

**Table T9 – ISO Standard Port and Tube/Hose Connection Combinations**

\*Will be included in ISO 8434-1 at the next revision.

Dimensions and pressures for reference only, subject to change.



**Tube/Hose End Summary**.....



| Tube/Hose End Type              | Illustration | Pressure – Dynamic | Pressure – Static | Seal Reliability | Vibration Resistance (in Rigid Systems) | Ease of Installation | Ease of Maintenance | Reusability | Temperature     |
|---------------------------------|--------------|--------------------|-------------------|------------------|---|----------------------|---------------------|-------------|-----------------|
| Seal-Lok O-Ring Face Seal       |              | Excellent          | Excellent         | Excellent        | Very Good                               | Excellent            | Excellent           | Excellent   | Limited by Seal |
| Triple-Lok 37° Flare            |              | Very Good          | Very Good         | Good             | Good                                    | Good                 | Very Good           | Good        | Excellent       |
| Ferulok Inch Bite Type          |              | Very Good          | Very Good         | Very Good        | Very Good                               | Good                 | Good                | Very Good   | Excellent       |
| EO Metric Bite Type             |              | Excellent          | Excellent         | Very Good        | Very Good                               | Good                 | Good                | Very Good   | Excellent       |
| EO-2 Soft Seal Metric Bite Type |              | Excellent          | Excellent         | Excellent        | Very Good                               | Very Good            | Good                | Excellent   | Limited by Seal |
| Intru-Lok Brass Flareless       |              | Fair (Low)         | Fair (Low)        | Very Good        | Good                                    | Good                 | Good                | Good        | Excellent       |
| JIS 30° Flare                   |              | Good               | Good              | Very Good        | Not Applicable                          | Very Good            | Very Good           | Very Good   | Limited by Seal |
| JIS 60° Cone B8363              |              | Good               | Good              | Very Good        | Not Applicable                          | Very Good            | Very Good           | Very Good   | Limited by Seal |
| Komatsu 30° Flare               |              | Good               | Good              | Very Good        | Not Applicable                          | Very Good            | Very Good           | Very Good   | Limited by Seal |
| K4 BSP Adapters                 |              | Good               | Good              | Very Good        | Not Applicable                          | Very Good            | Very Good           | Very Good   | Limited by Seal |
| NPSM (Swivel)                   |              | Good               | Good              | Very Good        | Not Applicable                          | Good                 | Good                | Very Good   | Limited by Seal |

Dimensions and pressures for reference only, subject to change.



**Port End Summary**..... **A**

| Port End Type and Seal Style  | Illustration  | Pressure – Dynamic | Pressure – Static | Temperature     | Positioning    | Contamination | Seal Reliability | Reusability | Fluid Compatibility |
|---|---|--------------------|-------------------|-----------------|----------------|---------------|------------------|-------------|---------------------|
| Tapered (NPT, NPTF, BSPT and Metric Taper)                                |    | Poor               | Good              | Excellent       | Poor           | Poor          | Poor             | Poor        | Excellent           |
| O-Ring in Chamfer (SAE J1926, ISO 6149 and JIS B2351)                     |    | Excellent          | Excellent         | Limited by Seal | Excellent      | Very Good     | Excellent        | Excellent   | Limited by Seal     |
| Spot Face with ED Seal (ISO 1179-2 and ISO 9974-2)                        |    | Excellent          | Excellent         | Limited by Seal | Not Applicable | Very Good     | Excellent        | Excellent   | Limited by Seal     |
| Spot Face with Bonded Seal (ISO 1179 and ISO 9974)                        |    | Good               | Good              | Good            | Not Applicable | Very Good     | Good             | Excellent   | Limited by Seal     |
| Spot Face with Cutting Face (ISO 1179-4 and ISO 9974-3)                   |  | Poor               | Fair              | Excellent       | Not Applicable | Fair          | Poor             | Poor        | Excellent           |
| Spot Face with O-Ring and Retaining Ring (ISO 1179-3)                     |  | Good               | Good              | Good            | Excellent      | Very Good     | Good             | Excellent   | Limited by Seal     |
| Spot Face with Hard Metal Seal (ISO 1179 and ISO 9974)                    |  | Poor               | Fair              | Excellent       | Not Applicable | Fair          | Poor             | Poor        | Excellent           |
| Spot Face with Soft Metal Seal (ISO 1179 and ISO 9974 with copper gasket) |  | Poor               | Fair              | Good            | Not Applicable | Very Good     | Poor             | Fair        | Excellent           |
| 4 Bolt Flange (SAE J518 and ISO 6162)                                     |  | Excellent          | Excellent         | Good            | Good           | Very Good     | Good             | Excellent   | Limited by Seal     |
| 4 Bolt Flange (ISO 6164)  |  | Excellent          | Excellent         | Good            | Good           | Good          | Good             | Excellent   | Limited by Seal     |

Dimensions and pressures for reference only, subject to change.

**Tube to Port<sup>1)</sup> Pairing for Medium Pressure<sup>2)</sup> Applications .....**



| Tube O.D.           |       |                 | Port Thread |           |              |            |
|---------------------|-------|-----------------|-------------|-----------|--------------|------------|
| Inch<br>(Dash Size) |       | Metric<br>(mm.) | SAE         | ISO       | NPTF         | BSPP       |
| 1/8                 | (-2)  | 4               | 5/16-24     | M8 x 1    | 1/16-27      | G 1/8-28   |
| 3/16                | (-3)  | 5               | 3/8-24      | M10 x 1   | 1/8-27       | G 1/8-28   |
| 1/4                 | (-4)  | 6               | 7/16-20     | M10 x 1   | 1/8-27       | G 1/8-28   |
| 5/16                | (-5)  | 8               | 1/2-20      | M12 x 1.5 | 1/8-27       | G 1/4-19   |
| 3/8                 | (-6)  | 10              | 9/16-20     | M14 x 1.5 | 1/4-18       | G 1/4-19   |
| 1/2                 | (-8)  | 12              | 3/4-16      | M16 x 1.5 | 3/8-18       | G 3/8-19   |
| —                   |       | 15              | 3/4-16      | M18 x 1.5 | 1/2-14       | G 1/2-14   |
| 5/8                 | (-10) | 16, 18          | 7/8-14      | M22 x 1.5 | 1/2-14       | G 1/2-14   |
| 3/4                 | (-12) | 20              | 1 1/16-12   | M27 x 2   | 3/4-14       | G 3/4-14   |
| 7/8                 | (-14) | 22              | 1 3/16-12   | M27 x 2   | 3/4-14       | G 3/4-14   |
| 1                   | (-16) | 25, 28          | 1 5/16-12   | M33 x 2   | 1-11 1/2     | G 1-11     |
| 1 1/4               | (-20) | 30, 35          | 1 5/8-12    | M42 x 2   | 1 1/4-11 1/2 | G 1 1/4-11 |
| 1 1/2               | (-24) | 38, 42          | 1 7/8-12    | M48 x 2   | 1 1/2-11 1/2 | G 1 1/2-11 |
| 2                   | (-32) | 50              | 2 1/2-12    | M60 x 2   | 2-11 1/2     | G 2-11     |

**Table T10 – Tube to Port Pairing for Medium Pressure Applications**

- 1) Ports are in accordance with the standards listed below:  
SAE J1926-1, ISO 6149-1, NPTF-SAE J476 and BSPP-ISO 1179-1
- 2) The pressure range covering all the sizes shown is 1000 to 5000 PSI.

**Tube to Port<sup>1)</sup> Pairing for High Pressure<sup>2)</sup> Applications**

| Tube O.D.           |       |                 | Port Thread |           |              |            |
|---------------------|-------|-----------------|-------------|-----------|--------------|------------|
| Inch<br>(Dash Size) |       | Metric<br>(mm.) | SAE         | ISO       | NPTF         | BSPP       |
| 1/8                 | (-2)  | 4               | 5/16-24     | M8 x 1    | 1/16-27      | G 1/8-28   |
| 3/16                | (-3)  | 5               | 3/8-24      | M10 x 1   | 1/8-27       | G 1/8-28   |
| 1/4                 | (-4)  | 6               | 7/16-20     | M12 x 1.5 | 1/8-27       | G 1/8-28   |
| 5/16                | (-5)  | 8               | 1/2-20      | M14 x 1.5 | 1/8-27       | G 1/4-19   |
| 3/8                 | (-6)  | 10              | 9/16-20     | M16 x 1.5 | 1/4-18       | G 1/4-19   |
| 1/2                 | (-8)  | 12              | 3/4-16      | M18 x 1.5 | 3/8-18       | G 3/8-19   |
| 5/8                 | (-10) | 14, 16          | 7/8-14      | M22 x 1.5 | 1/2-14       | G 1/2-14   |
| 3/4                 | (-12) | 20              | 1 1/16-12   | M27 x 2   | 3/4-14       | G 3/4-14   |
| 7/8                 | (-14) | —               | 1 3/16-12   | M30 x 2   | 3/4-14       | G 3/4-14   |
| 1                   | (-16) | 25              | 1 5/16-12   | M33 x 2   | 1-11 1/2     | G 1-11     |
| 1 1/4               | (-20) | 30              | 1 5/8-12    | M42 x 2   | 1 1/4-11 1/2 | G 1 1/4-11 |
| 1 1/2               | (-24) | 38              | 1 7/8-12    | M48 x 2   | 1 1/2-11 1/2 | G 1 1/2-11 |
| 2                   | (-32) | 50              | 2 1/2-12    | M60 x 2   | 2-11 1/2     | —          |

**Table T11 – Tube to Port Pairing for High Pressure Applications**

- 1) Ports are in accordance with the standards listed below:  
SAE J1926-1, ISO 6149-1, NPTF-SAE J476 and BSPP-ISO 1179-1
- 2) The pressure range covering all the sizes shown is 2500 to 9000 PSI.

Dimensions and pressures for reference only, subject to change.



## Conformance to Applicable Specifications and Approvals ..... **A** for TFD Products by Product Type or Subject

| Fittings              | Specifications  |
|-----------------------|---|
| Seal-Lok              | SAE J1453   |
| Metric Seal-Lok       | ISO 8434-3  |
| Triple-Lok            | SAE J514  |
|                       | MIL-F-18866, MS Sheets*                                       |
|                       | MS51500 - MS51534*  |
|                       | BS43687, part 4   |
| Ferulok               | ISO 8434-2  |
|                       | SAE J514  |
|                       | MIL-F-18866 MS Sheets*<br>MS51811 - MS51843*                  |
|                       | U.S. Coast Guard - meet applicable requirements of ASTM F1387 |
| EO/EO-2               | DIN 3861  |
|                       | ISO 8434-1-4, ISO 8434-4 (former DIN 2353)                    |
|                       | DIN 3865  |
|                       | DIN 3859  |
| Flange Adapters       | SAE J518  |
|                       | ISO 6162-1  |
|                       | ISO 6162-2  |
|                       | ISO 6164  |
| JIS Adapters*         | JIS B8363 (with some exceptions)                              |
| K4 Adapters           | BS 5200, ISO 8434-6*  |
| Pipe Fittings         | SAE J514  |
| Pipe Plugs            | SAE J531  |
| Straight Thread Plugs | SAE J514  |
| Pipe Swivel Adapters  | SAE J514  |
| All catalog products  | Canadian Registration   |

**Approvals:**

Parker tube fittings are recognized by various acceptance organizations, among which are:

- Germanischer Lloyd (GL)
- Lloyds Register of Shipping (LR)
- Det Norske Veritas (DNV)
- American Bureau of Shipping (ABS)
- Russian Maritime Register of Shipping (RMS)
- China Classification Society (CCS)
- Deutscher Verein des Gas- und Wasserfaches (DVGW)
- Canadian Technical Standards and Safety Registration (CRN)

For other applications, Parker tube fittings also approved by diverse national authorities.

Numerous original equipment manufacturers and end-users of various industries have approved Parker tube fittings.

**Attention:**

Type Approvals usually are limited to certain products, applications, working conditions, validity time or other restrictions. We will gladly inform you on your individual application and send out the required documentation.

| Plating                             | Specification  |
|-------------------------------------|--|
| Carbon Steel – Chromium 6 Free Zinc | ASTM B633 Type II FE/ZN8**      **Clear/Silver Color |
|                                     | MIL-STD-171E   |
|                                     | JIS 8610 Class 1 Grade 3                             |
| Stainless Steel Passivation         | QQ-P35 Type VI                                       |
|                                     | ASTM A380  |
| Carbon Steel – Zinc Phosphate       | DOD-P-16232, Class 1                                 |

| Plating  | Specification     | Comment   |
|----------|-------------------|---|
| Products | ASME / ANSI B31.1 | All products meet the design factor requirements of this specification. |

| Test Methods  | Specification         |
|---|-----------------------|
| Leak, Burst, Impulse, Over-Torque and Repeated Assembly | SAE J1644 (cancelled) |
|   | ISO 19879             |
| Vibration   | NFPA T3.8.3, ISO 7257 |

**Table T12 – Conformance Standards**

\*Some parts do not meet dimensional requirements.

Dimensions and pressures for reference only, subject to change.



**Media** .....**Fluid Compatibility**

The fluid compatibility chart on the following page is intended as a guide only and is not to be considered as a sole selection criteria to use Parker Tube Fittings in a specific application or with a specific fluid. Other factors that must be considered include, but are not limited to: Fluid temperature, ambient temperature, system pressure (both operating and peak) and applicable standards or regulations. For media not listed, please contact your Parker representative or the Tube Fittings Division.

**Protective Coatings on Steel**

Protective coatings such as electroplated zinc and cadmium<sup>1)</sup> and zinc phosphate are usually applied to steel fittings for extending their useful service life in corrosive environments. Cadmium and zinc corrode sacrificially, protecting the steel substrate from normal atmospheric rusting due to the common presence of oxygen, moisture and acidic gases. They are, however, rapidly attacked by many fluids including those containing acidic hydrogen and reactive fluorine, chlorine, bromine, iodine, and nitrogen. **Zinc plating will further be attacked by strong bases or water with pH > 12. Zinc reacts with glycol based fire resistant fluids and forms a gelatinous compound that can plug up filters and be harmful otherwise, in a system with many zinc plated tube and hose fittings.** Steel fittings with zinc phosphate coating or stainless steel fittings, along with brass fittings in low pressure applications, are viable options.

The other option is to run the fluid through the system, without components with moving parts in it, with an auxiliary power source, to generate and flush the gelatinous compound. Then re-connect all components, change filters and charge the system with new fluid.

The corrosion resistance of the Chromium-6 Free standard surface treatment is a minimum of 25% improved over traditional zinc gold (hexavalent) chromate surface. Additionally, the Chromium-6 Free surface meets the EU end of life vehicle directive and ROHS compliance.

Zinc-Nickel (Parker XTR) plating offers enhanced performance over both Chromium-6 Free (standard treatment) and traditional zincgold hexavalent chromate surfaces. Parker XTR plating increases protection in salt spray (ASTM B117) testing and in fertilizer (urea) applications.

**Caution: Where low toxicity and low corrosion are required, as in food or beverage applications, steel coated with any form of zinc or other protective coatings is not recommended.**

**Notes:**

- 1) Caution: Where low toxicity and low corrosion are required as in food or beverage applications, steel coated with any form of zinc or other protective coatings is not recommended.

**Choosing the Tube Material and Type**

Selection of tube material depends on the fluid, corrosive nature of the service environment, the operating temperature range and the maximum operating pressure. The tube O.D. and wall thickness selection depends on these four parameters.

A simple method of selecting the proper tube type and material is described below.

Table T16 lists several common tube types with their recommended operating temperature ranges, general application, and fitting compatibility. Based on the fluid system parameters and media, select the appropriate tube type and material.

If media and/or service environment is different from the commonly used ones listed in the general application column, please consult the Fluid Compatibility chart on the following page or contact the Tube Fittings Division.

For selecting proper tube O.D. and wall thickness use the procedure given on pages T4 and T28.

**Caution: When working with highly corrosive media, always consult the Tube Fittings Division.**





| Media                                  | Fitting Material |       |        | Seal Material |                    |              |          |
|--|------------------|-------|--------|---------------|--------------------|--------------|----------|
|  | Brass            | Steel | 316 SS | BUNA-N        | Ethylene Propylene | Fluorocarbon | Neoprene |
| Acetylene                              | NR               | F     | S      | S             | S                  | S            | F        |
| Air (oil free) @ 190°F                 | S                | F     | S      | S             | S                  | S            | S        |
| Air (oil free) @ 300°F                 | S                | F     | S      | F             | F                  | S            | F        |
| Air (oil free) @ 400°F                 | S                | F     | S      | NR            | NR                 | S            | NR       |
| Alcohol, Ethyl                         | S                | NR    | NR     | NR            | S                  | NR           | S        |
| Animal Oils (Lard Oil)                 | F                | F     | F      | S             | F                  | S            | F        |
| Aromatic Fuel - 50%                    | ID               | ID    | ID     | F             | NR                 | S            | NR       |
| Aromatic Solvents                      | ID               | ID    | F      | F             | ID                 | S            | NR       |
| Asphalt                                | NR               | NR    | S      | F             | NR                 | S            | F        |
| ASTM Oil #1                            | S                | S     | S      | S             | NR                 | S            | S        |
| ASTM Oil #2                            | S                | S     | S      | S             | NR                 | S            | F        |
| ASTM Oil #3                            | S                | S     | S      | S             | NR                 | S            | NR       |
| ASTM Oil #4                            | S                | S     | S      | F             | NR                 | S            | NR       |
| ATF Oil                                | S                | S     | S      | S             | NR                 | S            | F        |
| Automotive Brake Fluid                 | ID               | ID    | ID     | NR            | S                  | NR           | F        |
| Benzene                                | NR               | F     | NR     | NR            | NR                 | S            | NR       |
| Brine (Sodium Chloride)                | NR               | NR    | S      | S             | S                  | S            | S        |
| Butane                                 | NR               | S     | S      | S             | NR                 | S            | S        |
| Carbon Dioxide                         | S                | F     | S      | S             | S                  | S            | S        |
| Carbon Monoxide                        | S                | S     | S      | S             | S                  | S            | F        |
| Chlorine (Dry)                         | F                | F     | NR     | NR            | ID                 | F            | F        |
| Compressed Air                         | S                | F     | S      | S             | S                  | S            | S        |
| Crude Oil                              | NR               | F     | S      | F             | NR                 | S            | NR       |
| Cutting Oil                            | ID               | S     | S      | S             | NR                 | S            | F        |
| Diesel Fuel                            | S                | S     | S      | S             | NR                 | S            | NR       |
| Ethanol                                | S                | NR    | NR     | NR            | S                  | NR           | S        |
| Ethers                                 | S                | S     | S      | NR            | F                  | F            | NR       |
| Freon 11                               | S                | ID    | ID     | F             | NR                 | F            | NR       |
| Freon 12                               | S                | S     | NR     | F             | NR                 | S            | S        |
| Freon 22                               | S                | NR    | S      | NR            | NR                 | NR           | S        |
| Fuel Oil                               | NR               | S     | S      | S             | NR                 | S            | F        |
| Gasoline                               | S                | F     | S      | S             | NR                 | S            | NR       |
| Gas, Liquid Propane (LPG)              | S                | S     | S      | S             | NR                 | S            | F        |
| Gas, Natural                           | F                | S     | S      | S             | NR                 | S            | S        |
| Helium                                 | S                | S     | S      | S             | S                  | S            | S        |
| Hydraulic Oil, Petroleum Base          | S                | S     | S      | S             | NR                 | S            | S        |
| Hydraulic Oil, Water Base              | ID               | S     | S      | F             | S                  | NR           | F        |
| Hydrogen Gas                           | S                | S     | S      | S             | S                  | S            | S        |
| Jet Fuel                               | S                | S     | S      | S             | NR                 | S            | NR       |
| Kerosene                               | S                | S     | S      | S             | NR                 | S            | F        |
| Lubricating Oil SAE 10, 20, 30, 40, 50 | S                | S     | S      | S             | NR                 | S            | F        |
| Methanol                               | S                | S     | S      | S             | S                  | NR           | S        |
| MIL-F-8192 (JP-9)                      | S                | S     | S      | NR            | NR                 | S            | NR       |
| MIL-H-5606                             | S                | S     | S      | S             | NR                 | S            | F        |
| MIL-H-6083                             | S                | S     | S      | S             | NR                 | S            | S        |
| MIL-H-7083                             | S                | S     | S      | S             | S                  | F            | F        |
| MIL-H-8446 (MLO-8515)                  | F                | S     | S      | F             | NR                 | S            | S        |
| Mil-L-2104 & 2104B                     | S                | S     | S      | S             | NRX                | S            | F        |
| MIL-L-7808                             | NR               | F     | S      | S             | NR                 | S            | NR       |
| Mineral Oil                            | S                | S     | S      | F             | NR                 | S            | F        |
| Nitrogen                               | S                | S     | S      | F             | S                  | S            | S        |
| Petrolatum                             | S                | S     | S      | S             | NR                 | S            | F        |
| Petroleum Oil (<250°F)                 | S                | S     | S      | S             | NR                 | S            | F        |
| Propane                                | S                | S     | S      | S             | NR                 | S            | F        |
| R134A                                  | S                | S     | S      | NR            | S                  | NR           | NR       |
| Sea Water                              | F                | NR    | S      | S             | S                  | S            | F        |
| Skydrol 500, Type 2                    | NR               | S     | S      | NR            | S                  | NR           | NR       |
| Skydrol 7000, Type 2                   | NR               | S     | S      | NR            | S                  | F            | NR       |
| Soap Solutions                         | NR               | NR    | S      | S             | S                  | S            | F        |
| Steam (<400°F)                         | F                | S     | S      | NR            | S                  | NR           | NR       |
| Stoddard Solvent                       | F                | S     | S      | S             | NR                 | S            | F        |
| Transmission Fluid (Type A)            | S                | S     | S      | S             | NR                 | S            | F        |
| Trichloroethane                        | ID               | F     | S      | NR            | NR                 | S            | NR       |
| Water                                  | S                | F     | S      | S             | S                  | F            | F        |

**Table T13 – Fluid Compatibility Chart** Codes: S = Satisfactory F = Fair NR = Not recommended ID = Insufficient Data  
Dimensions and pressures for reference only, subject to change.



# Corrosion of Base Metals in Contact ..... **M**

The susceptibility of different base metals to corrosion while incontact, depends upon the difference between the contact potentials, or the electromotive voltages of the metals involved. The greater the potential difference is, the greater is the tendency for corrosion. The metal with the higher potential forms the anode and is corroded. In other words, the larger the separation distance in the electromotive chart between the two metals in contact, the higher the contact potential and chances for corrosion. For example, zinc and aluminum are very short distance apart in the chart;

therefore potential for corrosion when these two metals are in contact is very low. On the other hand, aluminum and passivated 316 stainless steel are far apart; hence, when in contact, the potential for corrosion is very high. Aluminum, being more anodic metal, will corrode in this combination.

As a general guideline, if the metals are half the length of the chart or more apart, the combination should be avoided. Also, it is not a good idea to combine an anodic metal part with thin cross section, such as thin wall tubing, with a cathodic or less anodic metal part of a heavy cross section, such as a fitting.

**Example:** A thin wall brass tube with steel fitting is a better, although not ideal, combination than a thin wall steel tube with brass fitting.

| Electromotive or Galvanic Series for Metals  |  |
|--|--|
| + Anodic<br>(least noble)<br>corroded<br><br>↑<br><br>Electric current flows from plus to minus<br>Direction of attack<br><br>↓<br><br>- Cathodic<br>(most noble)<br>protected | Magnesium  |
|  | Magnesium Alloys   |
|  | Zinc (Parker steel fittings are zinc plated)                   |
|  | Zinc-Nickel (Parker XTR Plating)                               |
|  | Beryllium  |
|  | Aluminum 5052, 3004, 3003, 1100, 6053                          |
|  | Cadmium  |
|  | Aluminum 2117, 2017, 2024 T4                                   |
|  | Mild steel (1018), wrought iron, free machining steel (12L14)  |
|  | Low alloy high strength steel, cast iron                       |
|  | Chrome iron (active)   |
|  | 430 Stainless (active)   |
|  | 302, 303, 321, 347, 410, 416, stainless steel (active)         |
|  | Ni-resist  |
|  | 316, 317 stainless steel (active)                              |
|  | Carpenter 20Cb-3 stainless (active)                            |
|  | Aluminum bronze (CA 687)                                       |
|  | Hastelloy C (active) Inconel 625 (active) Titanium (active)    |
|  | Lead/Tin solder  |
|  | Lead   |
|  | Tin  |
|  | Inconel 600 (active)   |
|  | Nickel (active)  |
|  | 60 Ni-15 Cr (active)   |
|  | 80 Ni-20 Cr (active)   |
|  | Hastelloy B (active)   |
|  | Naval brass (CA 464), Yellow brass (CA 268), Brass (CA360)     |
|  | Red brass (CA 230), Admiralty brass (CA 443)                   |
|  | Copper (CA 102)  |
|  | Maganese bronze (CA 675), Tin bronze (CA 903, 905)             |
|  | 410, 416 Stainless (passive) Phosphor bronze (CA 521, 524)     |
|  | Silicon bronze (CA 651, 655)                                   |
|  | Nickel silver (CA 732, 735, 745, 752, 754, 757, 764, 770, 794) |
|  | Cupro Ni 90-10   |
|  | Cupro Ni 80-20   |
|  | 430 Stainless steel (passive)                                  |
|  | Cupro Ni 70-30   |
|  | Nickel aluminum bronze (CA 630, 632)                           |
|  | Monel 400, K500  |
|  | Silver solder  |
|  | Nickel (passive)   |
|  | 60 Ni 15 Cr (passive)  |
|  | Inconel 600 (passive)  |
|  | 80 Ni 20 Cr (passive)  |
|  | Chrome iron (passive)  |
| 302, 303, 304, 321, 347 stainless steel (passive)  |  |
| 316, 317 stainless steel (passive) (Parker stainless steel fittings are passivated)  |  |
| Carpenter 20 Cb-3 stainless (passive), Incoloy 825   |  |
| Silver   |  |
| Titanium (passive), Hastelloy C & C276 (passive), Inconel 625 (passive)  |  |
| Graphic  |  |
| Zirconium  |  |
| Gold   |  |
| Platinum   |  |

**Table T14 – Electromotive or Galvanic Series for Metals**

# O-Ring Material Selection.....

Standard O-Rings supplied with Parker tube fittings and adapters are 90 durometer hard nitrile (Buna-N) Parker compound #N0552 or similar. These O-Rings are well suited for most industrial hydraulic and pneumatic systems. They have high extrusion resistance making them suitable for very high pressure static applications. Optional high temperature fluorocarbon, Parker compound #V0894, is also available for higher temperature specifications.

O-Rings for other than normal hydraulic media or higher temperature applications can be selected from the following chart. The chart should be used only as a general guide. Before making final selection for a given application, it is recommended that appropriate tests be conducted to assure compatibility with the fluid, temperature, pressure and other environmental conditions.

For fluids not shown in the chart, please contact the Tube Fittings Division or Parker Seal Group.

| Recommended for             | Temperature Range | Not Recommended For   | Polymer            | Abbreviated Name        | Parker Compound | No. Color              | SAE J515 Type    | Shore Hardness   |
|-----------------------------|-------------------|---|--------------------|-------------------------|-----------------|------------------------|------------------|------------------|
| Acids                       | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>®</sup> or FPM | V0747           | Black                  | —                | 75               |
| Acids                       | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>®</sup> or FPM | V0884           | Brown <sup>1)</sup>    | —                | 75               |
| Acids                       | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>®</sup> or FPM | V0894           | Brown <sup>1),5)</sup> | HK <sup>4)</sup> | 90 <sup>6)</sup> |
| Air                         | -30° to 250°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methanol | Nitrile-Butadiene  | NBR                     | N0674           | Black                  | —                | 70               |
| Air                         | -30° to 250°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methanol | Nitrile-Butadiene  | NBR                     | N0552           | Black                  | CH <sup>2)</sup> | 90 <sup>6)</sup> |
| Air                         | -30° to 275°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methanol | Nitrile-Butadiene  | NBR                     | N1059           | Black                  | CH <sup>2)</sup> | 90               |
| Air                         | -65° to 225°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methanol | Nitrile-Butadiene  | NBR                     | N0103           | Black                  | —                | 70               |
| Alcohols                    | -65° to 225°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                    | E0540           | Black                  | CA <sup>3)</sup> | 80               |
| Alcohols                    | -65° to 225°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                    | E0893           | Purple <sup>1)</sup>   | CA <sup>3)</sup> | 80               |
| Automotive brake fluids     | -65° to 225°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                    | E0540           | Black                  | CA <sup>3)</sup> | 80               |
| Automotive brake fluids     | -65° to 225°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                    | E0893           | Purple <sup>1)</sup>   | CA <sup>3)</sup> | 80               |
| CO2 Climate control systems | -65° to 225°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                    | E0962           | Black                  | —                | 90               |
| CNG Applications            | -65° to 225°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methanol | Nitrile-Butadiene  | NBR                     | N0756           | Black                  | —                | 75 <sup>6)</sup> |
| Di-ester base lubricants    | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>®</sup> or FPM | V0747           | Black                  | —                | 75               |
| Di-ester base lubricants    | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>®</sup> or FPM | V0884           | Brown <sup>1)</sup>    | —                | 75               |
| Di-ester base lubricants    | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>®</sup> or FPM | V0894           | Brown <sup>1),5)</sup> | HK <sup>4)</sup> | 90 <sup>6)</sup> |
| Dilute acids and alkalis    | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                    | E0540           | Black                  | CA <sup>3)</sup> | 80               |
| Dilute acids and alkalis    | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                    | E0893           | Purple <sup>1)</sup>   | CA <sup>3)</sup> | 80               |
| Dry heat (air to 400°F)     | -65° to 450°F     | Most petroleum fluids, ketones, water and steam   | Silicone           | Si                      | S0604           | Rust <sup>1)</sup>     | —                | 70               |
| Ethylene glycol base fluids | -30° to 250°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methanol | Nitrile-Butadiene  | NBR                     | N0674           | Black                  | —                | 70               |

Dimensions and pressures for reference only, subject to change.





| Recommended for                                    | Temperature Range | Not Recommended For   | Polymer            | Abbreviated Name         | Parker Compound | No. Color              | SAE J515 Type    | Shore Hardness   |
|--|-------------------|---|--------------------|--------------------------|-----------------|------------------------|------------------|------------------|
| Ethylene glycol base fluids                        | -30° to 250°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0552           | Black                  | CH <sup>2)</sup> | 90 <sup>6)</sup> |
| Ethylene glycol base fluids                        | -30° to 275°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N1059           | Black                  | CH <sup>2)</sup> | 90               |
| Ethylene glycol base fluids                        | -65° to 225°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0103           | Black                  | —                | 70               |
| Food product applications (meets FDA requirements) | -35° to 250°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0508           | Black                  | —                | 75               |
| Halogenated hydrocarbons                           | -15° to 400°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0747           | Black                  | —                | 75               |
| Halogenated hydrocarbons                           | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids   | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0884           | Brown <sup>1)</sup>    | —                | 75               |
| Halogenated hydrocarbons                           | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids   | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0894           | Brown <sup>1),5)</sup> | HK <sup>4)</sup> | 90 <sup>6)</sup> |
| High aniline point oils                            | -65° to 450°F     | Most petroleum fluids, ketones, water and steam   | Silicone           | Si                       | S0604           | Rust <sup>1)</sup>     | —                | 70               |
| High aniline point petroleum oils                  | -45° to 250°F     | Phosphate ester fluids and ketones  | Neoprene           | CR                       | C0873           | Black                  | —                | 70               |
| High aniline point petroleum oils                  | -45° to 250°F     | Phosphate ester fluids and ketones  | Neoprene           | CR                       | C0944           | Red <sup>1)</sup>      | —                | 70               |
| Hot water  | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0540           | Black                  | CA <sup>3)</sup> | 80               |
| Hot water  | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0893           | Purple <sup>1)</sup>   | CA <sup>3)</sup> | 80               |
| Hydrogen Fuel Cells                                | -65° to 180°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0507           | Black                  | —                | 90               |
| Hydrogen Fuel Cells                                | -65° to 225°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0304           | Black                  | —                | 75               |
| Ketones  | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0540           | Black                  | CA <sup>3)</sup> | 80               |
| Ketones  | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0893           | Purple <sup>1)</sup>   | CA <sup>3)</sup> | 80               |
| Mild Acids   | -45° to 250°F     | Phosphate ester fluids and ketones  | Neoprene           | CR                       | C0873           | Black                  | —                | 70               |
| Mild Acids   | -45° to 250°F     | Phosphate ester fluids and ketones  | Neoprene           | CR                       | C0944           | Red <sup>1)</sup>      | —                | 70               |
| Mineral Oils                                       | -30° to 250°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0674           | Black                  | —                | 70               |
| Mineral Oils                                       | -30° to 250°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0552           | Black                  | CH <sup>2)</sup> | 90 <sup>6)</sup> |
| Mineral Oils                                       | -30° to 275°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N1059           | Black                  | CH <sup>2)</sup> | 90               |
| Mineral Oils                                       | -65° to 225°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0103           | Black                  | —                | 70               |
| Natural Gas  | -30° to 250°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0674           | Black                  | —                | 70               |
| Natural Gas  | -30° to 250°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenerated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0552           | Black                  | CH <sup>2)</sup> | 90 <sup>6)</sup> |

Dimensions and pressures for reference only, subject to change.





| Recommended for                              | Temperature Range | Not Recommended For   | Polymer            | Abbreviated Name         | Parker Compound | No. Color              | SAE J515 Type    | Shore Hardness   |
|--|-------------------|---|--------------------|--------------------------|-----------------|------------------------|------------------|------------------|
| Natural Gas                                  | -30° to 275°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N1059           | Black                  | CH <sup>2)</sup> | 90               |
| Natural Gas                                  | -65° to 225°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0103           | Black                  | —                | 70               |
| Petroleum based oils and fluids              | -30° to 250°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0674           | Black                  | —                | 70               |
| Petroleum based oils and fluids              | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0747           | Black                  | —                | 75               |
| Petroleum based oils and fluids              | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0884           | Brown <sup>1)</sup>    | —                | 75               |
| Petroleum based oils and fluids              | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0894           | Brown <sup>1),5)</sup> | HK <sup>4)</sup> | 90 <sup>6)</sup> |
| Petroleum based oils and fluids              | -30° to 250°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0552           | Black                  | CH <sup>2)</sup> | 90 <sup>6)</sup> |
| Petroleum based oils and fluids              | -30° to 275°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N1059           | Black                  | CH <sup>2)</sup> | 90               |
| Petroleum based oils and fluids              | -65° to 225°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0103           | Black                  | —                | 70               |
| Phosphate ester base hydraulic fluids        | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0540           | Black                  | CA <sup>3)</sup> | 80               |
| Phosphate ester base hydraulic fluids        | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0893           | Purple <sup>1)</sup>   | CA <sup>3)</sup> | 80               |
| Phosphate ester base hydraulic fluids (some) | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0747           | Black                  | —                | 75               |
| Phosphate ester base hydraulic fluids (some) | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0884           | Brown <sup>1)</sup>    | —                | 75               |
| Phosphate ester base hydraulic fluids (some) | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0894           | Brown <sup>1),5)</sup> | HK <sup>4)</sup> | 90 <sup>6)</sup> |
| Refrigerants (freons, ammonia)               | -45° to 250°F     | Phosphate ester fluids and ketones  | Neoprene           | CR                       | C0873           | Black                  | —                | 70               |
| Refrigerants (freons, ammonia)               | -45° to 250°F     | Phosphate ester fluids and ketones  | Neoprene           | CR                       | C0944           | Red <sup>1)</sup>      | —                | 70               |
| Silicate ester lubricants                    | -45° to 250°F     | Phosphate ester fluids and ketones  | Neoprene           | CR                       | C0873           | Black                  | —                | 70               |
| Silicate ester lubricants                    | -45° to 250°F     | Phosphate ester fluids and ketones  | Neoprene           | CR                       | C0944           | Red <sup>1)</sup>      | —                | 70               |
| Silicone and di-ester base lubricants        | -30° to 250°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0674           | Black                  | —                | 70               |
| Silicone and di-ester base lubricants        | -30° to 250°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0552           | Black                  | CH <sup>2)</sup> | 90 <sup>6)</sup> |
| Silicone and di-ester base lubricants        | -30° to 275°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N1059           | Black                  | CH <sup>2)</sup> | 90               |
| Silicone and di-ester base lubricants        | -65° to 225°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0103           | Black                  | —                | 70               |

Dimensions and pressures for reference only, subject to change.





| Recommended for                              | Temperature Range | Not Recommended For   | Polymer            | Abbreviated Name         | Parker Compound | No. Color              | SAE J515 Type    | Shore Hardness   |
|--|-------------------|---|--------------------|--------------------------|-----------------|------------------------|------------------|------------------|
| Silicone and silicate ester based lubricants | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0747           | Black                  | —                | 75               |
| Silicone and silicate ester based lubricants | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0884           | Brown <sup>1)</sup>    | —                | 75               |
| Silicone and silicate ester based lubricants | -15° to 400°F     | Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids | Fluorocarbon       | FKM <sup>5)</sup> or FPM | V0894           | Brown <sup>1),5)</sup> | HK <sup>4)</sup> | 90 <sup>6)</sup> |
| Silicone oils and greases                    | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0540           | Black                  | CA <sup>3)</sup> | 80               |
| Silicone oils and greases                    | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0893           | Purple <sup>1)</sup>   | CA <sup>3)</sup> | 80               |
| Steam to 400°F                               | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0540           | Black                  | CA <sup>3)</sup> | 80               |
| Steam to 400°F                               | -65° to 275°F     | Petroleum based oils and di-ester base lubricants   | Ethylene-Propylene | EPDM                     | E0893           | Purple <sup>1)</sup>   | CA <sup>3)</sup> | 80               |
| Water under 150°F                            | -30° to 250°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0674           | Black                  | —                | 70               |
| Water under 150°F                            | -30° to 250°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0552           | Black                  | CH <sup>2)</sup> | 90 <sup>6)</sup> |
| Water under 150°F                            | -30° to 275°F     | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N1059           | Black                  | CH <sup>2)</sup> | 90               |
| Water under 150°F                            | -65° to 225°      | Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons and methonal | Nitrile-Butadiene  | NBR                      | N0103           | Black                  | —                | 70               |

**Table T15 – O-Ring Selection**

- 1) These Parker “Chromasure” color assurance O-Rings are available from the Parker Hannifin O-Ring Division. They help eliminate assembly errors, reduce warranty costs and liability risks, and assure safety in aftermarket business.
- 2) Formerly SAE Type I.
- 3) Formerly SAE Type II.
- 4) Formerly SAE Type III.
- 5) “FKM” is the ASTM designation for fluorocarbon. Its ISO designation is “FPM”. For “DIN” Fittings, color is green.
- 6) Standard compounds available from stock.
- 7) Use 90 durometer hard O-Rings for applications with 1500 psi or higher pressures.

Dimensions and pressures for reference only, subject to change.



# Tube and Fitting Material Compatibility.....

As a general rule, tube and fitting materials should be the same. If different materials must be considered, the following chart can be used as a general guide. Since operating conditions differ with applications, this chart should be used only as a guide and not a firm recommendation.

Before making a final decision on material combination, it should be sufficiently tested under appropriate conditions to assure suitability for the intended application. For additional material combinations, contact the Tube Fittings Division.

| Tube Material                               | Specification            | Construction              | Condition                     | Max. Hardness        | Temperature Range (7)                | Application  | Tube Material to Fitting & Material Compatibility |     |     |                                 |     |     |                              |     |     |                     |                                |          |     |    |    |          |          |
|---|--------------------------|---------------------------|-------------------------------|----------------------|--------------------------------------|--|---|-----|-----|---------------------------------|-----|-----|------------------------------|-----|-----|---------------------|--------------------------------|----------|-----|----|----|----------|----------|
|   |                          |                           |                               |                      |                                      |  | Seal-Lok ORFS (SAE J1453)                         |     |     | Triple-Lok 37° Flare (SAE J514) |     |     | Ferulok Flareless (SAE J514) |     |     | Intru-Lok Flareless | EO/EO-2 Flareless (ISO 8434-1) |          |     |    |    |          |          |
|   |                          |                           |                               |                      |                                      |  | S   | SS  | B   | S                               | SS  | B   | M                            | S   | SS  | M                   | B                              | S, SS, B |     |    |    |          |          |
| Carbon Steel C-1010                         | SAE J524 (ASTM A179) (8) | Seamless                  | Fully Annealed                | HRB 72               | -65° to 500°F<br>-55° to 260°C       | High pressure hydraulic, air, & some specialty chemicals                     | E   | NR  | (6) | G                               | NR  | (6) | NR                           | E   | NR  | NR                  | NR                             | NR       | NR  |    |    |          |          |
|   | SAE J525 (ASTM A178) (8) | Welded & Drawn            |                               |                      |                                      |  | E   | NR  | (6) | E                               | NR  | (6) | NR                           | E   | NR  | NR                  | NR                             | NR       | NR  |    |    |          |          |
|   | SAE J356                 | Welded & Flash Controlled |                               |                      |                                      |  | G   | NR  | (6) | NR                              | NR  | (6) | NR                           | G   | NR  | NR                  | NR                             | NR       | NR  |    |    |          |          |
| Carbon Steel C-1021                         | SAE J2467                | Welded & Flash Controlled | Fully Annealed                | HRB 75               | -65° to 500°F<br>-55° to 260°C       | High pressure hydraulic  | E   | NR  | (6) | NR                              | NR  | (6) | NR                           | E   | NR  | NR                  | NR                             | NR       |     |    |    |          |          |
|   | SAE J2435                | Welded & Drawn            |                               |                      |                                      |  | E   | NR  | (6) | E                               | NR  | (6) | NR                           | E   | NR  | NR                  | NR                             | NR       |     |    |    |          |          |
| Carbon Steel High Strength Low Alloy (HSLA) | SAE 2613                 | Welded & Flash Controlled | Sub-critically annealed       | HRB 90               | -65° to 500°F<br>-55° to 260°C       | High pressure hydraulic  | E   | NR  | (6) | NR                              | NR  | (6) | NR                           | NR  | NR  | NR                  | NR                             | NR       |     |    |    |          |          |
|   | SAE J2614                | Welded & Drawn            |                               |                      |                                      |  | E   | NR  | (6) | NR                              | NR  | (6) | NR                           | NR  | NR  | NR                  | NR                             | NR       |     |    |    |          |          |
| Alloy Steel 4130                            | ASTM A519                | Seamless                  |                               |                      | -65° to 500°F<br>-55° to 260°C       | High pressure hydraulics   | E   | NR  | NR  | NR                              | NR  | NR  | NR                           | NR  | NR  | NR                  | NR                             | NR       |     |    |    |          |          |
| St 37.4 (Carbon Steel)                      | DIN 2391 Part 2 (Metric) | Seamless                  | Fully Annealed                | HRB 72               | -65° to 500°F<br>-55° to 260°C       | High pressure hydraulic, air, & some specialty chemicals                     | E   | NR  | NR  | G                               | NR  | NR  | NR                           | NR  | NR  | NR                  | NR                             | E        |     |    |    |          |          |
| Stainless Steel 304 & 316                   | ASTM A213 ASTM A269      | Seamless                  | Fully Annealed                | HRB 90               | -425° to 1200°<br>-255° to 650°C (3) | High pressure, high temperature, or generally corrosive media (1)            | (6)   | E   | (6) | (6)                             | G   | (6) | NR                           | (6) | E   | NR                  | NR                             | NR       |     |    |    |          |          |
|   | ASTM A249 ASTM A269      | Welded & Drawn            |                               |                      |                                      |  | (6)   | E   | (6) | (6)                             | E   | (6) | NR                           | (6) | E   | NR                  | NR                             | NR       |     |    |    |          |          |
| 1.4571 1.4541 Stainless Steel               | DIN 17458 Tab 8 (Metric) | Seamless                  | Fully Annealed                | HRB 90               | -425° to 1200°<br>-255° to 650°C (3) | High pressure, high temperature, or generally corrosive media (1)            | (6)   | E   | NR  | (6)                             | G   | NR  | NR                           | NR  | E   | NR                  | NR                             | E        |     |    |    |          |          |
| Copper                                      | SAE J528 (ASTM B-75) (8) | Seamless                  | Soft Annealed Temper 0        | 60 Max. Rockwell 15T | -325° to 400°F<br>-200° to 205°C     | Low pressure, low temperature, water, oil & air                              | E   | (6) | E   | G                               | (6) | E   | NR                           | G   | (2) | NR                  | NR                             | E        |     |    |    |          |          |
| Aluminum 6061                               | ASTM-B210                | Seamless                  | T6 Temper                     | HRB 56               | -325° to 400°F<br>-200° to 205°C     | Low pressure, low temperature, water, oil, air & some specialty chemicals    | NR  | NR  | NR  | G                               | NR  | NR  | NR                           | E   | (2) | NR                  | NR                             | (6)      | NR  |    |    |          |          |
|   |                          |                           | 0 & T4 Temper                 | HRB 30               |                                      |  | E   | (5) | NR  | NR                              | G   | NR  | NR                           | NR  | E   | (2)                 | NR                             | NR       | (6) | NR |    |          |          |
| Monel 400                                   | ASTM-B165                | Seamless                  | Fully Annealed                | HRB 70               | -400° to 800°F<br>-240° to 425°C     | Sour gas, marine & general chemical processing media                         | NR  | (6) | NR  | NR                              | (6) | NR  | E                            | NR  | (6) | E                   | NR                             | NR       |     |    |    |          |          |
| Nylon                                       |                          | Extruded                  | Flexible & Semi-Rigid         |                      | -60° to 200°F<br>-50° to 95°C        | Lube lines, chemical process controls & air                                  | NR  | NR  | NR  | NR                              | NR  | NR  | NR                           | G   | (2) | G                   | (2)                            | G        | (2) | E  | G  | (2), (9) |          |
| Polyethylene                                | ASTM D-1248              | Extruded                  | Instrument Grade              |                      | -80° to 150°F<br>-60° to 65°C        | Instrumentation lines  | NR  | NR  | NR  | NR                              | NR  | NR  | NR                           | G   | (2) | G                   | (2)                            | G        | (2) | E  | G  | (2), (9) |          |
| PVC   |                          | Extruded                  | Instrument & Laboratory Grade |                      | 0° to 140°F<br>-20° to 60°C          | General purpose laboratory use   | NR  | NR  | NR  | NR                              | NR  | NR  | NR                           | NR  | NR  | NR                  | NR                             | NR       | G   | NR | NR |          |          |
| PTFE  |                          | Extruded & Cintered       |                               |                      | -65° to 400°F<br>-55° to 205°C       | Very low pressure, high temperature, fuel, lube, chemical & air applications | NR  | NR  | NR  | NR                              | NR  | NR  | NR                           | G   | (2) | G                   | (2)                            | G        | (2) | G  | NR | G        | (2), (9) |

**Table T16 – Tube and Fitting Material Compatibility**

**Ratings Key:**  
 NR Not Recommended  
 F Fair  
 G Good  
 E Excellent

**Fitting Materials Code:**  
 S Steel  
 SS Stainless Steel  
 B Brass  
 M Monel

**Notes:**

- 1) For highly corrosive media or service environment, contact the Tube Fittings Division.
- 2) Requires different assembly procedure. Contact the Tube Fittings Division.
- 3) Low temperature limit for stainless steel Ferulok fittings is -20°F (-30°C).
- 4) For brazing only. Grade 4130 not recommended with Parflange process.
- 5) For use with Parflange process only. Not recommended with brazing.
- 6) Use depends on specific application. Contact the Tube Fittings Division.
- 7) Applies to tube material.
- 8) Comparable specifications to SAE.
- 9) With metric version of tubing.
- 10) Not tested with Parflange. Contact the Tube Fittings Division.

Dimensions and pressures for reference only, subject to change.



# Pressure



## Fitting and Adapter Pressure Ratings

### Fitting Pressure Ratings

Pressure ratings shown on the product pages of this catalog are for dynamic systems. A vast majority of systems where our fittings are used fall in this category. However, there are applications, such as hydraulic jacks, where the system pressure is essentially static once it is pressurized. For this type of an application the fittings can be used at higher pressures.

The dynamic and static systems can be defined as follows:

**Dynamic:** A system in which the operating pressure fluctuates, in accordance with load, up to a maximum pressure limited by the relief valve. In addition, the system may also experience shocks, vibration and temperature excursions. Example: A backhoe.

**Static:** A system, once pressurized, is essentially free of pressure fluctuations, shock, vibration and temperature excursions, with such pressurizations not exceeding 30,000 in the life of the system. Example: A hydraulic jack.

The dynamic pressure ratings are based on a minimum design factor of 4. In other words, the fitting is capable of holding a pressure equal to 4 times the rated pressure before leakage or failure. For static applications, the design factor can be 3. Hence, the static rating can be determined by multiplying the dynamic rating by 1.33.

**Static pressure rating = 1.33 x Dynamic pressure rating**

Example: Static pressure rating for a fitting rated at 6000 psi = 1.33 x 6000 = 8000 psi

### Higher (dynamic) Ratings

Some parts are capable of performing at higher pressures than those shown on the product pages. For information on higher ratings, contact Tube Fittings Division.

### tubing Pressure Ratings

Using Tables T20 and T21, determine the tube O.D. and wall thickness combination that satisfies the following two conditions:

- A. Has recommended design pressure equal to or higher than maximum operating pressure.
- B. Provides tube I.D. equal to or greater than required flow diameter determined earlier.

Design pressure values in Tables T20 and T21 are based on the severity of service rating "A" (design factor of 4) in Table T19, and temperature derating factor of 1 in Table T7 on page T9.

If more severe operating conditions are involved, the values in Tables T20 and T21 should be multiplied by appropriate derating factors from Tables T19 and T7 before determining the tube O.D. and wall thickness combination. Contact the Tube Fittings Division when in doubt.

| Material and Type                     | Allowable Design Stress for Factor of 4 at 72°F | Tube Specification    |
|---------------------------------------|---|-----------------------|
| Steel C1010                           | 11,250 PSI                                      | SAE J356, J524, J525  |
| Steel C1021                           | 15,000 PSI                                      | SAE J2435, L2467      |
| Steel, High Strength Low Alloy (HSLA) | 18,000 PSI                                      | SAE J2613, J2614      |
| Stainless Steel 304 & 316             | 18,800 PSI                                      | ASTM A213, A249, A269 |
| Alloy Steel C4130                     | 18,800 PSI                                      | ASTM A519             |
| Copper, K or Y                        | 6,000 PSI                                       | SAE J528, ASTM B75    |
| Aluminum 6061-T6                      | 10,500 PSI                                      | ASTM B210             |
| Monel, 400                            | 17,500 PSI                                      | ASTM B165             |

**Table T17 – Design Stress Values**

**Design Pressure Formula (LAME'S)**

$$P = S \left( \frac{d_2 - d_1}{D_2 + d_1} \right) \text{ where:}$$

D = Outside diameter of tube, in.  
 d = Inside diameter of tube (D-2T), in.  
 P = Recommended design pressure, psi  
 S = Allowable stress for design factor of 4, psi  
 T = Tube wall thickness, in.

**Table T18 – Design Pressure Formula**

\*For thin wall tubes (D/T ≥ 10) the following formula may be Used: **P = 2ST/D**

| Severity of Service | Description   | Design Factor | Derating Factor |
|---------------------|---|---------------|-----------------|
| A (Normal)          | Moderate mechanical and hydraulic shocks.             | 4.00          | 1.00            |
| B (Severe)          | Severe hydraulic shocks and mechanical strain.        | 6.00          | 0.67            |
| C (Hazardous)       | Hazardous application with severe service conditions. | 8.00          | 0.50            |

**Table T19 – Severity of Service Design and Derating Factors**

Allowable design stress levels and formula used to arrive at the design pressure values are given in the following chart. Values in Table T7 are for fully annealed tubing.

The design factor is generally applied to ultimate strength of material (or burst pressure of tubing) to provide a measure of safety against the unknowns in material and operating conditions. The derating factors listed here should be applied directly to the design pressure values in Tables T20 and T21 to arrive at maximum recommended working pressures (i.e., multiply values in Tables T20 and T21 by these derating factors).

Dimensions and pressures for reference only, subject to change.



**Inch Tube Pressure Ratings** ..... **P**

| Inch Tubes*     |                   |                 |                 |              |                                      |               |
|-----------------|-------------------|-----------------|-----------------|--------------|--------------------------------------|---------------|
| Tube O.D. (in.) | Wall Thick. (in.) | Tube I.D. (in.) | Design Pressure |              |                                      |               |
|                 |                   |                 | Pressure C-1010 | Steel C-1021 | Stainless Steel 304 & 316, 4130 HSLA | Copper K or Y |
| 0.125           | 0.010             | 0.105           | 1,900           | 2,550        | 3,200                                | 1,000         |
| 0.125           | 0.020             | 0.085           | 4,100           | 5,500        | 6,850                                | 2,200         |
| 0.125           | 0.028             | 0.069           | 5,950           | 7,950        | 9,950                                | 3,150         |
| 0.125           | 0.035             | 0.055           | 7,550           | 10,100       | 12,650                               | 4,050         |
| 0.188           | 0.010             | 0.168           | 1,250           | 1,650        | 2,100                                | 650           |
| 0.188           | 0.020             | 0.148           | 2,600           | 3,500        | 4,400                                | 1,400         |
| 0.188           | 0.028             | 0.132           | 3,800           | 5,050        | 6,350                                | 2,000         |
| 0.188           | 0.035             | 0.118           | 4,850           | 6,500        | 8,150                                | 2,600         |
| 0.188           | 0.049             | 0.090           | 7,000           | 9,400        | 11,750                               | 3,750         |
| 0.250           | 0.020             | 0.210           | 1,900           | 2,550        | 3,200                                | 1,000         |
| 0.250           | 0.028             | 0.194           | 2,750           | 3,700        | 4,650                                | 1,450         |
| 0.250           | 0.035             | 0.180           | 3,350           | 4,750        | 5,900                                | 1,900         |
| 0.250           | 0.049             | 0.152           | 5,150           | 6,900        | 8,600                                | 2,750         |
| 0.250           | 0.058             | 0.134           | 6,200           | 8,300        | 10,350                               | 3,300         |
| 0.250           | 0.065             | 0.120           | 7,000           | 9,350        | 11,700                               | 3,750         |
| 0.250           | 0.083             | 0.084           | 8,950           | 11,950       | 14,900                               | 4,750         |
| 0.313           | 0.020             | 0.273           | 1,500           | 2,000        | 2,500                                | 800           |
| 0.313           | 0.028             | 0.257           | 2,150           | 2,900        | 3,600                                | 1,150         |
| 0.313           | 0.035             | 0.243           | 2,750           | 3,700        | 4,600                                | 1,450         |
| 0.313           | 0.049             | 0.215           | 4,000           | 5,350        | 6,700                                | 2,150         |
| 0.313           | 0.058             | 0.197           | 4,850           | 6,450        | 8,100                                | 2,550         |
| 0.313           | 0.065             | 0.183           | 5,500           | 7,350        | 9,150                                | 2,900         |
| 0.313           | 0.083             | 0.147           | 7,150           | 9,550        | 11,950                               | 3,800         |
| 0.313           | 0.095             | 0.123           | 8,200           | 10,950       | 13,700                               | 4,350         |
| 0.375           | 0.020             | 0.335           | 1,250           | 1,650        | 2,100                                | 650           |
| 0.375           | 0.028             | 0.319           | 1,800           | 2,400        | 3,000                                | 950           |
| 0.375           | 0.035             | 0.305           | 2,250           | 3,050        | 3,800                                | 1,200         |
| 0.375           | 0.049             | 0.277           | 3,300           | 4,400        | 5,500                                | 1,750         |
| 0.375           | 0.058             | 0.259           | 3,950           | 5,300        | 6,600                                | 2,100         |
| 0.375           | 0.065             | 0.245           | 4,500           | 6,000        | 7,500                                | 2,400         |
| 0.375           | 0.083             | 0.209           | 5,900           | 7,850        | 9,850                                | 3,150         |
| 0.375           | 0.095             | 0.185           | 6,800           | 9,100        | 11,400                               | 3,650         |
| 0.375           | 0.109             | 0.157           | 7,850           | 10,500       | 13,150                               | 4,200         |
| 0.500           | 0.028             | 0.444           | 1,300           | 1,750        | 2,200                                | 700           |
| 0.500           | 0.035             | 0.430           | 1,650           | 2,200        | 2,800                                | 850           |
| 0.500           | 0.049             | 0.402           | 2,400           | 3,200        | 4,000                                | 1,250         |
| 0.500           | 0.058             | 0.384           | 2,900           | 3,850        | 4,800                                | 1,500         |
| 0.500           | 0.065             | 0.370           | 3,250           | 4,350        | 5,450                                | 1,750         |
| 0.500           | 0.083             | 0.334           | 4,300           | 5,700        | 7,150                                | 2,250         |
| 0.500           | 0.095             | 0.310           | 4,950           | 6,650        | 8,300                                | 2,650         |
| 0.500           | 0.109             | 0.282           | 5,800           | 7,750        | 9,700                                | 3,100         |
| 0.500           | 0.120             | 0.260           | 6,450           | 8,600        | 10,750                               | 3,400         |
| 0.500           | 0.134             | 0.232           | 7,250           | 9,650        | 12,100                               | 3,850         |
| 0.500           | 0.148             | 0.204           | 8,000           | 10,700       | 13,350                               | 4,250         |
| 0.500           | 0.188             | 0.124           | 9,900           | 13,250       | 16,550                               | 5,300         |
| 0.625           | 0.028             | 0.569           | 1,050           | 1,400        | 1,750                                | 550           |
| 0.625           | 0.035             | 0.555           | 1,300           | 1,750        | 2,200                                | 700           |
| 0.625           | 0.049             | 0.527           | 1,900           | 1,900        | 1,900                                | 1,900         |

| Inch Tubes*     |                   |                 |                 |              |                                      |               |
|-----------------|-------------------|-----------------|-----------------|--------------|--------------------------------------|---------------|
| Tube O.D. (in.) | Wall Thick. (in.) | Tube I.D. (in.) | Design Pressure |              |                                      |               |
|                 |                   |                 | Pressure C-1010 | Steel C-1021 | Stainless Steel 304 & 316, 4130 HSLA | Copper K or Y |
| 0.625           | 0.058             | 0.509           | 2,250           | 3,000        | 3,750                                | 1,200         |
| 0.625           | 0.065             | 0.495           | 2,550           | 3,400        | 4,250                                | 1,350         |
| 0.625           | 0.083             | 0.459           | 3,350           | 4,450        | 5,600                                | 1,750         |
| 0.625           | 0.095             | 0.435           | 3,900           | 5,200        | 6,500                                | 2,050         |
| 0.625           | 0.109             | 0.407           | 4,500           | 6,050        | 7,550                                | 2,400         |
| 0.625           | 0.120             | 0.385           | 5,050           | 6,700        | 8,400                                | 2,700         |
| 0.625           | 0.134             | 0.357           | 5,700           | 7,600        | 9,500                                | 3,000         |
| 0.750           | 0.035             | 0.680           | 1,050           | 1,450        | 1,800                                | 550           |
| 0.750           | 0.049             | 0.652           | 1,550           | 2,050        | 2,600                                | 800           |
| 0.750           | 0.058             | 0.634           | 1,850           | 2,450        | 3,100                                | 1,000         |
| 0.750           | 0.065             | 0.620           | 2,100           | 2,800        | 3,500                                | 1,100         |
| 0.750           | 0.083             | 0.584           | 2,750           | 3,650        | 4,550                                | 1,450         |
| 0.750           | 0.095             | 0.560           | 3,150           | 4,250        | 5,300                                | 1,700         |
| 0.750           | 0.109             | 0.532           | 3,700           | 4,950        | 6,150                                | 1,950         |
| 0.750           | 0.120             | 0.510           | 4,100           | 5,500        | 6,850                                | 2,200         |
| 0.750           | 0.134             | 0.482           | 4,650           | 6,200        | 7,750                                | 2,450         |
| 0.750           | 0.148             | 0.454           | 5,200           | 6,950        | 8,650                                | 2,750         |
| 0.750           | 0.188             | 0.374           | 6,750           | 9,000        | 11,250                               | 3,600         |
| 0.875           | 0.035             | 0.805           | 900             | 1,200        | 1,550                                | 500           |
| 0.875           | 0.049             | 0.777           | 1,300           | 1,750        | 2,200                                | 700           |
| 0.875           | 0.058             | 0.759           | 1,550           | 2,100        | 2,600                                | 800           |
| 0.875           | 0.065             | 0.745           | 1,750           | 2,350        | 2,950                                | 950           |
| 0.875           | 0.083             | 0.709           | 2,300           | 3,100        | 3,850                                | 1,200         |
| 0.875           | 0.095             | 0.685           | 2,650           | 3,600        | 4,500                                | 1,400         |
| 0.875           | 0.109             | 0.657           | 3,100           | 4,150        | 5,200                                | 1,650         |
| 0.875           | 0.120             | 0.635           | 3,450           | 4,650        | 5,800                                | 1,850         |
| 0.875           | 0.134             | 0.607           | 3,900           | 5,250        | 6,550                                | 2,100         |
| 0.875           | 0.148             | 0.579           | 4,350           | 5,850        | 7,300                                | 2,300         |
| 1.000           | 0.035             | 0.930           | 800             | 1,050        | 1,350                                | 400           |
| 1.000           | 0.049             | 0.902           | 1,150           | 1,500        | 1,900                                | 600           |
| 1.000           | 0.058             | 0.884           | 1,350           | 1,800        | 2,300                                | 700           |
| 1.000           | 0.065             | 0.870           | 1,550           | 2,050        | 2,550                                | 800           |
| 1.000           | 0.083             | 0.834           | 2,000           | 2,650        | 3,350                                | 1,050         |
| 1.000           | 0.095             | 0.810           | 2,300           | 3,100        | 3,850                                | 1,200         |
| 1.000           | 0.109             | 0.782           | 2,700           | 3,600        | 4,500                                | 1,400         |
| 1.000           | 0.120             | 0.760           | 3,000           | 4,000        | 5,000                                | 1,600         |
| 1.000           | 0.134             | 0.732           | 3,350           | 4,500        | 5,650                                | 1,800         |
| 1.000           | 0.148             | 0.704           | 3,750           | 5,050        | 6,300                                | 2,000         |
| 1.000           | 0.156             | 0.688           | 4,000           | 5,350        | 6,700                                | 2,100         |
| 1.000           | 0.188             | 0.624           | 4,900           | 6,550        | 8,200                                | 2,600         |
| 1.000           | 0.220             | 0.560           | 5,850           | 7,800        | 9,750                                | 3,100         |
| 1.250           | 0.049             | 1.152           | 900             | 1,200        | 1,500                                | 450           |
| 1.250           | 0.058             | 1.134           | 1,050           | 1,450        | 1,800                                | 550           |
| 1.250           | 0.065             | 1.120           | 1,200           | 1,600        | 2,050                                | 650           |
| 1.250           | 0.083             | 1.084           | 1,550           | 2,100        | 2,650                                | 800           |
| 1.250           | 0.095             | 1.060           | 1,800           | 2,450        | 3,050                                | 950           |
| 1.250           | 0.109             | 1.032           | 2,100           | 2,800        | 3,550                                | 1,100         |
| 1.250           | 0.120             | 1.010           | 2,350           | 3,150        | 3,900                                | 1,250         |

**Table T20 – Inch Tube Pressure Ratings**  
 \*See Table T8 for tube specifications.

Dimensions and pressures for reference only, subject to change.



**Inch Tube Pressure Ratings (cont'd.)** ..... **P**

| Inch Tubes*     |                   |                 |                 |              |                                      |               |
|-----------------|-------------------|-----------------|-----------------|--------------|--------------------------------------|---------------|
| Tube O.D. (in.) | Wall Thick. (in.) | Tube I.D. (in.) | Design Pressure |              |                                      |               |
|                 |                   |                 | Pressure C-1010 | Steel C-1021 | Stainless Steel 304 & 316, 4130 HSLA | Copper K or Y |
| 1.250           | 0.134             | 0.982           | 2,650           | 3,550        | 4,400                                | 1,400         |
| 1.250           | 0.148             | 0.954           | 2,950           | 3,950        | 4,900                                | 1,550         |
| 1.250           | 0.156             | 0.938           | 3,100           | 4,150        | 5,200                                | 1,650         |
| 1.250           | 0.188             | 0.874           | 3,850           | 5,100        | 6,400                                | 2,050         |
| 1.250           | 0.220             | 0.810           | 4,550           | 6,100        | 7,650                                | 2,450         |
| 1.500           | 0.065             | 1.370           | 1,000           | 1,350        | 1,650                                | 500           |
| 1.500           | 0.083             | 1.334           | 1,300           | 1,750        | 2,150                                | 700           |
| 1.500           | 0.095             | 1.310           | 1,500           | 2,000        | 2,500                                | 800           |
| 1.500           | 0.109             | 1.282           | 1,750           | 2,300        | 2,900                                | 900           |
| 1.500           | 0.120             | 1.260           | 1,900           | 2,550        | 3,200                                | 1,000         |
| 1.500           | 0.134             | 1.232           | 2,150           | 2,900        | 3,600                                | 1,150         |
| 1.500           | 0.148             | 1.204           | 2,400           | 3,200        | 4,050                                | 1,250         |
| 1.500           | 0.156             | 1.188           | 2,550           | 3,400        | 4,250                                | 1,350         |
| 1.500           | 0.188             | 1.124           | 3,150           | 4,200        | 5,250                                | 1,650         |
| 1.500           | 0.220             | 1.060           | 3,750           | 5,000        | 6,250                                | 2,000         |
| 1.500           | 0.250             | 1.000           | 4,300           | 5,750        | 7,200                                | 2,300         |
| 2.000           | 0.065             | 1.870           | 750             | 1,000        | 1,250                                | 400           |
| 2.000           | 0.083             | 1.834           | 950             | 1,250        | 1,600                                | 500           |
| 2.000           | 0.095             | 1.810           | 1,100           | 1,450        | 1,850                                | 550           |
| 2.000           | 0.109             | 1.782           | 1,250           | 1,700        | 2,150                                | 650           |
| 2.000           | 0.120             | 1.760           | 1,400           | 1,900        | 2,350                                | 750           |
| 2.000           | 0.134             | 1.732           | 1,600           | 2,100        | 2,650                                | 850           |
| 2.000           | 0.148             | 1.704           | 1,750           | 2,350        | 2,950                                | 950           |
| 2.000           | 0.156             | 1.688           | 1,850           | 2,500        | 3,150                                | 1,000         |
| 2.000           | 0.188             | 1.624           | 2,300           | 3,050        | 3,800                                | 1,200         |
| 2.000           | 0.220             | 1.560           | 2,700           | 3,650        | 4,550                                | 1,450         |
| 2.000           | 0.250             | 1.500           | 3,100           | 4,200        | 5,250                                | 1,650         |
| 2.000           | 0.281             | 1.438           | 3,550           | 4,750        | 5,950                                | 1,900         |

**Table T20 – Inch Tube Pressure Ratings (cont'd.)**

\*See Table T6 for tube specifications.

Dimensions and pressures for reference only, subject to change.



**Metric Tube Pressure Ratings**..... **P**

| Metric Tubes    |                   |                 |                              |                        |
|-----------------|-------------------|-----------------|------------------------------|------------------------|
| Tube O.D. (mm.) | Wall Thick. (mm.) | Tube I.D. (mm.) | Static Design Pressure (Bar) |                        |
|                 |                   |                 | Steel Low-Carbon St. 37-4    | Stainless Steel 1.4571 |
| 4               | 0.5               | 3.0             | 313                          |                        |
| 4               | 0.75              | 2.5             | 409                          |                        |
| 4               | 1.0               | 2.0             | 522                          | 600                    |
| 5               | 1.0               | 3.0             | 432                          |                        |
| 6               | 0.75              | 4.5             | 333                          |                        |
| 6               | 1.0               | 4.0             | 389                          | 426                    |
| 6               | 1.5               | 3.0             | 549                          | 600                    |
| 6               | 2.0               | 2.0             | 692                          |                        |
| 6               | 2.25              | 1.5             | 757                          |                        |
| 8               | 1.0               | 6.0             | 333                          | 368                    |
| 8               | 1.5               | 5.0             | 431                          | 472                    |
| 8               | 2.0               | 4.0             | 549                          |                        |
| 8               | 2.5               | 3.0             | 658                          |                        |
| 10              | 1.0               | 8.0             | 282                          | 294                    |
| 10              | 1.5               | 7.0             | 373                          | 389                    |
| 10              | 2.0               | 6.0             | 478                          | 498                    |
| 10              | 2.5               | 5.0             | 576                          |                        |
| 10              | 3.0               | 4.0             | 666                          |                        |
| 12              | 1.0               | 10.0            | 235                          | 245                    |
| 12              | 1.5               | 9.0             | 353                          | 368                    |
| 12              | 2.0               | 8.0             | 409                          | 426                    |
| 12              | 2.5               | 7.0             | 495                          |                        |
| 12              | 3.0               | 6.0             | 576                          |                        |
| 12              | 3.5               | 5.0             | 651                          |                        |
| 14              | 1.5               | 11.0            | 302                          | 315                    |
| 14              | 2.0               | 10.0            | 357                          | 420                    |
| 14              | 2.5               | 9.0             | 434                          | 452                    |
| 14              | 3.0               | 8.0             | 507                          |                        |
| 14              | 3.5               | 7.0             | 576                          |                        |
| 14              | 4.0               | 6.0             | 641                          |                        |
| 15              | 1.0               | 13.0            | 188                          | 196                    |
| 15              | 1.5               | 12.0            | 282                          | 294                    |
| 15              | 2.0               | 11.0            | 336                          | 392                    |
| 15              | 3.0               | 9.0             | 478                          |                        |
| 16              | 1.5               | 13.0            | 264                          | 276                    |
| 16              | 2.0               | 12.0            | 353                          | 368                    |
| 16              | 2.5               | 11.0            | 386                          | 403                    |
| 16              | 3.0               | 10.0            | 452                          | 472                    |
| 18              | 1.0               | 16.0            | 157                          |                        |
| 18              | 1.5               | 15.0            | 235                          | 245                    |
| 18              | 2.0               | 14.0            | 313                          | 327                    |
| 18              | 2.5               | 13.0            | 392                          |                        |
| 18              | 3.0               | 12.0            | 409                          |                        |
| 20              | 1.5               | 17.0            | 212                          |                        |
| 20              | 2.0               | 16.0            | 282                          | 294                    |
| 20              | 2.5               | 15.0            | 353                          | 368                    |
| 20              | 3.0               | 14.0            | 373                          | 389                    |
| 20              | 3.5               | 13.0            | 426                          |                        |
| 20              | 4.0               | 12.0            | 478                          |                        |
| 22              | 1.5               | 19.0            | 192                          | 200                    |
| 22              | 2.0               | 18.0            | 256                          | 267                    |
| 22              | 2.5               | 17.0            | 320                          |                        |
| 22              | 3.0               | 16.0            | 343                          |                        |
| 25              | 2.0               | 21.0            | 226                          |                        |
| 25              | 2.5               | 20.0            | 282                          | 294                    |
| 25              | 3.0               | 19.0            | 338                          | 353                    |

| Metric Tubes    |                   |                 |                              |                        |
|-----------------|-------------------|-----------------|------------------------------|------------------------|
| Tube O.D. (mm.) | Wall Thick. (mm.) | Tube I.D. (mm.) | Static Design Pressure (Bar) |                        |
|                 |                   |                 | Steel Low-Carbon St. 37-4    | Stainless Steel 1.4571 |
| 25              | 4.0               | 17.0            | 394                          |                        |
| 25              | 4.5               | 16.0            | 437                          |                        |
| 25              | 5.0               | 15.0            | 478                          |                        |
| 28              | 1.5               | 25.0            | 151                          | 158                    |
| 28              | 2.0               | 24.0            | 201                          | 210                    |
| 28              | 2.5               | 23.0            | 252                          |                        |
| 28              | 3.0               | 22.0            | 302                          |                        |
| 30              | 2.0               | 26.0            | 188                          |                        |
| 30              | 2.5               | 25.0            | 235                          | 245                    |
| 30              | 3.0               | 24.0            | 282                          | 294                    |
| 30              | 4.0               | 22.0            | 336                          | 392                    |
| 30              | 5.0               | 20.0            | 409                          |                        |
| 35              | 2.0               | 31.0            | 161                          | 168                    |
| 35              | 2.5               | 30.0            | 201                          |                        |
| 35              | 3.0               | 29.0            | 242                          |                        |
| 35              | 4.0               | 27.0            | 322                          |                        |
| 38              | 2.5               | 33.0            | 186                          |                        |
| 38              | 3.0               | 32.0            | 223                          |                        |
| 38              | 4.0               | 30.0            | 297                          | 309                    |
| 38              | 5.0               | 28.0            | 332                          |                        |
| 38              | 6.0               | 26.0            | 390                          |                        |
| 38              | 7.0               | 24.0            | 446                          |                        |
| 42              | 2.0               | 38.0            | 134                          | 140                    |
| 42              | 3.0               | 36.0            | 201                          | 210                    |
| 42              | 4.0               | 34.0            | 269                          |                        |
| 50              | 6.0               | 38.0            | 338                          |                        |
| 50              | 9.0               | 32.0            | 437                          |                        |
| 65              | 8.0               | 49.0            | 347                          |                        |

**Table T21 – Metric Tube Pressure Ratings**

Dimensions and pressures for reference only, subject to change.



## Tube Selection Example



To select tube material and tube sizes for pressure, return and suction lines for a hydraulic power unit with the following operating parameters known:

Type of fluid: Petroleum base hydraulic fluid

Operating temperature range: -20°F to +140°F.

Maximum operating pressure: 3500 psi

Maximum flow rate through each line: 10 GPM

Severity of service: A (normal)

**1. Selecting Tube Material:** Table T6 indicates that carbon steel, C-1010, tubing would meet the media, operating temperature range, and maximum operating pressure (high) requirements.

**2. Sizing the Tube:** From Table T1, the recommended flow diameters for various lines for 10 GPM flow rate are: 0.405 for pressure line, 0.639 for return line, and 1.012 for suction line.

Now, using Tables T20 and T21, we need to find tubes with inside diameters (I.D.) equal to or larger than the above flow diameters, and wall thicknesses appropriate for design pressures of 3500 psi minimum for the pressure line and about 500 psi for return and suction lines. Since derating factors for Severity of Service (Table T19) and Max. Operating Temperature (Table T7) are both 1, design pressure values in Tables T20 and T21 do not need to be reduced. Matching tube I.D.s and design pressures in Tables T15 and T16 for above conditions, we find:

- A) For the pressure line, we would choose 5/8" O.D. x .083" wall tubing. The .095" and .109" wall tubes would also be satisfactory if .083" wall is not readily available.
- B) For the return line, either 3/4" x .035" or 3/4" x .049" would meet the requirements. If Ferulok fittings are being used, we will need to go to 3/4" x .065" because .065" is the smallest wall thickness recommended for 3/4" O.D. tubing used with Ferulok fittings in Table T22. This reduces the flow diameter about 3% below the recommended value, but is still in the acceptable range. The alternative is to go to 7/8" O.D. x .072" wall tubing, which is way too large.
- C) For the suction line, we can use any one of the following tubes: 1-1/4" O.D. x .049" to .083" wall tube for Triple-Lok or Seal-Lok fittings and 1-1/4" O.D. x .095" wall tube for Ferulok fittings.

One final consideration in choosing the right wall thickness for tubing is bending. If bending without the use of a mandrel is desired, then wall thickness of less than 7% of tube O.D. should not be used.

| Tube Material |           |        | Steel St. Steel Copper Aluminum | Steel St. Steel Monel | Steel Alloy Steel St. Steel Copper Monel | Copper Aluminum Plastics | Steel St. Steel  |
|---------------|-----------|--------|---------------------------------|-----------------------|--|--------------------------|------------------|
| Size          |           |        | SAE 37° Flare Triple-Lok        | SAE Flareless Ferulok | SAE O-Ring Face Seal Seal-Lok            | Intru-Lok                | Metric Flareless |
| O.D. (in.)    | O.D. (mm) | Dash # |                                 |                       |  |                          |                  |
| 1/8           | 4         | -2     | .010 - .035                     | .010 - .035           | —  | .012 - .028              | 0.5 - 1          |
| 3/16          | 6         | -3     | .010 - .035                     | .020 - .049           | —  | .012 - .035              | 1 - 2            |
| 1/4           | 8         | -4     | .020 - .065                     | .028 - .065           | .020 - .083                              | .020 - .049              | 1 - 2.5          |
| 5/16          | 10        | -5     | .020 - .065                     | .028 - .065           | .020 - .095                              | .020 - .065              | 1 - 3            |
| 3/8           | 12        | -6     | .020 - .065                     | .035 - .095           | .020 - .109                              | .028 - .065              | 1.5 - 3.5        |
| 1/2           | 14        | -8     | .028 - .083                     | .049 - .120           | .028 - .148                              | .035 - .083              | 1.5 - 4          |
| 5/8           | 15        | -10    | .035 - .095                     | .058 - .120           | .035 - .134                              | .035 - .083              | 1.5 - 4          |
| 3/4           | 16        | -12    | .035 - .109                     | .065 - .120           | .035 - .148                              | .035 - .095              | 2 - 4            |
| 7/8           | 18        | -14    | .035 - .109                     | .072 - .120           | —  | .049 - .095              | 2 - 4            |
| 1             | 20        | -16    | .035 - .120                     | .083 - .148           | .035 - .188                              | .049 - .120              | 2.5 - 4          |
| 1 1/4         | 22        | -20    | .049 - .120                     | .095 - .188           | .049 - .220                              |                          | 2.5 - 4          |
| 1 1/2         | 25        | -24    | .049 - .120                     | .095 - .220           | .049 - .250                              |                          | 2.5 - 4.5        |
| 2             | 28        | -32    | .058 - .134                     | .095 - .220           | .065 - .220                              |                          | 2.5 - 4.5        |
|               | 30        |        |                                 |                       |  |                          | 2.5 - 5          |
|               | 35        |        |                                 |                       |  |                          | 3 - 5            |
|               | 38        |        |                                 |                       |  |                          | 3 - 6            |
|               | 42        |        |                                 |                       |  |                          | 3.5 - 7          |

1) Brazing to attach sleeve can be used for all wall thicknesses. For flanging tool availability, see page R24.

**Table T22 – Recommended “Min./Max” Tube Wall Thickness for Common Fittings**

Dimensions and pressures for reference only, subject to change.



# How to Order Seal-Lok, Triple-Lok, Ferulok, Intru-Lok, JIS and K4

## TFD Standard Nomenclature Construction

| Box 1                             | Box 2                  | Box 3                         | Box 4                         | Box 5                  | Box 6                  |
|-----------------------------------|------------------------|-------------------------------|-------------------------------|------------------------|------------------------|
| Size                              | Shape or Style         | Sub-Style                     | Type                          | Material               | Plating Options        |
| 1 to 4 sets of numbers from Box 1 | Letter code from Box 2 | Number/Letter code from Box 3 | Number/Letter code from Box 4 | Letter code from Box 5 | Letter code from Box 6 |

**Example:** Steel Seal-Lok Adjustable Elbow Connector — 3/8" O.D. (-6) Tube to 7/16-20 UNF (-4) ORB = 6-4 C5L-S

(See the shading in the boxes below for the construction of this example)

| Tube End  |           | Port End  |                     | Port End  |                  |
|-----------|-----------|-----------|---------------------|-----------|------------------|
| Dash Size | Tube O.D. | Dash Size | SAE Straight Thread | Dash Size | NPTF Pipe Thread |
| -2        | 1/8       | -2        | 5/16-24             | -2        | 1/8              |
| -3        | 3/16      | -3        | 3/8-24              | -2        | 1/8              |
| -4        | 1/4       | -4        | 7/16-20             | -2        | 1/8              |
| -5        | 5/16      | -5        | 1/2-20              | -2        | 1/8              |
| -6        | 3/8       | -6        | 9/16-18             | -4        | 1/4              |
| -8        | 1/2       | -8        | 3/4-16              | -6        | 3/8              |
| -10       | 5/8       | -10       | 7/8-14              | -8        | 1/2              |
| -12       | 3/4       | -12       | 1 1/16-12           | -12       | 3/4              |
| -14       | 7/8       | -14       | 1 3/16-12           | -12       | 3/4              |
| -16       | 1         | -16       | 1 5/16-12           | -16       | 1                |
| -20       | 1 1/4     | -20       | 1 5/8-12            | -20       | 1 1/4            |
| -24       | 1 1/2     | -24       | 1 7/8-12            | -24       | 1 1/2            |
| -32       | 2         | -32       | 2 1/2-12            | -32       | 2                |

| Straights |   | 90° Elbows |                       |
|-----------|---|------------|-----------------------|
| B         | Nut   | C*         | Male Elbow Connector  |
| F*        | Male Connector  | CC*        | Long Male Elbow       |
| FF*       | Long Male Connector or Pipe Nipple                      | CCC*       | Extra Long Male Elbow |
| FFF*      | Extra Long Male Connector or Pipe Nipple                | D          | Female Elbow          |
| FN        | Cap   | E          | Union Elbow           |
| G*        | Female Connector  | WE         | Bulkhead Union Elbow  |
| H         | Union   | 45° Elbows |                       |
| HH        | Long Union  | N          | Union Elbow           |
| HPN*      | Plug, Straight Thread, Hollow Hex                       | V*         | Male Elbow Connector  |
| LH        | Large Hex Union   | WN         | Bulkhead Union Elbow  |
| PN*       | Plug, Straight Thread, Hex Head                         | Tees       |                       |
| T         | Sleeve or Ferrule                                       | J          | Union Tee             |
| TP        | Sleeve, Parflange                                       | M          | Female Run Tee        |
| TR        | Tube Reducer  | O          | Female Branch Tee     |
| T22       | Mountie   | R*         | Male Run Tee          |
| W         | Bulkhead Union  | S*         | Male Branch Tee       |
| WF        | Bulkhead Male   | WJ         | Bulkhead Branch Tee   |
| WG        | Bulkhead Female   | WJJ        | Bulkhead Run Tee      |
| WLN       | Bulkhead Locknut for Triple-Lok, Ferulok, and Intru-Lok | Cross      |                       |
| WLNL      | Bulkhead Locknut for Seal-Lok                           | K          | Union Cross           |

|  |                                     |
|--|-------------------------------------|
| Connectors (a)   |                                     |
| 3  | BSPT Port End                       |
| 4**  | BSPP Port End, O-Ring & RR          |
| 5**  | SAE Straight Thread Port End        |
| 8**  | Metric Port End, O-Ring & RR        |
| 9  | SAE-ORB with Metal Seal             |
| 42   | BSPP Port End, "ED" Seal            |
| 47**   | BSPP O-Ring Port, B2351             |
| 82   | Metric Port End, "ED" Seal          |
| 87**   | ISO 6149 Port End                   |
| J4 (e)   | Banjo Connection, BSPP, Soft Seal   |
| J8 (e)   | Banjo Connection, Metric, Soft Seal |
| Swivel Unions (b)  |                                     |
| 6  | Female Swivel                       |
| Swivel Connectors (c)  |                                     |
| 63   | BSPT Port, Swivel Connector         |
| 64**   | BSPP Port, Swivel Connector         |
| 642  | BSPP, "ED" Seal, Swivel Connector   |
| 65**   | SAE-ORB, Swivel Connector           |
| 68**   | Metric Port, Swivel Connector       |
| 682  | Metric Port, Swivel Connector       |
| 687**  | ISO 6149, Swivel Connector          |
| Straight Thread Plugs (d) (Modifiers for P)                  |                                     |
| 4, 5, 8, 9 and 87 as in Connectors above.                    |                                     |
| Notes  |                                     |
| a. Modifiers for Connectors as noted with asterisk in Box 2. |                                     |
| b. Modifier for C, V, R, S, H, E and J in Box 2.             |                                     |
| c. Modifiers for F only in Box 2.                            |                                     |
| d. Modifiers for P only in PN and HPN in Box 2.              |                                     |
| e. Applies to 90° elbows and tees only.                      |                                     |

|     |               |
|-----|---------------|
| I   | Intru-Lok     |
| K4  | 60° Cone BSPP |
| L** | Seal-Lok      |
| P4  | JIS 60° Cone  |
| T4  | JIS 30° Flare |
| U   | Ferulok       |
| X   | Triple-Lok    |

|      |                                      |
|------|--------------------------------------|
| B    | Brass                                |
| CUNI | Cupro-Nickel (ex. CUNI 70/30)        |
| D    | Dural (Aluminum)                     |
| M    | Monel                                |
| S    | Steel w/ zinc plating                |
| SS   | Stainless Steel. 316/316L passivated |

|    |                    |
|----|--------------------|
| ZJ | Parker XTR Plating |
|----|--------------------|

\*\*Placing the letter "O" after these sub-style modifiers and fitting types will indicate that you would like an O-Ring on that corresponding end.

Dimensions and pressures for reference only, subject to change.



## How to Order 4-Bolt Hydraulic Flanges

### TFD Standard Nomenclature Construction

| Box 1       | Box 2                  | Box 3 | Box 4                  | Box 5          | Box 6    | Box 7           |
|-------------|------------------------|-------|------------------------|----------------|----------|-----------------|
| Flange Size | Connection Description | Shape | Flange Connection Type | Mounting Style | Material | Kit Designation |

#### Box 1 – Port/Tube/Pipe Flange Size

| Symbol                 | Description         |
|------------------------|---------------------|
| One-to-two digit codes | Size in inches x 16 |

One code is required if end connections are the same size.  
Two codes are required if they are different sizes (e.g., 16-12).

#### Box 2 – Port/Tube/Pipe Connection Description

| Symbol   | Description                                       |
|----------|---|
| B3       | Braze Socket – silver braze                       |
| CP1      | Connector Plate – Code 61                         |
| CP2      | Connector Plate – Code 62                         |
| FCC1     | Flange Clamp, Captive – Code 61                   |
| FCC2     | Flange Clamp, Captive – Code 62                   |
| FCCT1    | Flange Clamp, Captive with Tapped Holes – Code 61 |
| FCCT2    | Flange Clamp, Captive with Tapped Holes – Code 62 |
| FCS1     | Flange Clamp, Split – Code 61                     |
| FCS2     | Flange Clamp, Split – Code 62                     |
| G        | NPTF Port   |
| G3       | BSPT Port   |
| G4       | BSPP Port   |
| G5       | SAE Port  |
| P        | Plug (blanking end)                               |
| SP       | Spacer w/o Gage Ports                             |
| SPG      | Spacer w/ 1/4-18 NPTF Gage Port                   |
| SPG5     | Spacer w/ 7/16-20 UNF Gage Port                   |
| SPGG5    | Spacer w/ 1/4-18 NPTF & 7/16-20 UNF Ports         |
| WSD1     | Weld Saddle – Pipe                                |
| WSD2     | Weld Saddle – Tube                                |
| W4       | Flat Weld Socket – Tube                           |
| W4S      | Flat Weld Socket – Tube (shallow)                 |
| W5       | Flat Weld Socket – Pipe                           |
| W5S      | Flat Weld Socket – Pipe (shallow)                 |
| W6       | Extended Weld Socket – Tube                       |
| W6S      | Extended Weld Socket – Tube (shallow)             |
| W7       | Extended Weld Socket – Pipe                       |
| W7S      | Extended Weld Socket – Pipe (shallow)             |
| WB1      | Weld Butt – Schedule 40                           |
| WB3      | Weld Butt – Schedule 80                           |
| WB5      | Weld Butt – Schedule 160                          |
| WB7      | Weld Butt – Schedule XXS                          |
| WBT      | Weld Butt – Tank Pilot                            |
| WPL      | Weld Plate  |
| W        | Weld Socket                                       |
| W2       | Weld Nipple                                       |
| W3 or WB | Weld Nipple – Weld Butt, Tube                     |

#### Box 3 – Shape Description

| Symbol | Description              |
|--------|--------------------------|
| None   | Block and Pad, Straight* |
| E      | Elbow 90°                |
| H      | Barstock, Straight       |
| J      | Tee                      |

\*The “Block” has O-Ring and drilled mounting holes, while the “Pad” has no O-Ring groove and tapped mounting holes.

#### Box 4 – Flange Connection Type

| Symbol | Description   |
|--------|---|
| Q1     | Code 61 Flange Head w/ O-Ring Groove                              |
| Q1N    | Code 61 Flange Head w/o O-Ring Groove                             |
| Q2     | Code 62 Flange Head w/ O-Ring Groove                              |
| Q2N    | Code 62 Flange Head w/o O-Ring Groove                             |
| Q1B    | Code 61 Flange Block w/ O-Ring Groove and Drilled Mounting Holes  |
| Q1P    | Code 61 Flange Block w/o O-Ring Groove and Drilled Mounting Holes |
| Q2B    | Code 62 Flange Block w/ O-Ring Groove and Drilled Mounting Holes  |
| Q2P    | Code 62 Flange Pad w/o O-Ring Groove and Tapped Mounting Holes    |
| QSB    | Square Flange Block w/ O-Ring Groove and Drilled Mounting Holes   |
| QSP    | Square Flange Pad w/o O-Ring Groove and Tapped Mounting Holes     |

#### Box 5 – Mounting Style

| Symbol | Description                    |
|--------|--------------------------------|
| Omit   | Inch Mounting Bolts (screws)   |
| M      | Metric Mounting Bolts (screws) |

#### Box 6 – Material

| Symbol | Description  |
|--------|--|
| S      | Steel, Zinc Plated (braze or weld parts may not be plated) |
| SX     | Steel, Oil Dipped  |
| SS     | Stainless Steel  |

#### Box 7 – Kit Designation

| Symbol | Description                       |
|--------|-----------------------------------|
| Omit   | Flange Only                       |
| M      | Kit (O-Ring, 4 bolts and washers) |

Dimensions and pressures for reference only, subject to change.



# How to Order EO and EO-2 Fittings and Accessories

## TFD Standard Nomenclature Construction

| Box 1       | Box 2           | Box 3           | Box 4           | Box 5                 | Box 6                        | Box 7      | Box 8    | Box 9      |
|-------------|-----------------|-----------------|-----------------|-----------------------|------------------------------|------------|----------|------------|
| Shape/Style | Tube Size (mm.) | EO-2 Designator | Pressure Series | Port Size/ Designator | Port Sealing Method Modifier | Modifier 1 | Material | Modifier 2 |

| Box 1 – Shape/Style Code |                               |                    |                            |
|--------------------------|-------------------------------|--------------------|----------------------------|
| <b>Straights</b>         |                               | <b>Tees</b>        |                            |
| AS                       | Weld Connector                | EL                 | Swivel Nut Run             |
| AS_ /                    | Weld Flange                   | ET                 | Swivel Nut Branch          |
| BFG                      | Square Flange Connector       | GMA1/              | Union w/ Test Point, Pin   |
| DA                       | Distance Adapter              | GMA3/              | Union w/ Test Point, M16x2 |
| DG101/                   | Rotary Union                  | LEE                | Adjustable Run             |
| DG102/                   | Rotary Connector              | T                  | Union                      |
| DG107/                   | Rotary Bulkhead Union         | TEE                | Adjustable Branch          |
| DVGE                     | Plain Bearing Rotary          | TH                 | High Pressure Banjo        |
| EGE                      | Swivel Nut Connector          | TR                 | Reducer Union              |
| EGEO                     | ISO 6149 Swivel Nut Connector | WV                 | Alternating Valve          |
| ESV                      | Weld Bulkhead Union           | <b>Cross</b>       |                            |
| G                        | Union                         | K                  | Union                      |
| GAI                      | Female Connector              | <b>Accessories</b> |                            |
| GE                       | Male Connector                | D                  | Cutting Ring               |
| GEO                      | ISO 6149 Connector            | DKA                | Metal Seal Ring            |
| GFS_ /                   | Flange Connector              | DKI                | Pressure Gage Seal         |
| GR                       | Reducer Union                 | DOZ                | EO-2 Seal Ring             |
| GZ                       | Swivel Union                  | DPR                | Progressive Ring           |
| GZR                      | Reducer Swivel Union          | E                  | Insert                     |
| MAV                      | Gage Connector                | ED                 | EOlastic Seal              |
| MAVE                     | Swivel Nut Gage Connector     | FM                 | EO-2 Functional Nut        |
| RED                      | Tube End Reducer              | GM                 | Bulkhead Locknut           |
| SKA                      | Weld Adapter                  | KD                 | Plastic Seal               |
| SV                       | Bulkhead Union                | KDS                | Elastomeric Seal           |
| VKA1/                    | Test Point Connector, Pin     | M                  | Tube Nut                   |
| VKA3/                    | Test Point Connector, M16x2   | OR                 | O-Ring                     |
| <b>90° Elbows</b>        |                               | PSR                | Progressive Ring (new)     |
| BFW                      | Square Flange Connector       | R                  | Tube                       |
| DG103/                   | Rotary Union                  | ROV                | Plug                       |
| DG104/                   | Rotary Connector              | VH                 | Insert                     |
| DG108/                   | Rotary Bulkhead Union         | VKA                | Cap                        |
| DVWE                     | Plain Bearing Rotary          | VSTI               | Hollow Hex Plug            |
| EW                       | Swivel Nut                    | <b>Valves</b>      |                            |
| SWVE                     | Banjo                         | RHD                | Union Check                |
| W                        | Union                         | RHV                | Connector Check            |
| WAS                      | Weld Connector                | RHZ                | Connector Check            |
| WE                       | Male Connector                | RHDI               | Female Check               |
| WEE                      | Adjustable                    | RVP                | Cartridge Check            |
| WFS_ /                   | Flange Connector              | DV                 | Low Pressure Shut Off      |
| WH                       | High Pressure Banjo           | LD                 | Medium Pressure Shut Off   |
| WSV                      | Bulkhead Union                | VDHA               | High Pressure Shut Off     |
| <b>Double 90° Elbows</b> |                               | VDHB               | High Pressure Shut Off     |
| DG105/                   | Rotary Union                  | KH                 | 2-way Ball Valve           |
| DG106/                   | Rotary Connector              | KH3/2-             | 3-way Ball Valve           |
| <b>45° Elbows</b>        |                               | WV                 | Alternating Union Tee      |
| EV                       | Swivel Nut                    |                    |                            |
| VEE                      | Adjustable                    |                    |                            |

| Box 2 – Tube Size (mm.) |
|-------------------------|
| 04                      |
| 05                      |
| 06                      |
| 08                      |
| 10                      |
| 12                      |
| 14                      |
| 15                      |
| 16                      |
| 18                      |
| 20                      |
| 22                      |
| 25                      |
| 28                      |
| 30                      |
| 35                      |
| 38                      |
| 42                      |

| Box 3 – EO-2 Designator |            |
|-------------------------|------------|
| Z                       | EO-2 Assy. |

| Box 4 – Pressure Series |            |
|-------------------------|------------|
| LL                      | Very Light |
| L                       | Light      |
| S                       | Heavy      |

| Box 5 – Port Size/ Designator (optional) |                             |
|--|-----------------------------|
| <b>Metric</b>                            |                             |
| M_                                       | Metric Parallel             |
| M_X_                                     | Metric Parallel (Jump Size) |
| M_X_keg                                  | Metric Taper                |
| <b>NPT – Inch</b>                        |                             |
| 1/8NPT                                   | NPT Thread                  |
| 1/4NPT                                   | NPT Thread                  |
| 3/8NPT                                   | NPT Thread                  |
| 1/2NPT                                   | NPT Thread                  |
| 3/4NPT                                   | NPT Thread                  |
| 1NPT                                     | NPT Thread                  |
| 1 1/3NPT                                 | NPT Thread                  |
| 1 1/2NPT                                 | NPT Thread                  |
| <b>SAE-ORB</b>                           |                             |
| 7/16UNF                                  | Inch Parallel Thread        |
| 9/16UNF                                  | Inch Parallel Thread        |
| 3/4UNF                                   | Inch Parallel Thread        |
| 3/4UNF                                   | Inch Parallel Thread        |
| 7/8UNF                                   | Inch Parallel Thread        |
| 11/16UNF                                 | Inch Parallel Thread        |
| 15/16UNF                                 | Inch Parallel Thread        |
| 1 5/8UNF                                 | Inch Parallel Thread        |
| 1 7/8UNF                                 |                             |
| <b>BSPP/BSPT</b>                         |                             |
| R_                                       | BSPP                        |
| R_/_keg                                  | BSPT                        |

| Box 6 – Port Sealing Method Modifier (optional) |                 |
|---|-----------------|
| ED  | EOlastic Seal   |
| OR  | ISO 6149 O-Ring |
| Kds   | Banjo Seal Ring |

| Box 7 – Modifier 1 (optional) |   |
|-------------------------------|---|
| OMD                           | Without Nut and Sleeve                      |
| VIT                           | FPM (omitted for Stainless)                 |
| NBR                           | Nitrile Seals (omitted for Steel and Brass) |
| _ _ B                         | Special Cracking Pressure (check valve)     |

| Box 8 – Material |                         |
|------------------|-------------------------|
| CF               | Chromium 6 Free         |
| MS               | Brass                   |
| 71               | Stainless Steel         |
| VZ               | Zinc Plated (tube only) |

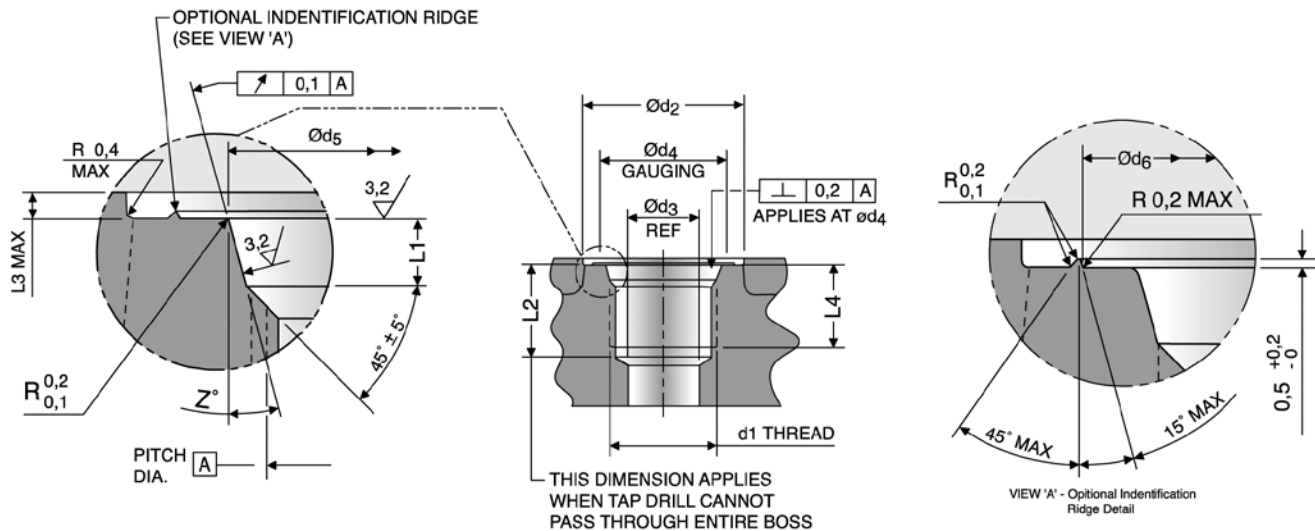
| Box 9 – Modifier 2 (optional) |             |
|-------------------------------|-------------|
| X                             | Unassembled |

Dimensions and pressures for reference only, subject to change.



# ISO 6149-1 – Metric Straight Thread O-Ring Port

(SAE 2244-1/DIN 3852, Part 3) Metric ISO 261, “M” Thread



| Thread Size      | Large d2 <sup>2)</sup> | Small d2 <sup>3)</sup> | d3 <sup>4)</sup> | d4   | d5        | d6        | L1        | L <sup>2)</sup> | L3  | L4                  | Z°  | Parker O-Ring Size <sup>6)</sup> |
|------------------|------------------------|------------------------|------------------|------|-----------|-----------|-----------|-----------------|-----|---------------------|-----|----------------------------------|
| d1 <sup>1)</sup> | min                    | min.                   | ref.             |      | +0.1<br>0 | +0.5<br>0 | +0.4<br>0 | min.            | max | min.<br>full thread | ±1° |                                  |
| M8 X 1           | 17                     | 14                     | 3                | 12.5 | 9.1       | 14        | 1.6       | 11.5            | 1   | 10                  | 12° | M8 ISO O-Ring                    |
| M10 X 1          | 20                     | 16                     | 4.5              | 14.5 | 11.1      | 16        | 1.6       | 11.5            | 1   | 10                  | 12° | M10 ISO O-Ring                   |
| M12 X 1.5        | 23                     | 19                     | 6                | 17.5 | 13.8      | 19        | 2.4       | 14              | 1.5 | 11.5                | 15° | M12 ISO O-Ring                   |
| M14 X 1.56)      | 25                     | 21                     | 7.5              | 19.5 | 15.8      | 21        | 2.4       | 14              | 1.5 | 11.5                | 15° | M14 ISO O-Ring                   |
| M16 X 1.5        | 28                     | 24                     | 9                | 22.5 | 17.8      | 24        | 2.4       | 15.5            | 1.5 | 13                  | 15° | M16 ISO O-Ring                   |
| M18 X 1.5        | 30                     | 26                     | 11               | 24.5 | 19.8      | 26        | 2.4       | 17              | 2   | 14.5                | 15° | M18 ISO O-Ring                   |
| M22 X 1.5        | 33                     | 29                     | 14               | 27.5 | 23.8      | 29        | 2.4       | 18              | 2   | 15.5                | 15° | M22 ISO O-Ring                   |
| M27 X 2          | 40                     | 34                     | 18               | 32.5 | 29.4      | 34        | 3.1       | 22              | 2   | 19                  | 15° | M27 ISO O-Ring                   |
| M30 X 2          | 44                     | 38                     | 21               | 36.5 | 32.4      | 38        | 3.1       | 22              | 2   | 19                  | 15° | M30 ISO O-Ring                   |
| M33 X 2          | 49                     | 43                     | 23               | 41.5 | 35.4      | 43        | 3.1       | 22              | 2.5 | 19                  | 15° | M33 ISO O-Ring                   |
| M42 X 2          | 58                     | 52                     | 30               | 50.5 | 44.4      | 52        | 3.1       | 22.5            | 2.5 | 19.5                | 15° | M42 ISO O-Ring                   |
| M48 X 2          | 63                     | 57                     | 36               | 55.5 | 50.4      | 57        | 3.1       | 25              | 2.5 | 22                  | 15° | M48 ISO O-Ring                   |
| M60 X 2          | 74                     | 67                     | 44               | 65.5 | 62.4      | 67        | 3.1       | 27.5            | 2.5 | 24.5                | 15° | M60 ISO O-Ring                   |

### FOR CARTRIDGE VALVE CAVITIES ONLY (SEE ISO 7789)

|                       |    |    |    |      |      |    |     |    |   |      |     |                |
|-----------------------|----|----|----|------|------|----|-----|----|---|------|-----|----------------|
| M20X1.5 <sup>7)</sup> | 32 | 27 | -- | 25.5 | 21.8 | 27 | 2.4 | -- | 2 | 14.5 | 15° | M20 ISO O-Ring |
|-----------------------|----|----|----|------|------|----|-----|----|---|------|-----|----------------|

**Table T23 – Port Detail – ISO 6149-1**

- 1) Per ISO 261 tolerance class 6H. Tap drill per ISO 2306 class 6H.
- 2) Spotface diameter with the optional identification ridge.
- 3) Spotface diameter without identification ridge. Port to be identified by marking “metric” next to it or “ISO 6149-1 Metric” on component name plate.
- 4) Reference only. Connecting hole application may require a different size.
- 5) Tap drill depths given require use of a bottoming tap to produce the specified full thread lengths. Where standard taps are used, increase tap drill depths accordingly.
- 6) Preferred for diagnostic port applications.
- 7) For cartridge valve cavity applications only.
- 8) 90 durometer nitrile is standard for hydraulic applications.

**NOTE:** For port tapping tools, see pages R34 and R35. See page S6 for assembly torques.

Dimensions and pressures for reference only, subject to change.

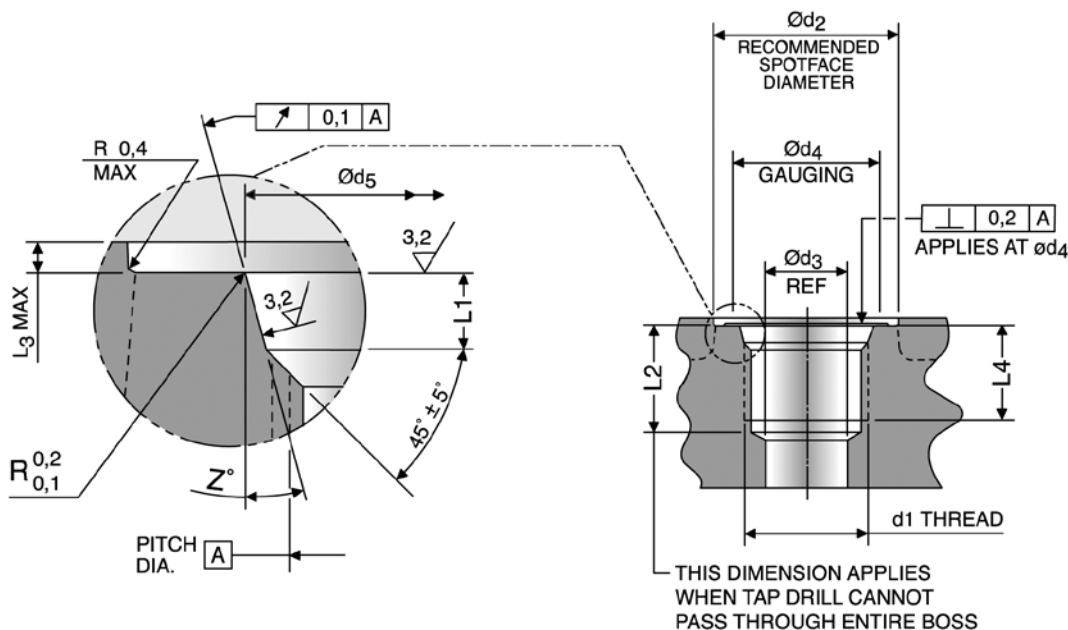




# SAE J1926-1 – SAE Straight Thread O-Ring Port (ISO 11926-1)

(Conforms to MS16142. Does NOT conform to MS33649<sup>(8)</sup>.)

UN/UNF Threads



| Nominal Tube OD <sup>1)</sup>            |               |                 | Thread Size<br>ANSI B1.1<br>(ISO 263)<br>(in.) | d2 dia. <sup>3)</sup><br>(mm.) | d3 dia.<br>min.<br>(mm.) | d4 dia.<br>min.<br>(mm.) | d5 dia. <sup>4)</sup><br>+0.13<br>-0.00<br>(mm.) | L1<br>+0.4<br>-0.00<br>(mm.) | L2 <sup>5)</sup><br>min.<br>(mm.) | L3 <sup>3), 6)</sup><br>min.<br>(mm.) | L4<br>Full<br>Thread<br>min.<br>(mm.) | Z<br>$\pm 1^\circ$<br>deg. | Parker<br>O-Ring<br>Size <sup>7)</sup> |
|--|---------------|-----------------|--|--------------------------------|--------------------------|--------------------------|--|------------------------------|-----------------------------------|---------------------------------------|---------------------------------------|----------------------------|--|
| Nom <sup>2)</sup><br>SAE<br>Dash<br>Size | Inch<br>(in.) | Metric<br>(mm.) |  |                                |                          |                          |  |                              |                                   |                                       |                                       |                            |  |
| -2                                       | 1/8           | ---             | 5/16-24 UNF-2B                                 | 17                             | 1.6                      | 11                       | 9.1  | 1.9                          | 12.0                              | 1.6                                   | 10.0                                  | 12°                        | 3-902                                  |
| -3                                       | 3/16          | 4               | 3/8-24 UNF-2B                                  | 19                             | 3.2                      | 13                       | 10.7   | 1.9                          | 12.0                              | 1.6                                   | 10.0                                  | 12°                        | 3-903                                  |
| -4                                       | 1/4           | 6               | 7/16-20 UNF-2B                                 | 21                             | 4.4                      | 15                       | 12.4   | 2.4                          | 14.0                              | 1.6                                   | 11.5                                  | 12°                        | 3-904                                  |
| -5                                       | 5/16          | 8               | 1/2-20 UNF-2B                                  | 23                             | 6.0                      | 16                       | 14.0   | 2.4                          | 14.0                              | 1.6                                   | 11.5                                  | 12°                        | 3-905                                  |
| -6                                       | 3/8           | 10              | 9/16-18 UNF-2B                                 | 25                             | 7.5                      | 18                       | 15.6   | 2.5                          | 15.5                              | 1.6                                   | 12.7                                  | 12°                        | 3-906                                  |
| -8                                       | 1/2           | 12              | 3/4-16 UNF-2B                                  | 30                             | 10.0                     | 22                       | 20.6   | 2.5                          | 17.5                              | 2.4                                   | 14.3                                  | 15°                        | 3-908                                  |
| -10                                      | 5/8           | 14, 15, 16      | 7/8-14 UNF-2B                                  | 34                             | 12.5                     | 26                       | 23.9   | 2.5                          | 20.0                              | 2.4                                   | 16.7                                  | 15°                        | 3-910                                  |
| -12                                      | 3/4           | 18, 20          | 1 1/16-12 UN-2B                                | 41                             | 16.0                     | 32                       | 29.2   | 3.3                          | 23.0                              | 2.4                                   | 19.0                                  | 15°                        | 3-912                                  |
| -14                                      | 7/8           | 22              | 1 3/16-12 UN-2B                                | 45                             | 18.0                     | 35                       | 32.3   | 3.3                          | 23.0                              | 2.4                                   | 19.0                                  | 15°                        | 3-914                                  |
| -16                                      | 1             | 25, 28          | 1 5/16-12 UN-2B                                | 49                             | 21.0                     | 38                       | 35.5   | 3.3                          | 23.0                              | 3.2                                   | 19.0                                  | 15°                        | 3-916                                  |
| -20                                      | 1 1/4         | 30, 32, 35      | 1 5/8-12 UN-2B                                 | 58                             | 27.0                     | 48                       | 43.5   | 3.3                          | 23.0                              | 3.2                                   | 19.0                                  | 15°                        | 3-920                                  |
| -24                                      | 1 1/2         | 38, 42          | 1 7/8-12 UN-2B                                 | 65                             | 33.0                     | 54                       | 49.8   | 3.3                          | 23.0                              | 3.2                                   | 19.0                                  | 15°                        | 3-924                                  |
| -32                                      | 2             | 50              | 2 1/2-12 UN-2B                                 | 88                             | 45.0                     | 70                       | 65.7   | 3.3                          | 23.0                              | 3.2                                   | 19.0                                  | 15°                        | 3-932                                  |

**Table T24 – Port Detail – SAE J1926-1 (ISO 11926-1)**

- Nominal tube OD is shown for the standard inch sizes and the conversion to equivalent millimeter sizes. Figures are for reference only, as any boss can be used for a tubing size depending upon other design criteria.
- See SAE J846 for more information.
- If face of boss is on a machined surface, dimensions d2 and L3 need not apply as long as corner radius R0.2 is maintained.
- Diameter d5 shall be concentric with thread pitch diameter within 0.004 in (0.1mm) FIM, and shall be free from longitudinal and spiral tool marks. Annular tool marks up to 100  $\mu$ m (2.5 $\mu$ m) max. shall be permissible.
- Tap drill depths given require use of bottoming taps to produce the specified full thread lengths. Where standard taps are used, the tap drill depths must be increased accordingly.
- Maximum recommended spotface depth to permit sufficient wrench grip for proper tightening of the fitting or locknut.
- 90 durometer nitrile is standard for hydraulic applications.
- See page T34.

**NOTE:** For port tapping tools, see pages R32 and R33. For assembly torques see page S5.

Dimensions and pressures for reference only, subject to change.

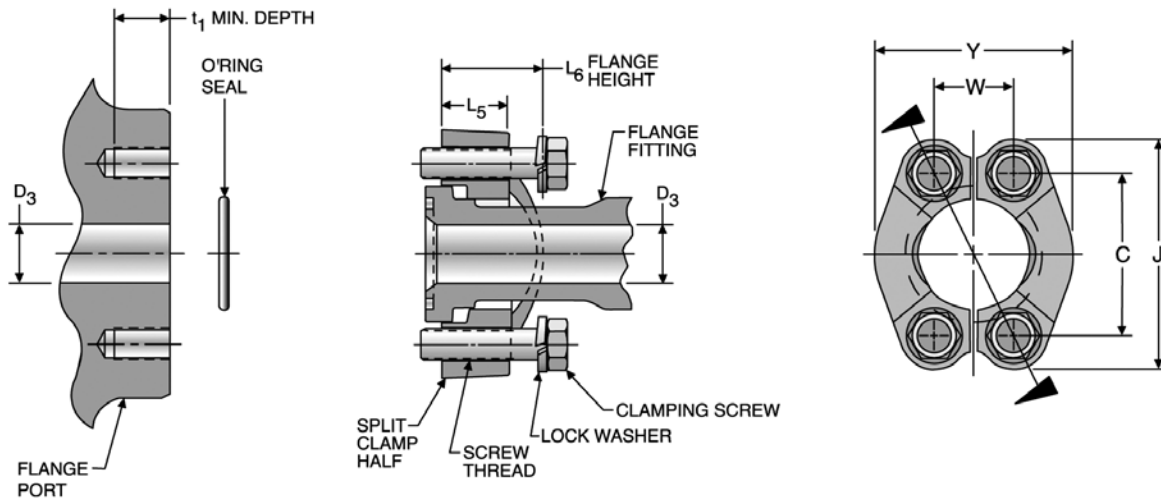
## SAE Straight Thread Connector Use in MS33649

SAE straight thread connectors, such as Parker F50X, need a special hex chamfer of 35° to a controlled diameter to function properly in MS33649 port. In the past, when MS33649 was more popular, Parker fittings were made with this chamfer. However, this port has been superseded by SAE J1926-1 in industrial applications for over 50 years.

Since J1926-1 is a superior design, Parker, along with other manufacturers, discourages the use of MS33649 port in non aircraft applications. In fact, a chamfer modification requirement for MS33649 will not be in the next printing of the SAE J514 specification, again to discourage the use of this port.

If you must use this port, you have to request fittings with this special chamfer requirement, which makes them special and more expensive.

## ISO 6162 – Four-Bolt Flange Connection (Includes SAE J518)



| Nominal Flange Size D3 |       | 2.5 to 31.5 MPa Series <sup>1)</sup><br>(SAE Code 61) |               |                                  |               |                              |       |       |             |           |                  |    | O-Rings <sup>3)</sup>      |                          |
|------------------------|-------|---|---------------|----------------------------------|---------------|------------------------------|-------|-------|-------------|-----------|------------------|----|----------------------------|--------------------------|
|                        |       | Clamping Screws<br>Screw Holes                        |               |                                  |               | Flange Half and Bolt Pattern |       |       |             |           |                  |    | ISO 3601-1<br>ID x Section | Parker<br>O-Ring<br>Size |
|                        |       | Type I  |               | Type II <sup>2)</sup> (SAE J518) |               | C<br>± 0.25                  | J     |       | W<br>± 0.25 | Y<br>Ref. | L5               | L6 |                            |                          |
| (in.)                  | (mm.) | Thread  | t, Min. depth | Thread (UNC)                     | t, Min. depth |                              | max.  | min.  |             |           |                  |    |                            |                          |
| 1/2                    | 13    | M8 x 1.5  | 12.5          | 5/16 - 18                        | 24            | 38.1                         | 54.9  | 53.1  | 17.5        | 46        | 13               | 19 | 19 x 3.55                  | 2-210                    |
| 3/4                    | 19    | M10 x 1.5   | 16.5          | 3/8 - 16                         | 22            | 47.6                         | 65.8  | 64.3  | 22.3        | 52        | 14               | 22 | 25 x 3.55                  | 2-214                    |
| 1                      | 25    | M10 x 1.5   | 14.5          | 3/8 - 16                         | 22            | 52.4                         | 70.6  | 69.1  | 26.2        | 59        | 16               | 22 | 32.5 x 3.55                | 2-219                    |
| 1 1/4                  | 32    | M10 x 1.5   | 16.5          | 7/16 - 14                        | 28            | 58.7                         | 80.3  | 78.5  | 30.2        | 73        | 14 <sup>4)</sup> | 24 | 37.5 x 3.55                | 2-222                    |
| 1 1/2                  | 38    | M12 x 1.75  | 19.5          | 1/2 - 13                         | 27            | 69.9                         | 94.5  | 93.0  | 35.7        | 83        | 16               | 25 | 47.5 x 3.55                | 2-225                    |
| 2                      | 51    | M12 x 1.75  | 19.5          | 1/2 - 13                         | 27            | 77.8                         | 103.1 | 100.1 | 42.9        | 97        | 16               | 26 | 56 x 3.55                  | 2-228                    |
| 2 1/2                  | 64    | M12 x 1.75  | 21.5          | 1/2 - 13                         | 30            | 88.9                         | 115.8 | 112.8 | 50.8        | 109       | 19               | 38 | 69 x 3.55                  | 2-232                    |
| 3                      | 76    | M16 x 2   | 28.5          | 5/8 - 11                         | 30            | 106.4                        | 136.7 | 133.4 | 61.9        | 131       | 22               | 41 | 85 x 3.55                  | 2-237                    |
| 3 1/2                  | 89    | M16 x 2   | 28.5          | 5/8 - 11                         | 33            | 120.7                        | 153.9 | 150.9 | 69.9        | 140       | 22               | 28 | 97.5 x 3.55                | 2-241                    |
| 4                      | 102   | M16 x 2   | 25.5          | 5/8 - 11                         | 30            | 130.2                        | 163.6 | 160.3 | 77.8        | 152       | 25               | 35 | 112 x 3.55                 | 2-245                    |
| 5                      | 127   | M16 x 2   | 27.5          | 5/8 - 11                         | 33            | 152.4                        | 182.6 | 185.7 | 92.1        | 181       | 28               | 41 | 136 x 3.55                 | 2-253                    |

| Nominal Flange Size D3 |       | 40 MPa Series <sup>1)</sup><br>(SAE Code 62) |               |                                  |               |                              |       |       |             |           |    |    | O-Rings <sup>3)</sup>      |                          |
|------------------------|-------|--|---------------|----------------------------------|---------------|------------------------------|-------|-------|-------------|-----------|----|----|----------------------------|--------------------------|
|                        |       | Clamping Screws<br>Screw Holes               |               |                                  |               | Flange Half and Bolt Pattern |       |       |             |           |    |    | ISO 3601-1<br>ID x Section | Parker<br>O-Ring<br>Size |
|                        |       | Type I                                       |               | Type II <sup>2)</sup> (SAE J518) |               | C<br>± 0.25                  | J     |       | W<br>± 0.25 | Y<br>Ref. | L5 | L6 |                            |                          |
| (in.)                  | (mm.) | Thread                                       | t, Min. depth | Thread (UNC)                     | t, Min. depth |                              | max.  | min.  |             |           |    |    |                            |                          |
| 1/2                    | 13    | M8 x 12.5                                    | 14.5          | 5/16 - 18                        | 21            | 38.1                         | 57.2  | 55.6  | 18.2        | 48        | 16 | 22 | 19 x 3.55                  | 2-210                    |
| 3/4                    | 19    | M10 x 1.5                                    | 16.5          | 3/8 - 16                         | 24            | 47.6                         | 72.1  | 70.6  | 23.8        | 60        | 19 | 28 | 25 x 3.55                  | 2-214                    |
| 1                      | 25    | M12 x 1.75                                   | 21.5          | 7/16 - 14                        | 27            | 52.4                         | 81.8  | 80.3  | 27.8        | 70        | 24 | 33 | 32.5 x 3.55                | 2-219                    |
| 1 1/4                  | 32    | M12 x 1.75                                   | 18.5          | 1/2 - 13                         | 25            | 58.7                         | 96.0  | 94.5  | 31.8        | 78        | 27 | 38 | 37.5 x 3.55                | 2-222                    |
| 1 1/2                  | 38    | M16 x 2                                      | 25.5          | 5/8 - 11                         | 35            | 69.9                         | 114.3 | 111.3 | 36.5        | 95        | 30 | 43 | 47.5 x 3.55                | 2-225                    |
| 2                      | 51    | M20 x 2.5                                    | 33.5          | 3/4 - 10                         | 38            | 77.8                         | 134.9 | 131.8 | 44.5        | 114       | 37 | 52 | 56 x 3.55                  | 2-228                    |

**Table T25 – Port Detail – ISO 6162**

- 1) 1 MPa = 10 bar = 145 PSI.
- 2) Not for new design.
- 3) 90 durometer nitrile is standard for hydraulic applications.

**NOTE:** For port tapping tools, see pages R32 and R33. See page S8 for assembly torques.

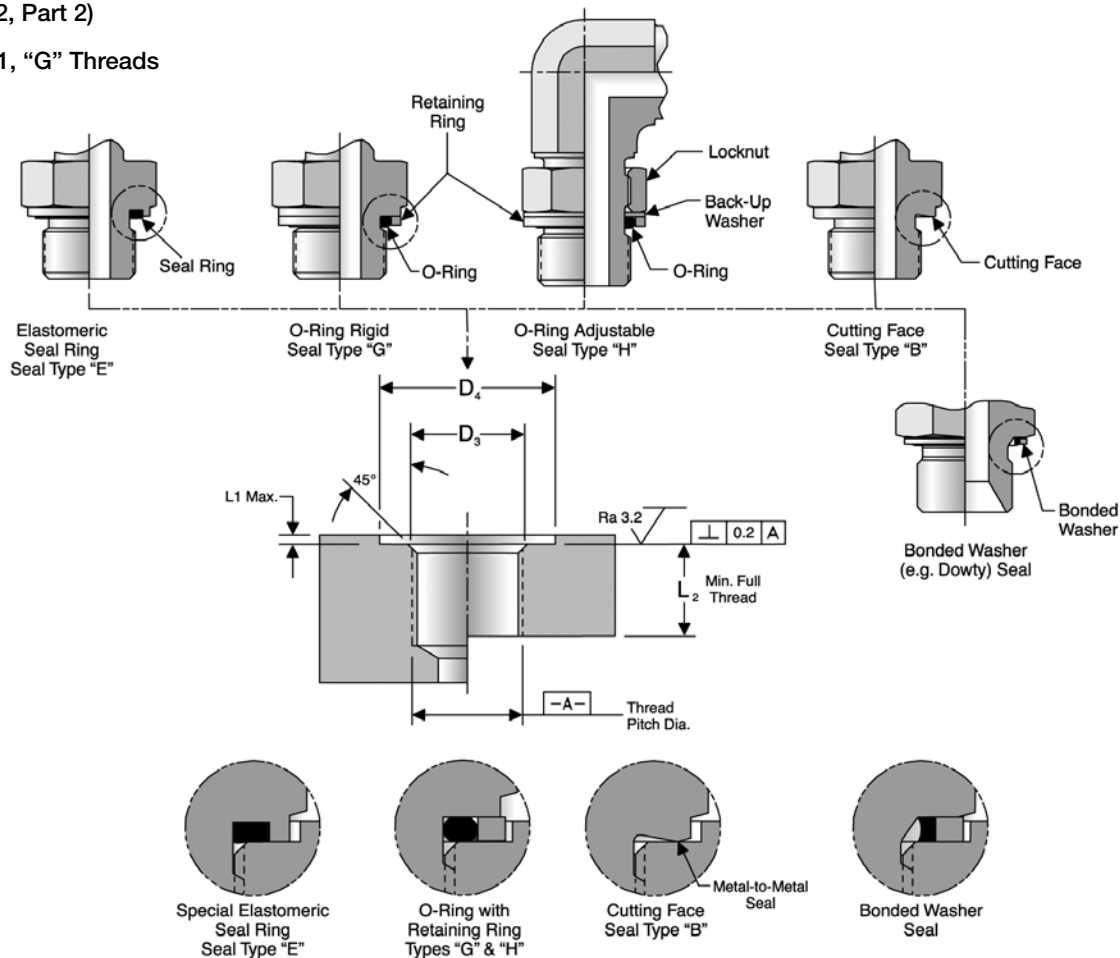
Dimensions and pressures for reference only, subject to change.



# ISO 1179-1<sup>1)</sup> — Flat Face Port with British Standard Pipe, Parallel (BSP) Threads

(DIN 3852, Part 2)

ISO 228-1, "G" Threads



Port Sealing Methods

| Thread Size (ISO 228-1) | D3 (mm.) | D4 (mm.)           |                  | L1 max. (mm.) | L2 min. (mm.) | Elastic Seal (Type E) O-Ring and Retaining Ring <sup>3)</sup> (Types G & H) |                           |                           |                         | Bonded Washer Part No. <sup>4)</sup> |
|-------------------------|----------|--------------------|------------------|---------------|---------------|---|---------------------------|---------------------------|-------------------------|--------------------------------------|
|                         |          | Narrow Types B & E | Wide Types G & H |               |               | Part No.  | O-Ring Size <sup>2)</sup> | O-Ring ID x section (mm.) | Retaining Ring Part No. |                                      |
| G 1/8-28                | 9.9      | 15                 | 17.2             | 1.0           | 8.5           | ED10X1X   | 5-585                     | 7.98 x 1.88               | 1/8 RR                  | D9DT-2                               |
| G 1/4-19                | 13.3     | 20                 | 20.7             | 1.5           | 12.5          | ED14X1.5X   | 2-111                     | 10.77 x 2.62              | 1/4 RR                  | D9DT-4                               |
| G 3/8 19                | 16.8     | 23                 | 24.5             | 2.0           | 12.5          | EDR3/8X   | 2-113                     | 13.94 x 2.62              | 3/8 RR                  | D9DT-6                               |
| G 1/2-14                | 21.1     | 28                 | 34.0             | 2.5           | 14.5          | EDR1/2X   | 5-256                     | 17.96 x 2.62              | 1/2 RR                  | D9DT-8                               |
| G 3/4-14                | 26.6     | 33                 | 40.0             | 2.5           | 16.5          | ED26X1.5X   | 2-119                     | 23.47 x 2.62              | 3/4 RR                  | D9DT-12                              |
| G 1-11                  | 33.5     | 41                 | 46.1             | 2.5           | 18.5          | ED33X2X   | 2-217                     | 29.74 x 3.53              | 1 RR                    | D9DT-16                              |
| G 1 1/4-11              | 42.2     | 51                 | 54.0             | 2.5           | 20.5          | ED42X2X   | 2-222                     | 37.69 x 3.53              | 1 1/4 RR                | D9DT-20                              |
| G 1 1/2-11              | 48.1     | 56                 | 60.5             | 2.5           | 22.5          | ED48X2X   | 2-224                     | 44.04 x 3.53              | 1 1/2 RR                | D9DT-24                              |
| G 2-11                  | 59.9     | 69                 | 73.3             | 3.0           | 26.0          | —   | —                         | —                         | —                       | D9DT-32                              |

Table T26 — Port Detail — ISO 1179-1

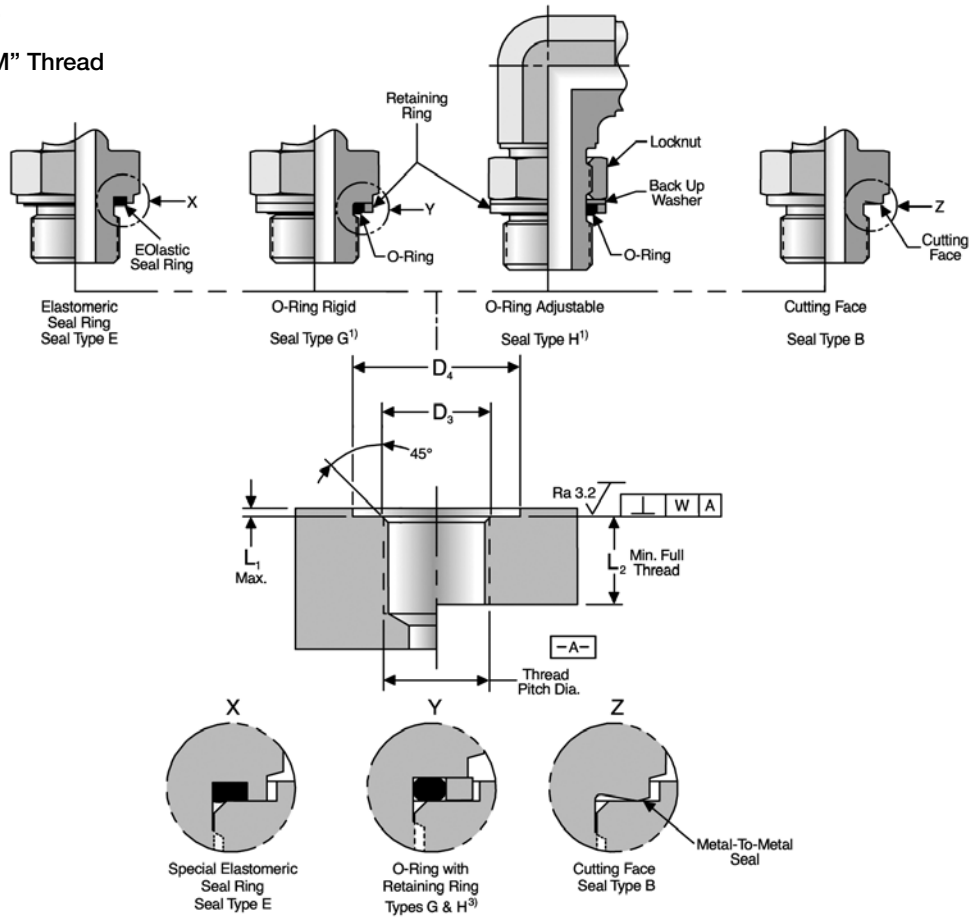
- 1) Conforms to proposed revision.
- 2) 90 durometer nitrile is standard for hydraulic applications.
- 3) See page N6 for O-ring and retaining ring ordering information.
- 4) See page N7 for details.

Dimensions and pressures for reference only, subject to change.

# ISO 9974-1 – Flat Face Port with Metric Threads

(DIN 3852, Part 1)

Metric ISO261, “M” Thread



(See Note 1)

ISO 9974 Port seal types available from Parker

| Thread Size (ISO 261) | D3 (mm.) | D4 (mm.) | L1 max. (mm.) | L2 min. (mm.) | W (mm.) | EOlastic Seal (Type E) |               | O-Ring and Retaining Ring¹) |                         |
|-----------------------|----------|----------|---------------|---------------|---------|------------------------|---------------|-----------------------------|-------------------------|
|                       |          |          |               |               |         | Part No.               | O-Ring Size²) | O-Ring ID x section (mm.)   | Retaining Ring Part No. |
| M8 x 1                | 8 +0.2   | 13       | 1             | 8             |         | ED8X1X                 | 3-902         | 6.07 x 1.63                 | M8 RR                   |
| M10 x 1               | 10 +0.2  | 15       | 1             | 8             |         | ED10X1X                | 6-074         | 8.00 x 1.50                 | M10 RR                  |
| M12 x 1.5             | 12 +0.2  | 18       | 1.5           | 12            |         | ED12X1.5X              | 2-012         | 9.25 x 1.78                 | M12 RR                  |
| M14 x 1.5             | 14 +0.2  | 20       | 1.5           | 12            | 0.1     | ED14X1.5X              | 2-013         | 10.82 x 1.78                | M14 RR                  |
| M16 x 1.5             | 16 +0.2  | 23       | 1.5           | 12            |         | ED16X1.5X              | 3-907         | 13.46 x 2.08                | M16 RR                  |
| M18 x 1.5             | 18 +0.2  | 25       | 2             | 12            |         | ED18X1.5XX             | 2-114         | 15.54 x 2.62                | M18 RR                  |
| M20 x 1.5³)           | 20 +0.2  | 27       | 2             | 14            |         | ED20X1.5X              | 2-017         | 17.17 x 1.78                | M20 RR                  |
| M22 x 1.5             | 22 +0.2  | 28       | 2.5           | 14            |         | ED22X1.5X              | 2-018         | 18.77 x 1.78                | M22 RR                  |
| M24 x 1.5⁴)           | 26 +0.2  | 30       | 2.5           | 14            |         | —                      | 2-019         | 20.35 x 1.78                | M24 RR                  |
| M26 x 1.5             | 26 +0.2  | 33       | 2.5           | 16            |         | ED26X1.5X              | 2-118         | 21.89 x 2.62                | M26 RR                  |
| M27 x 2               | 27 +0.2  | 33       | 2.5           | 16            |         | ED26X1.5X              | 2-119         | 23.47 x 2.62                | M27 RR                  |
| M33 x 2               | 33 +0.3  | 41       | 2.5           | 18            | 0.2     | ED33X2X                | 2-122         | 28.24 x 2.62                | M33 RR                  |
| M36 x 2⁴)             | 36 +0.3  | 43       | 2.5           | 18            |         | —                      | 2-124         | 31.42 x 2.62                | M36 RR                  |
| M42 x 2               | 42 +0.3  | 51       | 2.5           | 20            |         | ED42X2X                | 2-128         | 37.77 x 2.62                | M42 RR                  |
| M45 x 2⁴)             | 45 +0.3  | 50       | 2.5           | 20            |         | —                      | 2-130         | 40.94 x 2.62                | M45 RR                  |
| M48 x 2               | 48 +0.3  | 56       | 2.5           | 22            |         | ED48X2X                | 2-132         | 44.12 x 2.62                | M48 RR                  |

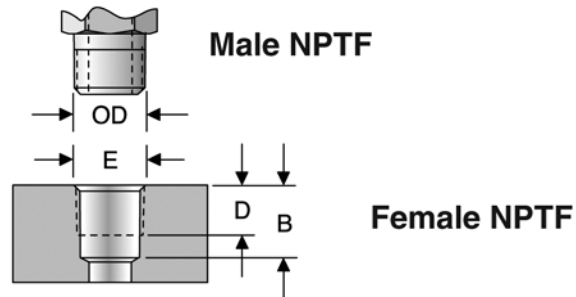
**Table T27 – Port Detail – ISO 9974-1**

- 1) Seal types G and H are not covered in ISO 9974-1. See page N6 for retaining ring and O-Ring ordering information.
- 2) 90 durometer nitrile is standard for hydraulic applications.
- 3) For diagnostic applications.
- 4) These sizes are not covered in ISO 9974-1.

Dimensions and pressures for reference only, subject to change.



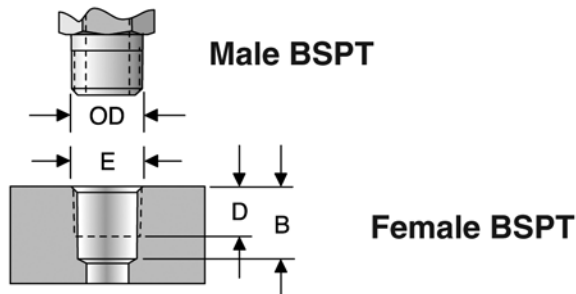
## NPTF and BSPT Dimensions



| Thread Size<br>NPTF | O.D.<br>Male Thread<br>Large Dia. | D Min..<br>Thread<br>Length | B Min..<br>Tap Drill<br>Depth <sup>1)</sup> | E<br>Chmf.<br>Dia. |
|---------------------|-----------------------------------|-----------------------------|---|--------------------|
| 1/8-27              | 0.41                              | 0.31                        | 0.38  | 0.42               |
| 1/4-18              | 0.55                              | 0.44                        | 0.47  | 0.55               |
| 3/8-18              | 0.68                              | 0.47                        | 0.53  | 0.69               |
| 1/2-14              | 0.85                              | 0.59                        | 0.69  | 0.85               |
| 3/4-14              | 1.06                              | 0.63                        | 0.75  | 1.06               |
| 1-11 1/2            | 1.33                              | 0.75                        | 0.84  | 1.34               |
| 1 1/4-11 1/2        | 1.67                              | 0.78                        | 0.84  | 1.68               |
| 1 1/2-11 1/2        | 1.91                              | 0.81                        | 0.88  | 1.92               |
| 2-11 1/2            | 2.39                              | 0.81                        | 0.91  | 2.39               |

**Table T28 – NPTF Dimensions**

1) For bottoming taps only.



| Thread Size<br>BSPT | O.D.<br>Male Thread<br>Large Dia. | D Min..<br>Thread<br>Length | B Min..<br>Tap Drill<br>Depth <sup>1)</sup> | E<br>Chmf.<br>Dia. |
|---------------------|-----------------------------------|-----------------------------|---|--------------------|
| 1/8-28              | 0.39                              | 0.31                        | 0.38  | 0.42               |
| 1/4-19              | 0.53                              | 0.44                        | 0.47  | 0.55               |
| 3/8-19              | 0.67                              | 0.47                        | 0.53  | 0.69               |
| 1/2-14              | 0.84                              | 0.59                        | 0.69  | 0.85               |
| 3/4-14              | 1.06                              | 0.63                        | 0.75  | 1.06               |
| 1-11                | 1.33                              | 0.75                        | 0.84  | 1.34               |
| 1 1/4-11            | 1.67                              | 0.78                        | 0.84  | 1.68               |
| 1 1/2-11            | 1.90                              | 0.81                        | 0.88  | 1.92               |
| 2-11                | 2.37                              | 0.81                        | 0.91  | 2.39               |

**Table T29 – BSPT Dimensions**

1) For bottoming taps only.

Dimensions and pressures for reference only, subject to change.

## Thread Guide



| Dash Size | Tube Size | Triple-Lok SAE 37° Flare | Ferulok SAE Flareless | SAE Straight Thread |
|-----------|-----------|--------------------------|-----------------------|---------------------|
| 2         | 1/8       | 5/16-24                  | 5/16-24               | 5/16-24             |
| 3         | 3/16      | 3/8-24                   | 3/8-24                | 3/8-24              |
| 4         | 1/4       | 7/16-20                  | 7/16-20               | 7/16-20             |
| 5         | 5/16      | 1/2-20                   | 1/2-20                | 1/2-20              |
| 6         | 3/8       | 9/16-18                  | 9/16-18               | 9/16-18             |
| 8         | 1/2       | 3/4-16                   | 3/4-16                | 3/4-16              |
| 10        | 5/8       | 7/8-14                   | 7/8-14                | 7/8-14              |
| 12        | 3/4       | 1 1/16-12                | 1 1/16-12             | 1 1/16-12           |
| 16        | 1         | 1 5/16-12                | 1 5/16-12             | 1 5/16-12           |
| 20        | 1 1/4     | 1 5/8-12                 | 1 5/8-12              | 1 5/8-12            |
| 24        | 1 1/2     | 1 7/8-12                 | 1 7/8-12              | 1 7/8-12            |
| 32        | 2         | 2 1/8-12                 | 2 1/8-12              | 2 1/8-12            |



| Dash Size | Tube Size | Seal-Lok O-Ring Face Seal | SAE 45° Flare | N.P.T.       |
|-----------|-----------|---------------------------|---------------|--------------|
| 2         | 1/8       | —                         | 5/16-24       | 1/8-27       |
| 3         | 3/16      | —                         | 3/8-24        | —            |
| 4         | 1/4       | 9/16-18                   | 9/16-18       | 1/4-18       |
| 5         | 5/16      | —                         | 1/2-20        | —            |
| 6         | 3/8       | 11/16-16                  | 5/8-18        | 3/8-18       |
| 8         | 1/2       | 13/16-16                  | 3/4-16        | 1/2-14       |
| 10        | 5/8       | 1-14                      | 7/8-14        | —            |
| 12        | 3/4       | 1 3/16-12                 | 1 1/16-14     | 3/4-14       |
| 16        | 1         | 1 7/16-12                 | 1 3/8-12      | 1-11 1/2     |
| 20        | 1 1/4     | 1 11/8-12                 | —             | 1 1/4-11 1/2 |
| 24        | 1 1/2     | 2-12                      | —             | 1 1/2-11 1/2 |
| 32        | 2         | —                         | —             | 2-11 1/2     |

Dimensions and pressures for reference only, subject to change.

