

## Tubing Types

Commercial tubing is available in a wide variety of materials, types of construction and quality. Each is best suited for certain specific applications.

**Steel Tubing** - Seamless SAE 1010 fully annealed and SAE welded types suitable for bending and flaring. This is the only tubing material approved without restrictions by SAE standards.

**Stainless Steel Tubing** - Both seamless \*18-8 fully annealed and welded types suitable for bending and flaring. Stainless steel tubing is recommended for use with very high pressures and here large diameter tubing is required. It is also suited for many applications where corrosion is a problem. \*(302, 303 and/or 304)

**Aluminum Tubing** - Seamless annealed is approved by SAE for low pressure applications.

**Copper Tubing** - Seamless fully annealed coils and fully annealed or quarterhard straight lengths can be used for systems that do not use petroleum based fluids (copper acts as an oil-oxidation catalyst, causing sludge). Copper also tends to work harden when flared or bent and has poor resistance to vibration. Therefore, the use of copper tubing is limited to low-pressure stationary applications and air circuits.

**Special Alloy Tubing** - May be required for specific corrosion problems. Information on these applications can be obtained from your tubing supplier or from tubing manufacturers.

## Tubing Size

The two variables in tubing size are the inside diameter (I.D.) and the wall thickness. Each of these is dependent upon a number of factors.

**Inside Diameter** - The tubing I.D. will determine the flow and velocity of the fluid in the system. Flow is the volume of fluid that is to be moved through the line to perform a given job within a specified time. Flow rate is expressed in gallons per minute (gpm). Velocity is the rate of speed at which the fluid passes through the line. It is expressed in feet per second (fps). With a given flow rate, the velocity will increase as the inside diameter of the tubing decreases. To determine the appropriate tubing I.D. for specific flow rate and velocity, refer to the Velocity vs. Flow chart on page A-38.

**Wall Thickness** - The required wall thickness of the tubing depends upon operating pressure, safety factor, temperatures, and tubing material. Operating Pressure is the pressure of the fluid in the system. It is expressed in pounds per square inch (psi). Safety Factor is a multiplier applied to the wall thickness that compensates for additional mechanical strains and hydraulic shocks to which the tubing may be subjected during operation. To determine the appropriate wall thickness, refer to the data on pages A-39-42.

## Pressure Drop

Total pressure supplied to a line must equal usable pressure (or output) plus the pressure that is lost through fluid transmission, which is referred to as pressure drop. These pressure drops cause loss of energy and should be kept to a minimum. Elements which cause pressure drop in the transmission of fluids include sudden enlargements or contractions, bends, fittings and valves.

Mathematical analysis of pressure drop, although possible, is not precise because of the interrelationship of factors such as fluid velocity, density, flow area and friction coefficients. Therefore, to obtain optimum efficiency, the system (or the questionable portions of the system) should be mocked-up to obtain empirical pressure drop data.

## WARNING

Refer to safety information regarding tubing selection on pages A-2-3.

To select tubing for a particular installation, two factors must be determined:

1. **Tubing Type** - material and construction and
2. **Size** - inside diameter (I.D.) and wall thickness.  
Information listed below will aid in your tubing selection.

**⚠ WARNING**

Refer to safety information regarding tubing selection on pages A-2-3.

Following is a typical problem that illustrates, step by step, the procedure for determining tube size.

Select 1010 steel tubing with the appropriate I.D. and wall thickness for the following conditions:

- Flow ..... 5 gpm
- Velocity .....not to exceed 10 fps
- Pressure ..... 2000 psi
- Safety Factor .....4:1

**Solution:**

1. Using the Flow/Velocity chart on Page A-38, follow the horizontal flow line (5 gpm) until it intersects the vertical velocity line (10fps). From this point, follow the diagonal line upward to get the required tube I.D. (.444). If the horizontal flow line and the vertical velocity line intersect between two diagonal lines, normally the larger inside diameter would be selected since it would mean less velocity.
2. Refer to the chart of Standard Size Hydraulic Tubing, at right. Note that .444 I.D. tubing is not listed. If you want to use standard tubing, select one with a larger I.D. Do not select a smaller size since this would increase the velocity to over the 10 fps limit. Therefore, by going to the next largest size, you would select the 5/8" O.D. tubing having an I.D. of .459 and a wall thickness of .083.
3. To determine whether this tubing will meet the pressure and safety factor requirements, refer to the Recommended Wall Thickness data on pages 31-34. For 5/8" O.D. tubing at 2000 psi, the chart for 1010 steel indicates that the minimum wall thickness with a safety factor of 4:1 is .04545. Since you have selected a tubing with a .083 wall, this would easily fulfill the requirements. However, for savings on weight and cost, you can select another tubing with a thinner wall that will still meet the performance requirements. Therefore, refer again to the chart on standard size tubing and select a tubing with a wall thickness closer to the minimum requirements. This would be the 5/8" O.D. tubing with a .527 I.D. and a .049 wall. This tubing will handle the pressure requirements of 2000 psi with a safety factor of 4:1, and also provides the required flow while keeping the velocity within the 10 fps limitation.

Tube O.D.	Tube I.D.	Wall	Tube O.D.	Tube I.D.	Wall
1/8"	.055	.035	3/4"	.584	.083
	.061	.032		.606	.072
	.065	.030		.620	.065
3/16"	.069	.028	.634	.058	
	.117	.035	.652	.049	
	.123	.032	.680	.035	
1/4"	.127	.030	7/8"	.657	.109
	.120	.065		.685	.095
	.134	.058		.709	.083
5/16"	.152	.049	.731	.072	
	.166	.042	.745	.065	
	.180	.035	.759	.058	
3/8"	.190	.030	.777	.049	
	.182	.065	1"	.760	.120
	.196	.058		.782	.109
.214	.049	.810		.095	
1/2"	.228	.042	.834	.083	
	.242	.035	.856	.072	
	.248	.032	.870	.065	
5/8"	.245	.065	.884	.058	
	.259	.058	.902	.049	
	.277	.049	1-1/4"	.982	.134
.291	.042	1.010		.120	
.305	.035	1.032		.109	
3/4"	.311	.032	1.060	.095	
	.310	.095	1.084	.083	
	.334	.083	1.106	.072	
1"	.358	.072	1.120	.065	
	.370	.065	1.134	.058	
	.384	.058	1.152	.049	
1-1/8"	.402	.049	1-1/2"	1.232	.134
	.416	.042		1.260	.120
	.430	.035		1.282	.109
1-1/4"	.436	.032	1.310	.095	
	.435	.095	1.334	.083	
	.459	.083	1.356	.072	
1-3/8"	.481	.072	1.370	.065	
	.495	.065	2"	1.732	.134
	.509	.058		1.760	.120
.527	.049	1.782		.109	
1-1/2"	.541	.042	1.810	.095	
	.555	.035	1.834	.083	
	.532	.109	1.856	.072	
1-3/4"	.560	.095	1.870	.065	

# Tubing Selection

**To Find the Required Tube I.D. Flow—20 gpm • Velocity—9 fps**

Follow horizontal flow line (20 gpm) until it intersects vertical velocity line (9 fps). From this point follow diagonal line to get required Tube I.D.—(.944).

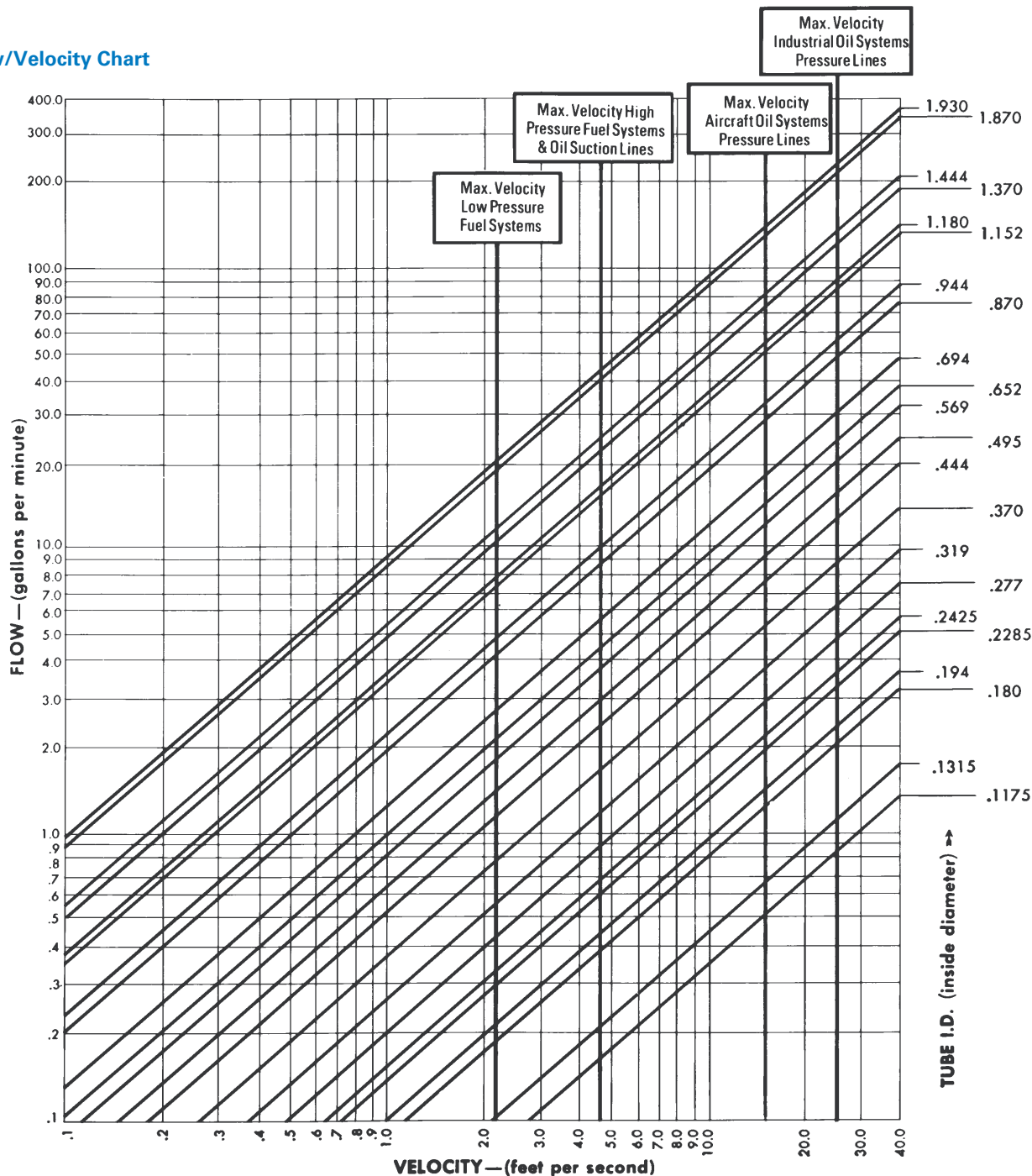
**To Find Permissible Flow Velocity—15 fps • Tube I.D.—.495**

Follow vertical velocity line (15 fps) until it intersects diagonal line representing .495 tube I.D. Then project this point horizontally to get the permissible flow—(9 gpm).

**To Find Velocity of Fluid in System Flow—6 gpm • Tube I.D.—.694**

Follow horizontal flow line (6 gpm) until it intersects diagonal line representing .694 tube I.D. Then project this point vertically downward to get the velocity of fluid—(5 fps).

**Flow/Velocity Chart**



**⚠ WARNING** Refer to safety information regarding tubing selection on pages A-2-3.

With the following Recommended Wall Thickness tables the tubing wall can be selected that is best suited for a particular application. The data given in these tables are raw figures based on the equation –

$$t = \frac{Dp(FS)}{2S}$$

t–wall thickness (inches)

D–O.D. of tube (inches)

p–pressure (psi)

FS–Safety Factor

S–tensile strength of tubing material

Therefore, many of the wall thicknesses given in these tables are not found on standard tubing, but serve to establish the minimum wall required.

**Safety Factor** – The standard safety factors indicate three grades of severity of service:

- 4:1 – mechanical and hydraulic shocks not excessive
- 6:1 – considerable mechanical strain and hydraulic shock
- 8:1 – hazardous applications with severe service conditions

**The wall thickness shown in these tables are based on ultimate strength of material and a safety factor of 4:1.**

### Recommended Wall Thickness Tables

**1010 STEEL** Based on 55,000#/in.2 Strength (F S=4)

Hose O.D.	Working Pressure (psi)				
	1,000	2,000	3,000	4,000	5,000
1/8	.00455	.00909	.01364	.01818	.02273
3/16	.00682	.01364	.02045	.02727	.03409
1/4	.00909	.01818	.02727	.03636	.04545
5/16	.01136	.02273	.03409	.04545	.05682
3/8	.01364	.02727	.04091	.05455	.06818
1/2	.01818	.03636	.05455	.07273	.09091
5/8	.02273	.04545	.06818	.09091	.11364
3/4	.02727	.05455	.08182	.10909	.13636
7/8	.03182	.06364	.09545	.12727	.15909
1	.03636	.07273	.10909	.14545	.18182
1-1/4	.04545	.09091	.13636	.18182	.22727
1-1/2	.05455	.10909	.16364	.21818	.27273
2	.07273	.14545	.21818	.29091	.36364

**4130 STEEL** Based on 90,000#/in.2 Strength (F S=4)

Hose O.D.	Working Pressure (psi)				
	1,000	2,000	3,000	4,000	5,000
1/8	.00278	.00556	.00833	.01111	.01389
3/16	.00417	.00833	.01250	.01667	.02083
1/4	.00556	.01110	.01667	.02222	.02778
5/16	.00694	.01389	.02083	.02778	.03472

Hose O.D.	Working Pressure (psi)				
	1,000	2,000	3,000	4,000	5,000
3/8	.00833	.01667	.02499	.03333	.04167
1/2	.01111	.02222	.03333	.04444	.05556
5/8	.01389	.02778	.04167	.05556	.06944
3/4	.01667	.03333	.04999	.06667	.08333
7/8	.01944	.03889	.05833	.07778	.09722
1	.02222	.04444	.06667	.08889	.11111
1-1/4	.02778	.05556	.08333	.11111	.13889
1-1/2	.03333	.06667	.09999	.13333	.16667
2	.04444	.08889	.13333	.17778	.22222

To obtain the recommended wall for a specific pressure based on a safety factor of 6:1, multiply the wall thickness indicated in the table by 1.5. For a safety factor of 8:1, multiply by 2:

**Temperature** – The wall thickness found by using these tables can be corrected for temperature by multiplying the wall thickness by the appropriate correction factor given in the chart below. The table is based on strength reduction due to increased temperature.

Temperature	1010 Steel	Stainless Steel	Copper	Aluminum
+100F.	1.00	1.00	1.00	1.00
+200F.	1.00	1.00	1.08	1.00
+300F.	1.00	1.00	1.22	1.08
+400F.	1.00	1.00	2.30	1.41
+500F.	1.00	1.00	–	2.10
+600F.	1.00	1.00	–	–
+700F.	1.00	1.00	–	–
+800F.	1.08	1.07	–	–
+900F.	1.32	1.13	–	–
+1000F.	1.66	1.22	–	–

**1020 STEEL** Based on 65,000#/in.2 Strength (F S=4)

TUBE O.D.	Working Pressure (psi)				
	1,000	2,000	3,000	4,000	5,000
1/8	.00385	.00790	.01154	.01538	.01923
3/16	.00577	.01154	.01731	.02308	.02885
1/4	.00769	.01538	.02308	.03077	.03846
5/16	.00962	.01923	.02885	.03846	.04808
3/8	.01154	.02308	.03462	.04615	.05769
1/2	.01538	.03077	.04615	.06154	.07692
5/8	.01923	.03846	.05769	.07692	.09615
3/4	.02308	.04615	.06923	.09231	.11538
7/8	.02692	.05385	.08077	.10769	.13462
1	.03077	.06154	.09231	.12308	.15385
1-1/4	.03846	.07692	.11538	.15385	.19231
1-1/2	.04615	.09231	.13846	.18462	.23077
2	.06154	.12308	.18462	.24615	.30769



**WARNING**

Refer to safety information regarding tubing selection on pages A-2-3.

TUBE O.D.	STAINLESS STEEL (304) ANNEALED BASED ON 75,000#/IN <sup>2</sup> STRENGTH (F.S. -4)					STAINLESS STEEL (304) ANNEALED BASED ON 105,000#/IN <sup>2</sup> STRENGTH (F.S. -4)				
	working pressure (psi)					working pressure (psi)				
	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000
1/8	.00333	.00666	.00999	.01333	.01666	.00238	.00476	.00714	.00952	.01190
3/16	.00499	.00999	.01498	.01999	.02499	.00357	.00714	.01071	.01429	.01786
1/4	.00666	.01332	.01998	.02667	.03333	.00476	.00952	.01429	.01905	.02381
5/16	.00833	.01665	.02497	.03333	.04165	.00595	.01190	.01786	.02381	.02976
3/8	.0099	.01998	.02997	.03999	.04998	.00714	.01429	.02143	.02857	.03571
1/2	.01332	.02664	.03996	.05333	.06664	.00957	.01904	.02857	.03810	.04762
5/8	.01665	.03333	.04995	.06666	.08330	.01190	.02381	.03571	.04762	.05952
3/4	.01998	.03996	.05994	.07999	.09996	.01429	.02857	.04286	.05714	.07143
7/8	.02331	.04662	.06996	.09333	.11662	.01667	.03333	.05000	.06666	.08333
1	.02664	.05328	.07992	.10666	.13328	.01904	.03810	.05714	.07619	.09524
1-1/4	.03333	.06666	.09999	.13333	.16666	.02381	.04762	.07143	.09524	.11905
1-1/2	.03996	.07992	.11988	.15999	.19992	.02857	.05714	.08371	.11429	.14286
2	.05328	.10656	.15984	.21333	.26666	.03810	.07619	.11428	.15238	.19048

TUBE O.D.	ANNEALED COPPER BASED ON 30,000#/IN <sup>2</sup> STRENGTH (F.S. -4)					COPPER (UNS C12200 LIGHT DRAWN) BASED ON 40,000#/IN <sup>2</sup> STRENGTH (F.S. -4)				
	working pressure (psi)					working pressure (psi)				
	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000
1/8	.00833	.01667	.02500	.03333	.04167	.00625	.01250	.01875	.02500	.03125
3/16	.01250	.02499	.03750	.04999	.06250	.00938	.01875	.02812	.03750	.04688
1/4	.01667	.03333	.05000	.06666	.08333	.01250	.02500	.03750	.05000	.06250
5/16	.02083	.04167	.06250	.08333	.10417	.01562	.03125	.04688	.06250	.07812
3/8	.02499	.04999	.07500	.09999	.12499	.01875	.03750	.05625	.07500	.09375
1/2	.03333	.06667	.10000	.13333	.16667	.02500	.05000	.07500	.10000	.12500
5/8	.04167	.08333	.12500	.16666	.20883	.03125	.06250	.09375	.12500	.15625
3/4	.04999	.09999	.15000	.19999	.24999	.03750	.07500	.11250	.15000	.18750
7/8	.05833	.11667	.17500	.23333	.29166	.04375	.08750	.13125	.17500	.21875
1	.06667	.13333	.20000	.26666	.33333	.05000	.10000	.15000	.20000	.25000
1-1/4	.08333	.16667	.25000	.33333	.41667	.06250	.12500	.18750	.25000	.31250
1-1/2	.09999	.19999	.30000	.39999	.49999	.07500	.15000	.22500	.30000	.37500
2	.13333	.26667	.40000	.53333	.66667	.10000	.20000	.30000	.40000	.50000

TUBE O.D.	ALUMINUM 3003 (H-14) BASED ON 20,000#/IN <sup>2</sup> STRENGTH (F.S. -4)					ALUMINUM 5052 (H-32) BASED ON 31,000#/IN <sup>2</sup> STRENGTH (F.S. -4)				
	working pressure (psi)					working pressure (psi)				
	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000
1/8	.01250	.02500	.3750	.05000		.00806	.01613	.02419	.03226	.04032
3/16	.01875	.03750	.05650	.07500		.01210	.02419	.03629	.04839	.06048
1/4	.02500	.05000	.07500	.10000		.01613	.03226	.04839	.06452	.08065
5/16	.03125	.06250	.09375	.12500		.02016	.04032	.06048	.08065	.10081
3/8	.03750	.07500	.11250	.15000		.02419	.04839	.07258	.09677	.12097
1/2	.05000	.10000	.15000	.20000		.03227	.06452	.09677	.12903	.16129
5/8	.06250	.12500	.18750	.25000		.04032	.08065	.12097	.16129	.20161
3/4	.07500	.15000	.22500	.30000		.04839	.09677	.14516	.19355	.24194
7/8	.08750	.17500	.26250	.35000		.05645	.11290	.16935	.22581	.28226
1	.10000	.20000	.30000	.40000		.06452	.12903	.19355	.25806	.32258
1-1/4	.12500	.25000	.37500	.50000		.08065	.16129	.24194	.32258	.40323
1-1/2	.15000	.30000	.45000	.60000		.09677	.19355	.29032	.38710	.48387
2	.20000	.40000	.60000	.80000		.12903	.25806	.38710	.51613	.64516

TUBE O.D.	CUPRO-NICKEL 30% BASED ON 52,000#/IN <sup>2</sup> STRENGTH (F.S. -4)				
	working pressure (psi)				
	1,000	2,000	3,000	4,000	5,000
1/8	.00481	.00962	.01442	.01923	.02404
3/16	.00721	.01442	.02163	.02885	.03606
1/4	.00962	.01923	.02885	.03846	.04808
5/16	.01202	.02404	.03606	.04808	.06010
3/8	.01442	.02885	.04327	.05769	.07212
1/2	.01923	.03846	.05769	.07692	.09615
5/8	.02404	.04808	.07212	.09615	.12019
3/4	.02885	.05769	.08654	.11538	.14423
7/8	.03365	.06731	.10096	.13462	.16827
1	.03846	.07692	.11538	.15385	.19231
1-1/4	.04808	.09615	.14423	.19231	.24038
1-1/2	.05769	.11538	.17308	.23077	.28846
2	.07692	.15385	.23077	.30769	.38462

**SHADED AREAS**

Tubing wall thickness listed in the shaded areas are generally either too light or too heavy for practical applications, and are listed only to provide data for accurate computation.

**⚠ WARNING**

Refer to safety information regarding tubing selection on pages A-2-3. These tables provide data on required wall thickness for various sizes and pressures, and when to use flared or flareless fittings.

Although heavier wall tubing can be ordered for higher operating pressures, only standard size hydraulic tubing is listed in these tables. High temperature effects are not considered in these tables.

**1010 STEEL TUBING WALL THICKNESS**

TUBE O.D.	4:1 SAFETY FACTOR					6:1 SAFETY FACTOR					8:1 SAFETY FACTOR				
	working pressure (psi)					working pressure (psi)					working pressure (psi)				
	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000
1/8	.028	.028	.028	.028	.028	.028	.028	.028	.028	.035	.028	.028	.028	.035	-
3/16	.030	.030	.030	.030	.035	.030	.030	.030	-	-	.030	.030	-	-	-
1/4	.030	.030	.030	.042	.049	.030	.030	.042	.058	-	.030	.035	.058	-	-
5/16	.032	.032	.035	.049	.058	.032	.032	.058	.065	-	.032	.049	.065	-	-
3/8	.032	.032	.042	.058	-	.032	.042	.058	-	-	.032	.058	-	-	-
1/2	.032	.042	.058	.072	-	.032	.058	.083	-	-	.042	.072	-	-	-
5/8	.035	.049	.072	.095	-	.035	.072	-	-	-	.049	.095	-	-	-
3/4	.035	.058	.083	.109	-	.049	.083	-	-	-	.058	.109	-	-	-
7/8	.049	.065	.095	-	-	.049	.095	-	-	-	.065	-	-	-	-
1	.049	.072	.109	-	-	.058	.109	-	-	-	.072	-	-	-	-
1-1/4	.049	.095	-	-	-	.072	-	-	-	-	.095	-	-	-	-
1-1/2	.065	.109	-	-	-	.083	-	-	-	-	.109	-	-	-	-
2	.072	-	-	-	-	.109	-	-	-	-	-	-	-	-	-

**1020 STEEL TUBING WALL THICKNESS**

TUBE O.D.	4:1 SAFETY FACTOR					6:1 SAFETY FACTOR					8:1 SAFETY FACTOR				
	working pressure (psi)					working pressure (psi)					working pressure (psi)				
	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000
1/8	.028	.028	.028	.028	.028	.028	.028	.028	.028	.030	.028	.028	.028	.030	-
3/16	.030	.030	.030	.030	.030	.030	.030	.030	.035	-	.030	.030	.035	-	-
1/4	.030	.030	.030	.030	.042	.030	.030	.035	.049	.058	.030	.030	.049	-	-
5/16	.032	.032	.032	.042	.049	.032	.032	.042	.058	-	.032	.042	.058	-	-
3/8	.032	.032	.035	.049	.058	.032	.035	.058	.065	-	.032	.049	-	-	-
1/2	.032	.032	.049	.065	.083	.032	.049	.072	-	-	.032	.065	-	-	-
5/8	.035	.042	.058	.083	-	.035	.058	.095	-	-	.042	.083	-	-	-
3/4	.035	.049	.072	.095	-	.035	.072	.109	-	-	.049	.095	-	-	-
7/8	.049	.058	.083	-	-	.049	.083	-	-	-	.058	.109	-	-	-
1	.049	.065	.095	-	-	.049	.095	-	-	-	.065	-	-	-	-
1-1/4	.049	.083	.120	-	-	.058	.120	-	-	-	.083	-	-	-	-
1-1/2	.065	.095	-	-	-	.072	-	-	-	-	.095	-	-	-	-
2	.065	-	-	-	-	.095	-	-	-	-	.134	-	-	-	-

 Both SAE 37° SINGLE FLARE FLARE-TWIN or ERMETO® flareless recommended.

 ERMETO® flareless only.

**Note:** Refer Only Weatherhead Ermeto flareless fittings can be used with high pressure, heavy wall tubing which is impractical to flare.

## ⚠ WARNING

Refer to safety information regarding tubing selection on pages A-2-3. These tables provide data on required wall thickness for various sizes and pressures, and when to use flared or flareless fittings.

Although heavier wall tubing can be ordered for higher operating pressures, only standard size hydraulic tubing is listed in these tables. High temperature effects are not considered in these tables.

### STAINLESS STEEL (304) ANNEALED TUBING WALL THICKNESS

TUBE O.D.	4:1 SAFETY FACTOR					6:1 SAFETY FACTOR					8:1 SAFETY FACTOR				
	working pressure (psi)					working pressure (psi)					working pressure (psi)				
	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000
1/8	.028	.028	.028	.028	.028	.028	.028	.028	.028	.035	.028	.028	.028	.028	.035
3/16	.030	.030	.030	.030	.030	.030	.030	.030	.030	.035	.030	.030	.030	.035	-
1/4	.030	.030	.030	.030	.035	.030	.030	.030	.042	.058	.030	.030	.035	.058	.065
5/16	.032	.032	.032	.035	.042	.032	.032	.035	.058	.065	.032	.032	.049	.065	-
3/8	.032	.032	.032	.042	.058	.032	.042	.065	.083	-	.032	.042	.058	-	-
1/2	.032	.032	.042	.058	.072	.032	.042	.065	.083	-	.032	.058	.083	-	-
5/8	.035	.035	.058	.072	.083	.035	.058	.083	.095	-	.035	.065	-	-	-
3/4	.035	.049	.065	.083	.109	.035	.065	.095	-	-	.049	.083	-	-	-
7/8	.049	.049	.072	.095	-	.049	.072	.109	-	-	.049	.095	-	-	-
1	.049	.058	.083	.109	-	.049	.083	.120	-	-	.058	.109	-	-	-
1-1/4	.049	.072	.109	-	-	.058	.109	-	-	-	.065	.134	-	-	-
1-1/2	.065	.083	.120	-	-	.065	.120	-	-	-	.083	-	-	-	-
2	.065	.109	-	-	-	.083	-	-	-	-	.109	-	-	-	-

### STAINLESS STEEL (304) 1/8 HARD TUBING WALL THICKNESS

TUBE O.D.	4:1 SAFETY FACTOR					6:1 SAFETY FACTOR					8:1 SAFETY FACTOR				
	working pressure (psi)					working pressure (psi)					working pressure (psi)				
	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000	1,000	2,000	3,000	4,000	5,000
1/8	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028
3/16	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.035
1/4	.030	.030	.030	.030	.030	.030	.030	.030	.030	.035	.030	.030	.030	.042	.049
5/16	.032	.032	.032	.032	.032	.032	.032	.032	.035	.049	.032	.032	.035	.049	.058
3/8	.032	.032	.032	.032	.042	.032	.032	.032	.042	.058	.032	.032	.042	.058	-
1/2	.032	.032	.032	.042	.049	.032	.032	.042	.058	.072	.032	.042	.058	.083	-
5/8	.035	.035	.042	.049	.065	.035	.035	.058	.072	.095	.035	.049	.072	.095	-
3/4	.035	.035	.049	.058	.072	.035	.049	.065	.095	.109	.035	.058	.095	-	-
7/8	.049	.049	.058	.072	.083	.049	.058	.083	.109	-	.049	.065	.109	-	-
1	.049	.049	.058	.083	.095	.049	.058	.095	-	-	.049	.072	-	-	-
1-1/4	.049	.049	.072	.095	.120	.049	.072	.109	-	-	.049	.095	-	-	-
1-1/2	.065	.065	.095	-	-	.065	.095	-	-	-	.065	-	-	-	-
2	.065	.083	.120	-	-	.065	-	-	-	-	.083	-	-	-	-

 Both SAE 37° SINGLE FLARE FLARE-TWIN or ERMETO® flareless recommended.

 ERMETO® flareless only.

**Note:** Refer Only Weatherhead Ermeto flareless fittings can be used with high pressure, heavy wall tubing which is impractical to flare.