

INSTRUMENTATION TUBING SERIES

Stainless Steel Instrumentation Tubing

SEAMLESS | COILED | FRACTIONAL | METRIC



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Types of Tubing

ST series and CT series

- ST series seamless straight-length tubing, internal surface pickled, bright annealed or cold worked followed by bright annealing, external surface machined finished.
- CT series coiled tubing, bright annealed, external surface machined finished.

Ordering Information and Dimensions

Fractional Tubing

Tube O.D. (in.)	Wall Thickness (in.)	Basic Ordering Number		Weight lb/ft.
		SS 316L	SS 304/304L	
1/8	0.028	SS-ST-FT2-028	S4-ST-FT2-028	0.029
3/16	0.028	SS-ST-FT3-028	S4-ST-FT3-028	0.049
1/4	0.035	SS-ST-FT4-035	S4-ST-FT4-035	0.082
	0.049	SS-ST-FT4-049	S4-ST-FT4-049	0.107
5/16	0.035	SS-ST-FT5-035	S4-ST-FT5-035	0.118
	0.049	SS-ST-FT5-049	S4-ST-FT5-049	0.141
3/8	0.035	SS-ST-FT6-035	S4-ST-FT6-035	0.130
	0.049	SS-ST-FT6-049	S4-ST-FT6-049	0.173
1/2	0.049	SS-ST-FT8-049	S4-ST-FT8-049	0.240
	0.065	SS-ST-FT8-065	S4-ST-FT8-065	0.307
5/8	0.065	SS-ST-FT10-065	S4-ST-FT10-065	0.397
	0.083	SS-ST-FT10-083	S4-ST-FT10-083	0.491
3/4	0.065	SS-ST-FT12-065	S4-ST-FT12-065	0.484
	0.083	SS-ST-FT12-083	S4-ST-FT12-083	0.605
7/8	0.083	SS-ST-FT14-083	S4-ST-FT14-083	0.715
	0.095	SS-ST-FT14-095	S4-ST-FT14-095	0.804
1	0.083	SS-ST-FT16-083	S4-ST-FT16-083	0.827
	0.095	SS-ST-FT16-095	S4-ST-FT16-095	0.934
1.1/4	0.109	SS-ST-FT20-109	S4-ST-FT20-109	1.355
	0.120	SS-ST-FT20-120	S4-ST-FT20-120	1.478
1.1/2	0.120	SS-ST-FT24-120	S4-ST-FT24-120	1.805
	0.134	SS-ST-FT24-134	S4-ST-FT24-134	1.989

Metric Tubing

Tube O.D. (mm)	Wall Thickness (mm)	Basic Ordering Number		Weight Kg/mm
		SS 316L	SS 304/304L	
6	1.0	SS-ST-MT6-1.0	S4-ST-MT6-1.0	0.125
8	1.0	SS-ST-MT8-1.0	S4-ST-MT8-1.0	0.175
10	1.0	SS-ST-MT10-1.0	S4-ST-MT10-1.0	0.226
	1.5	SS-ST-MT10-1.5	S4-ST-MT10-1.5	0.320
12	1.5	SS-ST-MT12-1.0	S4-ST-MT12-1.0	0.395
	2.0	SS-ST-MT12-1.5	S4-ST-MT12-1.5	0.501
14	1.5	SS-ST-MT14-1.5	S4-ST-MT14-1.5	0.470
	2.0	SS-ST-MT14-2.0	S4-ST-MT14-2.0	0.602
16	1.5	SS-ST-MT16-1.5	S4-ST-MT16-1.5	0.545
	2.0	SS-ST-MT16-2.0	S4-ST-MT16-2.0	0.702
18	1.5	SS-ST-MT18-1.5	S4-ST-MT18-1.5	0.620
	2.0	SS-ST-MT18-2.0	S4-ST-MT18-2.0	0.802
20	2.0	SS-ST-MT20-2.0	S4-ST-MT20-2.0	0.903
	2.5	SS-ST-MT20-2.5	S4-ST-MT20-2.5	1.094
22	2.0	SS-ST-MT22-2.0	S4-ST-MT22-2.0	1.010
	2.5	SS-ST-MT22-2.5	S4-ST-MT22-2.5	1.219
25	2.0	SS-ST-MT25-2.0	S4-ST-MT25-2.0	1.151
	2.5	SS-ST-MT25-2.5	S4-ST-MT25-2.5	1.410
28	2.5	SS-ST-MT28-2.5	S4-ST-MT28-2.5	1.594
	2.5	SS-ST-MT30-2.5	S4-ST-MT30-2.5	1.718
30	3.0	SS-ST-MT30-3.0	S4-ST-MT30-3.0	2.025
	3.0	SS-ST-MT32-3.0	S4-ST-MT32-3.0	2.175
32	3.5	SS-ST-MT32-3.5	S4-ST-MT32-3.5	2.501
	3.5	SS-ST-MT38-3.5	S4-ST-MT38-3.5	3.019
38	4.0	SS-ST-MT38-4.0	S4-ST-MT38-4.0	3.410

Tubing Selection

Proper selection, handling, and installation of tubing, when combined with proper selection of BF tube fittings, are essential to reliable tubing systems.

The following variables should be considered when ordering tubing for use with BF tube fittings:

- ⦿ Surface finish
- ⦿ Material
- ⦿ Hardness
- ⦿ Wall thickness.

Tubing Surface Roughness

Many ASTM specifications cover the above requirements, but they often are not very detailed on surface finish. We have established the following strict factory standards based on the usage requirements of different industries:

Products	General μm ($\mu\text{in.}$)		Sanitary μm ($\mu\text{in.}$)		High Purity μm ($\mu\text{in.}$)	
	External Surface	Internal Surface	External Surface	Internal Surface	External Surface	Internal Surface
MP Tubing	$Ra \leq 0.8(32)$	Clean	/	/	/	/
BA Tubing	/	/	$Ra \leq 0.6(25)$	$Ra \leq 0.6(25)$	$Ra \leq 0.6(25)$	$Ra \leq 0.38(15)$
Seamless Coiled Tubing	$Ra \leq 0.6(25)$	$Ra \leq 0.6(25)$	$Ra \leq 0.6(25)$	$Ra \leq 0.6(25)$	$Ra \leq 0.6(25)$	$Ra \leq 0.38(15)$

Tubing Material

Our suggested ordering instructions for each type of tubing are shown under the respective tables.

Tubing Outside Diameter Hardness

The key to selecting proper tubing for use with metal Beyond Fluid tube fittings is that the tubing must be softer than the fitting material. Beyond Fluid tube fittings are designed to work properly with the tubing that is suggested in the ordering instructions.

Beyond Fluid stainless steel tube fittings have been repeatedly tested successfully with tubing with hardness up to 200 HV and 90 HRB.

Tubing Wall Thickness

The accompanying tables show working pressure ratings of tubing in a wide range of wall thicknesses. Except as noted, allowable pressure ratings are calculated from S values as specified by ASME B31.3, Process Piping.

Beyond Fluid tube fittings have been repeatedly tested in both the minimum and maximum wall thicknesses shown.

Beyond Fluid tube fittings are not recommended for tube wall thicknesses outside the ranges shown in the accompanying tables for each size.

Tubing Handling

Good handling practices can greatly reduce scratches on tubing and protect the good surface finish that reliable tube manufacturers supply.

- ⦿ Tubing should never be dragged out of a tubing rack or across a rough surface.
- ⦿ Tube cutters or hacksaws should be sharp. Do not take deep cuts with each turn of the cutter or stroke of the saw.
- ⦿ Tube ends should be deburred. This helps to ensure that the tubing will go all the way through the ferrules without damaging the ferrule sealing edge.

Gas Service

Gases (air, hydrogen, helium, nitrogen, etc.) have very small molecules that can escape through even the most minute leak path. Some surface defects on the tubing can provide such a leak path. As tube outside diameter (OD) increases, so does the likelihood of a scratch or other surface defect interfering with proper sealing.

The most successful connection for gas service will occur if all installation instructions are carefully followed and the heavier wall thicknesses of tubing on the accompanying tables are selected.

Suggested Allowable Working Pressure for Stainless Steel Tubing

1. Fractional Stainless Steel Tubing

Allowable working pressures are calculated from an S value of 20 000 psi (137.8 MPa) for ASTM A269 tubing at –20 to 100° F (–28 to 37°C), as listed in ASME B31.3 and ASME B31.1, except as noted.

Suggested Ordering Information

High-quality, fully annealed (Type 304, 304/304L, 316, 316/316L, 317, 317/317L) seamless stainless steel hydraulic tubing, ASTM A269 or A213, or equivalent. Hardness not to exceed 90 HRB or 200 HV. Tubing to be free of scratches, suitable for bending and flaring.

Tube OD In.	Tube Wall Thickness (in.)													
	0.012	0.016	0.020	0.028	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.134	0.156	0.188
	Working Pressure (psig)													
1/16	6800	9400	12000											
1/8				8500	10900									
3/16				5400	7000	10200								
1/4				4000	5100	7500	10200							
5/16					4000	5800	8000							
3/8					3300	4800	6500	7500						
1/2					2600	3700	5100	6700						
5/8						2900	4000	5200	6000					
3/4						2400	3300	4200	4900	5800				
7/8						2000	2800	3600	4200	4800				
1							2400	3100	3600	4200	4700			
1.1/4								2400	2800	3300	3600	4100	4900	
1.1/2									2300	2700	3000	3400	4000	4900
2										2000	2200	2500	2900	3600

2. Metric Stainless Steel Tubing

Allowable working pressures are based on equations from ASME B31.3 and ASME B31.1 for EN ISO 1127 tubing (D4, T4 tolerance for 3 to 12 mm; D4, T3 tolerance 14 to 50 mm), using a stress value of 137.8 MPa (20 000 psi) and tensile strength of 516.4 MPa (74 900 psi), except as noted.

Suggested Ordering Information

High-quality, fully annealed (Type 304, 304/304L, 316, 316/316L, 317, 317/317L) seamless stainless steel hydraulic tubing, ASTM A269 or A213, or equivalent. Hardness not to exceed 90 HRB or 200 HV. Tubing to be free of scratches, suitable for bending and flaring.

Tube OD mm	Tube Wall Thickness (mm)													
	0.8	1.0	1.2	1.5	1.8	2.0	2.2	2.5	2.8	3.0	3.5	4.0	4.5	5.0
	Working Pressure (bar)													
3	670													
6	310	420	540	710										
8		310	390	520										
10		240	300	400	510	580								
12		200	250	330	410	470								
14		160	200	270	340	380	430							
15		150	190	250	310	360	400							
16			170	230	290	330	370	400						
18			150	200	260	290	320	370						
20			140	180	230	260	290	330	380					
22			140	160	200	230	260	300	340					
25					180	200	230	260	290	320				
28						180	200	230	260	280	330			
30						170	180	210	240	260	310			
32						160	170	200	220	240	290	330		
38							140	160	190	200	240	270	310	
42								150	170	190	220	250	290	
50										150	180	210	240	270

Suggested Allowable Working Pressure for Carbon Steel Tubing

3. Fractional Carbon Steel Tubing

Allowable working pressures are calculated from an S value of 15700 psi (108.2 MPa) for ASTM A179 tubing at -20 to 100°F (-28 to 37°C), as listed in ASME B31.3. For working pressure in accordance with ASME B31.1, multiply by 0.85.

Suggested Ordering Information

High-quality, soft annealed seamless carbon steel hydraulic tubing, ASTM A179 or equivalent. Hardness not to exceed 72 HRB or 130 HV. Tubing to be free of scratches, suitable for bending and flaring.

Tube OD In.	Tube Wall Thickness (in.)												
	0.028	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.134	0.148	0.165	0.180	0.220
	Working Pressure (psig)												
1/8	8000	10 200											
3/16	5100	6 600	9600										
1/4	3700	4 800	7000	9600									
5/16		3 700	5500	7500									
3/8		3 100	4500	6200									
1/2		2 300	3200	4500	5900								
5/8		1 800	2600	3500	4600	5300							
3/4			2100	2900	3700	4300	5100						
7/8			1800	2400	3200	3700	4300						
1			1500	2100	2700	3200	3700	4100					
1 1/4				1600	2100	2500	2900	3200	3600	4000	4600	5000	
1 1/2					1800	2000	2400	2600	2900	3300	3700	4100	5100
2						1500	1700	1900	2100	2400	2700	3000	3700

4. Metric Carbon Steel Tubing

Allowable working pressures are based on equations from ASME B31.3 for DIN 2391 tubing, using a stress value of 113 MPa (16 300 psi) and tensile strength of 340 MPa (49 300 psi).

Suggested Ordering Information

High-quality, soft annealed seamless carbon steel hydraulic tubing, ASTM A179 or equivalent. Hardness not to exceed 72 HRB or 130 HV. Tubing to be free of scratches, suitable for bending and flaring.

Tube OD mm	Tube Wall Thickness, mm												
	0.8	1.0	1.2	1.5	1.8	2.0	2.2	2.5	2.8	3.0	3.5	4.0	4.5
	Working Pressure (bar)												
3	630	790											
6	290	370	460	590									
8		270	330	430									
10		210	260	330									
12		170	210	270	330	380	420						
14		150	180	230	280	320	350						
15		140	170	210	260	290	330						
16		130	150	200	240	270	300	350					
18			140	170	210	240	270	310					
20			120	160	190	210	240	270	310				
22			110	140	170	190	210	240	280				
25			100	120	150	170	180	210	240	260			
28						150	160	190	210	230	270		
30						140	150	170	200	210	250		
32						130	140	160	180	200	230	270	
38							120	130	150	160	190	230	260

Suggested Allowable Working Pressure for Copper Tubing

5. Fractional Copper Tubing

Allowable working pressures are calculated from an S value of 6000 psi (41.3 MPa) for ASTM B75 and ASTM B88 tubing at –20 to 100°F (–28 to 37°C), as listed in ASME B31.3 and ASME B31.1.

Suggested Ordering Information

High-quality, soft annealed seamless copper tubing, ASTM B75 or equivalent. Also soft annealed (Temper O) copper water tube, type K or type L to ASTM B88.

Tube OD In.	Tube Wall Thickness (in.)									
	0.028	0.030	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.134
	Working Pressure (psig)									
1/8	2700	3000	3600							
3/16	1800	1900	2300	3400						
1/4	1300	1400	1600	2500	3500					
5/16			1300	1900	2700					
3/8			1000	1600	2200					
1/2			800	1100	1600	2100				
5/8				900	1200	1600	1900			
3/4				700	1000	1300	1500	1800		
7/8				600	800	1100	1300	1500		
1				500	700	900	1100	1300	1500	
1 1/8					600	800	1000	1100	1300	1400

6. Metric Copper Tubing

Allowable working pressures are calculated from an S value of 6000 psi (41.3 MPa) for ASTM B75 and ASTM B88 tubing at –20 to 100°F (–28 to 37°C), as listed in ASME B31.3 and ASME B31.1.

Suggested Ordering Information

High-quality, soft annealed seamless copper tubing, ASTM B75 and EN 1057 or equivalent. Also soft annealed (Temper O) copper water tube, type K or type L to ASTM B88.

Tube OD mm	Tube Wall Thickness, mm									
	0.8	1.0	1.2	1.5	1.8	2.0	2.2	2.5	2.8	3.0
	Working Pressure (bar)									
6	110	140	170	220						
8		100	120	160						
10		80	100	130						
12		60	80	100	130	140				
14		50	60	90	110	120				
15			60	80	100	110	120			
16				70	90	100	110	120		
18				60	80	90	100	110		
20				60	70	80	90	100	110	
22				50	60	70	80	90	100	
25				40	50	60	70	80	90	100
28					40	50	60	70	80	90

Suggested Allowable Working Pressure for Aluminium Tubing

7. Fractional Aluminium Tubing

Allowable working pressures are calculated from an S value of 14 000 psi (96.5 MPa) for ASTM B210, Type 6061-T6 tubing at -20 to 100°F (-28 to 37°C), as listed in ASME B31.3. For working pressure in accordance with ASME B31.1, multiply by 0.85.

Suggested Ordering Information

High-quality aluminum alloy drawn seamless tubing, ASTM B210 (Type 6061-T6) or equivalent.

Tube OD In.	Tube Wall Thickness (in.)				
	0.035	0.049	0.065	0.083	0.095
	Working Pressure (psig)				
1/8	8600				
3/16	5600	8000			
1/4	4000	5900			
5/16	3100	4600			
3/8	2600	3700			
1/2	1900	2700	3700		
5/8	1500	2100	2900		
3/4		1700	2400	3100	
1		1300	1700	2300	2700

8. Metric Aluminium Tubing

Allowable working pressures are calculated from an S value of 96.5 MPa (14 000 psi) for ASTM B210, Type 6061-T6 tubing at -28 to 37°C (-20 to 100°F), as listed in ASME B31.3. For working pressure in accordance with ASME B31.1, multiply by 0.85.

Suggested Ordering Information

High-quality aluminum alloy drawn seamless tubing, ASTM B210 (Type 6061-T6) or equivalent.

Tube OD mm	Tube Wall Thickness (in.)						
	1.0	1.2	1.5	1.8	2.0	2.2	2.5
	Working Pressure (psig)						
6	340	400					
8	240	300					
10	190	230					
12	160	190	240	250			
14	130	160	200	220			
15	120	150	190	200			
16	110	140	170	190			
18		120	150	190	210		
25			110	130	150	170	180

Suggested Allowable Working Pressure for Additional Alloys Tubing

9. Fractional Alloy 400 Tubing

Allowable working pressures are calculated from an S value of 18 700 psi (128.9 MPa) for ASTM B165 tubing at –20 to 100° F (–28 to 37°C), as listed in ASME B31.3 and ASME B31.1.

Suggested Ordering Information

High-quality, fully annealed seamless alloy 400 hydraulic tubing, ASTM B165 or equivalent. Hardness not to exceed 75 HRB or 137 HV. Tubing to be free of scratches, suitable for bending and flaring. OD tolerances not to exceed ± 0.005 in.

Tube OD In.	Tube Wall Thickness (in.)							
	0.028	0.035	0.049	0.065	0.083	0.095	0.109	0.120
	Working Pressure (psig)							
1/8	7900	10 100						
1/4	3700	4 800	7000	9500				
5/16		3 700	5400	7300				
3/8		3 100	4400	6100				
1/2		2 300	3200	4400				
3/4			2200	3000	4000	4600		
1				2200	2900	3400	3900	4300

10. Metric Alloy 400 Tubing

Allowable working pressures are calculated from an S value of 128.9 MPa (18 700 psi) for ASTM B165 tubing at –28 to 37° C (–20 to 100°F), as listed in ASME B31.3 and ASME B31.1.

Suggested Ordering Information

High-quality, fully annealed seamless alloy 400 hydraulic tubing, ASTM B165 or equivalent. Hardness not to exceed 75 HRB or 137 HV. Tubing to be free of scratches, suitable for bending and flaring. OD tolerances not to exceed ± 0.13 mm.

Tube OD mm	Tube Wall Thickness, mm									
	0.8	1.0	1.2	1.5	1.8	2.0	2.2	2.5	2.8	3.0
	Working Pressure (bar)									
6	310	390	490	620						
8		290	350	450						
10		220	280	350						
12		180	230	290						
14		160	190	240	270					
18			150	200	240	270	300			
20				180	210	240	270	290		
25					170	190	210	240	270	290

11. Fractional Alloy C276 Tubing

Allowable working pressures are based on equations from ASME B31.3 and ASME B31.1 for a maximum S value of 20 000 psi (137.8 MPa).

Suggested Ordering Information

High-quality, fully annealed alloy C-276 tubing, ASTM B622 or equivalent. Hardness not to exceed 100 HRB or 248 HV. Tubing to be free of scratches, suitable for bending and flaring. OD tolerances not to exceed ± 0.005 in.

Tube OD In.	Tube Wall Thickness (in.)			
	0.028	0.035	0.049	0.065
	Working Pressure (psig)			
1/4	4000	5100	7500	10 200
5/16		4000	5800	7 800
3/8		3300	4800	6 500
1/2		2600	3700	5 100

Suggested Allowable Working Pressure for Additional Alloys Tubing

12. Metric Alloy C276 Tubing

Allowable working pressures are based on equations from ASME B31.3 and ASME B31.1 for a maximum S value of 137.8 MPa (20 000 psi).

Suggested Ordering Information

High-quality, fully annealed alloy C-276 tubing, ASTM B622 or equivalent. Hardness not to exceed 100 HRB or 248 HV. Tubing to be free of scratches, suitable for bending and flaring. OD tolerances not to exceed ± 0.13 mm.

Tube OD mm	Tube Wall Thickness, mm			
	0.8	1.0	1.2	1.5
	Working Pressure (bar)			
6	310	420	520	670
8		310	390	500
10		240	300	380
12		200	240	310

13. Fractional Alloy 20 Tubing

Allowable working pressures are based on equations from ASME B31.3 and ASME B31.1 for a maximum S value of 20 000 psi (137.8 MPa).

Suggested Ordering Information

High-quality, fully annealed seamless or welded and drawn alloy 20 tubing, ASTM B729, B468 or equivalent. Hardness not to exceed 95 HRB. Tubing to be free of scratches, suitable for bending and flaring. OD tolerances not to exceed ± 0.005 in.

Tube OD In.	Tube Wall Thickness (in.)			
	0.028	0.035	0.049	0.065
	Working Pressure (psig)			
1/4	4000	5100	7500	10 200
3/8		3300	4800	6 500
1/2		2600	3700	5 100

14. Metric Alloy 20 Tubing

Allowable working pressures are based on equations from ASME B31.3 and ASME B31.1 for a maximum S value of 137.8 MPa (20 000 psi).

Suggested Ordering Information

High-quality, fully annealed seamless or welded and drawn alloy 20 tubing, ASTM B729, B468 or equivalent. Hardness not to exceed 95 HRB. Tubing to be free of scratches, suitable for bending and flaring. OD tolerances not to exceed ± 0.13 mm.

Tube OD mm	Tube Wall Thickness, mm			
	0.8	1.0	1.2	1.5
	Working Pressure (bar)			
6	310	420	520	670
8		310	390	500
10		240	300	380
12		200	240	310

Suggested Allowable Working Pressure for Additional Alloys Tubing

15. Fractional Alloy 600 Tubing

Allowable working pressures are based on equations from ASME B31.3 and ASME B31.1 for a maximum S value of 20000 psi (137.8 MPa).

Suggested Ordering Information

High-quality, fully annealed, cold drawn #1 temper alloy 600 seamless alloy tubing, ASTM B167 or equivalent. Hardness not to exceed 92 HRB or 198 HV. Tubing to be free of scratches, suitable for bending and flaring. Order to outside diameter and wall thickness only, not to inside diameter, average wall specification. OD tolerances not to exceed ± 0.005 in.

Tube OD In.	Tube Wall Thickness (in.)			
	0.028	0.035	0.049	0.065
	Working Pressure (psig)			
1/4	4000	5100	7500	10 200
3/8		3300	4800	6 500
1/2		2600	3700	5 100

16. Metric Alloy 600 Tubing

Allowable working pressures are based on equations from ASME B31.3 and ASME B31.1 for a maximum S value of 137.8 MPa (20 000 psi).

Suggested Ordering Information

High-quality, fully annealed seamless or welded and drawn alloy 20 tubing, ASTM B729, B468 or equivalent. Hardness not to exceed 95 HRB. Tubing to be free of scratches, suitable for bending and flaring. OD tolerances not to exceed ± 0.13 mm.

Tube OD mm	Tube Wall Thickness, mm			
	0.8	1.0	1.2	1.5
	Working Pressure (bar)			
6	310	420	520	670
8		310	390	500
10		240	300	380
12		200	240	310

17. Fractional Grade 2 Titanium Tubing

Allowable working pressures are based on equations from ASME B31.3 and a maximum S value of 16 700 psi (115.1 MPa) for ASTM B338 tubing at -20 to 100°F (-28 to 37°C). For working pressure in accordance with ASME B31.1, multiply by 0.85.

Suggested Ordering Information

High-quality, fully annealed seamless or welded and drawn grade 2 titanium tubing, ASTM B338 or equivalent. Tubing to be free of scratches, suitable for bending. OD tolerances not to exceed ± 0.005 in.

Tube OD In.	Tube Wall Thickness (in.)			
	0.028	0.035	0.049	0.065
	Working Pressure (psig)			
1/4	3500	4500	6700	9100
3/8		2900	4200	5800
1/2		2100	3100	4200

Suggested Allowable Working Pressure for Additional Alloys Tubing

18. Metric Grade 2 Titanium Tubing

Allowable working pressures are based on equations from ASME B31.3 and a maximum S value of 115.1 MPa (16 700 psi) for ASTM B338 tubing at –28 to 37°C (–20 to 100°F). For working pressure in accordance with ASME B31.1, multiply by 0.85.

Suggested Ordering Information

High-quality, fully annealed seamless or welded and drawn grade 2 titanium tubing, ASTM B338 or equivalent. Tubing to be free of scratches, suitable for bending. OD tolerances not to exceed ± 0.13 mm.

Tube OD mm	Tube Wall Thickness, mm			
	0.8	1.0	1.2	1.5
	Working Pressure (bar)			
6	290	380	470	600
8		270	360	460
10		210	260	340
12		180	220	280

19. Fractional SAF 2507 Tubing

Allowable working pressures are calculated from an S value of 38 700 psi (266.8 MPa) for ASTM A789 tubing at –20 to 100°F (–28 to 37°C), as listed in ASME B31.3. For tubing suitable for SAF 2507 super duplex weld fittings with working pressures calculated based on ASME B31.3 Chapter IX, see the Swagelok SAF 2507 Super Duplex Weld Fittings catalog, MS-01-173.

Suggested Ordering Information

High-quality, fully annealed SAF 2507 super duplex tubing, ASTM A789 or equivalent. Hardness not to exceed 32 HRC. Tubing to be free of scratches, suitable for bending and flaring.

Tube OD In.	Tube Wall Thickness (in.)				
	0.035	0.049	0.065	0.083	0.095
	Working Pressure (psig)				
1/4	10 000	15 000			
3/8	6 500	10 100	12 700		
1/2	5 000	7 200	10 100	12 900	
5/8		5 800	7 600	10 100	
3/4		4 700	6 300	8 500	10 000

20. Fractional Alloy 825 Tubing

Allowable working pressures are calculated from an S value of 23 300 psi (160.6 MPa) for ASTM B163 and ASTM B423 seamless tubing at –20 to 100°F (–28 to 37°C), as listed in ASME BPV 2007 Section II, Part D or ASME B31.3.

Suggested Ordering Information

High-quality, fully annealed seamless alloy 825 tubing, ASTM B163, ASTM B423, or equivalent. Hardness not to exceed HR15T90 or 201 HV. Tubing to be free of scratches, suitable for bending and flaring. Wall thickness tolerances not to exceed $\pm 10\%$.

Tube OD In.	Tube Wall Thickness (in.)		
	0.035	0.049	0.065
	Working Pressure (psig)		
1/4	6400	9300	11 600 ^①
3/8	4100	5900	8 200
1/2	3000	4300	5 900

Suggested Allowable Working Pressure for Additional Alloys Tubing

21. Metric Alloy 825 Tubing

Allowable working pressures are calculated from an S value of 160.6 MPa (23 300 psi) for ASTM B163 and ASTM B423 seamless tubing at –28 to 37°C (–20 to 100°F), as listed in ASME BPV 2007 Section II, Part D or ASME B31.3.

Suggested Ordering Information

High-quality, fully annealed seamless alloy 825 tubing, ASTM B163, ASTM B423, or equivalent. Hardness not to exceed HR15T90 or 201 HV. Tubing to be free of scratches, suitable for bending and flaring. Wall thickness tolerances not to exceed $\pm 10\%$.

Tube OD mm	Tube Wall Thickness, mm			
	1.0	1.2	1.5	1.8
	Working Pressure (bar)			
6	530	660		
8	420	530		
10	300	370	480	
12	250	300	390	480

22. Fractional Alloy 625 Tubing

Allowable working pressures are calculated from an S value of 26 700 psi (184.1 MPa) for ASTM B444 Grade 2 tubing at –20 to 100°F (–28 to 37°C), as listed in ASME BPV 2007 Section II, Part D, Table 1B.

Suggested Ordering Information

High-quality, fully annealed seamless alloy 625 tubing, ASTM B444, Grade 1 or 2, or equivalent. Hardness not to exceed 25

HRC or 266 HV. Tubing to be free of scratches, suitable for bending and flaring.

Tube OD In.	Tube Wall Thickness (in.)		
	0.035	0.049	0.065
	Working Pressure (psig)		
1/4	7300	10 700	14 600
3/8	4700	6 800	9 400
1/2	3500	5 000	6 800

23. Metric Alloy 625 Tubing

Allowable working pressures are calculated from an S value of 26 700 psi (184.1 MPa) for ASTM B444 Grade 2 tubing at –20 to 100°F (–28 to 37°C), as listed in ASME BPV 2007 Section II, Part D, Table 1B.

Suggested Ordering Information

High-quality, fully annealed seamless alloy 625 tubing, ASTM B444, Grade 1 or 2, or equivalent. Hardness not to exceed 25.

HRC or 266 HV. Tubing to be free of scratches, suitable for bending and flaring.

Tube OD mm	Tube Wall Thickness, mm			
	1.0	1.2	1.5	1.8
	Working Pressure (bar)			
6	610	750		
8	480	600		
10	350	430	550	
12	290	350	450	550

Pressure Ratings at Elevated Temperatures

24. Elevated Temperatures

Temperature		Tubing Materials													
°F	°C	Al	Copper	Carbon Steel ^①	304, 304L ^②	316, 316L ^②	317, 317L ^②	Alloy 400	Alloy 20 ^③	Alloy C-276 ^③	Alloy 600 ^③	Ti	SAF 2507	Alloy 825	Alloy 625
200	93	1.00	0.80	0.95	1.00	1.00	1.00	0.87	1.00	1.00	1.00	0.86	0.90	1.00	0.93
400	204	0.40	0.50	0.87 ^①	0.93	0.96	0.96	0.79	0.96	0.96	0.96	0.61	0.82	0.90	0.85
600	315				0.82	0.85	0.85	0.79	0.85	0.85	0.85	0.45	0.80	0.84	0.79
800	426				0.76	0.79	0.79	0.75	0.79	0.79	0.79			0.81	0.75
1000	537				0.69	0.76	0.76			0.76	0.35				0.73

① Based on 375°F (190°C) max.

② Dual-certified grades such as 304/304L, 316/316L, and 317/317L meet the minimum chemistry and the mechanical properties

of both alloy grades. ③ Based on the lower derating factor for stainless steel, in accordance with ASME B31.3.

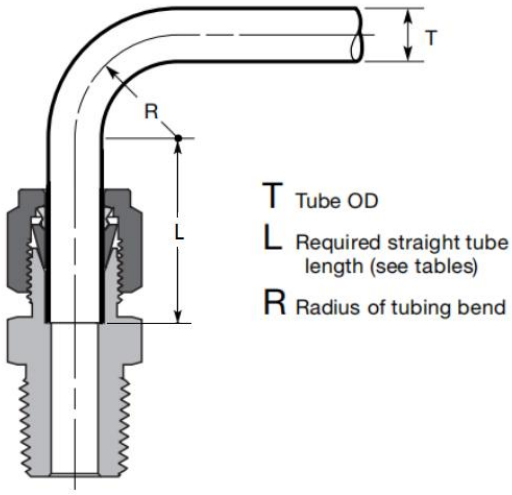
To determine allowable working pressure at elevated temperatures, multiply allowable working pressures from Tables 1 through

23 by a factor shown in Table 24.

Example: Type 316 stainless steel 1/2 in. OD 3 0.035 in. wall at 1000°F

1. The allowable working pressure at –20 to 100°F (–28 to 37°C) is 2600 psig (Table 3, page 4).
 2. The elevated temperature factor for 1000°F (537°C) is 0.76 (Table 24, above): 2600 psig × 0.76 = 1976 psig
- The allowable working pressure for 316 SS 1/2 in. OD 3 0.035 in. wall tubing at 1000°F (537°C) is 1976 psig.

Tubing Installation

 T Tube OD L Required straight tube length (see tables) R Radius of tubing bend	Fractional in.		Metric mm	
	T (Tube OD)	L	T (Tube OD)	L
	1/16	1/2	3	19
	1/8	23/32	6	21
	3/16	3/4	8	23
	1/4	13/16	10	25
	5/16	7/8	12	31
	3/8	15/16	14	32
	1/2	1 3/16	16	32
	5/8	1 1/4	18	32
	3/4	1 1/4	20	34
	7/8	1 5/16	22	34
	1	1 1/2	25	40
	1 1/4	2	28	46
	1 1/2	2 13/32	30	50
	2	3 1/4	32	54
			38	63
			50	80

Tubing properly selected and handled, combined with properly installed Beyond Fluid tube fittings, will give you a leak-tight system and provide reliable service in a wide variety of applications.

For maximum assurance of reliable performance, use:

- properly selected and handled high-quality tubing—such as provided by Beyond Fluid.
- Beyond Fluid tube fittings assembled in accordance with catalog instructions.
- an appropriate tube support system to limit the movement of tubing and fluid system components.

When installing fittings near tube bends, there must be a sufficient straight length of tubing to allow the tube to be bottomed in the Beyond Fluid fitting (see tables).

Medium Pressure Tubing 10000 psig

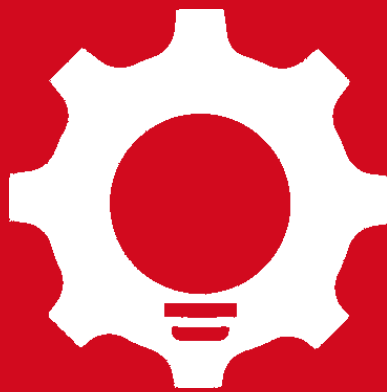
Fractional Tubing

OD		Wall Thickness		Working Pressure		Material
In.	mm	In.	mm	Psig	bar	
1/4	6.35			10000	689	316, 2507, C276, Alloy 400, Alloy 600, Alloy 625, Alloy 825...
3/8	9.53			10000	689	
1/2	12.70	0.120	3.05	10000	689	
9/16	14.29	0.125	3.18	10000	689	
3/4	19.05	0.156	3.96	10000	689	
1	25.40	0.218	5.54	10000	689	
1.1/2	38.10			10000	689	

Medium Pressure Tubing 20000 psig

Fractional Tubing

OD		Wall Thickness		Working Pressure		Material
In.	mm	In.	mm	Psig	bar	
1/4	6.35	0.071	1.80	20000	1379	316, 2507, C276, Alloy 400, Alloy 600, Alloy 625, Alloy 825...
3/8	9.53	0.086	2.18	20000	1379	
1/2	12.70	0.109	2.77	20000	1379	
9/16	14.29	0.125	3.18	20000	1379	
3/4	19.05	0.156	3.96	20000	1379	
1	25.40	0.219	5.56	20000	1379	
1.1/2	38.10	0.282	7.16	20000	1379	



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