

Flareless Tube Fittings Tubing Data Charts

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GYROLOK®

For Your Safety

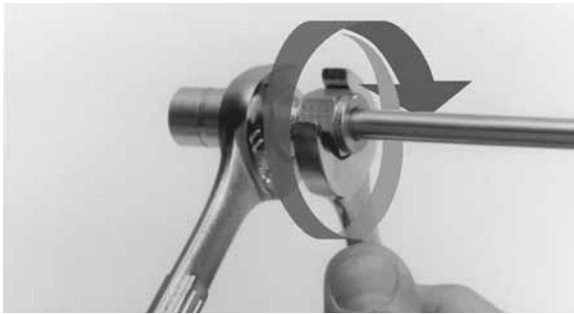
It is solely the responsibility of the system designer and user to select products suitable for their specific application requirements and to ensure proper installation, operation, and maintenance of these products. When selecting products, the total system design must be considered to ensure safe, trouble-free performance. Material compatibility, product ratings and application details should be considered in the selection. Improper selection or use of products described herein can cause personal injury or property damage.

Contact your authorized HOKE® sales and service representative for information about additional sizes and special alloys.

SAFETY WARNING:

HOKE® products are designed for installation only by professional suitably qualified licensed system installers experienced in the applications and environments for which the products are intended. These products are intended for integration into a system. Where these products are to be used with flammable or hazardous media, precautions must be taken by the system designer and installer to ensure the safety of persons and property. Flammable or hazardous media pose risks associated with fire or explosion, as well as burning, poisoning or other injury or death to persons and/or destruction of property. The system designer and installer must provide for the capture and control of such substances from any vents in the product(s). The system installer must not permit any leakage or uncontrolled escape of hazardous or flammable substances. The system operator must be trained to follow appropriate precautions and must inspect and maintain the system and its components including the product(s) and at regular intervals in accordance with timescales recommended by the supplier to prevent unacceptable wear or failure. We recommend that the regulators will be serviced every 5 Years after first installation.

Flareless Tube Fittings Tubing Data Charts



Design

GYROLOK® Flareless Tube Fittings have been carefully designed and manufactured to provide a wide range of outstanding leak-tight application capabilities. GYROLOK® ratings and specifications are as follow:

Pressure Ratings

GYROLOK® fittings are rated for working pressures higher than the tubing recommended for use with GYROLOK®. However, tubing should not be used above its maximum allowable working pressure.

Maximum allowable working pressures for tubing suitable for use with GYROLOK® are identified herein. If no pressure is identified for a given size and a wall thickness, then that tube size/wall combination is not suitable for use with GYROLOK® fittings. See caution below.

Vacuum Rating

GYROLOK® offers excellent vacuum capability. With good quality tubing, GYROLOK® fittings will be leak-tight at vacuum levels of 10^{-9} torr while tested with a leakage sensitivity of 10^{-9} sccs.

Materials

GYROLOK® & GYROLOK-XP® fittings are available in brass, 304 and 316 stainless steel, MONEL®, HASTELLOY®, INCONEL® & INCOLOY®, titanium, 2205 Duplex, 2507 Super Duplex and 254 SMO. Contact your local HOKE® distributor for further information.

Tubing

Fully annealed tubing to the specifications identified herein are suitable for use with GYROLOK® fittings.

The tubing selected, whether metallic or nonmetallic should be compatible with the process fluid, temperature and applications. The wall thickness selections should be based on pressure and temperature conditions.

Tubing should always be fully annealed. While welded tubing may be used with GYROLOK®, inconsistencies in its manufacture and performance are sometimes encountered. As a result we recommend the use of seamless tubing.

For proper fitting performance, the tubing surface finish should be good, free from nicks or scratches. Do not use out of round tubing which does not easily go through fitting components.

Fitting performance is maximized when tube ends are squarely cut, using a tubing cutter, and deburred.

Proper fitting performance demands that the fitting be significantly harder than the tubing on which it is used. For example, stainless steel tubing should never exceed a maximum surface hardness of Rockwell B90, while MONEL® tubing should never exceed a maximum surface hardness of Rockwell B75.

Gas Service

Gases (air, hydrogen, nitrogen, etc.) can escape through smaller leak paths than liquids. As such, the reduction of surface defects (scratches) on tubing becomes more important when the system media contains gases. As tubing wall thickness increases, the ability of the ferrules to coin out imperfections increases. The use of heavier wall tubing will help the ferrules to overcome minor surface defects that could contribute to gas leakage. HOKE recommends the following minimum wall thickness for tubing when system media contains gases.

TUBE OD (inches)	NOMINAL MINIMUM WALL THICKNESS (inches)	TUBE OD (inches)	NOMINAL MINIMUM WALL THICKNESS (inches)
1/8	0.028	3/4	0.065
3/16	0.028	7/8	0.083
1/4	0.028	1	0.083
5/16	0.035	1 1/4	0.109
3/8	0.035	1 1/2	0.134
1/2	0.049	2	0.180

Suggested Allowable Pressure Tables

Figures and tables are for reference only. HOKE makes no implication that these valves can be used for design work. Applicable codes and practices in industry should be reviewed and considered. ASME Codes are the successor to and replacement of ASA Piping Codes. For combinations not shown, consult factory .

Calculating Yield, Burst, and Maximum Allowable Working Pressures

Maximum allowable stress values and calculation factors are used to determine yield, burst, and maximum allowable working pressures. HOKE® has made these calculations for a variety of materials and included the results in charts beginning on page 6. The following information is presented to provide an understanding of how the numbers are derived.

Formulas

1. Maximum Allowable Working Pressure
Fractional: Factor × Maximum Allowable Stress Value (psi)
Metric: Factor × Maximum Allowable Stress Value (psi) × 0.06895
Factor × Maximum Allowable Stress Value (ksi) × 68.95
2. Calculated Yield Pressure
Fractional: Factor × Minimum Yield Strength (psi)
Metric: Factor × Minimum Yield Strength (psi) × 0.06895
3. Calculated Burst Pressure
Fractional: Factor × Minimum Tensile Strength (psi)
Metric: Factor × Minimum Tensile Strength (psi) × 0.6895

See table of “Maximum Allowable Stress Values for Material at Various Temperatures” on pages 3 and 4, and the “Calculation Factor Tables” on page 5.

Maximum Allowable Working Pressure Calculation Examples

The values listed on the “CALCULATION FACTOR TABLE” are for stainless steel and may be used to determine the maximum allowable pressure, yield pressure, burst pressure or any other pressure for which a stress value is available. The Calculation Factor Tables on page 5 are based on stainless steel tubing having maximum allowable outside diameter and minimum allowable wall thickness. Stress values may be obtained from “MAXIMUM ALLOWABLE STRESS VALUES FOR MATERIALS AT VARIOUS TEMPERATURES” table or other sources. All of the charts contained herein are based on use of tubing having the “worst” tolerance conditions allowed for that particular material.

Example 1

Suppose that you want to know the maximum allowable working pressure of 304 S. ST. seamless, ASTM A-213, ¼” O.D. by .035 wall tubing at a temperature of 100° F. This information can be directly obtained from the table “MAXIMUM ALLOWABLE WORKING PRESSURE – 304 STAINLESS STEEL” or calculated as follows:

First Find the factor (K) corresponding to ¼” O.D. × 0.035 wall on the “CALCULATION FACTOR TABLE”.

$$K = 0.2753$$

Second Find the allowable stress (S_A) for seamless 304 stainless steel tubing at 100° F on the “MAXIMUM ALLOWABLE STRESS VALUES FOR MATERIALS AT VARIOUS TEMPERATURES”.

$$S_A = 18,750 \text{ psi}$$

Third According to “CALCULATION FACTOR TABLE”, Maximum Allowable Working Pressure (P_A) = Factor (K) × Maximum Allowable Stress (S_A) Value in psi

$$\text{Therefore: } P_A = K \times S_A \\ P_A = 0.2753 \times 18,750 \text{ psi}$$

$P_A = 5161 \text{ psi}$ (Max. Allowable Working Pressure at 100° F)

Example 2

Suppose that you want to know the maximum allowable working pressure of 304 stainless steel seamless, ASTM A-213, 6mm O.D. by 1.2mm wall tubing at a temperature of 38° C. This information can be directly obtained from the table “MAXIMUM ALLOWABLE WORKING PRESSURE – 304 STAINLESS STEEL” or calculated as follows:

First Find the factor (K) corresponding to 6mm O.D. × 1.2mm wall on the “CALCULATION FACTOR TABLE”.

$$K = 0.4112$$

Second Find the allowable stress (S_A) for seamless 304 stainless steel tubing at 38° C on the “MAXIMUM ALLOWABLE STRESS VALUES FOR MATERIALS AT VARIOUS TEMPERATURES”.

$$S_A = 18,750 \text{ psi}$$

Third According to “CALCULATION FACTOR TABLE”, Maximum Allowable Working Pressure (P_A) = Factor (K) × Maximum Allowable Stress (S_A) Value in psi × 0.06895

$$\text{Therefore: } P_A = K \times S_A \times 0.06895 \\ P_A = .4112 \times 18,750 \text{ psi} \times 0.06895$$

$P_A = 532 \text{ bar}$ (Max. Allowable Working Pressure at 38° C)

CAUTION: Limited test data is available on certain materials, including HASTELLOY®, INCONEL®, 2205 Duplex, and 254 SMO. In such applications, further testing either by HOKE® or by the user is recommended to assure fitting suitability for the application.

Maximum Allowable Stress Values for Materials at Various Temperatures

Values in ksi (psi=ksi × 1000)

TEMPERATURE		COPPER	TYPE 304			TYPE 316		MONEL® 400	INCONEL® 600
°F	°C	SEAMLESS ANNEALED TUBING SPEC ASTM B-75	SEAMLESS ANNEALED TUBING SPEC ASTM A-213	WELDED ANNEALED TUBING SPEC ASTM A-249	SEAMLESS ANNEALED TUBING SPEC ASTM A-213	WELDED ANNEALED TUBING SPEC ASTM A-249	SEAMLESS ANNEALED TUBING SPEC ASTM B-165	SEAMLESS ANNEALED TUBING SPEC ASTM B-167	
-20 to +100	-29 to +38	6.0	18.75	15.9	18.7	16	17.5	20.0	
150	66	5.1	18.27	15.5	18.7	16	16.95	20.0	
200	93	4.8	17.8	15.1	18.7	16	16.4	20.0	
250	121	4.8	17.2	14.6	18.	15.8	15.9	20.0	
300	149	4.7	16.6	14.1	18.4	15.6	15.4	20.0	
350	177	4.0	16.4	13.9	18.2	15.5	15.1	20.0	
400	204	3.0	16.2	13.8	18.0	15.3	14.8	20.0	
450	232		16.0	13.6	18.0	15.3	14.7	20.0	
500	260		15.9	13.5	18.0	15.3	14.7	20.0	
550	288		15.9	13.5	17.5	14.9	14.7	20.0	
600	316		15.9	13.5	17.0	14.5	14.7	20.0	
650	343		15.9	13.5	16.7	14.2	14.7	20.0	
700	371		15.9	13.5	16.3	13.9	14.7	20.0	
750	399		15.6	13.3	16.1	13.7	14.6	20.0	
800	427		15.2	12.9	15.8	13.4	14.2	20.0	
850	454		14.9	12.7	15.7	13.4	11.0	19.6	
900	482		14.7	12.5	15.6	13.3	8.0	16.0	
950	510		14.4	12.2	15.4	13.1		10.6	
1000	538		14.1	12.0	15.3	13.0		7.0	
1050	566		12.4	10.5	15.1	12.8		4.5	
1100	593		9.8	8.3	12.4	10.5		3.0	
1200	649		6.1	5.2	7.4	6.3		2.0	
1250	677		4.7	4.0	5.5	4.7			
1300	704		3.7	3.2	4.1	3.5			
1350	732		2.9	2.5	3.1	2.6			
1400	760		2.3	2.0	2.3	2.0			
1450	788		1.8	1.5	1.7	1.5			
1500	815		1.4	1.2	1.3	1.1			
Min. Tensile Strength (ksi) @ 100° F	Min Tensile Strength (ksi) @ 38° C	30	75	75	75	75	70	80	
Min. Yield Strength (ksi) @ 100° F	Min Yield Strength (ksi) @ 38° C	9	30	30	30	30	28	35	

Maximum Allowable Stress Values for Materials at Various Temperatures

Values in ksi (psi=ksi × 1000)

TEMPERATURE		HASTELLOY® C-276		254 SMO	2205 DUPLEX	2507 SUPER DUPLEX	TITANIUM GRADE 2	
°F	°C	SEAMLESS SOLUTION ANNEALED TUBING SPEC ASTM B-622	WELDED SOLUTION ANNEALED TUBING SPEC ASTM B-626	SEAMLESS SOLUTION TREATED TUBING SPEC. ASTM A-269	SEAMLESS SOLUTION TREATED TUBING SPEC. ASTM A-789	SEAMLESS SOLUTION TREATED TUBING SPEC. ASTM A-789	SEAMLESS ANNEALED TUBING SPEC. ASTM B-338	WELDED ANNEALED TUBING SPEC. ASTM B-338
-20 to +100	-29 to +38	25	21.25	23.5	22.5	29.0	12.5	10.6
150	66	25	21.25	23.5	22.5	29.0	12.0	10.2
200	93	25	21.25	23.5	22.5	28.9	10.9	9.3
250	121	25	21.25	22.95	22.1	28.1	9.9	8.4
300	149	25	21.25	22.4	21.7	27.3	9.0	7.7
350	177	24.65	20.95	21.85	21.3	26.9	8.4	7.1
400	204	24.3	20.7	21.3	20.9	26.4	7.7	6.5
450	232	24.1	20.5	20.9	20.65	26.2	7.2	6.1
500	260	23.9	20.3	20.5	20.4	25.9	6.6	5.6
550	288	23.7	20.15	20.3	20.3	25.8	6.2	5.3
600	316	23.5	20	20.1	20.2	25.8	5.7	4.8
650	343	23.3	19.8	19.9				
700	371	23.1	19.6	19.9				
750	399	22.9	19.5	19.8				
800	427	22.8	19.4					
850	454	22.6	19.2					
900	482	22.3	18.9					
950	510	22.1	18.8					
1000	538	21.8	18.5					
1050	566	18.5	15.7					
1100	593	15	12.7					
1200	649	9.8	8.3					
1250	677	7.8	6.6					
1300	704							
1350	732							
1400	760							
1450	788							
1500	815							
Min. Tensile Strength (ksi) @ 100° F	Min. Tensile Strength (ksi) @ 38° C	100	100	94	90		50	50
Min. Yield Strength (ksi) @ 100° F	Min. Yield Strength (ksi) @ 38° C	41	41	44	65		40	40

Allowable stress values extracted from ASME Boiler and Pressure Vessels Code Section II Part D and ASME B31.3 Process Piping with permission of the publisher ASME.

Tubing Data Charts

Stainless Steel Calculation Factor Tables

For gas service, select a wall thickness that is **not** shaded (see Gas Service, page 1).

TUBING O.D. (inch)	WALL THICKNESS (inch)																
	0.010	0.012	0.016	0.020	0.028	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.134	0.148	0.156	0.180	0.188
1/16	0.3035	0.3733	0.5238	0.6910													
1/8					0.4585	0.5851											
3/16					0.2942	0.3791	0.5492										
1/4					0.2155	0.2753	0.4033	0.5493									
3/8					0.1405	0.1781	0.2566	0.3533	0.4631								
1/2						0.1316	0.1882	0.2559	0.3363	0.3922							
5/8							0.1486	0.2010	0.2625	0.3050	0.3574						
3/4							0.1227	0.1654	0.2152	0.2494	0.2904	0.3235					
7/8							0.1045	0.1406	0.1824	0.2110	0.2451	0.2725					
1								0.1220	0.1579	0.1824	0.2115	0.2349					
1 1/4									0.1249	0.1440	0.1666	0.1847	0.2080	0.2318	0.2455	0.2876	
1 1/2										0.1189	0.1374	0.1522	0.1711	0.1904	0.2015	0.2354	0.2469
2										0.0872	0.1006	0.1112	0.1248	0.1386	0.1465	0.1706	0.1787

For gas service, select a wall thickness that is **not** shaded (see Gas Service, page 1).

TUBING O.D. (mm)	WALL THICKNESS (mm)													
	0.5	0.6	0.7	0.8	1.0	1.2	1.5	1.6	1.8	2.0	2.2	2.5	3.0	4.0
3	0.3285	0.4039	0.4790	0.5543	0.7009									
4	0.2406	0.2944	0.3504	0.4075	0.5213	0.6341								
6			0.2252	0.2607	0.3346	0.4112	0.5259	0.5642						
8			0.1659	0.1914	0.2439	0.2985	0.3846	0.4131						
10				0.1512	0.1919	0.2339	0.2993	0.3219	0.3686	0.4143				
12				0.1250	0.1582	0.1922	0.2450	0.2631	0.2999	0.3377				
14					0.1345	0.1632	0.2074	0.2224	0.2530	0.2844	0.3164	0.3665		
15					0.1252	0.1517	0.1926	0.2065	0.2347	0.2635	0.2930	0.3398		
16						0.1418	0.1798	0.1927	0.2189	0.2456	0.2728	0.3147	0.3873	
18						0.1253	0.1586	0.1699	0.1928	0.2161	0.2398	0.2761	0.3388	
20						0.1123	0.1420	0.1520	0.1723	0.1929	0.2139	0.2459	0.3010	
22						0.1017	0.1284	0.1375	0.1557	0.1742	0.1930	0.2217	0.2708	
25								0.1203	0.1361	0.1522	0.1684	0.1931	0.2354	
28										0.1348	0.1491	0.1708	0.2078	0.2849
30										0.1254	0.1386	0.1587	0.1929	0.2640
32										0.1172	0.1296	0.1483	0.1801	0.2460
38												0.1238	0.1500	0.2041
50													0.1125	0.1523

Factors to left of heavy black line were calculated using the “Boardman Formula”, those to the right were calculated using the “Lamé Formula”.

Chart Factors have been established per “ASME Boiler and Pressure Vessel Code, Section VIII, UG-27 and Appendix 1, and ASME B31.3, Process Piping, Par. 304.1.2

For factor tables of other materials, contact HOKE® or your local distributor.

Tubing Data Charts

Copper Annealed Seamless Tubing

ASTM B-75 or Equal, Maximum Recommended Hardness HR_F 55

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 6,000 psi between -20° F and 100° F

For Welded Tubing

For welded tubing, a derating factor must be applied for weld integrity.

- 1) For double-welded tubing, multiply working pressure by 0.85.
- 2) For single-welded tubing, multiply working pressure by 0.80.

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 6,000 psi (41.3 MPa).

For gas service, select a wall thickness that is not shaded (see Gas Service on page 1).

TUBING O.D. (inch)	WALL THICKNESS (inch)														
	0.014	0.020	0.028	0.032	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.134	0.148	0.156	0.180
1/16	2800	4000													
1/8			2800	3300	3700										
3/16			1800	2100	2300	3400									
1/4			1300	1500	1600	2400	3400								
3/8				900	1000	1500	2100	2800							
1/2					700	1100	1500	2000							
5/8					600	800	1200	1500	1800						
3/4					500	700	900	1200	1500	1700					
7/8					400	600	800	1000	1200	1400					
1					300	500	700	900	1100	1200	1400				
1 1/4							500	700	800	1000	1100	1200	1300	1400	1700
1 1/2							400	600	700	800	900	1000	1100	1200	1400
2							300	400	500	600	600	700	800	800	1000

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 41.3 MPa between -29° C and 38° C

For Welded Tubing

For welded tubing, a derating factor must be applied for weld integrity.

- 1) For double-welded tubing, multiply working pressure by 0.85.
- 2) For single-welded tubing, multiply working pressure by 0.80.

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 6,000 psi (41.3 MPa).

For gas service, select a wall thickness that is not shaded (see Gas Service on page 1).

TUBING O.D. (mm)	WALL THICKNESS (mm)									
	0.8	1	1.2	1.5	1.8	2	2.2	2.5	3	4.0
3	240									
4	170	220	280							
6	100	140	170	220						
8	80	100	120	160						
10	60	80	90	120	150	170				
12	50	60	80	100	120	140				
14		50	60	80	100	110	130	150		
15		50	60	80	90	100	120	140		
16		40	50	70	90	100	110	130	160	
18		40	50	60	80	80	90	110	140	
20		30	40	50	70	80	80	100	120	
22		30	40	50	60	70	80	90	110	
25		30	30	40	50	60	60	80	90	
28		20	30	40	50	50	60	70	80	110
30						50	50	60	80	100
32						40	50	60	70	100
38								50	60	80

Ordering Information

High quality, fully annealed seamless tubing, ASTM B75 and EN 1057 or equivalent. Tubing to be free of scratches and suitable for bending. Secondary mechanical finishing is prohibited.

Tubing Data Charts

304 & 316 Stainless Steel Annealed Seamless Tubing

ASTM A-269 UNS S31600 or Equal, Maximum Recommended Hardness HR^B 90

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 20,000 psi between -20° F and 100° F

For Welded Tubing

For welded tubing, a derating factor must be applied for weld integrity.

- 1) For double-welded tubing, multiply working pressure by 0.85.
- 2) For single-welded tubing, multiply working pressure by 0.80.

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 20,000 psi (137.9 MPa).

For gas service, select a wall thickness that is not shaded (see Gas Service on page 1).

GYROLOK-XP® fittings are intended for use where pressures are indicated with the “XP” subscript.

Tubing is suitable for use with either 316 stainless steel or 254 SMO GYROLOK® fittings.

TUBING O.D. (inch)	WALL THICKNESS (inch)														
	0.010	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	0.180
1/16	5800	7100	9800	12600											
1/8					8900	11400									
3/16					5600	7300	10700								
1/4					4100	5300	7800	10700							
3/8						3400	5000	6800	7800						
1/2						2600	3700	5100	6700						
5/8							2900	4000	5300	6200					
3/4							2400	3300	4300	5000	5900				
7/8							2000	2800	3600	4200	4900				
1								2400	3100	3600	4200	4700			
1 1/4									2500 _{xp}	2800 _{xp}	3300 _{xp}	3700 _{xp}	4100 _{xp}	4900 _{xp}	
1 1/2										2300 _{xp}	2700 _{xp}	3000 _{xp}	3400 _{xp}	4000 _{xp}	4700 _{xp}
2											2000 _{xp}	2200 _{xp}	2500 _{xp}	2900 _{xp}	3400 _{xp}

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 137.9 MPa between -29° C and 38° C

For Welded Tubing

For welded tubing, a derating factor must be applied for weld integrity.

- 1) For double-welded tubing, multiply working pressure by 0.85.
- 2) For single-welded tubing, multiply working pressure by 0.80.

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 20,000 psi (137.9 MPa).

For gas service, select a wall thickness that is not shaded (see Gas Service on page 1).

GYROLOK-XP® fittings are intended for use where pressures are indicated with the “XP” subscript.

Tubing is suitable for use with either 316 stainless steel or 254 SMO GYROLOK® fittings.

TUBING O.D. (mm)	WALL THICKNESS (mm)									
	0.8	1	1.2	1.5	1.8	2	2.2	2.5	3	4.0
3	710									
4		760								
6	360	470	570	730						
8		328	413	551						
10		260	320	410	510	570				
12		220	260	340	410	470				
14		169	212	283	352	400	448			
15		159	201	262	324	366	414			
16			180	243	307	349	379	424		
18			170	220	260	290	330	380		
20			150	190	230	260	290	340		
22			140	169	212	234	262	303		
25					180	210	230	260	320	
28						180 _{xp}	200 _{xp}	230 _{xp}	280 _{xp}	
30						170 _{xp}	190 _{xp}	220 _{xp}	260 _{xp}	
32						160 _{xp}	170 _{xp}	200 _{xp}	240 _{xp}	340 _{xp}
38							170 _{xp}	200 _{xp}	280 _{xp}	

Ordering Information

High quality, fully annealed (Type 304, 304/304L, 316, 316/316L, 317, 317/317L) seamless tubing, ASTM A269 or equivalent. Tubing to be free of scratches and suitable for bending. Secondary mechanical finishing is prohibited.

Tubing Data Charts

6MO

ASTM A-269 UNS S31254 or Equal, Maximum Recommended Hardness HR^B 90

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 27,100 psi between -20° F and 100° F

For Welded Tubing

For welded tubing, a derating factor must be applied for weld integrity.

- 1) For double-welded tubing, multiply working pressure by 0.85.
- 2) For single-welded tubing, multiply working pressure by 0.80.

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 27,100 psi (186.9 MPa).

For gas service, select a wall thickness that is not shaded (see Gas Service on page 1).

GYROLOK-XP® fittings are intended for use where pressures are indicated with the “XP” subscript.

Tubing is suitable for use with either 316 stainless steel or 254 SMO GYROLOK® fittings.

TUBING O.D. (inch)	WALL THICKNESS (inch)							
	0.020	0.028	0.035	0.049	0.065	0.083	0.109	0.134
1/4	3200	4900	6300	9300				
3/8			4000	5800	8000			
1/2			3500	5100	6900	9100		
5/8				3600	4900	5900		
3/4				3000	4000	4900		
7/8				2500	3400	4250		
1					2900	3600		
1 1/4							4500 _{xp}	
1 1/2								4600 _{xp}

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 186.9 MPa between -29° C and 38° C

For Welded Tubing

For welded tubing, a derating factor must be applied for weld integrity.

- 1) For double-welded tubing, multiply working pressure by 0.85.
- 2) For single-welded tubing, multiply working pressure by 0.80.

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 186.9 MPa (27,100 psi).

For gas service, select a wall thickness that is not shaded (see Gas Service on page 1).

GYROLOK-XP® fittings are intended for use where pressures are indicated with the “XP” subscript.

Tubing is suitable for use with either 316 stainless steel or 254 SMO GYROLOK® fittings.

TUBING O.D. (mm)	WALL THICKNESS (mm)							
	0.8	1	1.2	1.5	1.8	2	2.5	3
3	550	724						
6	490	630	780	1000 _{xp}				
8		380	470	607				
10		360	440	560	690	780 _{xp}		
12		290	360	460	560	630 _{xp}		
14			270	340	420	455		
15			250	320	390	421		
16			230	300	360	393		
18			230	290	360	400 _{xp}		
20			210	260	320	360	460 _{xp}	
22				210	260	290		
25					250	280	360	440 _{xp}
38								280 _{xp}

Ordering Information: High quality, fully annealed 6 MO tubing, ASTM A269 or equivalent. Tubing to be free of scratches, and suitable for bending. Secondary mechanical finishing is prohibited.

Tubing Data Charts

HASTELLOY® C-276 Solution Annealed Seamless Tubing

ASTM B622 UNS N10276 or Equivalent, Maximum Recommended Hardness HRB 98

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 27,300 psi between -20° F and 400° F

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 27,300 psi (188.2 MPa).

TUBING O.D. (inch)	WALL THICKNESS (inch)				
	0.010	0.028	0.035	0.049	0.065
1/16	8700				
1/8			9700		
1/4		5100	6500	11,300	
3/8			4100	6000	8300
1/2			3600	5100	7000
5/8				3800	
3/4					4100
1					2900

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 188.2 MPa between -29° C and 204° C

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 188.2 MPa (27,300 psi).

TUBING O.D. (mm)	WALL THICKNESS (mm)					
	0.8	1.0	1.2	1.5	2.0	2.5
3		890				
6	490	640				
8		401	497			
10			440	560		
12				460		
18					400	
25					220	350

Ordering Information

High quality, fully seamless alloy C-276 tubing, ASTM B622 or equivalent. Tubing to be free of scratches and suitable for bending. Secondary mechanical finishing is prohibited.

Tubing Data Charts

MONEL® 400 (Nickel-Copper) Annealed Seamless Tubing

ASTM B-165 UNS N04400 or Equivalent, Maximum Recommended Hardness HRB 75

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 18,700 psi between -20° F and 100° F

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 18,700 psi (128.9 MPa).

TUBING O.D. (inch)	WALL THICKNESS (inch)			
	0.035	0.049	0.065	0.083
1/8	12100			
1/4		7300	9900	
3/8		4500	6300	
1/2		3300	4600	6100
5/8			2700	
3/4		2200	3000	
1			2200	

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 128.9 MPa between -29° C and 38° C

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 128.9 MPa (18,700 psi).

TUBING O.D. (mm)	WALL THICKNESS (mm)					
	0.8	1.0	1.2	1.5	2.0	2.5
3		890				
6	433	550				
8		401	497			
10			391	497		
12				365		
18					370	
25					220	350

Ordering Information

High quality, fully seamless alloy C-276 tubing, ASTM B622 or equivalent. Tubing to be free of scratches and suitable for bending. Secondary mechanical finishing is prohibited.

Tubing Data Charts

Grade 2 Titanium Annealed Seamless Tubing

ASTM B-338 UNS R50400 or Equivalent, Maximum Recommended Hardness HRB 90

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 16,700 psi between -20° F and 100° F

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 16,700 psi (115.1 MPa). For working pressure in accordance with ASME B31.1, multiply by 0.85.

TUBING O.D. (inch)	WALL THICKNESS (inch)			
	0.028	0.035	0.049	0.065
1/8		10500		
1/4	3600	4600	6800	9600
3/8		3000	4300	5900
1/2		2200	3100	4300
3/4				2700
1				2000

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 115.1 MPa between -29° C and 38° C

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 115.1 MPa (16,700 psi).

TUBING O.D. (mm)	WALL THICKNESS (mm)					
	0.8	1.0	1.2	1.5	2.0	2.5
6	300	390	480	610		
10		220	270	340	490	
12		180	220	280	390	
14					330	
16				210		
18				150	250	
20					220	280
25				130	170	220

Ordering Information

High quality, fully annealed seamless grade 2 titanium, ASTM B338 or equivalent.
Tubing to be free of scratches and suitable for bending. Secondary mechanical finishing is prohibited.

Tubing Data Charts

2507 Super Duplex Stainless Steel Solution Treated Seamless Tubing

ASTM A789 UNS S32750 or Equivalent, Maximum Recommended Hardness HRC 32

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 36,300 psi between -20° F and 200° F

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 36,300 psi (250.3 MPa).

TUBING O.D. (inch)	WALL THICKNESS (inch)		
	0.035	0.049	0.065
¼	10000		
⅜	6500	9100	
½	4800	6800	
⅝		5800	
¾		4700	6300
1			4400

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 250.3 MPa psi between -29° C and 93° C

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 250.3 MPa (36,300 psi).

GYROLOK-XP® fittings are intended for use where pressures are indicated with the “XP” subscript.

TUBING O.D. (mm)	WALL THICKNESS (mm)					
	1.0	1.5	1.8	2	2.5	3.0
6	850 _{xp}					
10	480 _{xp}	750 _{xp}				
12	390 _{xp}	610 _{xp}	750 _{xp}	850 _{xp}		
18		390 _{xp}	480 _{xp}	540 _{xp}		
20		350 _{xp}	430 _{xp}	610 _{xp}		
25		280 _{xp}	340 _{xp}	380 _{xp}	480 _{xp}	590 _{xp}

Ordering Information

High quality, fully annealed seamless 2507 super duplex tubing, ASTM A789 or equivalent. Tubing to be free of scratches and suitable for bending. Secondary mechanical finishing is prohibited.

Tubing Data Charts

INCONEL® 625 Nickel Alloy Seamless Tubing

ASTM B-444 UNS N06625 or Equivalent

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 26,700 psi between -20° F and 200° F

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 26,700 psi (184.1 MPa).

TUBING O.D. (inch)	WALL THICKNESS (inch)			
	0.035	0.049	0.065	0.083
¼	7600	11200		
⅜	4800	7100	9800	
½	3500	5000	6800	9000
¾			4300	

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 184.1 MPa psi between -28° C and 93° C

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 184.1 MPa (26,700 psi).

GYROLOK-XP® fittings are intended for use where pressures are indicated with the “XP” subscript.

TUBING O.D. (mm)	WALL THICKNESS (mm)				
	1.0	1.2	1.5	2.0	2.5
6	620 _{xp}				
10	350 _{xp}	430 _{xp}	550 _{xp}		
12	290 _{xp}	350 _{xp}	450 _{xp}		
18			290 _{xp}		
20			260 _{xp}	350 _{xp}	

Ordering Information

High quality, fully annealed seamless alloy 625 tubing, ASTM B444 or equivalent.

Tubing to be free of scratches and suitable for bending. Secondary mechanical finishing is prohibited.

INCOLOY® 825 Nickel Alloy Seamless Tubing

ASTM B-423 UNS N08825 or Equivalent

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 23,300 psi between -20° F and 100° F

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 23,300 psi (160.6 MPa).

TUBING O.D. (inch)	WALL THICKNESS (inch)			
	0.035	0.049	0.065	0.083
¼	6600	9800	14200	
⅜	4200	6100	8500	
½	3000	4400	6000	
¾			2230	5000
1			2900	3600

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 160.6 MPa psi between -29° C and 38° C

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 160.6 MPa (23,300 psi).

GYROLOK-XP® fittings are intended for use where pressures are indicated with the “XP” subscript.

TUBING O.D. (mm)	WALL THICKNESS (mm)				
	0.8	1.0	1.2	1.5	2.0
6		540 _{xp}	670 _{xp}	880 _{xp}	
10				480 _{xp}	

Ordering Information

High quality, fully annealed seamless alloy 825 tubing, ASTM B423 or equivalent.

Tubing to be free of scratches and suitable for bending. Secondary mechanical finishing is prohibited.

Tubing Data Charts

2205 Duplex Stainless Steel Solution Treated Seamless Tubing

ASTM A-789 UNS S31803 or Equivalent, Maximum Recommended Hardness HRc 30.5

Maximum Working Pressure (psi) for Fractional Sizes

Allowable Stress = 30,000 psi between -20° F and 200° F

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 30,000 psi (206.8 MPa). For working pressure in accordance with ASME B31.1 multiply by 0.85.

TUBING O.D. (inch)	WALL THICKNESS (inch)				
	0.020	0.028	0.035	0.049	0.065
¼	4300	6300	8100		
⅜		4000	5100	7500	
½		3100	3900	5600	7700
¾			3100	4400	6000

Maximum Working Pressure (bar) for Metric Sizes

Allowable Stress = 206.8 MPa psi between -29° C and 93° C

Allowable working pressures are calculated based on equations from ASME B31.1 and ASME B31.3 for a maximum allowable stress (S) of 206.8 MPa (30,000 psi). For working pressure in accordance with ASME B31.1 multiply by 0.85.

GYROLOK-XP® fittings are intended for use where pressures are indicated with the “XP” subscript.

TUBING O.D. (mm)	WALL THICKNESS (mm)				
	0.8	1.0	1.2	1.5	2.0
10	297	379	469	607	
12	241	310	379	490	
14		276	338	434	
15		255	310	400	
16		241	290	372	
18		207	255	324	
25				230 _{xp}	310 _{xp}

Ordering Information

High quality, fully annealed seamless 2205 duplex tubing, ASTM A789 or equivalent. Tubing to be free of scratches and suitable for bending. Secondary mechanical finishing is prohibited.

Tubing Tolerances

Copper ASTM B-75 (B-251 & B-251m)

O.D.	Tolerance
Up to 1/8" inclusive	±0.002"
Over 1/8"-5/8" inclusive	±0.002"
Over 5/8"-1" inclusive	±0.0025"
Over 1"-2" inclusive	±0.003"
Up to 3mm	±0.05mm
Over 3-16mm inclusive	±0.05mm
Over 16-25mm inclusive	±0.06mm
Over 25-51mm inclusive	±0.08mm

Wall Thickness Tolerance (inch)

Wall Thickness	1/32-1/8" inclusive	Over 1/8-5/8" inclusive	Over 5/8-1" inclusive	Over 1-2" inclusive
Up to 0.017" inclusive	±0.002"	±0.001"	±0.0015"	±0.002"
Over 0.017-0.024" inclusive	±0.003"	±0.002"	±0.002"	±0.0025"
Over 0.024-0.034" inclusive	±0.003"	±0.0025"	±0.0025"	±0.003"
Over 0.034-0.057" inclusive	±0.003"	±0.003"	±0.0035"	±0.0035"
Over 0.057-0.082" inclusive	—	±0.0035"	±0.004"	±0.004"
Over 0.082-0.119" inclusive	—	±0.004"	±0.005"	±0.005"
Over 0.119-0.164" inclusive	—	±0.005"	±0.006"	±0.006"

Wall Thickness Tolerance (mm)

Wall Thickness	0.80-3.0mm inclusive	Over 3.0-16mm inclusive	Over 16-25mm inclusive	Over 25-51mm inclusive
Over 0.40-0.60mm inclusive	±0.08mm	±0.05mm	±0.04mm	±0.06mm
Over 0.60-0.90mm inclusive	±0.08mm	±0.06mm	±0.06mm	±0.08mm
Over 0.90-1.5mm inclusive	±0.08mm	±0.08mm	±0.09mm	±0.09mm
Over 1.5-2.0mm inclusive	—	±0.09mm	±0.10mm	±0.10mm

304 and 316 Stainless Steel ASTM A-213 & A-249/A-249m (A-450) 254 SMO Stainless Steel ASTM A-269

O.D.	O.D. Tolerance	Wall Thickness Tolerance
Under 1" (25.4mm)	±0.004" (0.1mm)	Seamless (sizes ≤ 1 1/2") ±10%
1-1 1/2" (25.4-38.1mm)	±0.006" (0.15mm)	Seamless (sizes > 1 1/2") ±11%
Over 1 1/2-2" (38.1-50.8mm)	±0.008" (0.2mm)	Welded (all sizes) ±9%

2205 Duplex Stainless Steel ASTM A-789/A-789m & 2507 Super Duplex

O.D.	O.D. Tolerance	Wall Thickness Tolerance
Up to 1/2" (12.7mm) exclusive	±0.005" (0.13mm)	±15%
1/2-1 1/2" (12.7-38.1mm) exclusive	±0.005" (0.13mm)	±10%
1 1/2-2" (38.1-50.8mm) inclusive	±0.010" (0.2mm)	±10%

MONEL® 400 ASTM B-165 & INCONEL® 600 ASTM B-167

O.D.	O.D. Tolerance	Wall Thickness Tolerance
Over 0.400-5/8" (10-16mm) exclusive	±0.005" (0.13mm)	±15%
5/8-1 1/2" (16-38.1mm) inclusive	±0.0075" (0.19mm)	±10%
Over 1 1/2-2" (38.1-50.8mm) inclusive	±0.010" (0.25mm)	±10%

Tubing Tolerances

HASTELLOY® C-276 ASTM B-622 (Seamless)

O.D.	O.D. Tolerance	Wall Thickness Tolerance
0.500– $\frac{5}{8}$ " (12.7–15.9mm) inclusive	±0.005" (0.13mm)	±12½%
Over $\frac{5}{8}$ –1½" (15.9–38.1mm) inclusive	±0.0075" (0.19mm)	±10%
Over 1½–2" (38.1–50.8mm) inclusive	±0.010" (0.25mm)	±10%

HASTELLOY® C-276 ASTM B-622 (Welded)

O.D.	O.D. Tolerance	Wall Thickness Tolerance
Over $\frac{1}{8}$ – $\frac{5}{8}$ " (3.2–16mm) inclusive	±0.005" (0.13mm)	±15%
Over $\frac{5}{8}$ –1½" (16–38.1mm) inclusive	±0.0075" (0.19mm)	±12½%
Over 1½–2" (38.1–50.8mm) inclusive	±0.010" (0.25mm)	±12½%

Titanium ASTM B-338

O.D.	O.D. Tolerance	Wall Thickness Tolerance
Up to 1" (25.4mm) exclusive	±0.004" (0.102mm)	±10%
1–1½" (25.4–38.1mm) exclusive	±0.005" (0.127mm)	±10%
1½–2" (38.1–50.8mm) exclusive	±0.006" (0.152mm)	±10%
2" (50.8mm) inclusive	±0.007" (0.178mm)	±10%

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