Stainless Steel Tubing Pressure Ratings

<u>Pressure Ratings, Stainless Steel Tubing</u> for Hydraulic System Applications

The following chart lists the nominal pressure ratings for seamless or welded and drawn, fully annealed stainless steel tubing products conforming to ASTM A213, ASTM A249 or ASTM A269 respectively.

. These pressure ratings are derived from the Lamé formula with 18,800 psi (130MPa) allowable stress factors and approximately 4:1 design factor. Pressure

values shown in bold are for tubing wall thickness normally considered suitable for 37 degree single flaring to SAE J533. Many factors influence the pressure at which a hydraulic system will perform satisfactorily. The values shown below should not be used as a standard or specification and are not to be construed as guaranteed minimums.

Note: Pressure ratings are based on ASME B31.1 1998, TP304 and TP316 Maximum Allowable Stress values, -20° to 100° F.

Nomina	al Tube					Nomin	al Tube	Wall Thi	ckness				
O.D.		0.028	0.035	0.049	0.065	0.083	0.093	0.109	0.120	0.134	0.148	0.156	0.188
inch mm		0.71mm	0.89mm	1.24mm	1.65mm	2.11mm	2.41mm	2.77mm	3.05mm	3.40mm	3.76mm	3.96mm	4.78mm
					Reference	Working	 Pressures	at 4:1 Des	sign Facto	r(psi/MPa))		
0.125		10002	12709							- (I			
	3.18	69.2	88.0										
0.188		6392	8197										
	4.77	44.4	56.4										
0.250		4662	5941	8648	11731								
	6.35	32.3	40.6	59.4	81.2								
0.312		3685	4662	6768	9250								
	7.92	25.3	32.3	46.6	63.9								
0.375		3008	3835	5490	7520								
	9.53	20.8	26.5	37.6	51.9								
0.500			2782	4061	5490			9701					
	12.70		19.3	28.0	37.6								
0.625			2256	3158	4286								
	15.88		15.6	21.8	29.5		45.1	52.6					
0.750			1805	2632	3534								
	19.05		12.5	18.0	24.4								
0.875			1579	2256	3008								
4 000	22.23		10.8	15.6	20.8						0047		
1.000	05.40		1354	1955	2632							1	
4.405	25.40		9.3	13.5	18.0			30.8			43.6	1	
1.125	00.50			1730	2331								
4.050	28.58			11.9	15.9								420
1.250	24.75			1504	2030								
1.500	31.75			10.4	14.0 1730		21.4 2557	24.4 2933					
1.500	38.10				1730			2933					
1.750	30.10				1429								
1.750	44.45				9.9								
2.000	44.45				1278								
2.000	50.80				8.9								

<u>Calculation of Design Pressures for Alternate Tubing Materials</u>

Design pressures for alternate tubing materials may be calculated using the Lamé formula as follows:

$P=S((D^2-d^2)/(D^2+d^2))$ where:

D= nominal outside diameter of tubing d= nominal inside diameter of tubing

P= design pressure

S= allowable fiber stress of material at 4:1 design factor

Design stress and temperature derating factors for typical hydraulic system tubing materials and temperature ranges are listed below. Derating factors for TP304 and TP316 are derived from ASME B31.1-1998 Edition. Carbon steel tubing in these temperature ranges do not require derating.

Tubing	S= Allowable Fiber	Temperature Derating				
Material	Stress@ 25% UTS					
	Design Factor=4:1	Temp.	SS304	SS316		
C-1010	12,500 psi / 86MPa	100°F	1.00	1.00		
C-1021	15,000 psi / 103 MPa	200°F	0.84	0.86		
8630 GR	17,800 psi / 123 MPa	300°F	0.75	0.78		
TP304	18,800 psi / 130MPa	400°F	0.69	0.71		
TP316	18,800 psi / 130MPa	500°F	0.65	0.66		



<u>Pressure Ratings, Steel Tubing for General</u> Hydraulic System Applications

The following chart lists the nominal pressure ratings of tubing products which conform to SAE J524, SAE J525, SAE J526 and SAE J356. These pressure ratings are derived from the Lamé formula with 12,500 psi (86 MPa) allowable stress factors and approximately 4:1 design factor. Pressure values shown in bold are for tubing wall

thickness normally considered suitable for 37 degree single flaring to SAE J533. Many factors influence the pressure at which a hydraulic system will perform satisfactorily. The values shown below should not be used as a standard or specification and are not to be construed as guaranteed minimums.

Note: For single flaring to SAE J533, SAE J524 or J525 tubing is recommended. For double flaring applications, tubing to SAE J 524, J525, J526 or J356 may be used.

Nominal Tube			Nominal Tube Wall Thickness										
O.D.		0.028	0.035	0.049	0.065	0.083	0.093	0.109	0.120	0.134	0.148	0.156	0.188
inch	mm	0.71mm	0.89mm	1.24mm	1.65mm	2.11mm	2.41mm	2.77mm	3.05mm	3.40mm	3.76mm	3.96mm	4.78mm
					Reference	Working	Pressures	at 4·1 Dec	sign Facto	r(psi/MPa)			
0.125		6650	8450		T C T C T C T C C	- Working	licoouico	ut 4.1 Dc.		 			
0.120	3.18	46.0	58.5										
0.188	0110	4250	5450										
01100	4.77	29.5	37.5										
0.250		3100	3950	5750	7800								
	6.35	21.5	27.0	39.5	54.0								
0.312		2450	3100	4500	6150								
	7.92	16.8	21.5	31.0	42.5								
0.375		2000	2550	3650	5000	6550	7600						
	9.53	13.8	17.6	25.0	34.5	45.0	52.5						
0.500			1850	2700	3650	4800	5550	6450	7200				
	12.70		12.8	18.6	25.0	33.0	38.5	44.5	49.5				
0.625			1500	2100	2850	3750	4350	5050	5600				
	15.88		10.4	14.5	19.6	26.0	30.0	35.0	38.5				
0.750			1200	1750	2350	3050	3550	4150	4600				
	19.05		8.3	12.0	16.2	21.0	24.5	28.5	31.5				
0.875			1050	1500	2000	2600	3000	3500	3900				
	22.23		7.2	10.4	13.8	18.0	20.5	24.0	27.0				
1.000			900	1300	1750	2250	2600	3000	3350	3800	4200		
	25.40		6.2	9.0	12.0	15.5	18.0	20.5	23.0	26.0	29.0		
1.125				1150	1550	2000	2300	2650	2950	3300	3700		
	28.58			7.9	10.6	13.8	15.8	18.2	20.5	23.0	25.5		
1.250				1000	1350	1750	2050	2350	2650	2950	3300	3500	4300
	31.75			6.9	9.3	12.0	14.2	16.2	18.2	20.5	23.0	24.0	29.5
1.500					1150	1450	1700	1950	2150	2450	2700	2850	3500
	38.10				7.9	10.0	11.8	13.5	14.8	16.8	18.6	19.6	24.0
1.750					950	1250	1450	1650	1850	2050	2300	2400	2950
	44.45				6.6	8.6	10.0	11.4	12.8	14.2	15.8	16.6	20.5
2.000					850	1100	1250	1450	1600	1800	2000	2100	2550
	50.80				5.9	7.6	8.6	10.0	11.0	12.4	13.8	14.5	17.6

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Design stress and temperature derating factors for typical hydraulic system tubing materials and temperature ranges are listed below. Derating factors for SS-304 and SS-316 are derived from ASME B31.1-1998 Edition. Carbon steel tubing in these temperature ranges do not require derating.

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Material	Stress@ 25% UTS					
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SS-304	18,800 psi / 130MPa	400°F	0.69	0.71		
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