

Maximum A325 and A490 Bolt Loads at a Glance

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SEVERAL REQUESTS have been received for additional tables to those that appeared in the author's article "Maximum A325 Bolt Loads at a Glance", *Engineering Journal*, October 1967, page 143. The published tables covered only $\frac{3}{4}$ - and $\frac{7}{8}$ -in. diameter bolts, for both single shear and double shear connections. The specific requests were for including the one-inch diameter size bolts and for similar tables using A490 steel bolts.

For convenience the original tables are repeated; however, the reader's attention is called to the minor adjustments in nearly all bolt loads in order to conform with the more precise allowable bearing values given in the 1969 AISC Specification. The allowable bearing on base material is now

stated in tenths of a kip, whereas the previous specification gave the corresponding values in half-kips.

The identification of type connections (whether friction or bearing with bolt threads excluded from shear planes) is in accordance with the simplified designation adopted for the new Seventh Edition AISC Manual of Steel Construction. Suffixes are added to the bolt ASTM designation as follows:

- F for Friction type connection
- N for bearing type connection with bolt threads included in a shear plane
- X for bearing type connection with bolt threads excluded in all shear planes

Readers are referred to the original article for the logic, if not apparent, for using the maximum allowable bolt load for each condition.

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Table 1. Allowable SINGLE SHEAR Loads in Kips for 3/4-in. Dia. A325 Bolts										
F _y , ksi		36	42	45	46	50	55	60	65	
Material Thickness, In.	F _p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8	
	0.27									
	0.26	9.48			For all values in this shaded area, use 9.72 kips. A325-X					
	0.250 (1/4)	9.11								
	0.24	8.75								
	0.23	8.38								
	0.22	8.02	9.36							
	0.21	7.65	8.93	9.58						
	0.20	7.29	8.50	9.12	9.31					
	0.19	6.93	8.08	8.66	8.85	9.62				
	0.1875 (3/16)	6.83	7.97	8.55	8.73	9.49				
	0.18		7.65	8.21	8.38	9.11				
	0.17		7.23	7.75	7.92	8.61	9.47			
	0.16		6.80	7.30	7.45	8.10	8.92			
	0.15			6.84	6.99	7.59	8.36	9.11		
	0.14					7.09	7.80	8.50	9.22	
	0.13						7.24	7.90	8.56	
	0.125 (1/8)		For all values in this shaded area, use 6.63 kips. (No paint on contact surfaces) A325-F					6.97	7.59	8.23
	0.12							6.69	7.29	7.90
	0.11								6.68	7.24
	0.10									
0.001	0.036	0.043	0.046	0.047	0.051	0.056	0.061	0.066		

Table 2. Allowable SINGLE SHEAR Loads in Kips for 7/8-in. Dia. A325 Bolts								
F_y , ksi	36	42	45	46	50	55	60	65
F_p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	0.32							
	0.3125 ($\frac{5}{16}$)	13.18						
	0.30	12.76						
	0.29	12.33						
	0.28	11.91						
	0.27	11.48						
	0.26	11.06	12.90					
	0.250 ($\frac{1}{4}$)	10.63	12.40					
	0.24	10.21	11.91	12.77	13.04			
	0.23	9.78	11.41	12.24	12.50			
	0.22	9.36	10.91	11.70	11.95	12.99		
	0.21		10.42	11.17	11.41	12.40		
	0.20		9.92	10.64	10.87	11.81	13.00	
	0.19		9.43	10.11	10.32	11.22	12.35	
	0.1875 ($\frac{3}{16}$)		9.30	9.97	10.19	11.07	12.19	
	0.18			9.58	9.78	10.63	11.70	12.76
	0.17			9.04	9.24	10.04	11.05	12.05
	0.16					9.45	10.40	11.34
	0.15						9.75	10.63
	0.14						9.10	9.92
	0.13						9.21	9.99
	0.125 ($\frac{1}{8}$)							9.60
	0.12							9.22
	0.11							
	0.001	0.043	0.050	0.053	0.054	0.059	0.065	0.077

Table 3. Allowable SINGLE SHEAR Loads in Kips for 1-in. Dia. A325 Bolts								
F_y , ksi	36	42	45	46	50	55	60	65
F_p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	0.36							
	0.35	17.01						
	0.34	16.52						
	0.33	16.04						
	0.32	15.55						
	0.3125 ($\frac{5}{16}$)	15.19						
	0.31	15.07						
	0.30	14.58	17.01					
	0.29	14.09	16.44					
	0.28	13.61	15.88	17.02				
	0.27	13.12	15.31	16.42	16.77			
	0.26	12.64	14.74	15.81	16.15			
	0.250 ($\frac{1}{4}$)	12.15	14.17	15.20	15.52	16.87		
	0.24		13.61	14.59	14.90	16.20		
	0.23		13.04	13.98	14.28	15.52	17.09	
	0.22		12.47	13.38	13.66	14.85	16.35	
	0.21		11.91	12.77	13.04	14.17	15.60	17.01
	0.20			12.16	12.42	13.50	14.86	16.20
	0.19				11.80	12.82	14.12	15.39
	0.1875 ($\frac{3}{16}$)					12.66	13.93	15.19
	0.18				12.15	13.37	14.58	15.80
	0.17					12.63	13.77	14.93
	0.16					11.89	12.96	14.05
	0.15						12.15	13.17
	0.14							12.29
	0.13							
	0.001	0.049	0.057	0.061	0.062	0.067	0.074	0.088

Table 4. Allowable DOUBLE SHEAR Loads in Kips for 3/4-in. Dia. A325 Bolts								
F _y , ksi	36	42	45	46	50	55	60	65
F _p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	0.54							
	0.53	19.32						
	0.52	18.95						
	0.51	18.59						
	0.500 (1/2)	18.22						
	0.49	17.86						
	0.48	17.50						
	0.47	17.13						
	0.46	16.77						
	0.45	16.40	19.14					
	0.44	16.04	18.71					
	0.4375 (7/16)	15.95	18.60					
	0.43	15.67	18.29					
	0.42	15.31	17.86	19.15				
	0.41	14.94	17.44	18.70	19.10			
	0.40	14.58	17.01	18.24	18.63			
	0.39	14.22	16.58	17.78	18.16			
	0.38	13.85	16.16	17.33	17.70	19.24		
	0.375 (3/8)	13.67	15.95	17.10	17.47	18.98		
	0.37	13.49	15.73	16.87	17.23	18.73		
	0.36		15.31	16.42	16.77	18.22		
	0.35		14.88	15.96	16.30	17.72		
	0.34		14.46	15.50	15.84	17.21	18.95	
	0.33		14.03	15.05	15.37	16.71	18.39	
	0.32		13.61	14.59	14.90	16.20	17.83	
	0.3125 (5/16)		13.29	14.25	14.55	15.82	17.41	18.98
	0.31			14.14	14.44	15.69	17.27	18.83
	0.30			13.68	13.97	15.19	16.72	18.22
	0.29				13.51	14.68	16.16	17.62
	0.28				14.17	15.60	17.01	19.10
	0.27				13.67	15.05	16.40	17.78
	0.26					14.49	15.79	17.12
	0.250 (1/4)					13.93	15.19	16.46
	0.24					13.37	14.58	15.80
	0.23						13.97	15.15
	0.22						13.36	14.49
	0.21							13.83
	0.20							
	0.001	0.036	0.043	0.046	0.047	0.051	0.056	0.066

Table 5. Allowable DOUBLE SHEAR Loads in Kips for 7/8-in. Dia. A325 Bolts									
	F _y , ksi	36	42	45	46	50	55	60	65
	F _p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	0.625 ($\frac{5}{8}$)								
	0.62	26.37							
	0.61	25.94							
	0.60	25.51							
	0.59	25.09							
	0.58	24.66							
	0.57	24.24							
	0.5625 ($\frac{9}{16}$)	23.92							
	0.56	23.81							
	0.55	23.39							
	0.54	22.96							
	0.53	22.54	26.29						
	0.52	22.11	25.80						
	0.51	21.69	25.30						
	0.500 ($\frac{1}{2}$)	21.26	24.81						
	0.49	20.84	24.31	26.07					
	0.48	20.41	23.81	25.54	26.08				
	0.47	19.99	23.32	25.00	25.54				
	0.46	19.56	22.82	24.47	25.00				
	0.45	19.14	22.33	23.94	24.45				
	0.44	18.71	21.83	23.41	23.91	25.99			
	0.4375 ($\frac{7}{16}$)	18.60	21.71	23.27	23.77	25.84			
	0.43	18.29	21.33	22.88	23.37	25.40			
	0.42		20.84	22.34	22.82	24.81			
	0.41		20.34	21.81	22.28	24.22			
	0.40		19.84	21.28	21.73	23.62	26.00		
	0.39		19.35	20.75	21.19	23.03	25.35		
	0.38		18.85	20.22	20.65	22.44	24.70		
	0.375 ($\frac{3}{8}$)		18.60	19.95	20.38	22.15	24.38		
	0.37		18.36	19.68	20.10	21.85	24.05	26.22	
	0.36			19.15	19.56	21.26	23.40	25.51	
	0.35			18.62	19.02	20.67	22.75	24.81	
	0.34			18.09	18.47	20.08	22.10	24.10	26.12
	0.33					19.49	21.45	23.39	25.35
	0.32					18.90	20.80	22.68	24.58
	0.3125 ($\frac{5}{16}$)					18.46	20.32	22.15	24.00
	0.31					18.31	20.15	21.97	23.82
	0.30						19.50	21.26	23.05
	0.29						18.85	20.55	22.28
	0.28						18.20	19.84	21.51
	0.27							19.14	20.74
	0.26							18.43	19.97
	0.250 ($\frac{1}{4}$)								19.21
	0.24								18.44
	0.23								
	0.001	0.043	0.050	0.053	0.054	0.059	0.065	0.071	0.077

Table 6. Allowable DOUBLE SHEAR Loads in Kips for 1-in. Dia. A325 Bolts								
F _p , ksi	36	42	45	46	50	55	60	65
F _p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	0.72							
	0.71	34.51						
	0.70	34.02						
	0.69	33.53						
	0.6875 ($\frac{11}{16}$)	33.41						
	0.68	33.05						
	0.67	32.56						
	0.66	32.08						
	0.65	31.59						
	0.64	31.10						
	0.63	30.62						
	0.625 ($\frac{5}{8}$)	30.37						
	0.62	30.13						
	0.61	29.65						
	0.60	29.16	34.02					
	0.59	28.67	33.45					
	0.58	28.19	32.89					
	0.57	27.70	32.32					
	0.5625 ($\frac{9}{16}$)	27.34	31.89	34.20				
	0.56	27.22	31.75	34.05				
	0.55	26.73	31.18	33.44	34.15			
	0.54	26.24	30.62	32.83	33.53			
	0.53	25.76	30.05	32.22	32.91			
	0.52	25.27	29.48	31.62	32.29			
	0.51	24.79	28.92	31.01	31.67	34.42		
	0.500 ($\frac{1}{2}$)	24.30	28.35	30.40	31.05	33.75		
	0.49	23.81	27.78	29.79	30.43	33.07		
	0.48		27.22	29.18	29.81	32.40		
	0.47		26.65	28.58	29.19	31.72		
	0.46		26.08	27.94	28.57	31.05	34.18	
	0.45		25.51	27.36	27.95	30.37	33.43	
	0.44		24.95	26.75	27.32	29.70	32.69	
	0.4375 ($\frac{7}{16}$)		24.81	26.60	27.17	29.53	32.51	
	0.43		24.38	26.14	26.70	29.02	31.95	
	0.42		23.81	25.54	26.08	28.35	31.21	34.02
	0.41			24.93	25.46	27.67	30.46	33.21
	0.40			24.32	24.84	27.00	29.72	32.40
	0.39			23.71	24.22	26.32	28.98	31.59
	0.38				23.60	25.65	28.23	30.78
	0.375 ($\frac{3}{8}$)					25.31	27.86	30.37
	0.37					24.97	27.49	29.97
	0.36					24.30	26.75	29.16
	0.35					23.62	26.00	28.35
	0.34						25.26	27.54
	0.33						24.52	26.73
	0.32						23.78	25.92
	0.3125 ($\frac{5}{16}$)							25.31
	0.31							25.11
	0.30							24.30
	0.29							
	0.28							24.58
	0.27							23.71
	0.26							
	0.001	0.049	0.057	0.061	0.062	0.067	0.074	0.081
								0.088

Table 7. Allowable SINGLE SHEAR Loads in Kips for 3/4-in. Dia. A490 Bolts										
F _y , ksi		36	42	45	46	50	55	60	65	
F _u , ksi		48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8	
Material Thickness, In.	0.39			For all values in this shaded area, use 14.14 kips. A490-X						
	0.38	13.85								
	0.375 (3/8)	13.67								
	0.37	13.49								
	0.36	13.12								
	0.35	12.76								
	0.34	12.39								
	0.33	12.03	14.03							
	0.32	11.66	13.61							
	0.3125 (5/16)	11.39	13.29							
	0.31	11.30	13.18	14.14						
	0.30	10.93	12.76	13.68	13.97					
	0.29	10.57	12.33	13.22	13.51					
	0.28	10.21	11.91	12.77	13.04					
	0.27	9.84	11.48	12.31	12.58	13.67				
	0.26	9.48	11.06	11.86	12.11	13.16				
	0.250 (1/4)	9.11	10.63	11.40	11.64	12.66	13.93			
	0.24		10.21	10.94	11.18	12.15	13.37			
	0.23		9.78	10.49	10.71	11.64	12.82	13.97		
	0.22		9.36	10.03	10.25	11.14	12.26	13.36		
	0.21		8.93	9.58	9.78	10.63	11.70	12.76	13.83	
	0.20			9.12	9.31	10.12	11.14	12.15	13.17	
	0.19				8.85	9.62	10.59	11.54	12.51	
	0.1875 (3/16)					9.49	10.45	11.39	12.35	
	0.18					9.11	10.03	10.93	11.85	
	0.17		For all values in this shaded area, use 8.84 kips. (No paint on contact surfaces) A490-F					9.47	10.33	11.19
	0.16							8.92	9.72	10.54
	0.15								9.11	9.88
	0.14									9.22
	0.13									
	0.001	0.036	0.043	0.046	0.047	0.051	0.056	0.061	0.066	

Table 8. Allowable SINGLE SHEAR Loads in Kips for 7/8-in. Dia. A490 Bolts								
F _p , ksi	36	42	45	46	50	55	60	65
F _p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	0.46							
	0.45	19.14						
	0.44	18.71						
	0.4375 (7/16)	18.60						
	0.43	18.29						
	0.42	17.86						
	0.41	17.44						
	0.40	17.01						
	0.39	16.58						
	0.38	16.16	18.85					
	0.375 (3/8)	15.95	18.60					
	0.37	15.73	18.36					
	0.36	15.31	17.86	19.15				
	0.35	14.88	17.36	18.62	19.02			
	0.34	14.46	16.87	18.09	18.47			
	0.33	14.03	16.37	17.56	17.93			
	0.32	13.61	15.88	17.02	17.39	18.90		
	0.3125 (5/16)	13.29	15.50	16.62	16.98	18.46		
	0.31	13.18	15.38	16.49	16.84	18.31		
	0.30	12.76	14.88	15.96	16.30	17.72		
	0.29	12.33	14.39	15.43	15.76	17.13	18.85	
	0.28		13.89	14.90	15.21	16.54	18.20	
	0.27		13.40	14.36	14.67	15.95	17.55	19.14
	0.26		12.90	13.83	14.13	15.36	16.90	18.43
	0.250 (1/4)		12.40	13.30	13.58	14.77	16.25	17.72
								19.21
	0.24			12.77	13.04	14.17	15.60	17.01
	0.23			12.24	12.50	13.58	14.95	16.30
	0.22					12.99	14.30	15.59
	0.21					12.40	13.65	14.88
	0.20						13.00	14.17
								15.36
	0.19						12.35	13.47
	0.1875 (3/16)						12.19	13.29
	0.18							12.76
	0.17							12.05
	0.16							12.29
	0.15							
	0.001	0.043	0.050	0.053	0.054	0.059	0.065	0.071
								0.077

Table 9. Allowable SINGLE SHEAR Loads in Kips for 1-in. Dia. A490 Bolts								
F _y , ksi	36	42	45	46	50	55	60	65
F _p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	0.52							
	0.51	24.79						
	0.500 (1/2)	24.30						
	0.49	23.81						
	0.48	23.33						
	0.47	22.84						
	0.46	22.36						
	0.45	21.87						
	0.44	21.38	24.95					
	0.4375 (7/16)	21.26	24.81					
	0.43	20.90	24.38					
	0.42	20.41	23.81					
	0.41	19.93	23.25	24.93				
	0.40	19.44	22.68	24.32	24.84			
	0.39	18.95	22.11	23.71	24.22			
	0.38	18.47	21.55	23.10	23.60			
	0.375 (3/8)	18.22	21.26	22.80	23.29			
	0.37	17.98	20.98	22.50	22.98	24.97		
	0.36	17.50	20.41	21.89	22.36	24.30		
	0.35	17.01	19.84	21.28	21.73	23.62		
	0.34	16.52	19.28	20.67	21.11	22.95		
	0.33	16.04	18.71	20.06	20.49	22.27	24.52	
	0.32		18.14	19.46	19.87	21.60	23.78	
	0.3125 (5/16)		17.72	19.00	19.41	21.09	23.22	25.31
	0.31		17.58	18.85	19.25	20.92	23.03	25.11
	0.30		17.01	18.24	18.63	20.25	22.29	24.30
	0.29		16.44	17.63	18.01	19.57	21.55	23.49
	0.28		15.88	17.02	17.39	18.90	20.80	22.68
	0.27			16.42	16.77	18.22	20.06	21.87
	0.26			15.81	16.15	17.55	19.32	21.06
	0.250 (1/4)					16.87	18.57	20.25
	0.24					16.20	17.83	19.44
	0.23						17.09	18.63
	0.22						16.35	17.82
	0.21							17.01
	0.20							16.20
	0.19							16.68
	0.1875 (3/16)							16.46
	0.18							15.80
	0.17							
	0.001	0.049	0.057	0.061	0.062	0.067	0.074	0.088

Table 10. Allowable DOUBLE SHEAR Loads in Kips for 3/4-in. Dia. A490 Bolts								
F _v , ksi	36	42	45	46	50	55	60	65
F _p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	0.78							
	0.77	28.07						
	0.76	27.70						
	0.750 (3/4)	27.34						
	0.74	26.97						
	0.73	26.61						
	0.72	26.24						
	0.71	25.88						
	0.70	25.51						
	0.69	25.15						
	0.6875 (11/16)	25.06						
	0.68	24.79						
	0.67	24.42						
	0.66	24.06	28.07					
	0.65	23.69	27.64					
	0.64	23.33	27.22					
	0.63	22.96	26.79					
	0.625 (5/8)	22.78	26.58					
	0.62	22.60	26.37	28.27				
	0.61	22.23	25.94	27.82				
	0.60	21.87	25.51	27.36	27.94			
	0.59	21.51	25.09	26.90	27.48			
	0.58	21.14	24.66	26.45	27.01			
	0.57	20.78	24.24	25.99	26.55			
	0.5625 (9/16)	20.50	23.92	25.65	26.20			
	0.56	20.41	23.81	25.54	26.08			
	0.55	20.05	23.39	25.08	25.62	27.84		
	0.54	19.68	22.96	24.62	25.15	27.34		
	0.53	19.32	22.54	24.17	24.68	26.83		
	0.52	18.95	22.11	23.71	24.21	26.32		
	0.51	18.59	21.69	23.26	23.75	25.82		
	0.500 (1/2)	18.22	21.26	22.80	23.29	25.31	27.86	
	0.49	17.86	20.84	22.34	22.82	24.81	27.31	
	0.48		20.41	21.89	22.36	24.30	26.75	
	0.47		19.99	21.43	21.89	23.79	26.19	
	0.46		19.56	20.98	21.42	23.29	25.63	27.94
	0.45		19.14	20.52	20.96	22.78	25.08	27.34
	0.44		18.71	20.06	20.49	22.27	24.52	26.73
	0.4375 (7/16)		18.60	19.95	20.38	22.15	24.38	26.58
	0.43		18.29	19.61	20.03	21.77	23.96	26.12
	0.42		17.86	19.15	19.56	21.26	23.40	25.51
	0.41			18.70	19.10	20.76	22.85	24.91
	0.40			18.24	18.63	20.25	22.29	24.30
	0.39			17.78	18.16	19.74	21.73	23.69
	0.38				17.70	19.24	21.18	23.08
	0.375 (3/8)					18.98	20.90	22.78
	0.37					18.73	20.62	22.48
	0.36					18.22	20.06	21.87
	0.35					17.72	19.50	21.26
	0.34						18.95	20.65
	0.33						18.39	20.05
	0.32						17.83	19.44
	0.3125 (5/16)							18.98
	0.31							18.83
	0.30							18.22
	0.29							19.10
	0.28							18.44
	0.27							17.78
	0.26							
	0.001	0.036	0.043	0.046	0.047	0.051	0.056	0.061
								0.066

Table 11. Allowable DOUBLE SHEAR Loads in Kips for 7/8-in. Dia. A490 Bolts									
Material Thickness, In.	F _y , ksi	36	42	45	46	50	55	60	65
	F _p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
	0.91								
	0.90	38.27							
	0.89	37.85							
	0.88	37.42							
	0.875 (7/8)	37.21							
	0.87	37.00		For all values in this shaded area, use 38.48 kips. A490-X					
	0.86	36.57							
	0.85	36.15							
	0.84	35.72							
	0.83	35.30							
	0.82	34.87							
	0.8125 (13/16)	34.55							
	0.81	34.45							
	0.80	34.02							
	0.79	33.59							
	0.78	33.17							
	0.77	32.74	38.20						
	0.76	32.32	37.71						
	0.750 (3/4)	31.89	37.21						
	0.74	31.47	36.71						
	0.73	31.04	36.22						
	0.72	30.62	35.72	38.30					
	0.71	30.19	35.22	37.77					
	0.70	29.77	34.73	37.24	38.04				
	0.69	29.34	34.23	36.71	37.49				
	0.6875 (11/16)	29.24	34.11	36.57	37.36				
	0.68	28.92	33.74	36.18	36.95				
	0.67	28.49	33.24	35.64	36.41				
	0.66	28.07	32.74	35.11	35.86				
	0.65	27.64	32.25	34.58	35.32	38.39			
	0.64	27.22	31.75	34.05	34.78	37.80			
	0.63	26.79	31.26	33.52	34.23	37.21			
	0.625 (5/8)	26.58	31.01	33.25	33.96	36.91			
	0.62	26.37	30.76	32.98	33.69	36.62			
	0.61	25.94	30.26	32.45	33.15	36.03			
	0.60	25.51	29.77	31.92	32.60	35.44			
	0.59	25.09	29.27	31.39	32.06	34.85	38.36		
	0.58	24.66	28.78	30.86	31.52	34.26	37.71		
	0.57	24.24	28.28	30.32	30.97	33.67	37.06		
	0.5625 (9/16)		27.91	29.92	30.56	33.22	36.57		
	0.56		27.78	29.79	30.43	33.07	36.41		
	0.55		27.29	29.26	29.89	32.48	35.76		
	0.54		26.79	28.73	29.34	31.89	35.11	38.27	
	0.53		26.29	28.20	28.80	31.30	34.46	37.56	
	0.52		25.80	27.66	28.26	30.71	33.81	36.85	
	0.001	0.043	0.050	0.053	0.054	0.059	0.065	0.071	0.077

Table 11 continued next page

Table 11 (Continued)									
F _y , ksi		36	42	45	46	50	55	60	65
F _p , ksi		48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	0.51		25.30	27.13	27.71	30.12	33.16	36.15	
	0.500 (1/2)		24.81	26.60	27.17	29.53	32.51	35.44	38.41
	0.49		24.31	26.07	26.63	28.94	31.86	34.73	37.64
	0.48			25.54	26.08	28.35	31.21	34.02	36.88
	0.47			25.00	25.54	27.76	30.56	33.31	36.11
	0.46			24.47	25.00	27.17	29.91	32.60	35.34
	0.45				24.45	26.58	29.26	31.89	34.57
	0.44					25.99	28.61	31.18	33.80
	0.4375 (7/16)					25.84	28.44	31.01	33.61
	0.43					25.40	27.96	30.48	33.03
	0.42					24.81	27.31	29.77	32.27
	0.41					24.22	26.66	29.06	31.50
	0.40						26.00	28.35	30.73
	0.39						25.35	27.64	29.96
	0.38						24.70	26.93	29.19
	0.375 (3/8)						24.38	26.58	28.81
	0.37							26.22	28.43
	0.36							25.51	27.66
	0.35							24.81	26.89
	0.34							24.10	26.12
	0.33								25.35
	0.32								24.58
	0.3125 (5/16)								
	0.001	0.043	0.050	0.053	0.054	0.059	0.065	0.071	0.077

Table 12. Allowable DOUBLE SHEAR Loads in Kips for 1-in. Dia. A490 Bolts								
F _y , ksi	36	42	45	46	50	55	60	65
F _p , ksi	48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8
Material Thickness, In.	1.04							
	1.03	50.06						
	1.02	49.57						
	1.01	49.09						
	1.000 (1)	48.60						
	0.99	48.11	For all values in this shaded area, use 50.27 kips. A490-X					
	0.98	47.63						
	0.97	47.14						
	0.96	46.66						
	0.95	46.17						
	0.94	45.68						
	0.9375 (15/16)	45.56						
	0.93	45.20						
	0.92	44.71						
	0.91	44.23						
	0.90	43.74						
	0.89	43.25						
	0.88	42.77	49.90					
	0.875 (7/8)	42.52	49.61					
	0.87	42.28	49.33					
	0.86	41.80	48.76					
	0.85	41.31	48.19					
	0.84	40.82	47.63					
	0.83	40.34	47.06					
	0.82	39.85	46.49	49.86				
	0.8125 (13/16)	39.49	46.07	49.40				
	0.81	39.37	45.93	49.25				
	0.80	38.88	45.36	48.64	49.68			
	0.79	38.39	44.79	48.03	49.06			
	0.78	37.91	44.23	47.42	48.44			
	0.77	37.42	43.66	46.82	47.82			
	0.76	36.94	43.09	46.21	47.20			
	0.750 (3/4)	36.45	42.52	45.60	46.57			
	0.74	35.96	41.96	44.99	45.95	49.95		
	0.73	35.48	41.39	44.38	45.33	49.27		
	0.72	34.99	40.82	43.78	44.71	48.60		
	0.71	34.51	40.26	43.17	44.09	47.92		
	0.70	34.02	39.69	42.56	43.47	47.25		
	0.69	33.53	39.12	41.95	42.85	46.57		
	0.6875 (11/16)	33.41	38.98	41.80	42.69	46.41		
	0.68	33.05	38.56	41.34	42.23	45.90		
	0.67	32.56	37.99	40.74	41.61	45.22	49.78	
	0.66	32.08	37.42	40.13	40.99	44.55	49.04	
	0.65	31.59	36.85	39.52	40.36	43.87	48.29	
	0.64		36.29	38.91	39.74	43.20	47.55	
	0.001	0.049	0.057	0.061	0.062	0.067	0.074	0.081
								0.088

Table 12 continued next page

Table 12 (Continued)										
F _p , ksi		36	42	45	46	50	55	60	65	
F _p , ksi		48.6	56.7	60.8	62.1	67.5	74.3	81.0	87.8	
Material Thickness, In.	0.63		35.72	38.30	39.12	42.52	46.81			
	0.625 ($\frac{5}{8}$)		35.44	38.00	38.81	42.19	46.44			
	0.62		35.15	37.70	38.50	41.85	46.07	50.22		
	0.61		34.59	37.09	37.88	41.17	45.32	49.41		
	0.60		34.02	36.48	37.26	40.50	44.58	48.60		
	0.59		33.45	35.87	36.64	39.82	43.84	47.79		
	0.58		32.89	35.26	36.02	39.15	43.09	46.98		
	0.57		32.32	34.66	35.40	38.47	42.35	46.17	50.05	
	0.5625 ($\frac{9}{16}$)		31.89	34.20	34.93	37.97	41.79	45.56	49.39	
	0.56		31.75	34.05	34.78	37.80	41.61	45.36	49.17	
	0.55			33.44	34.15	37.12	40.86	44.55	48.29	
	0.54			32.83	33.53	36.45	40.12	43.74	47.41	
	0.53			32.22	32.91	35.77	39.38	42.93	46.53	
	0.52			31.62	32.29	35.10	38.64	42.12	45.66	
	0.51				31.67	34.42	37.89	41.31	44.78	
	0.500 ($\frac{1}{2}$)					33.75	37.15	40.50	43.90	
	0.49					33.07	36.41	39.69	43.02	
	0.48					32.40	35.66	38.88	42.14	
	0.47					31.72	34.92	38.07	41.27	
	0.46						34.18	37.26	40.39	
	0.45						33.43	36.45	39.51	
	0.44						32.69	35.64	38.63	
	0.4375 ($\frac{7}{16}$)						32.51	35.44	38.41	
	0.43						31.95	34.83	37.75	
	0.42							34.02	36.88	
	0.41			For all values in this shaded area, use 31.42 kips. (No paint on contact surfaces) A490-F					33.21	36.00
	0.40								32.40	35.12
	0.39								31.59	34.24
	0.38									33.36
	0.375 ($\frac{3}{8}$)									32.92
	0.37								32.49	
	0.36								31.61	
	0.35									
	0.001	0.049	0.057	0.061	0.062	0.067	0.074	0.081	0.088	