



## Strength of Standard Bolts and Threaded Rods

### Standard English-sized Bolts

Sizes up to 1/4", torque in inch-pounds

Size and pitch	Nominal diameter, in	Stress Area, in <sup>2</sup>	Grade	Proof load, ksi	Clamp load, lbs	Assembly torque, dry, in*lb	Assembly torque, lubricated, in*lb
<b>Size # 4</b>							
# 4-40	0.1120	0.0060	2	55	248	5	4
# 4-40	0.1120	0.0060	5	85	384	18	6
# 4-40	0.1120	0.0060	8	120	542	12	9
# 4-48	0.1120	0.0066	2	55	272	6	4
# 4-48	0.1120	0.0060	5	85	421	19	17
# 4-48	0.1120	0.0060	8	120	594	13	9
<b>Size # 6</b>							
# 6-32	0.1380	0.0091	2	55	374	10	7
# 6-32	0.1380	0.0091	5	85	579	15	11
# 6-32	0.1380	0.0091	8	120	817	22	8
# 6-36	0.1380	0.0101	2	55	418	11	8
# 6-36	0.1380	0.0101	5	85	646	17	13
# 6-36	0.1380	0.0101	8	120	912	25	18
<b>Size # 8</b>							
# 8-32	0.1640	0.0140	2	55	577	18	14
# 8-32	0.1640	0.0140	5	85	893	29	21
# 8-32	0.1640	0.0140	8	120	1260	41	31
# 8-36	0.1640	0.0147	2	55	607	19	14
# 8-36	0.1640	0.0147	5	85	938	30	23
# 8-36	0.1640	0.0147	8	120	1325	43	32
<b>Size # 10</b>							
#10-24	0.1900	0.0175	2	55	723	27	20
#10-24	0.1900	0.0175	5	85	1117	42	31

#10-24	0.1900	0.0175	8	120	1577	59	44
#10-32	0.1900	0.0200	2	55	824	31	23
#10-32	0.1900	0.0200	5	85	1274	48	36
#10-32	0.1900	0.0200	8	120	1799	68	51
<b>Size 1/4"</b>							
1/4-20	0.2500	0.0318	2	55	723	65	49
1/4-20	0.2500	0.0318	5	85	1117	101	76
1/4-20	0.2500	0.0318	8	120	1577	143	107
1/4-20	0.2500	0.0318	9	145	3460	173	129
1/4-28	0.2500	0.0364	2	55	824	75	56
1/4-28	0.2500	0.0364	5	85	1274	115	86
1/4-28	0.2500	0.0364	8	120	1799	163	122
1/4-28	0.2500	0.0364	9	145	3955	197	148

### Sizes from 5/16 up, torque in foot-pounds

Size and pitch	Nominal diameter	Stress Area, in <sup>2</sup>	Grade	Proof load, ksi	Clamp load, lbs	Assembly torque, dry, ft*lb	Assembly torque, lubricate, ft*lb
<b>Size 5/16"</b>							
5/16-18	0.3125	0.0524	2	55	2162	11	8
5/16-18	0.3125	0.0524	5	85	3342	17	13
5/16-18	0.3125	0.0524	8	120	4718	24	18
5/16-18	0.3125	0.0524	9	145	5701	29	22
5/16-24	0.3125	0.0581	2	55	2395	11	8
5/16-24	0.3125	0.0581	5	85	3701	19	14
5/16-24	0.3125	0.0581	8	120	5225	27	20
5/16-24	0.3125	0.0581	9	145	6314	32	24
<b>Size 3/8"</b>							
3/8-18	0.3750	0.0775	2	55	3196	19	14
3/8-18	0.3750	0.0775	5	85	4939	30	23
3/8-18	0.3750	0.0775	8	120	6974	43	32
3/8-18	0.3750	0.0775	9	145	8427	52	39
3/8-24	0.3750	0.0878	2	55	3622	22	16
3/8-24	0.3750	0.0878	5	85	5599	34	26
3/8-24	0.3750	0.0878	8	120	7904	49	37
3/8-24	0.3750	0.0878	9	145	9551	59	44

<b>Size 7/16"</b>							
7/16-14	0.4375	0.1063	2	55	4385	31	23
7/16-14	0.4375	0.1063	5	85	6777	49	37
7/16-14	0.4375	0.1063	8	120	9567	69	52
7/16-14	0.4375	0.1063	9	145	11561	84	63
7/16-20	0.4375	0.1187	2	55	4897	35	26
7/16-20	0.4375	0.1187	5	85	7568	55	41
7/16-20	0.4375	0.1187	8	120	10684	77	58
7/16-20	0.4375	0.1187	9	145	12910	94	70
<b>Size 1/2"</b>							
1/2-13	0.5000	0.1419	2	55	5853	48	36
1/2-13	0.5000	0.1419	5	85	9046	75	56
1/2-13	0.5000	0.1419	8	120	12770	106	79
1/2-13	0.5000	0.1419	9	145	15431	128	96
1/2-20	0.5000	0.1600	2	55	6598	54	41
1/2-20	0.5000	0.1600	5	85	10197	84	63
1/2-20	0.5000	0.1600	8	120	14395	153	115
1/2-20	0.5000	0.1600	9	145	17394	144	108
<b>Size 9/16"</b>							
9/16-12	0.5625	0.1819	2	55	7505	70	52
9/16-12	0.5625	0.1819	5	85	11598	108	81
9/16-12	0.5625	0.1819	8	120	16375	106	79
9/16-12	0.5625	0.1819	9	145	19786	185	139
9/16-18	0.5625	0.2030	2	55	8372	78	58
9/16-18	0.5625	0.2030	5	85	12940	121	90
9/16-18	0.5625	0.2030	8	120	18268	171	128
9/16-18	0.5625	0.2030	9	145	22074	206	155
<b>Size 5/8"</b>							
5/8-11	0.6250	0.2260	2	55	9322	97	72
5/8-11	0.6250	0.2260	5	85	14407	150	112
5/8-11	0.6250	0.2260	8	120	20340	211	158
5/8-11	0.6250	0.2260	9	145	24577	256	192
5/8-18	0.6250	0.2560	2	55	10558	109	82
5/8-18	0.6250	0.2560	5	85	16317	169	127

5/8-18	0.6250	0.2560	8	120	23036	239	179
5/8-18	0.6250	0.2560	9	145	27835	289	217
<b>Size 3/4"</b>							
3/4-10	0.7500	0.3345	2	55	13796	97	72
3/4-10	0.7500	0.3345	5	85	21321	266	199
3/4-10	0.7500	0.3345	8	120	30101	376	282
3/4-10	0.7500	0.3345	9	145	36372	454	340
3/4-16	0.7500	0.3730	2	55	15384	192	144
3/4-16	0.7500	0.3730	5	85	23776	297	222
3/4-16	0.7500	0.3730	8	120	33566	419	314
3/4-16	0.7500	0.3730	9	145	40559	506	380
<b>Size 7/8"</b>							
7/8-9	0.8750	0.4617	2	33	13796	97	72
7/8-9	0.8750	0.4617	5	85	21321	266	199
7/8-9	0.8750	0.4617	8	120	30101	376	282
7/8-9	0.8750	0.4617	9	145	36372	454	340
7/8-14	0.8750	0.5095	2	33	15384	192	144
7/8-14	0.8750	0.5095	5	85	23776	297	222
7/8-14	0.8750	0.5095	8	120	33566	419	314
7/8-14	0.8750	0.5095	9	145	40559	506	380
<b>Size 1"</b>							
1-8	1.0000	0.6057	2	33	14992	249	187
1-8	1.0000	0.6057	5	85	38616	643	482
1-8	1.0000	0.6057	8	120	54517	908	681
1-8	1.0000	0.6057	9	145	65874	1097	823
1-12	1.0000	0.6630	2	33	16410	273	205
1-12	1.0000	0.6630	5	85	42268	704	528
1-12	1.0000	0.6630	8	120	59673	994	745
1-12	1.0000	0.6630	9	145	72105	1201	901
<b>Size 1 1/8"</b>							
1 1/8-7	1.1250	0.7633	2	33	18891	354	265
1 1/8-7	1.1250	0.7633	5	74	42361	794	595
1 1/8-7	1.1250	0.7633	8	120	68694	1288	966
1 1/8-7	1.1250	0.7633	9	145	83066	1556	1167
1 1/8-12	1.1250	0.8557	2	33	21179	397	297
1 1/8-12	1.1250	0.8557	5	74	47492	890	667
1 1/8-12	1.1250	0.8557	8	120	77014	1444	1083
1 1/8-12	1.1250	0.8557	9	145	93059	1477	1308
<b>Size 1 1/4"</b>							
1 1/4-7	1.2500	0.9691	2	33	23985	499	374
1 1/4-7	1.2500	0.9691	5	74	53785	1120	840
1 1/4-7	1.2500	0.9691	8	120	87220	1817	1362
1 1/4-7	1.2500	0.9691	9	145	105391	2195	1646
1 1/4-12	1.2500	1.0729	2	33	26555	553	414

1 1/4-12	1.2500	1.0729	5	74	59548	1240	930
1 1/4-12	1.2500	1.0729	8	120	96565	2011	1508
1 1/4-12	1.2500	1.0729	9	145	116682	2430	1823
<b>Size 1 3/8"</b>							
1 3/8-6	1.3750	1.1549	2	33	28583	655	491
1 3/8-6	1.3750	1.1549	5	74	64096	1468	1101
1 3/8-6	1.3750	1.1549	8	120	103939	2381	1786
1 3/8-6	1.3750	1.1549	9	145	125593	2878	2158
1 3/8-12	1.3750	1.3147	2	33	32539	745	559
1 3/8-12	1.3750	1.3147	5	74	72966	1672	1254
1 3/8-12	1.3750	1.3147	8	120	118324	2711	2033
1 3/8-12	1.3750	1.3147	9	145	142974	3276	2457
<b>Size 1 1/2"</b>							
1 1/2-6	1.5000	1.4053	2	33	34780	869	652
1 1/2-6	1.5000	1.4053	5	74	77891	1949	1462
1 1/2-6	1.5000	1.4053	8	120	126472	3161	2371
1 1/2-6	1.5000	1.4053	9	145	152821	3820	2865
1 1/2-12	1.5000	1.5810	2	33	39130	978	733
1 1/2-12	1.5000	1.5810	5	74	87746	2193	1645
1 1/2-12	1.5000	1.5810	8	120	142292	3557	2667
1 1/2-12	1.5000	1.5810	9	145	171936	4298	3223
<b>Size 1 3/4"</b>							
1 3/4-5	1.7500	1.8995	2	33	47011	1371	1028
1 3/4-5	1.7500	1.8995	5	74	105420	3074	2306
1 3/4-5	1.7500	1.8995	8	120	170951	4986	3739
<b>Size 2"</b>							
2-4.5	2.0000	2.4982	2	33	61831	2061	1545
2-4.5	2.0000	2.4982	5	74	138651	4621	3466
2-4.5	2.0000	2.4982	8	120	224840	7497	5621
<b>Size 2 1/4"</b>							
2 1/4-4.5	2.2500	3.2477	2	33	80380	3014	2260
2 1/4-4.5	2.2500	3.2477	5	74	180246	6759	5069
2 1/4-4.5	2.2500	3.2477	8	120	292292	10960	8220
<b>Size 2 1/2"</b>							
2 1/2-4	2.5000	3.9988	2	33	98971	4213	3092
2 1/2-4	2.5000	3.9988	5	74	221935	9247	6935

2 1/2-4	2.5000	3.9988	8	120	359894	14995	11246
<b>Size 2 3/4"</b>							
2 3/4-4	2.7500	4.9340	2	33	122166	5597	4197
2 3/4-4	2.7500	4.9340	5	74	273837	12550	9413
2 3/4-4	2.7500	4.9340	8	120	444061	20352	15264
<b>Size 3"</b>							
3-4	3.0000	5.9674	2	33	147692	7384	5538
3-4	3.0000	5.9674	5	74	331189	16559	12419
3-4	3.0000	5.9674	8	120	537063	26853	20139
<b>Size 3 1/4"</b>							
3 1/4-4	3.2500	7.0989	2	33	175698	9516	7137
3 1/4-4	3.2500	7.0989	5	74	393989	21341	16005
3 1/4-4	3.2500	7.0989	8	120	638901	34607	25955
<b>Size 3 1/2"</b>							
3 1/2-4	3.5000	8.3286	2	33	206133	12024	9018
3 1/2-4	3.5000	8.3286	5	74	462238	26963	20222
3 1/2-4	3.5000	8.3286	8	120	749575	43725	32793
<b>Size 3 3/4"</b>							
3 3/4-4	3.7500	9.6565	2	33	238998	14937	11203
3 3/4-4	3.7500	9.6565	5	74	535935	33495	25121
3 3/4-4	3.7500	9.6565	8	120	869085	54317	40738
<b>Size 4"</b>							
4-4	4.0000	11.0826	2	33	274293	18286	13714
4-4	4.0000	11.0826	5	74	615082	41005	30754
4-4	4.0000	11.0826	8	120	997430	66495	49871
<b>Size 4 1/4"</b>							
4 1/4-4	4.2500	12.6068	2	33	312018	22101	16575
4 1/4-4	4.2500	12.6068	5	74	699677	49560	37170
4 1/4-4	4.2500	12.6068	8	120	1134611	80368	60276
<b>Size 4 1/2"</b>							
4 1/2-4	4.5000	14.2292	2	33	352172	26212	19809
4 1/2-4	4.5000	14.2292	5	74	789720	59229	44421
4 1/2-4	4.5000	14.2292	8	120	1280628	96047	72035

## Shear strengths of bolts by diameter

### Bolt Safe Working Loads (lbs)

Safe tensile load at 6,000 psi load; safe shear strength at 7500 psi load)

Bolt Diameter (inches)	NF Thread Grade 2 Iron Bolt		
	Shear (at thread root)	Shear (Full Bolt)	Tensile (at thread root)
1/4	200	370	160
5/16	340	575	270
3/8	510	830	410
7/16	700	1130	560
1/2	940	1470	760
9/16			
5/8	1510	2300	1210
3/4	2260	3310	1810
7/8	3140	4510	2520
1	4130	5890	3300
1 1/8	5200	7450	4160
1 1/4	6670	9200	5350
1 3/8	7900	11130	6340
1 1/2	9700	13250	7700
1 5/8	11360	15550	9090
1 3/4	13080	18000	10470
1 7/8	15370	20700	12300
2	17250	23560	13800

### Bolt Tensile Strength (Breaking Strength - pounds)

Bolt Diameter (inches)	Grade 2		Grade 5		Grade 8	
	Coarse	Fine	Coarse	Fine	Coarse	Fine
1/4	2350	2700	3800	4350	4750	5450
5/16	3900	4300	6300	6950	7850	8700
3/8						
7/16	7850	8800	12800	14400	15900	17800
1/2	10500	11800	17000	19200	21300	24000
9/16	13500	15000	21800	24400	27300	30400
5/8	16700	18900	27100	30700	33900	38400
3/4	24700	27600	40100	44800	50100	56000

## Threaded rods

### High Tensile B7S Coil Rod or B8S UNC Threaded Bar

Thread Diameter	Thread Pitch		Safe Working Load (~2:1 Safety Factor)	Max Working Load to Elastic Limit	Average Ultimate Strength
	Coil Thread	V Thread			
3/8" (10mm)	8	16 NC	4,900 lbs. (21.8 kN)	7,500 lbs. (33.4 kN)	9,800lbs. (43.6 kN)
1/2" (12mm)	6	13 NC	9,000 lbs. (40.0 kN)	13,000 lbs. (57.8 kN)	18,000 lbs. (80.1 kN)
5/8" (16mm)	4-1/2	11 NC	11,250 lbs. (50.0 kN)	18,000 lbs. (80.0 kN)	22,500 lbs. (100.0 kN)
3/4" (20mm)	4-1/2	10 NC	19,000 lbs. (84.5 kN)	30,000 lbs. (133.5 kN)	38,000 lbs. (169.0 kN)
7/8" (22mm)	4-1/2	9 NC	29,000 lbs. (129.0 kN)	46,000 lbs. (204.6 kN)	58,000 lbs. (258.0 kN)
1" (25mm)	3-1/2	8 NC	37,500 lbs. (166.8 kN)	60,000 lbs. (266.8 kN)	75,000 lbs. (333.5 kN)
1-1/8" (30mm)	3-1/2	-	40,500 lbs. (180.0 kN)	62,000 lbs. (283.8 kN)	81,000 lbs. (359.8 kN)
1-1/4" (32mm)	3-1/2	7 NC	51,000 lbs. (254.2 kN)	79,000 lbs. (381.3 kN)	102,00 lbs. (508.3 kN)
1-1/2" (38mm)	3-1/2	-	70,000 lbs. (311.4 kN)	112,000 lbs. (498.2 kN)	140,000 lbs. (622.8 kN)
2" (51mm)	-	6 UN	139,000 lbs. (656.7 kN)	215,000 lbs. (1,080.3 kN)	279,000 lbs. (1,313.0 kN)