

ASTM A307

Bolt Size (in)	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)		
				Waxed	Galv	Plain
1/4	20	1,145	859	2	4	4
5/16	18	1,886	1415	4	9	7
3/8	16	2,790	2,093	7	16	13
7/16	14	3,827	2,870	10	26	21
1/2	13	5,108	3,831	16	40	32
9/16	12	6,552	4,914	23	58	46
5/8	11	8,136	6,102	32	79	64
3/4	10	12,024	9,018	56	141	113
7/8	9	15,200	11,400	83	208	166
1	8	20,000	15,000	125	313	250
1 1/8	7	25,200	18,900	177	443	354
1 1/4	7	32,000	24,000	250	625	500
1 3/8	6	38,100	28,575	327	819	655
1 1/2	6	46,400	34,800	435	1,088	870
1 3/4	5	68,400	51,300	748	1,870	1,496
2	4 1/2	90,000	67,500	1,125	2,813	2,250
2 1/4	4 1/2	117,000	87,750	1,645	4,113	3,291
2 1/2	4	144,000	108,000	2,250	5,625	4,500
2 3/4	4	177,480	133,110	3,050	7,626	6,101
3	4	214,920	161,190	4,030	10,074	8,060
3 1/4	4	255,600	191,700	5,192	12,980	10,384
3 1/2	4	299,880	224,910	6,560	16,400	13,120
3 3/4	4	347,760	260,820	8,151	20,377	16,301
4	4	398,880	299,160	9,972	24,930	19,944

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SAE Grade 2

Bolt Size (in)	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)		
				Waxed	Galv	Plain
1/4	20	1,750	1,313	3	7	5
5/16	18	2,900	2,175	6	14	11
3/8	16	4,250	3,188	10	25	20
7/16	14	5,850	4,388	16	40	32
1/2	13	7,800	5,850	24	61	49
9/16	12	10,000	7,500	35	88	70
5/8	11	12,400	9,300	48	121	97
3/4	10	18,400	13,800	86	216	173
7/8	9	15,200	11,400	83	208	166
1	8	20,000	15,000	125	313	250
1 1/8	7	25,200	18,900	177	443	354
1 1/4	7	32,000	24,000	250	625	500
1 3/8	6	38,100	28,575	327	819	655
1 1/2	6	46,400	34,800	435	1,088	870

ASTM A325

Bolt Size (in)	TPI	Tension		Tightening Torque Range (ft lbs) (Min - Max)		
		Min	Max	Plain	Galv	Waxed
1/2	13	12,000	14,000	100 - 117	125 - 146	50 - 58
5/8	11	19,000	23,000	198 - 240	247 - 299	99 - 120
3/4	10	28,000	34,000	350 - 425	438 - 531	175 - 213
7/8	9	39,000	47,000	569 - 685	711 - 857	284 - 343
1	8	51,000	61,000	850 - 1,017	1,063 - 1,271	425 - 508
1-1/8	7	56,000	67,000	1,050 - 1,256	1,313 - 1,570	525 - 625
1-1/4	7	71,000	85,000	1,479 - 1,771	1,849 - 2,214	740 - 885
1-3/8	6	85,000	102,000	1,948 - 2,338	2,435 - 2,922	974 - 1,169
1-1/2	6	103,000	124,000	2,575 - 3,100	3,219 - 3,875	1,288 - 1,550

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ASTM A449 / SAE Grade 5

Bolt Size (in)	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)		
				Waxed	Galv	Plain
1/4	20	2,700	2,025	4	11	8
5/16	18	4,450	3,338	9	22	17
3/8	16	6,600	4,950	15	39	31
7/16	14	9,050	6,788	25	62	49
1/2	13	12,050	9,038	38	94	75
9/16	12	15,450	11,588	54	136	109
5/8	11	19,200	14,400	75	188	150
3/4	10	28,400	21,300	133	333	266
7/8	9	39,250	29,438	215	537	429
1	8	51,500	38,625	322	805	644
1 1/8	7	56,450	42,338	397	992	794
1 1/4	7	71,700	53,775	560	1,400	1,120
1 3/8	6	85,450	64,088	734	1,836	1,469
1 1/2	6	104,000	78,000	975	2,438	1,950
1 3/4	5	104,500	78,375	1,143	2,857	2,286
2	4 1/2	137,500	103,125	1,719	4,297	3,438
2 1/4	4 1/2	178,750	134,063	2,514	6,284	5,027
2 1/2	4	220,000	165,000	3,438	8,594	6,875
2 3/4	4	271,150	203,363	4,660	11,651	9,321
3	4	328,350	246,263	6,157	15,391	12,313

ASTM A490

Bolt Size (in)	TPI	Tension (lbs)		Tightening Torque Range (ft lbs) (Min - Max)	
		Min	Max	Plain	Lubricated
1/2	13	15,000	18,000	125 - 150	63 - 75
5/8	11	24,000	29,000	250 - 302	125 - 151
3/4	10	35,000	42,000	438 - 525	219 - 263
7/8	9	49,000	59,000	715 - 860	357 - 430
1	8	64,000	77,000	1,067 - 1,283	533 - 642
1-1/8	7	80,000	96,000	1,500 - 1,800	750 - 900
1-1/4	7	102,000	122,000	2,125 - 2,542	1,063 - 1,271
1-3/8	6	121,000	145,000	2,773 - 3,323	1,386 - 1,661
1-1/2	6	148,000	178,000	3,700 - 4,450	1,850 - 2,225

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ASTM A193 Grade B7

Bolt Size (in)	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)		
				Waxed	Galv	Plain
1/4	20	3,350	2,513	5	13	10
5/16	18	5,500	4,125	11	27	21
3/8	16	8,150	6,113	19	48	38
7/16	14	11,150	8,363	30	76	61
1/2	13	14,900	11,175	47	116	93
9/16	12	19,100	14,325	67	168	134
5/8	11	23,750	17,813	93	232	186
3/4	10	35,050	26,288	164	411	329
7/8	9	48,500	36,375	265	663	530
1	8	63,650	47,738	398	995	796
1 1/8	7	80,100	60,075	563	1,408	1,126
1 1/4	7	101,750	76,313	795	1,987	1,590
1 3/8	6	121,300	90,975	1,042	2,606	2,085
1 1/2	6	147,550	110,663	1,383	3,458	2,767
1 3/4	5	199,500	149,625	2,182	5,455	4,364
2	4 1/2	262,500	196,875	3,281	8,203	6,563
2 1/4	4 1/2	341,250	255,938	4,799	11,997	9,598
2 1/2	4	420,000	315,000	6,563	16,406	13,125
2 3/4	4	468,500	351,263	8,050	20,124	16,100
3	4	567,150	425,363	10,634	26,585	21,268
3 1/4	4	674,500	505,875	13,701	34,252	27,402
3 1/2	4	791,350	593,513	17,311	43,277	34,622
3 3/4	4	917,700	688,275	21,509	53,771	43,017
4	4	1,052,600	789,450	26,315	65,788	52,630

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ASTM A354 Grade BD / SAE Grade 8

Bolt Size (in)	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)	
				Lubricated	Plain
1/4	20	3,800	2,850	6	12
5/16	18	6,300	4,725	12	25
3/8	16	9,300	6,975	22	44
7/16	14	12,750	9,563	35	70
1/2	13	17,050	12,788	53	107
9/16	12	21,850	16,388	77	154
5/8	11	27,100	20,325	106	212
3/4	10	40,100	30,075	188	376
7/8	9	55,450	41,588	303	606
1	8	72,700	54,525	454	909
1 1/8	7	91,550	68,663	644	1,287
1 1/4	7	120,000	90,000	938	1,875
1 3/8	6	138,600	103,950	1,191	2,382
1 1/2	6	168,600	126,450	1,581	3,161
1 3/4	5	228,000	171,000	2,494	4,988
2	4 1/2	300,000	225,000	3,750	7,500
2 1/4	4 1/2	390,000	292,500	5,484	10,969
2 1/2	4	480,000	360,000	7,500	15,000
2 3/4	4	517,650	388,238	8,897	17,794
3	4	626,850	470,138	11,753	23,507
3 1/4	4	745,500	559,125	15,143	30,286
3 1/2	4	874,650	655,988	19,133	38,266
3 3/4	4	1,014,300	760,725	23,773	47,545
4	4	1,163,400	872,550	29,085	58,100

Notes:

1. Values calculated using industry accepted formula $T = KDP$ where T = Torque, K = torque coefficient (dimensionless), D = nominal diameter (inches), P = bolt clamp load, lb.
2. K values: waxed (e.g. pressure wax as supplied on high strength nuts) = .10, hot dip galvanized = .25, and plain non-plated bolts (as received) = .20.
3. Torque has been converted into ft/lbs by dividing the result of the formula by 12
4. All calculations are for Coarse Thread Series (UNC).
5. Grade 2 calculations only cover fasteners 1/4"-3/4" in diameter up to 6" long; for longer fasteners the torque is reduced significantly.
6. Clamp loads are based on 75% of the minimum proof loads for each grade and size.
7. Proof load, stress area, yield strength, and other data is based on IFI 7th Edition (2003) Technical Data N68, SAE J429, ASTM A307, A325, A354, A449, and A490.

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