

## 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

*This chart of estimated torque calculations are only offered as a guide. Use of its content by anyone is the sole responsibility of that person and they assume all risk. Due to many variables that affect the torque-tension relationship like human error, surface texture, and lubrication the only way to determine the correct torque is through experimentation under actual joint and assembly conditions.*

## 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 N-68, SAE J429, ASTM A307, A325, A354, A449, and A490.

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