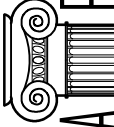


Installation Drawings: Offered for reference only.
Ask for installation drawings that are similar to your jobs requirements.

SALES 877 774 3280 TOLL FREE
INTERNATIONAL +1.1.949.281.7345
SALES@LAGUNAPRECAST.COM
WWW.LAGUNAPRECAST.COM


LAGUNA PRECAST

DESCRIPTION:

RAIL CALC.

OWNER:

PRODUCT / SHEET #:

PC-4

DATE: Aug 03, 2015 - 10:36am

REVISIONS

SCALE: AS NOTED

DRAWN BY:

Technical Data

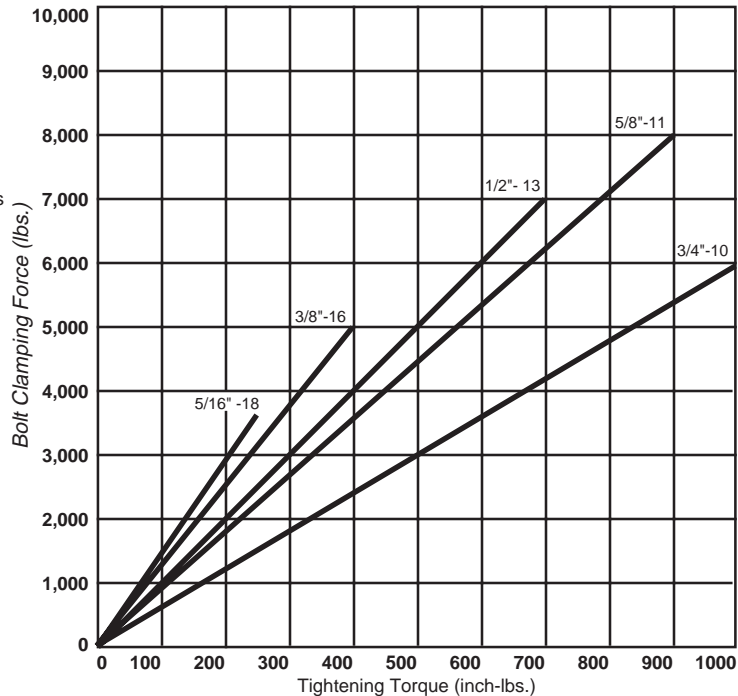
Suggested Tightening Torque Values To Produce Corresponding Bolt Clamping Loads

Size	Tensile Stress Area Bolt Dia. (in.) A (sq. in.)		SAE Grade 2 Bolts					SAE Grade 5 Bolts					SAE Grade 7 ³			SAE Grade 8 ⁴				
			Tensile Strength (min psi)	Proof Load (psi)	Clamp ² Load		Tightening Torque		Tensile Strength (min psi)	Proof Load (psi)	Clamp ² Load		Tightening Torque		Clamp ² Load	Tightening Torque		Clamp ² Load	Tightening Torque	
					P (lb.)	K=0.20	K=0.15	Dry			Lub.	P (lb.)	K=0.20	K=0.15		Dry	Lub.		P (lb.)	K=0.20
			lb. in.			lb. in.			lb. in.			lb. in.			lb. in.					
4-40	0.1120	0.00604	74,000	55,000	240	5	4	120,000	85,000	380	8	6	480	11	8	540	12	9		
4-48	0.1120	0.00661			280	6	5			420	9	7	520	12	9	600	13	10		
6-32	0.1380	0.00909			380	10	8			580	16	12	720	20	15	820	23	17		
6-40	0.1380	0.01015			420	12	9			640	18	13	800	22	17	920	25	19		
8-32	0.1640	0.01400			580	19	14			900	30	22	1100	36	27	1260	41	31		
8-36	0.1640	0.01474			600	20	15			940	31	23	1160	38	29	1320	43	32		
10-24	0.1900	0.01750			720	27	21			1120	43	32	1380	52	39	1580	60	45		
10-32	0.1900	0.02000			820	31	23			1285	49	36	1580	60	45	1800	68	51		
1/4-20	0.2500	0.0318			1320	66	49			2020	96	75	2500	120	96	2860	144	108		
1/4-28	0.2500	0.0364			1500	76	56			2320	120	86	2860	144	108	3280	168	120		
			lb. ft.			lb. ft.			lb. ft.			lb. ft.			lb. ft.			lb. ft.		
5/16-18	0.3125	0.0524			2160	11	8			3340	17	13	4120	21	16	4720	25	18		
5/16-24	0.3125	0.0580			2400	12	9			3700	19	14	4560	24	18	5220	25	20		
3/8-16	0.3750	0.0775			3200	20	15			4940	30	23	6100	40	30	7000	45	35		
3/8-24	0.3750	0.0878			3620	23	17			5600	35	25	6900	45	35	7900	50	35		
7/16-14	0.4375	0.1063			4380	30	24			6800	50	35	8400	60	45	9550	70	55		
7/16-20	0.4375	0.1187			4900	35	25			7550	55	40	9350	70	50	10700	80	60		
1/2-13	0.5000	0.1419			5840	50	35			9050	75	55	11200	95	70	12750	110	80		
1/2-20	0.5000	0.1599			6600	55	40			10700	90	65	12600	100	80	14400	120	90		
9/16-12	0.5625	0.1820			7500	70	55			11600	110	80	14350	135	100	16400	150	110		
9/16-18	0.5625	0.2030			8400	80	60			12950	120	90	16000	150	110	18250	170	130		
5/8-11	0.6250	0.2260			9300	100	75			14400	150	110	17800	190	140	20350	220	170		
5/8-18	0.6250	0.2560			10600	110	85			16300	170	130	20150	210	160	23000	240	180		
3/4-10	0.7500	0.3340			13800	175	130			21300	260	200	26300	320	240	30100	380	280		
3/4-16	0.7500	0.3730	60,000	33,000	15400	195	145			23800	300	220	29400	360	280	33600	420	320		
7/8-9	0.8750	0.4620			11400	165	125			29400	430	320	36400	520	400	41600	600	460		
7/8-14	0.8750	0.5090			12600	185	140			32400	470	350	40100	580	440	45800	660	500		
1-8	1.0000	0.6060			15000	250	190			38600	640	480	47700	800	600	54500	900	680		
1-12	1.0000	0.6630			16400	270	200			42200	700	530	52200	860	660	59700	1000	740		
1-1/8-7	1.1250	0.7630			18900	350	270	105,000	74,000	42300	800	600	60100	1120	840	68700	1280	960		
1-1/8-12	1.1250	0.8560			21200	400	300			47500	880	660	67400	1260	940	77000	1440	1080		
1-1/4-7	1.2500	0.9690			24000	500	380			53800	1120	840	76300	1580	1100	87200	1820	1360		
1-1/4-12	1.2500	1.0730			26600	550	420			59600	1240	920	84500	1760	1320	96600	2000	1500		
1-3/8-6	1.3750	1.1550			28600	660	490			64100	1460	1100	91000	2080	1560	104000	2380	1780		
1-3/8-12	1.3750	1.3150			32500	740	560			73000	1680	1260	104000	2380	1780	118400	2720	2040		
1-1/2-6	1.5000	1.4050			34800	870	650			78000	1940	1460	111000	2780	2080	126500	3160	2360		
1-1/2-12	1.5000	1.5800			39100	980	730			87700	2200	1640	124005	3100	2320	142200	3560	2660		

Notes:

- Tightening torque values are calculated from the formula $T = KDP$, where T = tightening torque, lb-in.; K = torque-friction coefficient; D = nominal bolt diameter, in.; and P = bolt clamping load developed by tightening, lb.
 - Clamp load is also known as preload or initial load in tension on bolt. Clamp load (lb.) is calculated by arbitrarily assuming usable bolt strength is 75% of bolt proof load (psi) times tensile stress area (sq. in.) of threaded section of each bolt size. Higher or lower values of clamp load can be used depending on the application requirements and the judgement of the designer.
 - Tensile strength (min psi) of all Grade 7 bolts is 133,000. Proof load is 105,000 psi.
 - Tensile strength (min psi) of all Grade 8 bolts is 150,000 psi. Proof load is 120,000 psi.
- Ref.: Fastening Reference. Machine Design. Nov. 1977.

Bolt Clamping Force vs. Tightening Torque for Unlubricated Steel Bolts.





Bolt Torque Chart

Related FAQs

- [Tension vs. Torque](#)
- [Torque Charts and Anchor Bolts](#)
- [Concerns in Calculating Torque](#)

¹ **Proofload** is the published number that full size headed bolts are tested to. The bolt is stressed up to the proofload value, and if there is no deformation, elongation, or fracture, then the bolt is deemed to have passed. For bolting specifications that do not have a published proofload, it is usually calculated at 92% of ultimate yield strength.

² **Clampload** is calculated at 75% of proofload. This is done to allow a safety buffer so that the bolt does not get too close to the proofload value. If you exceed the proofload value when tensioning the bolt, you run the risk of bolt failure. Clampload is only an estimated number, there may be situations where the engineer calls for the bolts to be tensioned to a different value.

Notes:

- Values calculated using industry accepted formula $T = KDP$ where T = Torque, K = torque coefficient (dimensionless), D = nominal diameter (inches), P = bolt clamp load, lb.
- 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.
- Torque has been converted into ft/lbs by dividing the result of the formula by 12
- All calculations are for Coarse Thread Series (UNC).
- Grade 2 calculations only cover fasteners $\frac{1}{4}$ "- $\frac{3}{4}$ " in diameter up to 6" long; for longer fasteners the torque is reduced significantly.
- Clamp loads are based on 75% of the minimum proof loads for each grade and size.
- 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.

Suggested Starting Values

The below 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.**

A307 GRADE 2 A325 A449 A193 B7 A490 A354

ASTM A307

Bolt Size	TPI	Proof Load (lbs) ¹	Clamp Load (lbs) ²	Tightening Torque (ft lbs)		
				Galv+Waxed	Galv	Plain
1/4	20	1,145	859	2	4	4
5/16	18	1,886	1,415	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

▲ Top of page

SAE Grade 2

Bolt Size	TPI	Proof Load (lbs) ¹	Clamp Load (lbs) ²	Tightening Torque (ft lbs)		
				Galv+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

▲ Top of page

ASTM A325

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

▲ Top of page

ASTM A449 / SAE GRADE 5*

Bolt Size	TPI	Proof Load (lbs) ¹	Clamp Load (lbs) ²	Tightening Torque (ft lbs)		
				Galv+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

SAE J429

Scope

SAE J429 covers the mechanical and material requirements for inch series fasteners used in automotive and related industries in sizes to 1-1/2" inclusive.

Below is a basic summary the most common grades. SAE J429 covers a number of other grades and grade variations not covered in this summary, including 4, 5.1, 5.2, 8.1, and 8.2.


J429 Mechanical Properties

Grade	Nominal Size, inches	Full Size Proofload, psi	Yield Strength, min, psi	Tensile Strength, min, psi	Elong, min, %	RA, min, %	Core Hardness, Rockwell	Tempering Temperature, min
1	1/4 thru 1-1/2	33,000	36,000	60,000	18	35	B7 to B100	N/A
* 2	1/4 thru 3/4	55,000	57,000	74,000	18	35	B80 to B100	N/A
	Over 3/4 thru 1-1/2	33,000	36,000	60,000	18	35	B70 to B100	
5	1/4 thru 1	85,000	92,000	120,000	14	35	C25 to C34	800F
	Over 1 thru 1-1/2	74,000	81,000	105,000	14	35	C19 to C30	
8	1/4 thru 1-1/2	120,000	130,000	150,000	12	35	C33 to C39	800F

Grade 2 requirements for sizes 1/4" thru 3/4" apply only to bolts 6" and shorter, and to studs of all lengths. For bolts longer than 6", Grade 1 requirements shall apply.

J429 Chemical Requirements

Grade	Material	Carbon, %	Phosphorus, %	Sulfur, %	Grade Marking
1	Low or Medium Carbon Steel	0.55 max	0.030 max	0.050 max	None
2	Low or Medium Carbon Steel	0.15 - 0.55	0.030 max	0.050 max	None
5	Medium Carbon Steel	0.28 - 0.55	0.030 max	0.050 max	!

					
8	Medium Carbon Alloy Steel	0.28 - 0.55	0.030 max	0.050 max	

J429 Recommended Hardware

Nuts	Washers
J995	N/A

Alternate Grades

For fasteners larger than 1-1/2" in diameter, the following ASTM grades should be considered.

SAE J429 Grade	ASTM Equivalent
Grade 1	A307 Grades A or B
Grade 2	A307 Grades A or B
Grade 5	A449
Grade 8	A354 Grade BD

This chart compares SAE and ASTM specifications that are similar but not identical in diameters through 1½".