

BOLT RESISTANCE



GRADE 2 SAE						
Dia. and Thread Per Inch	Tension Zone	Traction Resistance	Proof Load (lbs)	Clamp Load (lbs)	Torque	
					Dry lb. ft.	Lub. lb. ft.
1/4-20	0.0318	74	1750	1310	5.5	4.2
28	0.0364	74	2000	1500	6.3	4.7
5/16-18	0.0524	74	2900	2160	11	8
24	0.0580	74	3200	2400	12	9
3/8-16	0.0775	74	4250	3200	20	15
24	0.0878	74	4800	3620	23	17
7/16-14	0.1063	74	5850	4380	32	24
20	0.1187	74	6550	4900	36	27
1/2-13	0.1419	74	7800	5850	50	35
20	0.1599	74	8800	6600	55	40
9/16-12	0.1820	74	10000	7500	70	55
18	0.2030	74	11200	8400	80	60
5/8-11	0.226	74	12400	9320	100	75
18	0.256	74	14100	10560	110	85
3/4-10	0.334	74	18400	13800	175	130
16	0.373	74	20500	15390	200	140
7/8-9	0.462	74	15200	11430	170	125
14	0.509	74	16800	12600	180	140
1-8	0.606	74	20000	15000	250	190
14	0.679	74	22400	16800	280	210
1-1/8-7	0.763	74	25200	18900	350	270
12	0.856	74	28200	21200	400	300
1-1/4-7	0.969	74	32000	24000	500	380
12	1.073	74	35400	26550	550	420
1-1/2-6	1.405	74	46400	34800	870	650
12	1.581	74	52200	39150	980	730

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The torque values for Grades 2.5 and 8 were based on the formula below:

$$T = CDF$$

where:

T = Torque (inches – lbs.)

D = Nominal bolt diameter (inches)

F = Clamp tension (lbs.)

C = Coefficient of friction

The value of C is supposed to equal .20 for non-coated bolts and .15 for lubricated and coated bolts. Actual values of C may vary between .05 and .35 under common conditions.

The values associated to the L9 Fastening torque system are applicable to nuts, bolts and washers, and not to screws used in tapped holes, which are developed and tested in a lab environment. When exposed to actual conditions (as opposed to lab conditions), values can change and produce a bolt tension (F) of about $\pm 15\%$ of the recommended value. When L9 hexagonal screws are used with L9 washers in tapped holes with tension control, the assembly torque value must be determined according to the actual conditions.

The recommended assembly torque values are to be used as a guide. The torque specifications – especially for critical joints – must be determined based on actual assembly conditions due to the many factors that can affect the tension.

These clamp tension values are based on 75% of the minimum resistance specification for each grade and size.

GRADE 5 SAE						
Dia. and Thread Per Inch	Tension Zone	Traction Resistance	Proof Load (lbs)	Clamp Load (lbs)	Torque	
					Dry lb. ft.	Lub. lb. ft.
1/4-20	0.0318	120	2700	2020	8	6.3
28	0.0364	120	3100	2320	10	7.2
5/16-18	0.0524	120	4450	3340	17	13
24	0.0580	120	4900	3700	19	14
3/8-16	0.0775	120	6600	4950	30	23
24	0.0878	120	7450	5600	35	25
7/16-14	0.1063	120	9050	6780	50	35
20	0.1187	120	10100	7570	55	40
1/2-13	0.1419	120	12100	9050	75	55
20	0.1599	120	13600	10200	85	65
9/16-12	0.1820	120	15500	11600	110	80
18	0.2030	120	17300	12950	120	90
5/8-11	0.226	120	19200	14400	150	110
18	0.256	120	21800	16350	170	130
3/4-10	0.334	120	28400	21300	260	200
16	0.373	120	31700	23780	300	220
7/8-9	0.462	120	39300	29450	430	320
14	0.509	120	43300	32450	470	350
1-8	0.606	120	51500	38600	640	480
14	0.679	120	57700	43300	720	540
1-1/8-7	0.763	120	56500	42300	790	590
12	0.856	120	63300	47500	890	670
1-1/4-7	0.969	120	71700	53800	1120	840
12	1.073	120	79400	59600	1240	930
1-1/2-6	1.405	120	10400	78000	1950	1460
12	1.581	120	11700	87700	2200	1640

Force/Grade	Applicable Sizes	Proof Strength (psi)	Minimum Tensile Strength (psi)	Tension (psi)
Grade 2 SAE	1/4 to 3/4 dia	55,000	57,000	74,000
	more than 3/4" to 1-1/2" dia.	33,000	36,000	60,000
	more than 6" long	33,000	36,000	60,000
Grade 5 SAE	1/4" to 1" dia.	85,000	92,000	120,000
	more than 1" to 1-1/2" dia.	74,000	81,000	105,000

BOLT RESISTANCE



GRADE 8 SAE						
Dia. and Thread Per Inch	Tension Zone	Traction Resistance	Proof Load (lbs)	Clamp Load (lbs)	Torque	
					Dry lb. ft.	Lub. lb. ft.
1/4-20	0.0318	150	3800	2850	12	9
28	0.0364	150	4350	3250	14	10
5/16-18	0.0524	150	6300	4700	24	18
24	0.0580	150	6950	5200	27	20
3/8-16	0.0775	150	9300	6980	45	35
24	0.0878	150	10500	7900	50	35
7/16-14	0.1063	150	12800	9550	70	50
20	0.1187	150	14200	10650	80	60
1/2-13	0.1419	150	17000	12750	110	80
20	0.1599	150	19200	14400	120	90
9/16-12	0.1820	150	21800	16350	150	110
18	0.2030	150	24400	18230	170	130
5/8-11	0.226	150	27100	20350	210	160
18	0.256	150	30700	23000	240	180
3/4-10	0.334	150	40100	30100	380	280
16	0.373	150	44800	33500	420	310
7/8-9	0.462	150	55400	41600	600	450
14	0.509	150	61100	45800	670	500
1-8	0.606	150	72700	54500	910	680
14	0.679	150	81500	61100	1020	760
1-1/8-7	0.763	150	91600	68700	1290	970
12	0.856	150	102700	77000	1440	1080
1-1/4-7	0.969	150	116300	87200	1820	1360
12	1.073	150	128800	96600	2010	1510
1-1/2-6	1.405	150	168600	126500	3160	2370
12	1.581	150	189700	142200	3560	2670

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where:

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D = Nominal bolt diameter (inches)

F = Clamp tension (lbs.)

C = Coefficient of friction

The value of C is supposed to equal .20 for non-coated bolts and .15 for lubricated and coated bolts. Actual values of C may vary between .05 and .35 under common conditions.

The values associated to the L9 Fastening torque system are applicable to nuts, bolts and washers, and not to screws used in tapped holes, which are developed and tested in a lab environment. When exposed to actual conditions (as opposed to lab conditions), values can change and produce a bolt tension (F) of about $\pm 15\%$ of the recommended value. When L9 hexagonal screws are used with L9 washers in tapped holes with tension control, the assembly torque value must be determined according to the actual conditions.

The recommended assembly torque values are to be used as a guide. The torque specifications – especially for critical joints – must be determined based on actual assembly conditions due to the many factors that can affect the tension.

These clamp tension values are based on 75% of the minimum resistance specification for each grade and size.

L9 FASTENING SYSTEM						
Dia. and Thread Per Inch	Tension Zone	Traction Resistance	Proof Load (lbs)	Clamp Load (lbs)	Torque	
					Dry lb. ft.	Lub. lb. ft.
1/4-20	0.0318	180	4610	3450	11	10
28	0.0364	180	5270	3950	13	12
5/16-18	0.0524	180	7290	5700	21	19
24	0.0580	180	8410	6300	23	20
3/8-16	0.0775	180	11230	8450	33	30
24	0.0878	180	12730	9550	38	35
7/16-14	0.1063	180	15410	11550	60	55
20	0.1187	180	17210	12900	65	60
1/2-13	0.1419	180	20570	15450	95	85
20	0.1599	180	23180	17400	105	95
9/16-12	0.1820	180	26393	19800	140	120
18	0.2030	180	29430	22100	150	135
5/8-11	0.226	180	32770	24550	185	170
18	0.256	180	37120	27800	205	190
3/4-10	0.334	180	48430	36350	290	265
16	0.373	180	54080	40600	355	330
7/8-9	0.462	180	66990	50300	505	475
14	0.509	180	73800	55400	585	520
1-8	0.606	180	87870	66900	775	550
14	0.679	180	98450	73800	900	700
1-1/8-7	0.763	180	110630	83000	1150	1025
12	0.856	180	124120	93100	1325	1150
1-1/4-7	0.969	180	140500	105400	1600	1400
12	1.073	180	155580	116700	1750	1600
1-1/2-6	1.405	180	203720	152800	3250	2900
12	1.581	180	229240	171900	3650	3300

Force/Grade	Applicable Sizes	Proof Strength (psi)	Minimum Tensile Strength (psi)	Tension (psi)
Grade 8 SAE	1/4 to 1-1/2 dia	55,000	57,000	74,000
L9 Fastening system	1/4 to 1-1/2 dia	85,000	92,000	120,000