Metric Multistandard

TIGHTENING TORQUES

Metric Bolts, Screws and Nuts

Ref: Manufacturer's Catalog

Failure of threaded fasteners due to over-tightening can occur by bolt shank fracture or by stripping of the nut and/or bolts' thread. A bolt or screw assembled with a nut of the appropriate class is intended to provide an assembly capable of being tightened to the bolt proof load without thread stripping occurring.

The torque value to be set for a particular size of screw is dependent upon:

1. Material of the screw
2. Parent material (steel, non-ferrous metal or plastic)
3. Whether the screw is untreated or plated
4. Whether the screw is dry or lubricated
5. The depth of the thread

Tables below are given for informational use only. The exact torque values are found by tests based upon work experience.

Tightening Torques - Untreated Screw (Black Finish) - Friction Coefficient 0.14

PROPERTY CLASS	TORQUE Ma	NOMINAL DIAMETER - COARSE THREAD																		
		M3	M4	M5	M6	M7	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30	M33	M36	M39
5.6	Nm	0.60	1.37	2.70	4.6	7.6	11	22	39	62	95	130	184	250	315	470	635	865	1111	1440
	ft/lb	0.44	1.01	1.99	3.3	5.6	8.1	16	28	45	70	95	135	184	232	346	468	637	819	1062
8.8	Nm	1.37	3.10	6.15	10.5	17.5	26	51	89	141	215	295	420	570	725	1070	1450	1970	2530	3290
	ft/lb	1.01	2.29	4.54	7.7	12.9	19	37	65	103	158	217	309	420	534	789	1069	1452	1865	2426
10.9	Nm	1.92	4.49	8.65	15	25	36	72	125	198	305	420	590	800	1020	1510	2050	2770	3560	4620
	ft/lb	1.42	3.25	6.38	11	18.4	26	53	92	146	224	309	435	590	752	1113	1511	2042	2625	3407
12.9	Nm	2.30	5.25	10.4	18	29	43	87	150	240	365	500	710	960	1220	1810	2450	3330	4280	5550
	ft/lb	1.70	3.87	7.6	13	21.3	31	64	110	177	269	368	523	708	899	1334	1806	2455	3156	4093

PROPERTY CLASS	TORQUE Ma	NOMINAL DIAMETER - FINE THREAD								
		M8 x 1	M10 x 1.25	M12 x 1.25	M14 x 1.5	M16 x 1.5	M18 x 1.5	M20 x 1.5	M22 x 1.5	M24 x 2
8.8	Nm	27	52	95	150	225	325	460	610	780
	ft/lb	19	38	70	110	165	239	339	449	575
10.9	Nm	38	73	135	210	315	460	640	860	1100
	ft/lb	28	53	99	154	232	339	472	634	811
12.9	Nm	45	88	160	250	380	550	770	1050	1300
	ft/lb	33	64	118	184	280	405	567	774	958

Tightening Torques - Electrically Zinc Plated - Friction Coefficient 0.125

PROPERTY CLASS	TORQUE Ma	NOMINAL DIAMETER - COARSE THREAD																		
		M3	M4	M5	M6	M7	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30	M33	M36	M39
5.6	Nm	0.56	1.28	2.50	4.3	7.1	10.5	21	36	58	88	121	171	230	295	435	590	800	1030	1340
	ft/lb	0.41	0.94	1.84	3.1	5.2	7.7	15	26	42	64	89	126	169	217	320	435	590	759	988
8.8	Nm	1.28	2.90	5.75	9.9	16.5	24	48	83	132	200	275	390	530	675	995	1350	1830	2360	3050
	ft/lb	0.94	2.14	4.24	7.3	12.1	17.7	35	61	97	147	202	287	390	497	733	995	1349	1740	2249
10.9	Nm	1.80	4.10	8.1	14	23	34	67	117	185	285	390	550	745	960	1400	1900	2580	3310	4290
	ft/lb	1.33	3.02	5.97	10.3	16.9	25	49	86.2	136	210	287	405	549	708	1032	1401	1902	2441	3163
12.9	Nm	2.15	4.95	9.70	16.5	27	40	81	140	220	340	470	660	890	1140	1680	2280	3090	3980	5150
	ft/lb	1.59	3.65	7.15	12.1	19.9	29	59	103	162	250	346	486	656	840	1239	1681	2278	2935	3798

PROPERTY CLASS	TORQUE Ma	NOMINAL DIAMETER - FINE THREAD								
		M8 x 1	M10 x 1.25	M12 x 1.25	M14 x 1.5	M16 x 1.5	M18 x 1.5	M20 x 1.5	M22 x 1.5	M24 x 2
8.8	Nm	25	49	88	140	210	305	425	570	720
	ft/lb	18	36	64	103	154	224	313	420	531
10.9	Nm	35	68	125	195	295	425	600	800	1000
	ft/lb	25	50	92	143	217	313	442	590	737
12.9	Nm	42	82	150	235	350	510	720	960	1200
	ft/lb	30	60	110	173	258	376	531	708	885

STANDARD TORQUE VALUE CHART

FASTENER	TYPE	MIN. TENSILE STRENGTH	MATERIAL	BODY SIZE OR OUTSIDE DIAMETER OF FASTENER																																
				2	3	4	5	6	8	10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3
	SAE 0-1-2	74,000 PSI	LOW CARBON STEEL								6	12	20	32	47	69	96	155	206	310	480	675	900	1100	1470	1900	2360	2750	3450	4400	7350	9500
	SAE 3	100,000 PSI	MEDIUM CARBON STEEL								9	17	30	47	69	103	145	234	372	551	872	1211	1624	1943	2660	3463	4695	5427	7226	8049	13450	17548
	SAE 5	120,000 PSI	MEDIUM CARBON HEAT TREAT STEEL								10	19	33	54	78	114	154	257	382	587	794	1105	1500	1775	2425	3150	4200	4550	6550	7175	13000	16000
	SAE 6	133,000 PSI	MEDIUM CARBON STEEL QUENCHED TEMPERED								12.5	24	43	69	106	150	209	350	550	825	1304	1815	2424	2913	3985	5189	6980	7491	10825	14983	20151	26286
	SAE 7	133,000 PSI	MEDIUM CARBON ALLOY STEEL								13	25	44	71	110	154	215	360	570	840	1325	1825	2500	3000	4000	5300	7000	7500	11000	15500	21000	27000
	SAE 8	160,000 PSI	MEDIUM CARBON ALLOY STEEL								14	29	47	78	119	169	230	380	600	900	1430	1975	2650	3200	4400	5650	7600	8200	12000	17000	23000	29000
	SOCKET HEAD CAP SCREW	160,000 PSI	HIGH CARBON CASE HARDENED STEEL	TORQUE VALUES: All figures are foot-pounds except those marked with an asterisk (*), which are inch-pounds.							16	33	54	84	125	180	250	400	640	970	1520	2130	2850	3450	4700	6100	8200	8800	13000	18000	24000	31000
	SOCKET SET SCREW	212,000 PSI	HIGH CARBON CASE HARDENED STEEL						9*	16*	30*	70*	140*	18	29	43	63	100	146																
	MACHINE SCREW YELLOW BRASS	60,000 PSI	COPPER (CU) 63% ZINC (ZN) 37%	2*	3.3*	4.4*	6.4*	8*	16*	20*	65*	110*	17	27	37	49	78	104	160	215	325	400		595										
	SILICONE BRONZE TYPE "B"	70,000 PSI	COPPER (CU) 96% ZINC (ZN) 2% SILICON (SI) 2%	2.3*	3.7*	4.9*	7.2*	10*	19*	22*	70*	125*	20	30	41	53	88	117	180	250	365	450		655										

STUDS — Use SAE 2, 5 or 8 values when grade is known, with a nut of sufficient strength.

There is no difference in the above chart between the torque figures for fine or coarse threads. The torque figures for a finely-threaded fastener as compared to a coarsely-threaded fastener of the same diameter may be slightly higher but hardly worth mentioning.

CAUTION
There are many varying factors which affect torque. The figures in this chart are safe figures for standard torque applications only.

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TABLE 1 - MECHANICAL PROPERTIES OF CAPSCREWS

GRADE	SIZE	PROOF STRESS (PSI)	TENSILE STRESS MIN. (PSI)	SURFACE HARDNESS HR3ON	CORE HARDNESS ROCKWELL
2	1/4 - 1-1/2"	33,000	60,000		B70 MIN. B100 MAX.
5	1/4 - 1"	85,000	120,000	54 MAX.	C25 - C34
	OVER 1 - 1-1/2"	74,000	105,000	50 MAX.	C19 - C30
8	1/4 - 1-1/2"	120,000	150,000	58.6 MAX.	C33 - C39

(SAE J429)

TABLE 2 - PROOF LOAD AND TENSILE STRENGTH REQUIREMENTS

Coarse Thread Series — UNC

Nominal Die of Products and Threads per in	Grade 2		Grade 5		Grade 8	
	Proof Load, lb.	Tensile Strength Min, lb.	Proof Load, lb.	Tensile Strength Min, lb	Proof Load, lb	Tensile Strength Min, lb
1/4 - 20	1750	2350	2700	3800	3800	4750
5/16 - 18	2900	3900	4450	6300	6300	7850
3/8 - 16	4250	5750	6600	9300	9300	11,600
7/16 - 14	5850	7850	9050	12,800	12,800	15,900
1/2 - 13	7800	10,500	12,100	17,000	17,000	21,300
9/16 - 12	10,000	13,500	15,500	21,800	21,800	27,300
5/8 - 11	12,400	16,700	19,200	27,100	27,100	33,900
3/4 - 10	18,400	24,700	28,400	40,100	40,100	50,100
7/8 - 9	15,200	27,700	39,300	55,400	55,400	69,300
1 - 8	20,000	36,400	51,500	72,700	72,700	90,900
1-1/8 - 7	25,200	45,800	56,500	80,100	91,600	114,400
1-1/4 - 7	32,000	58,100	71,700	101,700	116,300	145,400
1-3/8 - 6	38,100	69,300	85,500	121,300	138,600	173,200
1-1/2 - 6	46,400	84,300	104,000	147,500	168,600	210,800

Fine Thread Series — UNF

1/4 - 28	2000	2700	3100	4350	4350	5450
5/16 - 24	3200	4300	4900	6950	6950	8700
3/8 - 24	4800	6500	7450	10,500	10,500	13,200
7/16 - 20	6550	8800	10,100	14,200	14,200	17,800
1/2 - 20	8800	11,800	13,600	19,200	19,200	24,000
9/16 - 18	11,200	15,000	17,300	24,400	24,400	30,400
5/8 - 18	14,100	18,900	21,800	30,700	30,700	38,400
3/4 - 16	20,500	27,600	31,700	44,800	44,800	56,000
7/8 - 14	16,800	30,500	43,300	61,100	61,100	76,400
1 - 12	21,900	39,800	56,400	79,600	79,600	99,400
1 - 14 uns	22,400	40,700	57,700	81,500	81,500	101,900
1-1/8 - 12	28,200	51,400	63,300	89,900	102,700	128,400
1-1/4 - 12	35,400	64,400	79,400	112,700	128,800	161,000
1-3/8 - 12	43,400	78,900	97,300	138,100	157,800	197,200
1-1/2 - 12	52,200	94,900	117,000	166,000	189,700	237,200

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