







Torque-Tension Relationship ISO 898-1 Property Class 4.6, 8.8, 10.9 & 12.9 Metric Course Thread

Caution: All material included in this chart is advisory only, and its use by anyone is voluntary. In developing this information, Fastenal has made a determined effort to present its contents accurately. Extreme caution should be used when using a formula for torque/tension relationships. Torque is only an indirect indication of tension. Under/over tightening of fasteners can result in costly equipment failure or personal injury.

	Nominal Dia (mm)	5	6	8	10	12	14	16	18	20	22	24	27	30	33	36	39	
	Thread Pitch	0.8	1	1.25	1.5	1.75	2	2	2.5	2.5	2.5	3	3	3.5	3.5	4	4	
 ISO 898-1 Property Class 4.6	Min Tensile (N)	5680	8040	14640	23200	33720	46000	62800	76800	98000	121200	141200	183600	224400	277600	326800	390400	
	Min Proof Strength (N)	3195	4523	8235	13050	18968	25875	35325	43200	55125	68175	79425	103275	126225	156150	183825	219600	
	Clamp Load (N)	2396	3392	6176	9788	14226	19406	26494	32400	41344	51131	59569	77456	94669	117113	137869	164700	
	Min Tensile (lbs)	1278	1809	3294	5220	7587	10350	14130	17280	22050	27270	31770	41310	50490	62460	73530	87840	
	Min Proof Strength (lbs)	719	1018	1853	2936	4268	5822	7948	9720	12403	15339	17871	23237	28401	35134	41361	49410	
	Clamp Load (lbs)	539	763	1390	2202	3201	4366	5961	7290	9302	11505	13403	17428	21300	26350	31020	37058	
	Torque (Nm)																	
	Ecoguard	1.6	2.6	6.4	12.7	22.2	35.3	55.1	75.8	107	146	186	272	369	502	645	835	
	Lubricated	1.9	3.3	7.9	15.7	27.3	43.5	67.8	93.3	132	180	229	335	454	618	794	1028	
	Dry	2.4	4.1	9.9	19.6	34.1	54.3	84.8	117	165	225	286	418	568	773	993	1285	
	Torque (ft-lbs)																	
	Ecoguard	1.1	2.0	4.7	9.4	16.4	26.1	40.6	55.9	79.3	108	137	201	272	371	476	616	
Lubricated	1.3	2.3	5.5	10.8	18.9	30.1	46.9	64.5	91.5	124	158	231	314	428	549	711		
 ISO 898-1 Property Class 8.8	Min Tensile (N)	11360	16080	29280	46400	67440	92000	125600	159360	203350	251490	292990	380970	465630	576020	678110	810080	
	Min Proof Strength (N)	8236	11658	21228	33640	48894	66700	91060	115200	147000	181800	211800	275400	336600	416400	490200	585600	
	Clamp Load (N)	6177	8744	15921	25230	36671	50025	68295	86400	110250	136350	158850	206550	252450	312300	367650	439200	
	Min Tensile (lbs)	2556	3618	6588	10440	15174	20700	28260	35856	45754	56585	65923	85718	104767	129605	152575	182268	
	Min Proof Strength (lbs)	1853	2623	4776	7569	11001	15008	20489	25920	33075	40905	47655	61965	75735	93690	110295	131760	
	Clamp Load (lbs)	1390	1967	3582	5677	8251	11256	15366	19440	24806	30679	35741	46474	56801	70268	82721	98820	
	Torque (Nm)																	
	Ecoguard	4.0	6.8	16.6	32.8	57.2	91.0	142	202	287	390	496	725	985	1340	1721	2227	
	Lubricated	4.6	7.9	19.1	37.8	66.0	105	164	233	331	450	572	837	1136	1546	1985	2569	
	Dry	6.2	10.5	25.5	50.5	88.0	140	219	311	441	600	762	1115	1515	2061	2647	3426	
	Torque (ft-lbs)																	
	Ecoguard	3.0	5.0	12.2	24.2	42.2	67.2	105	149	211	288	366	535	726	988	1269	1642	
Lubricated	3.4	5.8	14.1	27.9	48.7	77.5	121	172	244	332	422	617	838	1140	1464	1895		
Dry	4.6	7.7	18.8	37.2	64.9	103	161	229	325	443	562	823	1117	1520	1952	2527		
 ISO 898-1 Property Class 10.9	Min Tensile (N)	14768	20904	38064	60320	87672	119600	163280	199680	254800	315120	367120	477360	583440	721760	849680	1015040	
	Min Proof Strength (N)	11786	16683	30378	48140	69969	95450	130310	159360	203350	251490	292990	380970	465630	576020	678110	810080	
	Clamp Load (N)	8840	12512	22784	36105	52477	71588	97733	119520	152513	188618	219743	285728	349223	432015	508583	607560	
	Min Tensile (lbs)	3323	4703	8564	13572	19726	26910	36738	44928	57330	70902	82602	107406	131274	162396	191178	228384	
	Min Proof Strength (lbs)	2652	3754	6835	10832	15743	21476	29320	35856	45754	56585	65923	85718	104767	129605	152575	182268	
	Clamp Load (lbs)	1989	2815	5126	8124	11807	16107	21990	26892	34315	42439	49442	64289	78575	97203	114431	136701	
	Torque (Nm)																	
	Ecoguard	5.7	9.8	23.7	46.9	81.9	130	203	280	397	539	686	1003	1362	1853	2380	3080	
	Lubricated	6.6	11.3	27.3	54.2	94.5	150	235	323	458	622	791	1157	1572	2138	2746	3554	
	Dry	8.8	15.0	36.5	72.2	126	200	313	430	610	830	1055	1543	2095	2851	3662	4739	
	Torque (ft-lbs)																	
	Ecoguard	4.2	7.2	17.5	34.6	60.4	96.1	150	206	292	398	506	740	1005	1367	1756	2272	
Lubricated	4.9	8.3	20.2	39.9	69.7	111	173	238	337	459	583	854	1159	1577	2026	2622		
Dry	6.5	11.1	26.9	53.3	92.9	148	231	317	450	612	778	1138	1546	2103	2701	3495		
 ISO 898-1 Property Class 12.9	Min Tensile (N)	17324	24522	44652	70760	102846	140300	191540	234240	298900	369660	430660	559980	684420	846680	996740	1190720	
	Min Proof Strength (N)	13774	19497	35502	56260	81771	111550	152290	186240	237650	293910	342410	445230	544170	673180	792490	946720	
	Clamp Load (N)	10331	14623	26627	42195	61328	83663	114218	139680	178238	220433	256808	333923	408128	504885	594368	710040	
	Min Tensile (lbs)	3898	5517	10047	15921	23140	31568	43097	52704	67253	83174	96899	125996	153995	190503	224267	267912	
	Min Proof Strength (lbs)	3099	4387	7988	12659	18398	25099	34265	41904	53471	66130	77042	100177	122438	151466	178310	213012	
	Clamp Load (lbs)	2324	3290	5991	9494	13799	18824	25699	31428	40103	49597	57782	75133	91829	113599	133733	159759	
	Torque (Nm)																	
	Ecoguard	6.7	11.4	27.7	54.9	95.7	152	238	327	463	630	801	1172	1592	2166	2782	3600	
	Lubricated	7.7	13.2	32.0	63.3	110	176	274	377	535	727	925	1352	1837	2499	3210	4154	
	Dry	10.3	17.5	42.6	84.4	147	234	365	503	713	970	1233	1803	2449	3332	4279	5538	
	Torque (ft-lbs)																	
	Ecoguard	5.0	8.4	20.4	40.5	70.6	112	175	241	342	465	591	865	1174	1598	2052	2655	
Lubricated	5.7	9.7	23.6	46.7	81.4	130	202	278	394	537	682	998	1355	1843	2367	3064		
Dry	7.6	12.9	31.4	62.2	109	173	270	371	526	715	909	1330	1806	2458	3157	4085		

Minimum tensile and proof strengths per ISO 898-1 where applicable.
 The torque values can only be achieved if nut (or tapped hole) has a proof load greater than or equal to the bolt's minimum ultimate tensile strength.
 Clamp load calculated as 75% of the proof load when specified by the standard.
 Torque values calculated from formula T=KDF, where
 K = estimated at 0.13 for Ecoguard, 0.15 used for "lubricated" conditions and 0.20 for "dry" conditions.
 D = Nominal Diameter
 F = Clamp Load

Note: When using Zinc Plated (lubricated with wax) Top Lock Nuts, the K value can vary between 0.12-0.16.