

TABLES & OTHER *Information*

Mechanical Data - Mild Steel

Tensile, Torque and Shear Calculations for Standard Number and Fractional Thread Sizes

Low Carbon C1008/C1010/C1018 ASTM A307 Thread Class UN-2A

Fastener	ND	TPI	PD	MD	SAF	SAP	SAT ^a	UTM ^b	YTM ^b	PTM ^c	UTS	YTS
										90% YTM	UTM•SAT	YTM•SAT
	Nominal Diameter (in)	Threads per Inch	Calculated Pitch Diameter (in)	Calculated Minor Diameter (in)	Calculated Stress Area Full Body (in ²)	Calculated Stress Area Pitch (in ²)	Calculated Stress Area Threads (in ²)	Material Ultimate Tensile Strength Min (PSI)	Material Yield Tensile Strength Min (PSI)	Material Proof Tensile Strength Min (PSI)	Fastener Thread Ultimate Tensile Strength Min (lbs)	Fastener Thread Yield Strength Min (lbs)
#4-40	0.110	40	0.094	0.078	0.0095	0.0069	0.0058	55,000	50,000	45,000	317	288
#6-32	0.138	32	0.118	0.097	0.0150	0.0109	0.0091	55,000	50,000	45,000	500	454
#8-32	0.164	32	0.144	0.123	0.0211	0.0162	0.0140	55,000	50,000	45,000	770	700
#10-32	0.190	32	0.170	0.149	0.0284	0.0226	0.0200	55,000	50,000	45,000	1,100	1,000
#10-24	0.190	24	0.163	0.136	0.0284	0.0209	0.0175	55,000	50,000	45,000	964	877
1/4-20	0.250	20	0.218	0.185	0.0491	0.0372	0.0318	55,000	50,000	45,000	1,750	1,591
5/16-18	0.313	18	0.276	0.240	0.0767	0.0600	0.0524	55,000	50,000	45,000	2,884	2,622
3/8-16	0.375	16	0.334	0.294	0.1104	0.0878	0.0775	55,000	50,000	45,000	4,262	3,875
7/16-14	0.438	14	0.391	0.345	0.1503	0.1201	0.1063	55,000	50,000	45,000	5,847	5,315
1/2-13	0.500	13	0.450	0.400	0.1963	0.1591	0.1419	55,000	50,000	45,000	7,804	7,095
5/8-11	0.625	11	0.566	0.507	0.3068	0.2516	0.2260	55,000	50,000	45,000	12,430	11,300
3/4-10	0.750	10	0.685	0.620	0.4418	0.3686	0.3345	55,000	50,000	45,000	18,395	16,723
7/8-9	0.875	9	0.803	0.731	0.6013	0.5062	0.4617	55,000	50,000	45,000	25,395	23,087
1-8	1.000	8	0.919	0.838	0.7854	0.6630	0.6057	55,000	50,000	45,000	33,316	30,287

Fastener	PL	PR ^d	PP ^e	FC ^f	TR	TP	TU ^g	YSM ^h	YSF	YSP	YST	YTF
	PTM•SAT	75% PL	90% PL		FC•PR•ND	FC•PP•ND	FC•UTS•ND	0.577•YTM	YSM•SAF	YSM•SAP	YSM•SAT	YTM•SAF
	Fastener Proof Load (lbs)	Fastener Preload Reused (lbs)	Fastener Preload Permanent (lbs)	Friction Coefficient	Torque Reused (in•lb) <i>Working Torque</i>	Torque Permanent (in•lb) <i>Yield Torque</i>	Torque Ultimate (in•lb)	Material Yield Shearing Stress Min (PSI)	Fastener Full Body Yield Shear Min (lbs)	Fastener Pitch Yield Shear Min (lbs)	Fastener Thread Yield Shear Min (lbs)	Fastener Full Body Yield Tensile Strength Min (lbs)
#4-40	259	194	233	0.2	4	5.1	7.0	28,850	274	199	166	475
#6-32	409	307	368	0.2	8	10.2	13.8	28,850	432	314	262	748
#8-32	630	473	567	0.2	16	18.6	25.3	28,850	609	468	404	1,056
#10-32	900	675	810	0.2	26	30.8	41.8	28,850	818	653	577	1,418
#10-24	789	592	710	0.2	22	27.0	36.6	28,850	818	602	506	1,418
1/4-20	1,432	1,074	1,289	0.2	54	64.4	87.5	28,850	1,416	1,072	918	2,454
5/16-18	2,359	1,770	2,123	0.2	111	132.7	180.2	28,850	2,213	1,731	1,513	3,835
3/8-16	3,487	2,615	3,138	0.2	196	235.4	319.6	28,850	3,186	2,534	2,236	5,522
7/16-14	4,784	3,588	4,306	0.2	314	376.7	511.6	28,850	4,337	3,466	3,067	7,517
1/2-13	6,385	4,789	5,747	0.2	479	574.7	780.4	28,850	5,665	4,589	4,094	9,817
5/8-11	10,170	7,628	9,153	0.2	953	1,144.1	1,553.8	28,850	8,851	7,258	6,520	15,340
3/4-10	15,051	11,288	13,546	0.2	1,693	2,031.9	2,759.3	28,850	12,746	10,634	9,649	22,089
7/8-9	20,778	15,584	18,700	0.2	2,727	3,272.6	4,444.2	28,850	17,348	14,604	13,321	30,066
1-8	27,259	20,444	24,533	0.2	4,089	4,906.6	6,663.2	28,850	22,659	19,129	17,476	39,270



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Mechanical Data - Metric - Mild Steel

Tensile, Torque and Shear Calculations for Metric Thread Sizes

Low Carbon C1008/C1010/C1018 ASTM F568 Thread Class 6g Property Class 4.6

Fastener	ND	P	PD	MD	SAF	SAP	SAT ^a	UTM ^b	YTM ^b	PTM ^c	UTS	YTS
										90% YTM	UTM*SAT	YTM*SAT
4mm - 0.7	4.00	0.7	3.55	3.14	12.566	9.872	8.779	378	344	309	332	302
5mm - 0.8	5.000	0.8	4.480	4.019	19.6350	15.7660	14.1825	378	344	309	536	487
6mm - 1.0	6.00	1	5.35	4.77	28.274	22.484	20.123	378	344	309	761	691
8mm - 1.25	8.000	1.25	7.188	6.466	50.2655	40.5806	36.6085	378	344	309	1,384	1,258
10mm - 1.50	10.00	1.5	9.03	8.16	78.540	63.981	57.990	378	344	309	2,192	1,992

Fastener	PL	PR ^d	PP ^e	FC ^f	TR	TP	TU ^g	YSM ^h	YSF	YSP	YST	YTF
	PTM*SAT	75% PL	90% PL		FC*PR*ND	FC*PP*ND	FC*UTS*ND	0.577*YTM	YSM*SAF	YSM*SAP	YSM*SAT	YTM*SAF
Fastener	Fastener Proof Load (N)	Fastener Preload Reused (N)	Fastener Preload Permanent (N)	Friction Coefficient	Torque Reused (N•M)	Torque Permanent (N•M)	Torque Ultimate (N•M)	Material Yield Shearing Stress Min (Mpa)	Fastener Full Body Yield Shear Min (N)	Fastener Pitch Yield Shear Min (N)	Fastener Thread Yield Shear Min (N)	Fastener Full Body Yield Tensile Strength Min (N)
4mm - 0.7	271	204	244	0.2	1.6	2.0	2.7	198	249	196	174	432
5mm - 0.8	438	329	395	0.2	3.3	3.9	5.4	198	389	312	281	674
6mm - 1.0	622	467	560	0.2	5.6	6.7	9.1	198	560	446	399	971
8mm - 1.25	1,132	849	1,019	0.2	13.6	16.3	22.1	198	996	804	726	1,727
10mm - 1.50	1,793	1,345	1,613	0.2	26.9	32.3	43.8	198	1,557	1,268	1,149	2,698

Notes:

a	Stress area for the treads is calculated on an area approximately half way between the root diameter and pitch diameter. This more closely reflects actual results versus using root diameter for stress area calculations
b	Data provided by our suppliers
c	Proof Tensile is estimated to be 90% of Yield Tensile when Proof Tensile data is not readily available.
d	Preload for reuse of threaded fastener is 75% of Proof Load. Fastener may be rebolted multiple times with no degradation.
e	Preload for permanent installation of fastener is 90% of Proof Load. Fastener is permanently stretched and will not achieve the same clamping force on reuse.
f	Friction Coefficient will vary greatly depending on bolting conditions including lubrication. 0.2 is standard when bolt condition is plain finish or unknown.
g	Ultimate Torque is not useful in designing a bolted joint. Preloaded torque is more practical. This data is provided as a reference only.
h	Using the distortion-energy theory; Maximum Shear Stress equals .577 times the Maximum Tensile.

Source: "Mechanical Engineering Design", 5th ed.; Shigley and Mischke, McGraw Hill, C1989.

CAUTION:

Fasteners should not be used at their tensile or shear limits. A safety factor must be applied to engineering calculations. The particular safety factor will vary depending on the application. **The end user will choose the safety factor for his/her application.**



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