TABLES & OTHER *Information*

Mechanical Data - Aluminum

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

Aluminum 5356 Thread Class UN-2A

	ND	TPI	PD	MD	SAF	SAP	SAT[a]	UTM[b]	YTM[b]	PTM[c]	UTS	YTS
										90% YTM	UTM•SAT	YTM•SAT
Fastener	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	45,000	25,000	22,500	259	144
#6-32	0.138	32	0.118	0.097	0.0150	0.0109	0.0091	45,000	25,000	22,500	409	227
#8-32	0.164	32	0.144	0.123	0.0211	0.0162	0.0140	45,000	25,000	22,500	630	350
#10-32	0.190	32	0.170	0.149	0.0284	0.0226	0.0200	45,000	25,000	22,500	900	500
#10-24	0.190	24	0.163	0.136	0.0284	0.0209	0.0175	45,000	25,000	22,500	789	438
1/4-20	0.250	20	0.218	0.185	0.0491	0.0372	0.0318	45,000	25,000	22,500	1,432	796
5/16-18	0.313	18	0.276	0.240	0.0767	0.0600	0.0524	45,000	25,000	22,500	2,359	1,311
3/8-16	0.375	16	0.334	0.294	0.1104	0.0878	0.0775	45,000	25,000	22,500	3,487	1,937
7/16-14	0.438	14	0.391	0.345	0.1503	0.1201	0.1063	45,000	25,000	22,500	4,784	2,658
1/2-13	0.500	13	0.450	0.400	0.1963	0.1591	0.1419	45,000	25,000	22,500	6,385	3,547
5/8-11	0.625	11	0.566	0.507	0.3068	0.2516	0.2260	45,000	25,000	22,500	10,170	5,650
3/4-10	0.750	10	0.685	0.620	0.4418	0.3686	0.3345	45,000	25,000	22,500	15,051	8,362
7/8-9	0.875	9	0.803	0.731	0.6013	0.5062	0.4617	45,000	25,000	22,500	20,778	11,543

	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 (lbs)	Fastener Preload Reused (lbs)	Fastener Preload Permanent (lbs)	Friction Coefficient	Torque Reused (in•lb)	Torque Permanent (in•lb)	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	130	97	117	0.2	2	3	6	14,425	137	100	83	238
#6-32	204	153	184	0.2	4	5	11	14,425	216	157	131	374
#8-32	315	236	284	0.2	8	9	21	14,425	305	234	202	528
#10-32	450	337	405	0.2	13	15	34	14,425	409	326	288	709
#10-24	394	296	355	0.2	11	13	30	14,425	409	301	253	709
1/4-20	716	537	644	0.2	27	32	72	14,425	708	536	459	1,227
5/16-18	1,180	885	1,062	0.2	55	66	147	14,425	1,106	866	756	1,917
3/8-16	1,744	1,308	1,569	0.2	98	118	262	14,425	1,593	1,267	1,118	2,761
7/16-14	2,392	1,794	2,153	0.2	157	188	419	14,425	2,169	1,733	1,534	3,758
1/2-13	3,193	2,395	2,873	0.2	239	287	639	14,425	2,832	2,295	2,047	4,909
5/8-11	5,085	3,814	4,577	0.2	477	572	1,271	14,425	4,426	3,629	3,260	7,670
3/4-10	7,525	5,644	6,773	0.2	847	1,016	2,258	14,425	6,373	5,317	4,825	11,045
7/8-9	10,389	7,792	9,350	0.2	1,364	1,636	3,636	14,425	8,674	7,302	6,661	15,033

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Mechanical Data -Metric - Aluminum

Tensile, Torque and Shear Calculations for Metric Thread Sizes

Aluminum 5356 Thread Class 6g Property Class 4.6 Elongation 20%

	ND	TPI	PD	MD	SAF	SAP	SAT[a]	UTM[b]	YTM[b]	PTM[c]	UTS	YTS
										90% YTM	UTM•SAT	YTM•SAT
Fastener	Nominal Diameter (mm)	Pitch	Calculated Pitch Diameter (mm)	Calculated minor Diameter (mm)	Calculated Stress Area Full Body (mm^2)	Calculated Stress Area Pitch (mm^2)	Calculated Stress Area Threads (mm^2)	Material Ultimate Tensile Strength Min (MPa)	Material Yield Tensile Strength Min (MPa)	Material Proof Tensile Strength Min (MPa)	Fastener Ultimate Tensile Strength Min (N)	Fastener Thread Yield Strength Min (N)
4mm - 0.7	4.00	0.7	3.55	3.14	12.566	9.872	8.779	310	172	155	272	151
5mm - 0.8	5.000	0.8	4.480	4.019	19.6350	15.7660	14.1825	310	172	155	440	244
6mm - 1.0	6.00	1	5.35	4.77	28.274	22.484	20.123	310	172	155	624	346
8mm - 1.25	8.000	1.25	7.188	6.466	50.2655	40.5806	36.6085	310	172	155	1,135	630
10mm - 1.50	10.00	1.5	9.03	8.16	78.540	63.981	57.990	310	172	155	1,798	997

	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	136	102	122	0.2	0.8	1.0	2.2	99	125	98	87	216
5mm - 0.8	220	165	198	0.2	1.6	2.0	4.4	99	195	156	141	338
6mm - 1.0	312	234	280	0.2	2.8	3.4	7.5	99	281	223	200	486
8mm - 1.25	567	425	510	0.2	6.8	8.2	18.2	99	499	403	363	865
10mm - 1.50	898	673	808	0.2	13.5	16.2	36.0	99	779	635	576	1,351

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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