

Ultimate Tensile Loads For Threaded Fasteners



The Ultimate Tensile Load is the final load or force that a metal specimen (in this case threaded fasteners) can withstand before it fractures. It is one of the most important mechanical properties used to determine the strength and durability of metal components.

This property will depend on the material the fasteners are made from. It is more commonly expressed in textbooks and datasheets as **Ultimate Tensile Strength (Stress)** which is the Ultimate Tensile Load divided by the area it is spread over. However, measuring the Ultimate Tensile Load is more practical than measuring stress in most applications.

Why it is important for fasteners

This property is crucial for threaded fasteners because they are usually connecting two key components together. In a lot of mechanical failures, the threaded fasteners fail first and initiate fractures. Hence, it is important to know when they might fail.

Ultimate Tensile Loads for Metric Fasteners

Tables 1 and 2 below show the Ultimate Tensile Loads for standard metric bolts for both coarse and fine pitch threads. The values for the Ultimate Tensile Loads are based on the specifications provided in ISO 898 Part 1.

This standard lays out specifications for the mechanical and physical properties for metric threaded fasteners made from carbon and alloy steel tested within a temperature range of 10 °C to 35 °C.

Table 1

Minimum Ultimate Tensile Loads — ISO Metric Fine Thread

Nominal Size	Pitch, mm (Fine)	Nominal Stress Area, mm ²	Minimum Tensile Load, N (Property Class 8.8)
M8	1.00	39.2	31360
M10	1.00	64.5	49000
M10	1.25	61.2	51600
M12	1.25	92.1	70500
M12	1.50	88.1	73700
M14	1.50	125	100000
M16	1.50	167	134000
M18	1.50	216	179000
M20	1.50	272	226000
M22	1.50	333	276000
M24	2.00	384	319000
M27	2.00	496	412000
M30	2.00	621	515000
M33	2.00	761	632000
M36	3.00	865	718000
M39	3.00	1030	855000



Table 2

Minimum Ultimate Tensile Loads — ISO Metric Coarse Thread

Nominal Bolt Size	Pitch, mm (Coarse)	Nominal stress area, mm ²	Minimal Ultimate Tensile Loads, N (Property classes 4.8 to 10.9)				
			4.8	5.8	6.8	8.8	10.9
M3	0.50	5.03	2110	2620	3020	4020	5230
M3.5	0.60	6.78	2850	3530	4070	5420	7050
M4	0.70	8.78	3690	4570	5270	7020	9130
M5	0.80	14.2	5960	7380	8520	11350	14800
M6	1.00	20.1	8440	10400	12100	161000	20900
M7	1.00	28.9	12100	15000	17300	231000	30100
M8	1.25	36.6	15400	19000	22000	292000	38100
M10	1.50	58	24400	30200	34800	464000	60300
M12	1.75	84.3	35400	43800	50600	67400	87700
M14	2.00	115	48300	59800	69000	92000	120000
M16	2.00	157	65900	81600	94000	125000	163000
M18	2.50	192	80600	99800	115000	159000	200000
M20	2.50	245	103000	127000	147000	203000	250000
M22	2.50	303	127000	158000	182000	252000	315000
M24	3.00	353	148000	184000	212000	293000	367000
M27	3.00	459	193000	239000	275000	381000	477000
M30	3.50	561	236000	292000	337000	466000	583000
M33	3.50	694	292000	361000	416000	576000	722000
M36	4.00	817	343000	425000	490000	678000	850000
M39	4.00	976	410000	508000	586000	810000	1020000



Ultimate Tensile Loads For Imperial Fasteners

The minimum tensile loads for imperial threaded fasteners are based on the requirements set in the standard SAE J429. This standard covers the requirements for chemical and material properties for inch series bolts, studs and threaded fasteners made from steel.

Tables 3 and 4 show the minimum ultimate tensile loads for UNC (coarse) and UNF (fine) threads.

Table 3

Minimum Tensile Load for Imperial Bolts (UNC)

Nominal Size (in)	Stress area (in ²)	Minimum Tensile Load (kN)	
		Grade 5	Grade 8
1/4 – 20	0.0318	16.9	21.1
5/16 – 18	0.0524	28.0	34.9
3/8 – 16	0.0775	41.4	51.6
7/16 – 14	0.1063	56.9	70.7
1/2 – 13	0.1419	75.6	94.7
9/16 – 12	0.182	96.9	121.4
5/8 – 11	0.226	120.5	150.8
3/4 – 10	0.334	178.4	222.9
7/8 – 9	0.462	246.4	308.2
1 – 8	0.606	323.3	404.3
1 1/8 – 7	0.763	356.3	508.9
1 1/4 – 7	0.969	452.3	646.8
1 3/8 – 6	1.155	539.6	770.4
1 1/2 – 6	1.405	656.1	937.7

Table 4

Minimum Tensile Load for Imperial Bolts (UNF)

Nominal Size (in)	Stress area (in ²)	Minimum Tensile Load (kN)	
		Grade 5	Grade 8
1/4 – 28	0.0364	19.3	24.2
5/16 – 24	0.058	30.9	38.6
3/8 – 24	0.0878	46.7	58.7
7/16 – 20	0.1187	63.1	79.1
1/2 – 20	0.1599	85.4	106.7
9/16 – 18	0.203	108.5	135.2
5/8 – 18	0.256	136.5	170.8
3/4 – 16	0.373	199.2	249.1
7/8 – 14	0.509	271.7	339.8
1 – 12	0.663	354.0	442.1
1 1/8 – 12	0.856	400.0	571.1
1 1/4 – 12	1.073	501.3	716.1
1 3/8 – 12	1.315	614.2	877.1
1 1/2 – 12	1.581	738.4	1055.1

ⓘ The data provided in this document is for general guidance only and should not be solely relied upon when working to stringent specifications. We recommend consulting with qualified experts regarding any technical queries. This information may change without written notice.