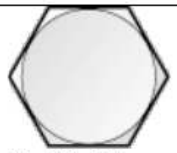
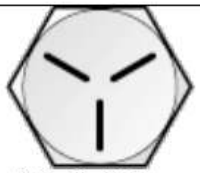
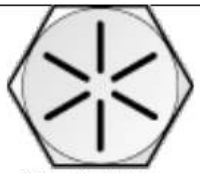
Bolt Grade Markings and Strength Chart

Head Marking	Grade and Material	Nominal Size Range (inch / mm)	Mechanical Properties		
			Proof Load (psi / MPa)	**Min. Yield Strength** (psi / MPa)	**Min. Tensile Strength** (psi / MPa)
US Bolts					
 No Markings	**Grade 2** Low or medium carbon steel	1/4 thru 3/4	55,000/ 380	57,000 / 395	74,000 / 510
		Over 3/4 thru 1-1/2	33,000 /230	36,000 / 250	60,000 / 415
 3 Radial Lines	**Grade 5** Medium Carbon Steel, Quenched and Tempered	1/4 thru 3/4	85,000 / 585	92,000 / 630	120,000 / 830
		Over 3/4 thru 1-1/2	74,000 / 510	81,000 / 560	105,000 / 725
 6 Radial Lines	**Grade 8** Medium Carbon Alloy Steel, Quenched and Tempered	1/4 thru 1-1/2	120,000 / 830	130,000 / 895	150,000 / 1,035
Metric Bolts					
 8.8	**Class 8.8** Medium Carbon Steel, Quenched and Tempered	All Sizes below 16mm	84,000 / 580	93,000 / 640	116,000 / 800
		16mm - 72mm	87,000 / 600	96,000 / 660	120,000 / 830
 10.9	**Class 10.9** Alloy Steel, Quenched and Tempered	5mm - 100mm	120,000 / 830	136,000 / 940	151,000 / 1040
12.9	**Class 12.9** Alloy Steel, Quenched and Tempered	1.6mm - 100mm	141,000 / 970	160,000 / 1100	177,000 / 1220

- **Tensile Strength:** The maximum load in tension (pulling apart) which a material can withstand before breaking or fracturing.
- **Yield Strength:** The maximum load at which a material exhibits a specific permanent deformation
- **Proof Load:** An axial tensile load which the product must withstand without evidence of any permanent set.

Metric Tap & Clearance Drill Sizes

Screw Size (mm)	Thread Pitch (mm)	Tap Drill: 75% Thread for Aluminum, Brass, & Plastics		Tap Drill: 50% Thread for Steel, Stainless, & Iron		Clearance Drill: Close Fit		Clearance Drill: Standard Fit	
		Drill Size (mm)	Closest American Drill	Drill Size (mm)	Closest American Drill	Drill Size (mm)	Closest American Drill	Drill Size (mm)	Closest American Drill
M1.5	0.35	1.15	56	1.25	55	1.60	1/16	1.65	52
M1.6	0.35	1.25	55	1.35	54	1.70	51	1.75	50
M 1.8	0.35	1.45	53	1.55	1/16	1.90	49	2.00	5/64
M 2	0.45	1.55	1/16	1.70	51	2.10	45	2.20	44
	0.40	1.60	52	1.75	50				
M 2.2	0.45	1.75	50	1.90	48	2.30	3/32	2.40	41
M 2.5	0.45	2.05	46	2.20	44	2.65	37	2.75	7/64
M 3	0.60	2.40	41	2.60	37	3.15	1/8	3.30	30
	0.50	2.50	39	2.70	36				
M 3.5	0.60	2.90	32	3.10	31	3.70	27	3.85	24
M 4	0.75	3.25	30	3.50	28	4.20	19	4.40	17
	0.70	3.30	30	3.50	28				
M 4.5	0.75	3.75	25	4.00	22	4.75	13	5.00	9
M 5	1.00	4.00	21	4.40	11/64	5.25	5	5.50	7/32
	0.90	4.10	20	4.40	17				
	0.80	4.20	19	4.50	16				
M 5.5	0.90	4.60	14	4.90	10	5.80	1	6.10	B
M 6	1.00	5.00	8	5.40	4	6.30	E	6.60	G
	0.75	5.25	4	5.50	7/32				
M 7	1.00	6.00	B	6.40	E	7.40	L	7.70	N
	0.75	6.25	D	6.50	F				
M 8	1.25	6.80	H	7.20	J	8.40	Q	8.80	S
	1.00	7.00	J	7.40	L				
M 9	1.25	7.80	N	8.20	P	9.50	3/8	9.90	25/64
	1.00	8.00	O	8.40	21/64				
M 10	1.50	8.50	R	9.00	T	10.50	Z	11.00	7/16
	1.25	8.80	11/32	9.20	23/64				
	1.00	9.00	T	9.40	U				
M 11	1.50	9.50	3/8	10.00	X	11.60	29/64	12.10	15/32
M 12	1.75	10.30	13/32	10.90	27/64	12.60	1/2	13.20	33/64
	1.50	10.50	Z	11.00	7/16				
	1.25	10.80	27/64	11.20	7/16				
M 14	2.00	12.10	15/32	12.70	1/2	14.75	37/64	15.50	39/64
	1.50	12.50	1/2	13.00	33/64				
	1.25	12.80	1/2	13.20	33/64				
M 15	1.50	13.50	17/32	14.00	35/64	15.75	5/8	16.50	21/32
M 16	2.00	14.00	35/64	14.75	37/64	16.75	21/32	17.50	11/16
	1.50	14.50	37/64	15.00	19/32				
M 17	1.50	15.50	39/64	16.00	5/8	18.00	45/64	18.50	47/64
M 18	2.50	15.50	39/64	16.50	41/64	19.00	3/4	20.00	25/32
	2.00	16.00	5/8	16.75	21/32				
	1.50	16.50	21/32	17.00	43/64				
M 19	2.50	16.50	21/32	17.50	11/16	20.00	25/32	21.00	53/64
M 20	2.50	17.50	11/16	18.50	23/32	21.00	53/64	22.00	55/64
	2.00	18.00	45/64	18.50	47/64				
	1.50	18.50	47/64	19.00	3/4				

Tap & Clearance Drill Sizes

Screw Size	Major Diameter	Threads Per Inch	Minor Diameter	Tap Drill				Clearance Drill			
				75% Thread for Aluminum, Brass, & Plastics		50% Thread for Steel, Stainless, & Iron		Close Fit		Free Fit	
				Drill Size	Dec. Eq.	Drill Size	Dec. Eq.	Drill Size	Dec. Eq.	Drill Size	Dec. Eq.
0	.0600	80	.0447	3/64	.0469	55	.0520	52	.0635	50	.0700
1	.0730	64	.0538	53	.0595	1/16	.0625	48	.0760	46	.0810
		72	.0560	53	.0595	52	.0635				
2	.0860	56	.0641	50	.0700	49	.0730	43	.0890	41	.0960
		64	.0668	50	.0700	48	.0760				
3	.0990	48	.0734	47	.0785	44	.0860	37	.1040	35	.1100
		56	.0771	45	.0820	43	.0890				
4	.1120	40	.0813	43	.0890	41	.0960	32	.1160	30	.1285
		48	.0864	42	.0935	40	.0980				
5	.125	40	.0943	38	.1015	7/64	.1094	30	.1285	29	.1360
		44	.0971	37	.1040	35	.1100				
6	.138	32	.0997	36	.1065	32	.1160	27	.1440	25	.1495
		40	.1073	33	.1130	31	.1200				
8	.1640	32	.1257	29	.1360	27	.1440	18	.1695	16	.1770
		36	.1299	29	.1360	26	.1470				
10	.1900	24	.1389	25	.1495	20	.1610	9	.1960	7	.2010
		32	.1517	21	.1590	18	.1695				
12	.2160	24	.1649	16	.1770	12	.1890	2	.2210	1	.2280
		28	.1722	14	.1820	10	.1935				
		32	.1777	13	.1850	9	.1960				
1/4	.2500	20	.1887	7	.2010	7/32	.2188	F	.2570	H	.2660
		28	.2062	3	.2130	1	.2280				
		32	.2117	7/32	.2188	1	.2280				
5/16	.3125	18	.2443	F	.2570	J	.2770	P	.3230	Q	.3320
		24	.2614	I	.2720	9/32	.2812				
		32	.2742	9/32	.2812	L	.2900				
3/8	.3750	16	.2983	5/16	.3125	Q	.3320	W	.3860	X	.3970
		24	.3239	Q	.3320	S	.3480				
		32	.3367	11/32	.3438	T	.3580				
7/16	.4375	14	.3499	U	.3680	25/64	.3906	29/64	.4531	15/32	.4687
		20	.3762	25/64	.3906	13/32	.4062				
		28	.3937	Y	.4040	Z	.4130				
1/2	.5000	13	.4056	27/64	.4219	29/64	.4531	33/64	.5156	17/32	.5312
		20	.4387	29/64	.4531	15/32	.4688				
		28	.4562	15/32	.4688	15/32	.4688				
9/16	.5625	12	.4603	31/64	.4844	33/64	.5156	37/64	.5781	19/32	.5938
		18	.4943	33/64	.5156	17/32	.5312				
		24	.5114	33/64	.5156	17/32	.5312				
5/8	.6250	11	.5135	17/32	.5312	9/16	.5625	41/64	.6406	21/32	.6562
		18	.5568	37/64	.5781	19/32	.5938				
		24	.5739	37/64	.5781	19/32	.5938				
11/16	.6875	24	.6364	41/64	.6406	21/32	.6562	45/64	.7031	23/32	.6562
3/4	.7500	10	.6273	21/32	.6562	11/16	.6875	49/64	.7656	25/32	.7812
		16	.6733	11/16	.6875	45/64	.7031				
		20	.6887	45/64	.7031	23/32	.7188				
13/16	.8125	20	.7512	49/64	.7656	25/32	.7812	53/64	.8281	27/32	.8438
7/8	.8750	9	.7387	49/64	.7656	51/64	.7969	57/64	.8906	29/32	.9062
		14	.7874	13/16	.8125	53/64	.8281				
		20	.8137	53/64	.8281	27/32	.8438				
15/16	.9375	20	.8762	57/64	.8906	29/32	.9062	61/64	.9531	31/32	.9688
1	1.000	8	.8466	7/8	.8750	59/64	.9219	1-1/64	1.0156	1-1/32	1.0313
		12	.8978	15/16	.9375	61/64	.9531				
		20	.9387	61/64	.9531	31/32	.9688				

UNC-Unified National Coarse Thread Pitch

UNC threads according ANSI B1.1:

Major Diameter (in)	Threads per inch	Major Dia. (in)	Major Dia. (mm)	Tap Drill Size (mm)	Pitch (mm)
#1 - 64	64	0.073	1.854	1.5	0.397
#2 - 56	56	0.086	2.184	1.8	0.453
#3 - 48	48	0.099	2.515	2.1	0.529
#4 - 40	40	0.112	2.845	2.35	0.635
#5 - 40	40	0.125	3.175	2.65	0.635
#6 - 32	32	0.138	3.505	2.85	0.794
#8 - 32	32	0.164	4.166	3.5	0.794
#10 - 24	24	0.19	4.826	4	1.058
#12 - 24	24	0.216	5.486	4.65	1.058
1/4" - 20	20	0.25	6.35	5.35	1.27
5/16" - 18	18	0.313	7.938	6.8	1.411
3/8" - 16	16	0.375	9.525	8.25	1.587
7/16" - 14	14	0.438	11.112	9.65	1.814
1/2" - 13	13	0.5	12.7	11.15	1.954
9/16" - 12	12	0.563	14.288	12.6	2.117
5/8" - 11	11	0.625	15.875	14.05	2.309
3/4" - 10	10	0.75	19.05	17	2.54
7/8" - 9	9	0.875	22.225	20	2.822
1" - 8	8	1	25.4	22.85	3.175
1 1/8" - 7	7	1.125	28.575	25.65	3.628
1 1/4" - 7	7	1.25	31.75	28.85	3.628
1 3/8" - 6	6	1.375	43.925	31.55	4.233
1 1/2" - 6	6	1.5	38.1	34.7	4.233
1 3/4" - 5	5	1.75	44.45	40.4	5.08
2" - 4 1/2	4 1/2	2	50.8	46.3	5.644
2 1/4" - 4 1/2	4 1/2	2.25	57.15	52.65	5.644
2 1/2" - 4	4	2.5	63.5	58.5	6.35
2 3/4" - 4	4	2.75	69.85	64.75	6.35
3" - 4	4	3	76.2	71.1	6.35
3 1/4" - 4	4	3.25	82.55	77.45	6.35
3 1/2" - 4	4	3.5	88.9	83.8	6.35
3 3/4" - 4	4	3.75	95.25	90.15	6.35
4" - 4	4	4	101.6	96.5	6.35

UNF - Unified National Fine Thread Pitch

UNF threads ANSI B1.1:

Major Diameter (in)	Threads per inch	Major Dia. (in)	Major Dia. (mm)	Tap Drill Size (mm)	Pitch (mm)
#0 - 80	80	0.06	1.524	1.25	0.317
#1 - 72	72	0.073	1.854	1.55	0.353
#2 - 64	64	0.086	2.184	1.9	0.397
#3 - 56	56	0.099	2.515	2.15	0.453
#4 - 48	48	0.112	2.845	2.4	0.529
#5 - 44	44	0.125	3.175	2.7	0.577
#6 - 40	40	0.138	3.505	2.95	0.635
#8 - 36	36	0.164	4.166	3.5	0.705
#10 - 32	32	0.19	4.826	4.1	0.794
#12 - 28	28	0.216	5.486	4.7	0.907
1/4" - 28	28	0.25	6.35	5.5	0.907
5/16" - 24	24	0.313	7.938	6.9	1.058
3/8" - 24	24	0.375	9.525	8.5	1.058
7/16" - 20	20	0.438	11.112	9.9	1.27
1/2" - 20	20	0.5	12.7	11.5	1.27
9/16" - 18	18	0.563	14.288	12.9	1.411
5/8" - 18	18	0.625	15.875	14.5	1.411
3/4" - 16	16	0.75	19.05	17.5	1.587
7/8" - 14	14	0.875	22.225	20.4	1.814
1" - 12	12	1	25.4	23.25	2.117
1 1/8" - 12	12	1.125	28.575	26.5	2.117
1 1/4" - 12	12	1.25	31.75	29.5	2.117
1 3/8" - 12	12	1.375	34.925	32.75	2.117
1 1/2" - 12	12	1.5	38.1	36	2.117

METRIC PRODUCTS

Size	Thread Pitch	Major Dia.		T.P.I.
	mm	mm	inch	inch
M1.6	0.35	1.60	0.063	73
M2.0	0.40	2.00	0.079	64
M2.5	0.45	2.50	0.098	56
M3	0.50	3.00	0.118	51
M4	0.70	4.00	0.157	36
M5	0.80	5.00	0.197	32
M6	1.00	6.00	0.236	25
M8	1.25	8.00	0.315	20
M10	1.50	10.00	0.394	17
M12	1.75	12.00	0.472	14½
M14	2.00	14.00	0.551	12½
M16	2.00	16.00	0.630	12½
M20	2.50	20.00	0.787	10
M24	3.00	24.00	0.945	8½

BRITISH INCH PRODUCTS

Size	T.P.I.		Major Dia.
	BSW	BSF/BA	inch
8BA		59.1	0.087
6BA		47.9	0.110
1/8	40		0.125
5BA		43.0	0.126
4BA		38.5	0.142
3BA		34.8	0.161
2BA		31.4	0.185
3/16	24	32.0	0.187
1BA		28.2	0.209
0BA		25.4	0.236
1/4	20	26.0	0.250
5/16	18	22.0	0.313
3/8	16	20.0	0.375
7/16	14	18.0	0.438
1/2	12	16.0	0.500
5/8	11	14.0	0.625
3/4	10	12.0	0.750
7/8	9	11.0	0.875
1	8	10.0	1.000

AMERICAN INCH PRODUCTS

Size	T.P.I.		Major Dia.
	UNC	UNF	inch
0		80	0.060
1	64	72	0.073
2	56	64	0.086
3	48	56	0.099
4	40	48	0.112
5	40	44	0.125
6	32	40	0.138
8	32	36	0.164
10	24	32	0.190
12	24	28	0.216
1/4	20	28	0.250
5/16	18	24	0.313
3/8	16	24	0.375
7/16	14	20	0.438
1/2	13	20	0.500
5/8	11	18	0.625
3/4	10	16	0.750
7/8	9	14	0.875
1	8	14/12	1.000