MAX MACHINING

Hole and Hardware Chart

Countersinks, counterbores, PEM self clinching hole sizes, NPT pipe tap drills.

MAXMACHINING.COM · REV. NOV 2026

Countersinks THEORETICAL SHARP Ø, 82°

SCREW	FLAT HEAD MACHINE SCREW ASME B18.6.3, 82°	FLAT SOCKET HEAD CAP SCREW ASME B18.3, 82°
#2	.1720 4.37 mm	.1970 5.00 mm
#3	.1990 5.05 mm	.2260 5.74 mm
#4	.2250 5.71 mm	.2550 6.48 mm
#5	.2520 6.40 mm	.2810 7.14 mm
#6	.2790 7.09 mm	.3070 7.80 mm
#8	.3320 8.43 mm	.3590 9.12 mm
#10	.3850 9.78 mm	.4110 10.44 mm
#12	.4380 11.13 mm	·
1/4	.5070 12.88 mm	.5310 13.49 mm
5/16	.6350 16.13 mm	.6560 16.66 mm
3/8	.7620 19.35 mm	.7810 19.84 mm
7/16	.8120 20.62 mm	.8440 21.44 mm
1/2	.8750 22.22 mm	.9380 23.83 mm
5/8	1.1250 28.57 mm	1.1880 30.18 mm
3/4	1.3750 34.92 mm	1.4380 36.53 mm

COUNTERSINK CALLOUT

Diameters are the theoretical sharp corner of the head. A head sits flush when the countersink is at or a few thousandths over this value. Flat head machine screws and flat socket heads differ, so pick the right column. Typical callout: ⌵ Ø.385 X 82°

Metric countersinks ISO 10642, 90°

SCREW	FLAT SOCKET HEAD ISO 10642, 90°
M3	6.72 mm 0.265 in
M4	8.96 mm 0.353 in
M5	11.20 mm 0.441 in
M6	13.44 mm 0.529 in
M8	17.92 mm 0.706 in
M10	22.40 mm 0.882 in
M12	26.88 mm 1.058 in
M16	33.60 mm 1.323 in
M20	40.32 mm 1.587 in

Counterbores, metric ASME B18.3.1M

SCREW SHCS	COUNTERBORE Ø	DEPTH head height	CLOSE FIT HOLE	MEDIUM FIT HOLE
M3	6.5 mm 0.256 in	3.0 mm	3.2 mm	3.4 mm
M4	8.0 mm 0.315 in	4.0 mm	4.3 mm	4.5 mm
M5	10.0 mm 0.394 in	5.0 mm	5.3 mm	5.5 mm
M6	11.0 mm 0.433 in	6.0 mm	6.4 mm	6.6 mm
M8	15.0 mm 0.591 in	8.0 mm	8.4 mm	9.0 mm
M10	18.0 mm 0.709 in	10.0 mm	10.5 mm	11.0 mm
M12	20.0 mm 0.787 in	12.0 mm	13.0 mm	13.5 mm
M16	26.0 mm 1.024 in	16.0 mm	17.0 mm	17.5 mm
M20	33.0 mm 1.299 in	20.0 mm	21.0 mm	22.0 mm

Counterbores, inch SOCKET HEAD CAP SCREWS, ASME B18.3

SCREW SHCS	COUNTERBORE Ø	DEPTH head height	CLOSE FIT HOLE	FREE FIT HOLE
#2	.1880 4.78 mm	.0860 2.18 mm	#43 .0890 2.26 mm	#41 .0960 2.44 mm
#4	.2190 5.56 mm	.1120 2.84 mm	#32 .1160 2.95 mm	#30 .1285 3.26 mm
#5	.2500 6.35 mm	.1250 3.17 mm	#30 .1285 3.26 mm	#29 .1360 3.45 mm
#6	.2810 7.14 mm	.1380 3.51 mm	#27 .1440 3.66 mm	#25 .1495 3.80 mm
#8	.3120 7.92 mm	.1640 4.17 mm	#18 .1695 4.31 mm	#16 .1770 4.50 mm
#10	.3750 9.52 mm	.1900 4.83 mm	#9 .1960 4.98 mm	#7 .2010 5.11 mm
1/4	.4380 11.13 mm	.2500 6.35 mm	F .2570 6.53 mm	H .2660 6.76 mm
5/16	.5310 13.49 mm	.3120 7.92 mm	P .3230 8.20 mm	Q .3320 8.43 mm
3/8	.6250 15.88 mm	.3750 9.52 mm	W .3860 9.80 mm	X .3970 10.08 mm
7/16	.7190 18.26 mm	.4380 11.13 mm	29/64 .4531 11.51 mm	15/32 .4688 11.91 mm
1/2	.8120 20.62 mm	.5000 12.70 mm	33/64 .5156 13.10 mm	17/32 .5312 13.49 mm
5/8	1.0000 25.40 mm	.6250 15.88 mm	41/64 .6406 16.27 mm	21/32 .6562 16.67 mm
3/4	1.1880 30.18 mm	.7500 19.05 mm	49/64 .7656 19.45 mm	25/32 .7812 19.84 mm
1	1.6250 41.27 mm	1.0000 25.40 mm	1-1/64 1.0156 25.80 mm	1-1/32 1.0312 26.19 mm

COUNTERBORE CALLOUT

Depth equals the head height so the head sits flush. Add a few thousandths for a washer or coating. Typical callout: Ø.2660 THRU, ⌴ Ø.438 ↧ .250

PEM self clinching hardware HOLE SIZE IN SHEET, FROM THE PENNENGINEERING DATA SHEETS

Nuts, S / SS / CLS / CLSS, inch

THREAD (CODE)	HOLE IN SHEET in	MIN SHEET -0 in	MIN SHEET -1 in	MIN SHEET -2 in	MIN SHEET -3 in
#4-40 (440)	.1660 +.003 / -.000	.0300	.0400	.0560	.0900
#6-32 (632)	.1875 +.003 / -.000	.0300	.0400	.0560	.0900
#8-32 (832)	.2130 +.003 / -.000	.0300	.0400	.0560	.0900
#10-32 (032)	.2500 +.003 / -.000	.0300	.0400	.0560	.0900
1/4-20 (0420)	.3440 +.003 / -.000	.0470	.0560	.0900	.1250
5/16-18 (0518)	.4130 +.003 / -.000	·	.0560	.0900	.1250
3/8-16 (0616)	.5000 +.003 / -.000	·	.0900	.1250	.2500

Nuts, S / SS / CLS / CLSS, metric

THREAD	HOLE IN SHEET mm	MIN SHEET -00 mm	MIN SHEET -0 mm	MIN SHEET -1 mm	MIN SHEET -2 mm
M3	4.22 mm +0.08	·	0.80	1.00	1.40
M4	5.41 mm +0.08	·	0.80	1.00	1.40
M5	6.35 mm +0.08	·	0.80	1.00	1.40
M6	8.75 mm +0.08	0.92	1.20	1.40	2.29
M8	10.50 mm +0.08	·	·	1.40	2.29
M10	14.00 mm +0.08	·	·	2.29	3.18

Pipe tap drills, NPT, no reamer

PIPE THREAD NPT	TPI	TAP DRILL no reamer
1/16-27	27	D .2460 6.25 mm
1/8-27	27	R .3390 8.61 mm
1/4-18	18	7/16 .4375 11.11 mm
3/8-18	18	37/64 .5781 14.68 mm
1/2-14	14	23/32 .7188 18.26 mm
3/4-14	14	59/64 .9219 23.42 mm
1-11.5	11.5	1-5/32 1.1562 29.37 mm
1-1/4-11.5	11.5	1-1/2 1.5000 38.10 mm
1-1/2-11.5	11.5	1-47/64 1.7344 44.05 mm
2-11.5	11.5	2-7/32 2.2188 56.36 mm

Flush head studs, FH / FHS

THREAD FH / FHS	HOLE IN SHEET in	MIN SHEET in
#4-40	.1110 +.003 / -.000	.0400
#6-32	.1370 +.003 / -.000	.0400
#8-32	.1630 +.003 / -.000	.0400
#10-32	.1890 +.003 / -.000	.0400
1/4-20	.2490 +.003 / -.000	.0620
5/16-18	.3110 +.003 / -.000	.0930

THREAD FH / FHS	HOLE IN SHEET mm	MIN SHEET mm
M3	3.00 mm +0.08	1.0 mm
M3.5	3.50 mm +0.08	1.0 mm
M4	4.00 mm +0.08	1.0 mm
M5	5.00 mm +0.08	1.0 mm
M6	6.00 mm +0.08	1.6 mm
M8	8.00 mm +0.08	2.4 mm

Thru threaded standoffs, SO / SOS / SOA

THREAD SO / SOS / SOA	HOLE IN SHEET in	MIN SHEET in
#4-40	.1660 +.003 / -.000	.0400
#6-32	.2130 +.003 / -.000	.0400
#8-32	.2810 +.003 / -.000	.0500
#10-32	.2810 +.003 / -.000	.0500

THREAD SO / SOS / SOA	HOLE IN SHEET mm	MIN SHEET mm
M3	4.22 mm +0.08 / -0.13	1.00 mm
M3.5	5.41 mm +0.08 / -0.13	1.00 mm
M4	7.14 mm +0.08 / -0.13	1.27 mm
M5	7.14 mm +0.08 / -0.13	1.27 mm

CAUTION

Hole sizes and minimum sheet thickness are from the PennEngineering data sheets for the **S, SS, CLS, FH, FHS and SO** families. Other brands and other families (stainless sheet types, miniature, floating) differ. Hole size is a maximum as well as a minimum: oversize and the hardware spins. Verify the exact part number against its data sheet before you cut.

PIPE THREADS

Drill, then taper ream for the cleanest NPT thread; these drill sizes are for tapping without a reamer. Tap depth sets the fit: gage with an L1 ring or plug. NPTF (dryseal) uses the same drills and needs a reamer.