TONNAGE CALCULATION CHART & HOLE PUNCH TECHNICAL DATA

Tons of pressure required to punch mild steel.

This chart should be used to calculate the punching tonnage required for various applications , both manual and power assisted.

1. First select your hole diameter from the scale running horizontally across the top of the chart.
2. Then read down the scale on the left hand side of the chart to find your material thickness.
3. The figure shown in red at the intersection of these two figures is the tonnage requirement. (e.g. a 1/2" dia. hole through 3mm mild steel requires 4.7 tons of pressure).

				Hole Diameter																			
Material Thickness			inches	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	11/16"	3/4"	13/16"	7/8"	15/16"	1"	1.1/2"	2"	2.1/2"	3"	3.1/2"	4"
	gauge	inches	mm	3.18	4.78	6.35	7.92	9.52	11.11	12.7	14.3	15.9	17.5	19.0	20.6	22.2	23.8	25.4	38.1	50.8	63.5	76.2	88.9	101.6
	20	0.036	0.91	0.4	0.5	0.7	0.9	1.1	1.2	1.4	1.6	1.8	1.9	2.1	2.3	2.5	2.6	2.8	4.2	5.6	7.0	8.5	9.9	11.3
	18	0.048	1.22	0.5	0.7	0.9	1.2	1.4	1.6	1.9	2.1	2.4	2.6	2.8	3.1	3.3	3.5	3.8	5.5	7.5	9.4	11.3	13.0	15.0
	16	0.062	1.57	0.6	0.9	1.2	1.5	1.8	2.1	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	7.0	9.5	11.7	14.0	16.5	18.8
	14	0.075	1.90	0.7	1.1	1.5	1.8	2.2	2.6	2.9	3.3	3.7	4.0	4.4	4.8	5.1	5.5	5.9	8.8	11.7	14.7	17.6	20.5	23.5
	12	0.105	2.67	1.0	1.5	2.1	2.6	3.1	3.6	4.1	4.6	5.1	5.7	6.2	6.7	7.2	7.7	8.2	12.3	16.4	20.5	24.5	28.8	32.8
	11	0.120	3.05	1.2	1.8	2.4	2.9	3.5	4.1	4.7	5.1	5.9	6.2	7.1	7.6	8.3	8.8	9.4	14.0	18.8	23.5	28.2	32.7	37.6
	10	0.135	3.43	1.3	2.0	2.6	3.3	4.0	4.6	5.3	5.9	6.6	7.3	7.9	8.6	9.2	9.9	10.6	15.9	21.0	26.5	31.7	37.0	42.2
	3/16"	0.188	4.78	n/a	2.8	3.7	4.6	5.5	6.4	7.4	8.3	9.2	10.1	11.0	12.0	12.9	13.8	14.8	22.0	29.5	36.8	44.2	51.5	60.0
	1/4"	0.250	6.35	n/a	n/a	4.9	6.1	7.4	8.6	9.8	11.1	12.3	13.5	14.7	16.0	17.2	18.4	19.7	34.4	39.3	49.0	60.0	68.7	78.5
	5/16"	0.312	7.92	n/a	n/a	n/a	7.8	9.2	10.7	12.3	13.9	15.4	17.0	18.5	20.0	21.5	23.0	24.6	43.0	49.0	61.5	73.5	86.0	98.0
	3/8"	0.375	9.52	n/a	n/a	n/a	n/a	11.1	12.8	14.8	16.5	18.5	20.2	22.1	23.8	25.8	27.5	29.5	51.5	59.0	73.6	88.4	103.0	118.0
	1/2"	0.500	12.7	n/a	n/a	n/a	n/a	n/a	n/a	19.7	22.0	24.6	26.9	29.5	31.8	34.4	36.8	39.4	68.8	78.5	98.2	118.0	137.0	1.6

Selecting a Punch or Press

The following information, while not totally applicable to all manually operated tools included in this publication, is provided as a convenient general reference for metal punching operations up to and including large power presses.

Hole Size x Material Thickness

Punching holes in metal is the fast, economical way to get precise hole size, smoothness and minimum burr. Compressive strength of the punch steel determines that the thickness of the metal being punched must not exceed the diameter of the punch. This relationship varies with the type of material. For example: the minimum hole diameter will be 1/4" in 1/4" mild steel, 1/4" in 3/16" stainless steel, and 1/4" in 5/16" aluminium.

Maximum Rated Capacity

All punching tools have their maximum capacities for safe, dependable operation over a long time span. Tools listed in this brochure have a "rated capacity" based on their design strength. Before selecting a tool, use the following information and refer to our **'Tonnage Calculation Chart'** on page 83 to determine the specific tonnage required to punch the size and shape holes through the type and gauge of material being considered. These figures are for flat punch points – shear on the punches (see following section headed 'Shear Punches') will reduce the tonnage requirement.

Determining Tonnages

For Round Holes: to determine tonnages for hot rolled mild steel (typically used in bar size angle iron, channels and tees) with a 50,000 psi shear strength, read direct from our **'Tonnage Calculation Chart'** above.

Other Materials: for materials other than mild steel select the proper multiplier from the chart below, and apply it to the tonnage required for mild steel shown in our **'Tonnage Calculation Chart'** above.

Metal Type	Multiplier
Aluminium (2024-0)	0.36
Brass (1/4 hard)	0.70
Copper (1/2 hard)	0.52
Steel (50% carbon)	1.60
Steel, cold drawn (1018)	1.24
Steel, ASTM-A36	1.20
Steel, stainless (303)	1.50

Example: 1" round hole thro' 26 ga. Aluminium (2024-0) 1.4 x 0.36 = 0.5 tons

Selecting a Punch or Press

For punching irregular shaped holes (square, rectangular, radius end, triangular, etc.,) multiply the length of metal to be cut by the multiplier given for a 1" length in the chart below.
Example: The shear length, or total distance around, a 1"x 2" rectangular hole = 6". To punch such a hole in 20 gauge mild steel 6" x 1.01 = 6.06 tons. For stainless steel this would be 6" x 1.50 – 9.0 tons.

Metal	Mild Steel	Stainless Steel	Brass
Gauge	Multiplier	Multiplier	Multiplier
20	1.01	1.50	0.75
18	1.25	1.75	1.00
16	1.75	2.50	1.25
13	2.50	3.50	2.00
11	3.25	4.75	2.25
3/16"	4.25	7.00	3.25
1/4"	6.25	9.50	4.50
5/16"	8.00	12.00	5.50
3/8"	9.50	14.25	6.25
7/16"	11.00	15.50	7.75
1/2"	12.50	18.75	8.75
5/8"	15.75	23.50	11.00
3/4"	18.75	28.25	13.25
7/8"	22.00	33.00	15.50
1"	25.00	37.50	17.50

Die Clearance

The relationship of the large die hole size to the punch size is die clearance and is stated as a percentage of the thickness of the material being punched. The range of clearances varies from 10% for thin materials to 20% for thicker materials. For 3/4" material the total die clearance is 0.150". Clearance should always be specified when there is any reason for doubt.

Die clearance has the following effects:

too much clearance

1. extra roll-in at the top of the hole
2. too much burr at the bottom of he hole

too little clearance

1. more punching pressure needed - can reduce tool life
2. high stripping force causes part distortion and extra punch wear

correct clearance

1. straighter hole through material
2. minimum distortion at the top of the hole
3. minimum burr at the bottom of the hole

Effects of die clearance are more noticeable in thicker materials (such as 1/4") than in thinner materials (such as 16 gauge). If you are unsure as to what clearance you should allow for, please contact our technical sales office.

Shear Punches

Shear may be added to almost any punch 1/2" or larger to reduce the shock load on machine components and the punch & die, and increase their life expectancy. Shear, in essence, proportions the force through part of the stroke length of the ram – much less material is being cut at any one time than would be a punch without shear. (There is no advantage in adding shear to a punch smaller than 1/2"). Shear is most effective when punching 14 gauge or lighter materials and can reduce the punching force by as much as 50%.