Selecting a punch

The following information is provided as a convenient general reference guide for metal punching operations.

Hole size vs. 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 6.4 mm in 6.4 mm mild steel, 6.4 mm in 4.8 mm stainless steel, and 6.4 mm in 7.9 mm aluminum.

Maximum rated capacity

All punching tools have their maximum capacity for safe, dependable operation over a long life span. The hydraulic punches listed in this catalog have a “rated capacity” based on their design strength. Before selecting a tool, use the following charts to determine the specific tonnage required to punch the size and shape holes through the type and gauge metal considered.

Determining tonnages for round holes

To determine tonnages for hot rolled mild steel (typically used in bar size angle iron, channels, tees and zees) with a 3,500 bar shear strength, read directly from chart #1. **Example:** To punch a 9.5 mm diameter hole thru 9.5 mm thick mild steel, chart #1 shows 11.1 tons are required. For ASTM A-36 steel (typically used for structural size wide flange, H and I beams, tees and zees) with a 4,200 bar shear strength, read direct from chart #2. **Example:** To punch a 6.4 mm round hole in 6.4 mm thick A-36 steel, chart #2 shows 5.9 tons of force is needed.

CHART #1 Tons of pressure required to punch mild steel

Material Thickness		Round Hole Diameter (mm)											
		3.2	4.8	6.4	7.9	9.5	11.1	12.7	14.3	15.9	17.5	19.1	20.6
mm	Inches												
0.9	1/32	.4	.5	.7	.9	1.1	1.2	1.4	1.6	1.8	1.9	2.1	2.3
1.2	3/64	.5	.7	.9	1.2	1.4	1.6	1.9	2.1	2.4	2.6	2.8	3.1
1.6	1/16	.6	.9	.6	1.5	1.8	2.1	2.3	2.6	2.9	3.2	3.5	3.8
1.9	5/64	.7	1.1	1.2	1.8	2.2	2.6	2.9	3.3	3.7	4.0	4.4	4.8
2.7	7/64	1.0	1.5	1.5	2.6	3.1	3.6	4.1	4.6	5.1	5.7	6.2	6.7
3.0	1/8	1.2	1.8	2.1	2.9	3.5	4.1	4.7	5.1	5.9	6.2	7.1	7.6
3.4	9/64	1.3	2.0	2.4	3.3	4.0	4.6	5.3	5.9	6.6	7.3	7.9	8.6
4.8	3/16	—	2.8	2.6	4.6	5.5	6.4	7.4	8.3	9.2	10.1	11.0	12.0
6.4	1/4	—	—	3.7	6.1	7.4	8.6	9.8	11.1	12.3	13.5	14.7	16.0
7.9	5/16	—	—	4.9	7.8	9.2	10.7	12.3	13.9	15.4	17.0	18.5	20.0
9.5	3/8	—	—	—	—	11.1	12.8	14.8	16.5	18.5	20.2	22.1	23.8
12.7	1/2	—	—	—	—	—	—	19.7	22.0	24.6	26.9	29.5	31.8

Tons of Pressure

CHART #2 Tons of pressure required to punch ASTM-A36 structural steel

Material Thickness		Round Hole Diameter (mm)											
		3.2	4.8	6.4	7.9	9.5	11.1	12.7	14.3	15.9	17.5	19.1	20.6
mm	Inches												
2.7	7/64	1.2	1.9	2.5	3.1	3.7	4.3	4.9	5.6	6.2	6.8	7.4	8.0
3.0	1/8	1.4	2.1	2.8	3.5	4.2	4.9	5.7	6.4	7.1	7.8	8.5	9.2
3.4	9/64	—	2.4	3.2	4.0	4.8	5.6	6.4	7.2	7.9	8.7	9.5	10.3
4.8	3/16	—	3.3	4.4	5.5	6.6	7.7	8.8	9.9	11.0	12.1	13.2	14.3
6.4	1/4	—	4.4	5.9	7.4	8.6	10.3	11.8	13.2	14.7	16.2	17.7	19.1
7.9	5/16	—	—	7.4	9.2	11.0	12.9	14.7	16.5	18.4	20.2	22.0	24.0
9.5	3/8	—	—	8.8	11.0	13.3	15.5	17.7	19.9	22.1	24.3	26.5	28.7
12.7	1/2	—	—	—	—	—	—	23.6	26.5	29.4	32.4	35.3	38.3

Tons of Pressure

Determining tonnages for irregular shaped holes

When punching irregular shaped holes (square, obround, ect.) multiply the length of metal to be cut by the multiplier given for a 25.4 mm length of cut in chart #3. Example: The shear length (or total distance around a 12.7 mm square hole) is 50.8 mm. To punch such a hole in 6.4 mm thick mild steel, multiply 50.8 x .246 (from chart #3) = 12.5 tons. For stainless steel this would be 50.8 x .374 = 19 tons.

CHART #3
Tons of pressure required to shear 25.4 mm length

Material Thickness	Mild Steel	Stainless Steel	Brass
4.76 mm	.167	.276	.128
6.35 mm	.246	.374	.177
7.94 mm	.314	.472	.216
9.53 mm	.373	.560	.246
11.11 mm	.432	.649	.305
12.70 mm	.491	.737	.344

Tons of Pressure

Die Clearance

The relationship of the larger 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 clearance varies from 10% for thin materials to 20% for thicker materials. For 19 mm material, the total die clearance is 3.8 mm.

Clearance should always be specified when there is any reason for doubt (see illustrations below). Effects of die clearance are more noticeable in thicker materials (such as 12.7 mm) than in thinner material (such as 4.76 mm). When ordering die sets, specify the type and thickness of material being punched (see chart #4).

CHART #4 Clearance for Mild Steel

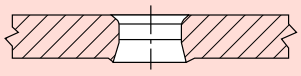
Material Thickness	Approximate Decimal Thickness (inches)	Overall Clearance– Add to Punch Size
4.554 mm	.1793	.553
6.35 mm	.1875	.584
7.94 mm	.250	.940
9.53 mm	.3125	1.194
11.11 mm	.375	1.448
12.70 mm	.500	1.905

Tons of Pressure

NOTE: Most grades of half hard aluminum use the same clearance as shown above. In many cases, your own experience may dictate that you call for clearances different from the above, especially when punching other materials such as stainless steel. Special clearances may be ordered for that purpose.

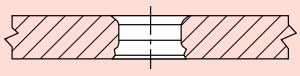
Die clearance has the following effects:

Too much clearance



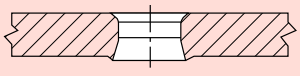
1. Extra roll-in at top of the hole.
2. Too much burr at bottom of the hole.

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 thru material.
2. Minimum distortion at top of hole.
3. Minimum burr at bottom of hole.