

# Calculation of Perforating Pressure

The formula for the tonnage required to perforate a given material, using flat faced punches and dies, is

$$P = \frac{LTS}{2000}$$

P = Punching load in tons

L = Length of cut in inches. Use the circumference ( $\pi D$ ) for round holes and the perimeter for holes of other shapes.

T = Thickness of material in inches

S = Ultimate shear strength of material in pounds per square inch

## EXAMPLE:

Material-AISI 1020 Cold Rolled Steel, .030 thick

Punch or Hole Diameter .375

$$P = \frac{LTS}{2000} = \frac{1.1781 \times .030 \times 52,000}{2000} = .9189 \text{ or } 1 \text{ ton}$$

L = 1.1781 from Decimal Equivalent Chart

S = 52,000 P.S.I. From Shear Strength Table

## LOAD DISTRIBUTION:

To determine whether a punch or a die button will "sink" into the die set plates, calculate the force per unit area by the formula  $Sc = \frac{2000P}{As}$  where:

Sc = Compressive Stress, in pounds per square inch

P = Perforating load, in tons

A = Surface area, in square inches

**Punches - Head Type** ... use head area ( Ball-Lock type are normally used with hardened backing plate)

**Die Buttons - Head Type** ... Use head area minus slug hole area

**Headless** ... Use body area minus slug hole area.

If the Calculated Compressive Stress (Sc) is greater than 20,000 P.S.I. select a larger Punch Shank or

Body Dia. or use a hardened backing plate. This rule applies for both all-steel and semi-steel die set punch plates.

## EXAMPLE:

Punching Load (P) = .9189 tons

Punch Data: Point Dia. .375

Shank Dia. .500

Head Dia. .625

Die Button Data : Body Dia. .875

Slug Hole Dia.  $1\frac{1}{32}$

(See Dec. Equiv. Chart for areas)

$$Sc = \frac{2000P}{A} = \frac{2000 \times .9189}{.3068} = 5990 \text{ P.S.I.}$$

Since Sc is less than 20,000 P.S.I. the punch head will not "sink" into the die set plate.

$$Sc = \frac{2000P}{A} = \frac{2000 \times .9189}{(.60132 - .22166)} = 4841 \text{ P.S.I.}$$

Sc is less than 20,000 P.S.I. and the die button will not "sink".

# Shear Strength Chart

Material Description	Hardness	Ultimate		Material Description	Hardness	Ultimate	
		Tensile P.S.I.	Shear P.S.I.			Tensile P.S.I.	Shear P.S.I.
<b>STEELS</b>				<b>ALUMINUM BASE*</b>			
Low Carbon, H.R. Sheet ASTM A-415	Rb 70	60,000	50,000	ALLOY - TEMPER			
Low Carbon, C.R. Sheet Special Killed Drawing Quality	Rb 50	50,000	40,000	1100-0	BHN23	13,000	9,000
Low Carbon, C.R. Sheet (Soft)	Rb 46-50	53,000	42,000	- H14	BHN32	18,000	11,000
(1/4 Hard)	Rb 60-75	60,000	45,000	2024-0	BHN47	27,000	18,000
(1/2 Hard)	Rb 70-85	72,000	50,000	-T3	BHN120	70,000	41,000
(Hard)	Rb 80-95	92,000	61,000	3003-0	BHN28	16,000	11,000
.40-.50% Carbon Steel H.R. Sheet	BHN200	100,000	80,000	- H14	BHN40	22,000	14,000
SAE 1074 C.R.Annealed Spring Steel	Rb 90	95,000	75,000	- H16	BHN47	26,000	15,000
SAE 1095 C.R.Annealed Spring Steel	Rb 95	100,000	80,000	3105- H25	BHN47	26,000	16,000
SAE 1074 or 1095 Spring Steel	Rc 45-50	260,000	200,000	5005- H34	BHN41	23,000	14,000
Hardened to Spring Temper				5052- 0	BHN47	28,000	18,000
Abrasion-Resisting	BHN200/245	120,000	100,000	5052- H32	BHN60	33,000	20,000
Cor-Ten Steel	BHN140	70,000	50,000	6061- 0	BHN30	18,000	12,000
Tri-Ten Steel	BHN120	60,000	50,000	-T6	BHN95	45,000	30,000
T-1 Steel (Types A&B) 100,000 P.S.I. Y.S.	BHN260	130,000	105,000	7075- 0	BHN60	33,000	22,000
				-T6	BHN150	83,000	48,000
<b>STAINLESS STEEL</b>				<b>COPPER BASE</b>			
202-Annealed	Rb 95	110,000	90,000	**ALLOY- TEMPER			
302, 303, 304-Annealed	Rb85	95,000	75,000	110- Electrolytic Tough Pitch Copper			
310-Annealed	Rb90	105,000	90,000	- .050mm G.S.	Rb40	32,000	22,000
316, 321, 430-Annealed	Rb 90	95,000	75,000	-1/2 Hard	Rb40	42,000	26,000
410-Annealed	Rb85	85,000	75,000	-Hard	Rb50	50,000	28,000
				220 Comm Bronze, 90 % -1/2 Hard	Rb58	52,000	35,000
				320 Red Brass, 85 % -1/4 Hard	Rb55	50,000	35,000
				260 Cartridge Brass, 70 % -.035mm G.S.	Rf68	49,000	34,000
				-1/2 Hard	Rb70	62,000	40,000
				-Spring	Rb91	94,000	48,000
				280 Muntz Metal -1/8 Hard	Rb55	60,000	42,000
				342-A High Leaded Brass -1/2 Hard	Rb70	61,000	40,000
				675 Manganese Bronze, A -Soft Anneal	Rb65	65,000	42,000

\* 500 Kg Load 10mm Ball

\*\* Copper Development Association No.