## Material Multiplication Factor (F)

| Material Description | Multiplier (F) | Material Description | Multiplier (F) |
|---|---|---|---|
| Aluminium - Soft Sheet | 0.30 | Steel – Mild | 1.00 |
| Aluminium – Half Hard | 0.38 | Steel – ASTM-A36 | 1.20 |
| Aluminium – Hard | 0.50 | Steel – 50 Carbon | 1.40 |
| Brass – Soft Sheet | 0.60 | Steel – Cold Drawn | 1.20 |
| Brass – Half Hard | 0.70 | Steel – Stainless | 1.40 |
| Copper – Rolled | 0.57 | Spring Steel (Tempered) | 4.00 |

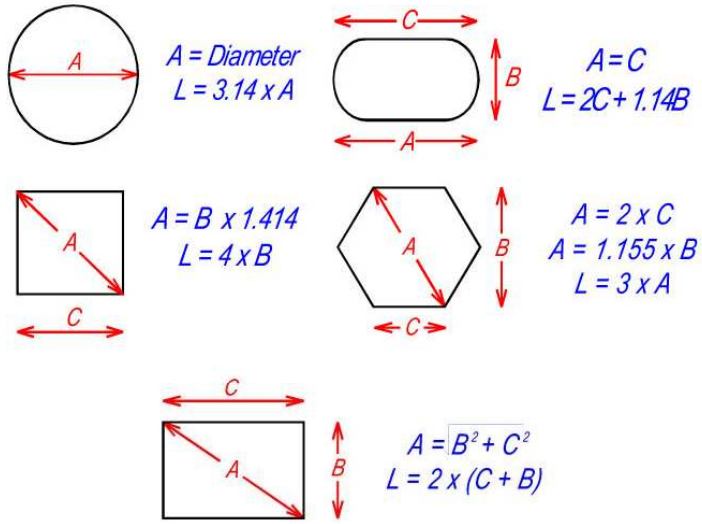
Based on Mild Steel Shear Strength of 50,000 P.S.I (345 MPa)

## Total Cutting Edge

*In order to calculate the tonnage required to cut out a shape, it is necessary to work out the total length of the cutting edge, ("L").*

*Ie. The perimeter of the shape to be cut.*

***Example:***




## Tonnage Calculation

*The tonnage required for punching any shape hole in a material is given by the following formula:*

*Required Tonnage = **L** x **G** x **S** where:-*
***"L"** is the total length of the cutting edge*
***"G"** is the material thickness*
***"S"** is the shear strength of the material*
*Hence required tonnage.*

***Example 1:** For a 50.mm square in 2.mm mild steel*
***L** = 50 x 4 = 200 **G** = 2 & **S** = 0.345*
*Hence required tonnage.*
***T** = 200 x 2 x 0.345 = 137.95 KN*

### Punches with Shear

*The tonnage required for punching with shear is given by the formula:-* ***T** = **L** x **G** x **S** x **F***

Where **"F"** is the shear factor (see **'Calculating the effect of shear'**)

***Example 2:** For a 3/8" x 3" Slitting Tool with 3/16" Shear Cutting ¼" Hard Aluminium*
***F** = 0.63 (from graph below)*
***L** = 2 (3/8 x 3) = 2.25 **G** = 0.25 **S** = 12 **F** = 0.63*
*Hence required tonnage:*
***T** = 2.25 x 0.25 x 12 x 0.63 = 4.25 ton*