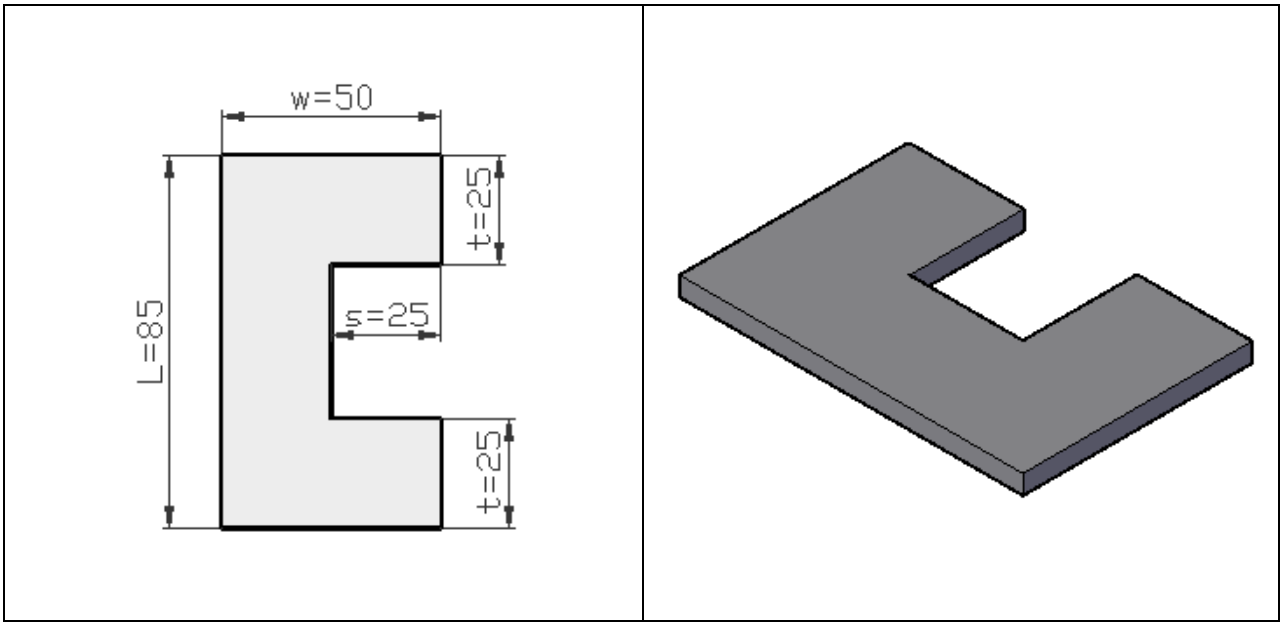
Blanking - Punching

1. A **blanking die** is to be designed to blank the part outline shown in the figure below. The material is **4 mm thick stainless steel** (the allowance for the stainless steel is **a = 0.075**). Determine the dimensions of the **blanking punch** and the **die opening**.



Solution:

Since *a* = 0.075, the clearance is given by,

c = 0.075 (4) = 0.3 mm.

Blanking die dimensions: the same as for the part in the figure:

L = 85 mm w = 50 mm t = 25 mm s = 25 mm

Blanking punch dimensions:

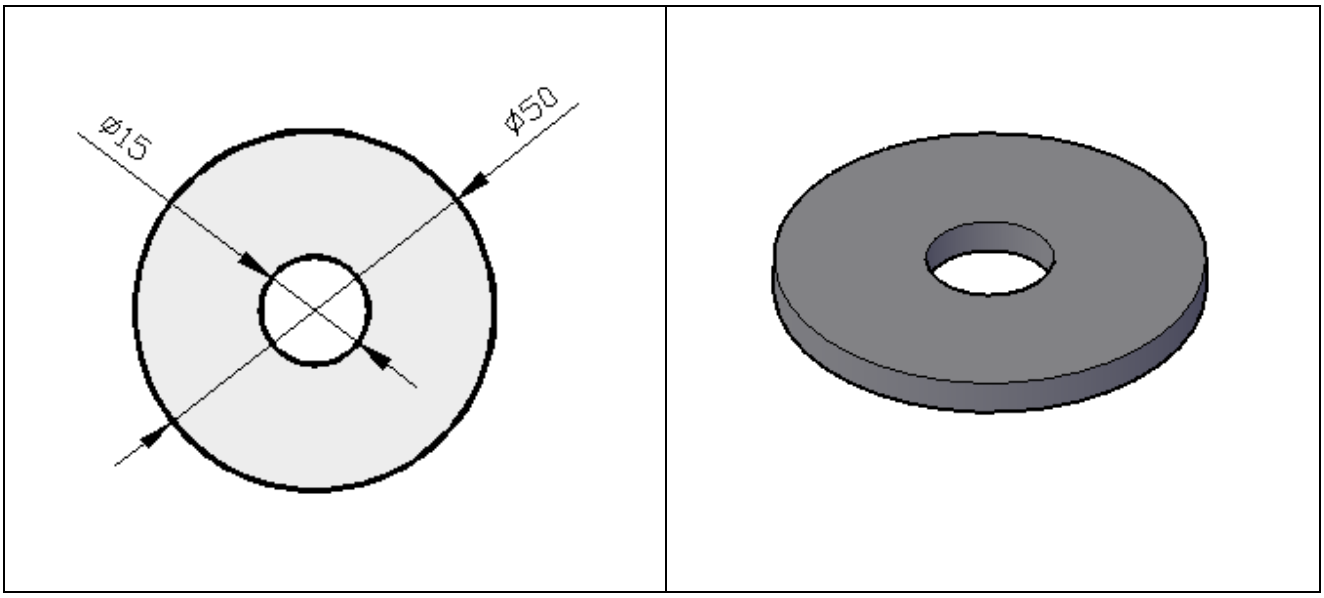
Length **L** = 85 - 2(0.3) = **84.4 mm**

Width **w** = 50 - 2(0.3) = **49.4 mm**

Top and bottom **t** widths = 25 - 2(0.3) = **24.4 mm**

The **s** = **25 mm** inset dimension remains the same.

2. A **compound die** will be used to blank and punch a **large washer** out of 6061ST aluminum alloy (the allowance is **a = 0.06**). sheet stock **3.50 mm thick**. The **outside diameter** of the washer is **50 mm** and the **inside diameter** is **15 mm**. Determine (a) the punch and die sizes for the blanking operation, and (b) the punch and die sizes for the punching operation.



Solution:

Since $a = 0.06$, the clearance is given by,

$$c = 0.06\ (3.5) = 0.21 \text{ mm}$$

(a) Blanking punch diameter = $D_b - 2c = 50 - 2(0.21) =$ **49.58 mm**

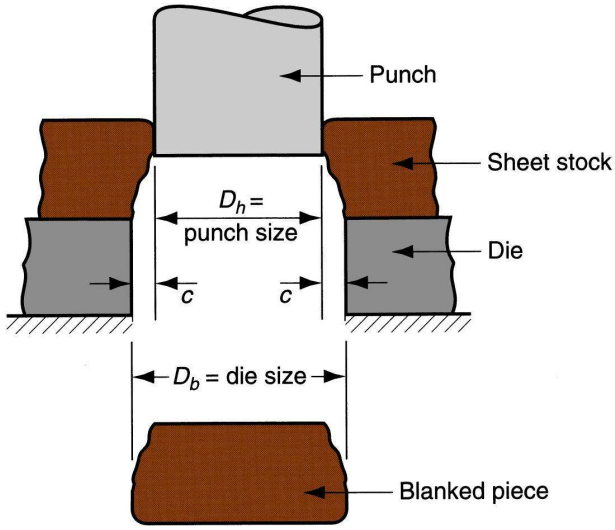
Blanking die diameter = $D_b =$ **50 mm**

(b) Punching punch diameter = $D_h =$ **15 mm**

Punching die diameter = $D_h + 2c = 30 + 2(0.21) =$ **15.42 mm**

3.

A blanking operation is to be performed on **2 mm thick** cold rolled steel. The part is circular with **diameter = 75 mm**. Determine: a) the appropriate punch and die sizes for this operation if the allowance for the cold rolled steel is **a = 0.075**. b) the blanking force required if the steel has a **shear strength = 325 MPa** and the **tensile strength is 450 MPa**



Solution:

(a) Since $a = 0.075$, the clearance is given by,

$c = 0.075\ (2) = 0.15$ mm.

Thus the Punch diameter D_h is calculated as

$\mathbf{D_h} = D_b - 2c = 75.0 - 2(0.15) =$ **74.70 mm**.

and the Die diameter is $\boldsymbol{D_b}$ = **75 mm.**

(b) the blanking force is given by

$$F = StL$$

The thick of the metal stock t is given by the problem as $t = 2$ mm

The length of cut edge is calculated as:

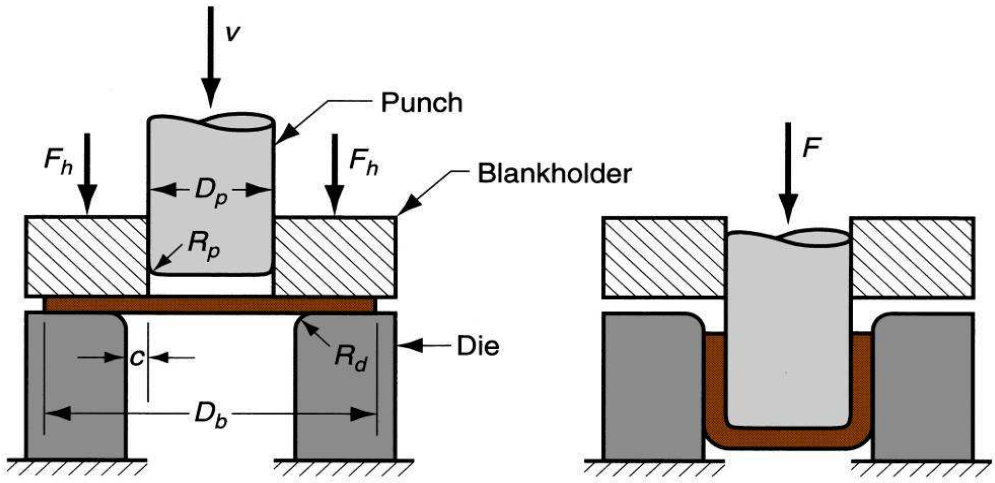
$$L = \pi D = 75\pi = 235.65 \text{ mm}$$

Thus the blanking force is

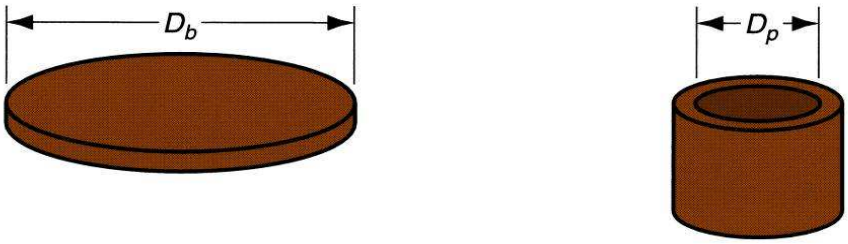
$\boldsymbol{F}$ = 325 (2) (235.65) = **153,200 N**

Deep drawing

A cup is to be drawn in a deep drawing operation. The height of the cup is **75 mm** and its inside diameter = **100 mm.** The sheet metal thickness = **2 mm**. If the blank diameter = **225 mm**, determine (a) drawing ratio, (b) reduction, and (c) thickness-to-diameter ratio. (d) Does the operation seem feasible?



(a)



(1) (2)

(b)

Solution:

(a) Drawing ratio $DR = D_b/D_p = 225/100 =$ **2.25**

(b) Reduction $r = (D_b - D_p)/D_b = (225 - 100)/225 = 0.555 =$ **55.5%**

(c) Thickness-to-diameter ratio $t/D_b = 2/225 = 0.0089 =$ **0.89%**

(d) Feasibility? **No**!

DR is too large (greater than 2),

r is too large (greater than 50%),

and ***t/D*** is too small (less than 1%).