Question #81305

Find the maximum diameter of hole that can be punch in a M.S plate 10 mm thick having ultimate shear of 200 N/mm^2. The allowable crushing stress in punch material is 350 N/mm^2.

Answer:

Based on the puncher stress, the maximum allowable axial force is

$$F = \sigma_{pm} \frac{\pi d^2}{4}, \tag{1}$$

where σ_{pm} = 350 N/mm^2 – the crushing stress in punch material,

d is the diameter of hole to be punched.

Based on the shear stress of the plate, the force required to punch a hole is

$$F = \sigma_{MS} \pi d t, \tag{2}$$

where σ_{MS} = 200 N/mm^2 – the ultimate shear of the M.S. plate,

t = 10 mm – the thickness of the M.S. plate.

For the maximum diameter of a hole, the forces in (1) and (2) are the same. Thus

$$\sigma_{pm} \frac{\pi d^2}{4} = \sigma_{MS} \pi d t,$$

$$d = 4t \frac{\sigma_{MS}}{\sigma_{pm}}. \tag{3}$$

Substitute into (3)

$$d = 4 \cdot 10 \frac{200}{350} = 22.9 \text{ mm}.$$