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ISRO | BHEL | DRDO & OTHER PSUs

GATE

PRODUCTION

METAL FORMING

MOST EXPECTED QUESTIONS

Live@ 11:30Am

PART-3

Gaurav sir

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GATE 2023 RESULT

GATE

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YouTube Classes Schedule

ENGINEERS

MECHANICAL ENGINEERING

EXAM TARGET	SUBJECT	TIME	FACULTY
ALL PSUs	ENGINEERING MATHS	10:00 AM	ANANT SIR
ALL PSUs	PRODUCTION	11:30 AM	GAURAV SIR
ALL PSUs	THERMODYNAMICS	3:00 PM	KANISTH SIR
GATE 2024-25	HMT	4:30 PM	YOGESH SIR
GATE 2024-25	SOM	9:00 PM	MUKESH SIR

FREE APP
CLASS SCHEDULE

MECHANICAL ENGINEERING

GATE

HMT	MONDAY Live @11AM	YOGESH SIR
PRODUCTION	TUESDAY Live @11AM	GAURAV SIR
SOM	WEDNESDAY Live @8PM	MUKESH SIR
THERMODYNAMICS	THURSDAY Live @11AM	KANISTH SIR
ENGINEERING MATHEMATICS	FRIDAY Live @11AM	ANANT SIR

Hydrostatic Extrusion

⇓

Brittle material

⇓

By indusing Ductile Nature in Brittle Material.

⇓

Induced Ductility

What does hydrostatic pressure in extrusion process improve?

(a) Ductility
(b) Compressive strength
(c) Brittleness
(d) Tensile strength

Semi brittle materials can be extruded by

(a) Impact extrusion

(b) Closed cavity extrusion

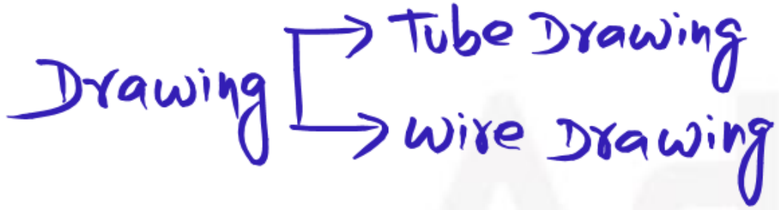
(c) Hydrostatic extrusion

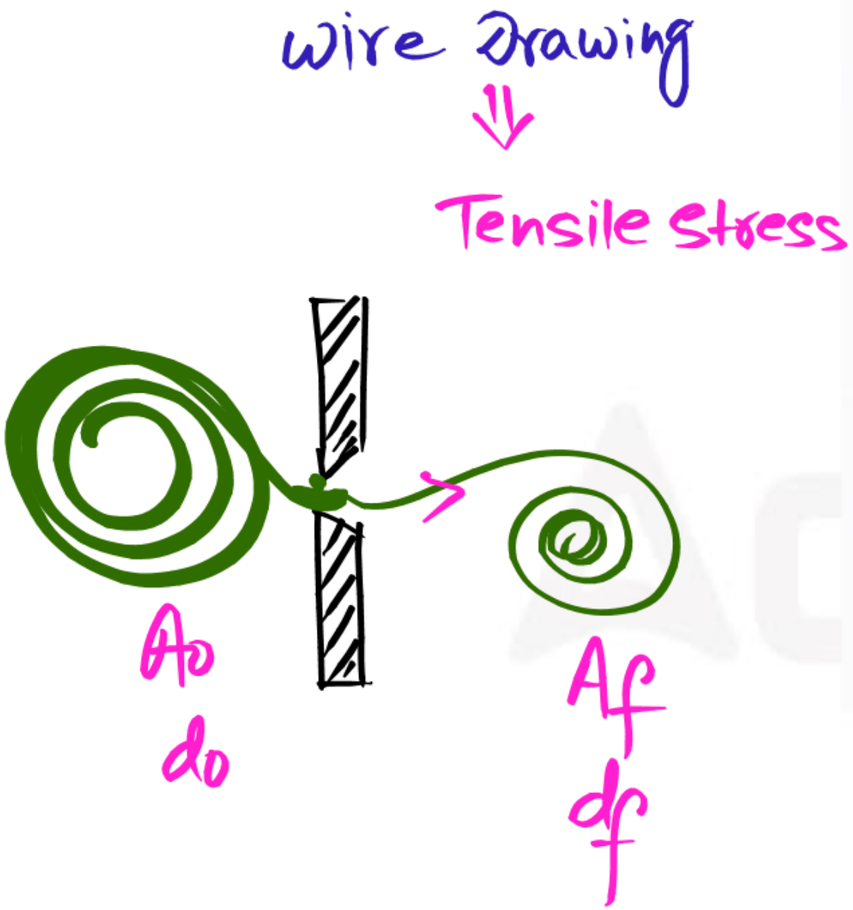
(d) Backward extrusion

Which metal forming process is used for manufacture of long steel wire?

(a) Deep drawing (b) Forging

(c) Drawing (d) Extrusion





Which of the following types of stresses is/are involved in the wire-drawing operation?

(a) Tensile only

(b) Compressive only

(c) A combination of tensile and compressive stresses

(d) A combination of tensile, compressive and shear stresses

A moving mandrel is used in

(a) Wire drawing

(b) Tube drawing ✓

(c) Metal Cutting

(d) Forging

Tube Drawing

⇓

With the help of

Mandrel

⇓

* Stationery Mandrel
* Floating Mandrel
* Moving Mandrel

Which one of the following processes necessarily requires mandrel of requisite diameter to form the internal hole?

(a) Hydrostatic Extrusion

(b) Tube drawing

(c) Swaging

(d) Wire Drawing

Rotary swaging is a process for shaping

a) Round bars and tubes

b) Billets

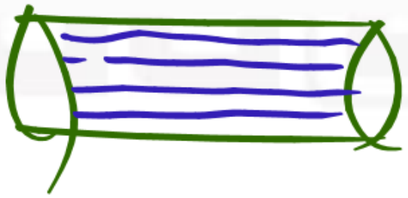
c) Dies

d) Rectangular blocks

Surface cracking occurring at low temperature in hydrostatic extrusion is know as

(a) Fluid Defect
(b) Bamboo Defect
(c) Fishtailing
(d) Arrowhead Fracture

* Bamboo Defect
⇓
Extrusion Defect
⇓
Due to low temp
⇓
Hydrostatic Extrusion



In wire drawing process, the bright shining surface on the wire is obtained if one

(a) does not use a lubricant

(b) uses solid powdery lubricant.

(c) uses thick paste lubricant

(d) uses thin film lubricant

Using direct extrusion process, a round billet of 100 mm length and 50 mm diameter is extruded. Considering an ideal deformation process (no friction and no redundant work), extrusion ratio 4, and average flow stress of material 300 MPa, the pressure (in MPa) on the ram will be

(a) 416 (b) 624 (c) 700 (d) 832

Given Data :→

* $L = 100\,mm$
* $r = 4$
* $d_o = 50\,mm$
* $\sigma_f = 300\,MPa$

* Extrusion pressure (σ) = ?

Solution :→ $* \sigma = \sigma_f \times \ln\left(\frac{A_o}{A_f}\right) \Rightarrow \sigma_f \times \ln r$

$* \sigma = 300 \times \ln 4 = 416\,MPa.$

A brass billet is to be extruded from its initial diameter of 100 mm to a final diameter of 50 mm. The working temperature of 700°C and the extrusion constant is 250 MPa. The force required for extrusion is

(a) 5.44 MN (b) 2.72 MN

(c) 1.36 MN (d) 0.36 MN

Given Data :→

* $d_0 = 100mm$
* $d_f = 50mm$
* $K = 250MPa$
* Extrusion force = ?

Solution :→ $\sigma_e = K \times \ln\left(\frac{A_0}{A_f}\right) = 2 \times K \times \ln\left(\frac{d_0}{d_f}\right) = 2 \times 250 \times \ln\left(\frac{100}{50}\right)$

$F_e = \sigma_e \times A_0 \Rightarrow \sigma_e \times \frac{\pi}{4}(d_0)^2 = 2.72\,MN$

Extrusion

$$* \sigma_e = \sigma_f \times \ln\left(\frac{A_o}{A_f}\right) \Rightarrow 2 \times \sigma_f \times \ln\left(\frac{d_o}{d_f}\right)$$

$$* \sigma_e = K \ln\left(\frac{A_o}{A_f}\right) \Rightarrow K \ln(r)$$

$$* r = \frac{A_o}{A_f}$$

Extrusion force $= \sigma_e \times A_o$

Drawing

$$* \sigma_d = \sigma_f \times \ln\left(\frac{A_o}{A_f}\right) = 2 \times \sigma_f \times \ln\left(\frac{d_o}{d_f}\right)$$

$$* F_d = \sigma_d \times A_f$$

For rigid perfectly-plastic work material, negligible interface friction and no redundant work, the theoretically maximum possible reduction in the wire drawing operation is

(a) 0.36 (b) 0.63

(c) 1.00 (d) 2.72

Extrusion force DOES NOT depend upon the

(a) Extrusion ratio

(b) Type of extrusion process

(c) Material of the die

(d) Working temperature

* Extrusion force

* $F_e = \sigma_e \times A_0$

* $F_e = \sigma_f \times \ln\left(\frac{A_0}{A_f}\right) \times A_0$

* $F_e = \sigma_f \times A_0 \times \ln(r)$

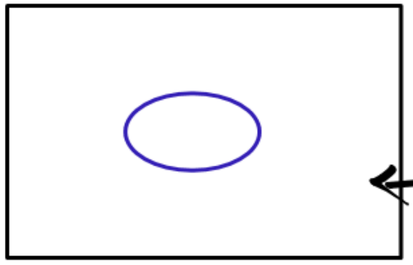
* $\sigma_e = K \times \ln(r)$

$K = f(T_w, \text{Ex process})$

A metal disc of 20 mm diameter is to be punched from a sheet of 2 mm thickness. The punch and the die clearance is 3%. The required punch diameter is

(a) 19.88 mm (b) 19.94 mm

(c) 20.06 mm (d) 20.12 mm



t = 2mm

Blanking

Solution :→

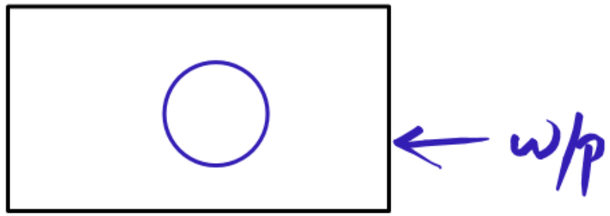
* Punch Dia = Blank Dia − 2c

* Punch Dia = 20 − 2 × 0.060 = 20 − 0.120

* c = 2 × 3% = 2 × 0.030

* c = 0.060

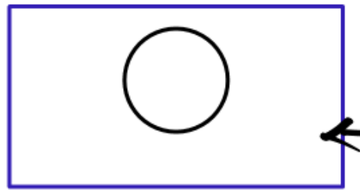
* Punch Dia = 19.88



Punching

⇓

* Punch Size = Dia of Hole
* Die Size = Punch size + 2·c



Blanking

⇓

* Die Size = Blank Size
* Punch Size = Die Size - 2c

clearance (c)

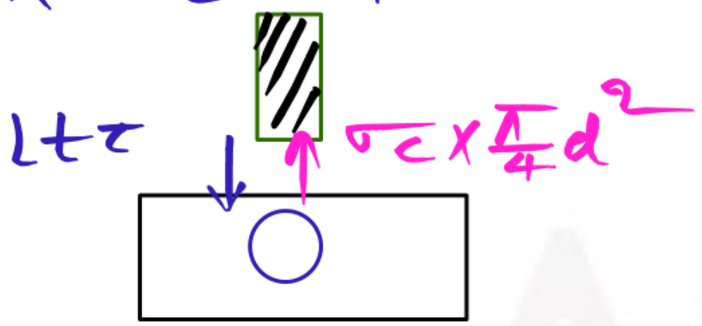
⇓

* c = % X Sheet Thickness

* $c = 0.0032t\sqrt{E}$

Given Data :→

* $\sigma_c = 4\tau$



* $\sigma_c \times \frac{\pi}{4} d^2 = L t \tau$

* $\sigma_c \times \frac{\pi}{4} d^2 = \pi d t \tau$

* $\boxed{d = \frac{4t\tau}{\sigma_c}}$

With a punch for which the maximum crushing stress is 4 times the maximum shearing stress of the plate, the biggest hole that can be punched in the plate would be of diameter equal to

(a) $\frac{1}{4}$ × Thickness of plate

(b) $\frac{1}{2}$ × Thickness of plate

(c) Plate thickness

(d) 2 × Plate thickness

Solution :→

* $d = \frac{4t\tau}{\sigma_c}$

* $d = \frac{4t\tau}{4\tau}$

* $d = t$

A hole is to be punched in a 15 mm thick plate having ultimate shear strength of 3N-mm^{-2}. If the allowable crushing stress in the punch is 6 N-mm^{-2}, the diameter of the smallest hole which can be punched is equal to

(a) 15 mm (b) 30 mm

(c) 60 mm (d) 120 mm

Given Data :→

* $t = 15mm$
* $\tau = 3\ MPa$
* $\sigma_c = 6\ MPa$
* $d = ?$

Solution :→ $* \sigma_c \times \frac{\pi}{4} d^2 = \pi d t \tau$

$$* \ d = \frac{4t\tau}{\sigma_c} = \frac{4 \times 15 \times 3}{6} = 30\ mm$$

Spring back in metal forming depends on

(a) Modulus of Elasticity

(b) Load Applied

(c) Strain Rate

(d) None of these

A shell of 100 mm diameter and 100 mm height with the corner radius of 0.4 mm is to be produced by cup drawing. The required blank diameter is

(a) 118 mm (b) 161 mm

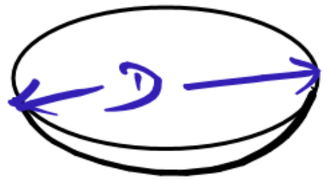
(c) 224 mm (d) 312 mm

Given Data's →

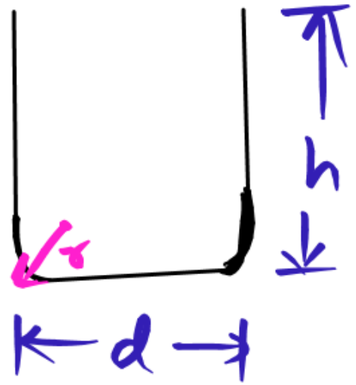
* $d = 100mm$
* $h = 100mm$
* $r = 0.4mm$
* $D = \sqrt{d^2 + 4dh}$
* $D = \sqrt{(100)^2 + 4 \times 100 \times 100}$
* $D = 223.6mm$

* $\frac{d}{r} = \frac{100 \times 10}{0.4} = 250$
* corner radius Neglected

$* \frac{\pi}{4} D^2 = \frac{\pi}{4} d^2 + \pi d h$



Drawing →



$* D = \sqrt{d^2 + 4dh}$ → $* \frac{d}{r} \geq 20$ → corner radius neglected

$* \frac{d}{r} < 20$

$* D = \sqrt{d^2 + 4dh} - \frac{r}{2}$ $* \frac{d}{r} < 20$

* D → Blank dia
* d → cup dia
* h → cup height
* r → corner radius

A cup of 10 cm height and 5 cm diameter is to be made from a sheet metal of 2 mm thickness. The number of deductions necessary will be

(a) One

(b) Two

(c) Three

(d) Four

In blanking operation the clearance provided is

(a) 50% on punch and 50% on die

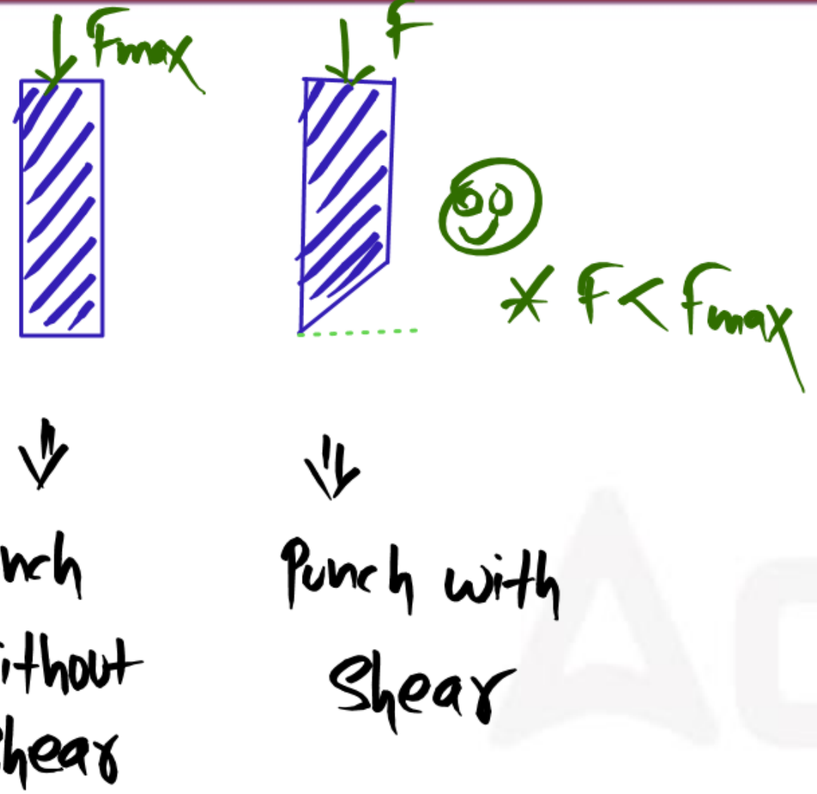
(b) On die

(c) On punch

(d) On die or punch depending upon designer's choice

* Punching → clearance on Die → Shear on Punch

* Blanking → clearance on Punch → Shear on Die



Consider the following statements related to piercing and blanking:

1. Shear on the punch reduces the maximum cutting force
2. Shear increases the capacity of the press needed
3. Shear increases the life of the punch
4. The total energy needed to make the cut remains unaltered due to provision of shear

Which of these statements are correct?

(a) 1 and 2 (b) 1 and 4
(c) 2 and 3 (d) 3 and 4

In sheet metal blanking, shear is provided on punches and dies so that

(a) Press load is reduced

(b) Good cut edge is obtained.

(c) Warping of sheet is minimized

(d) Cut blanks are straight.

In a blanking operation, the clearance is provided on

(a) The die

(b) Both the die and the punch equally

(c) The punch

(d) Brittle the punch nor the die

In which one of the following is a flywheel generally employed?

(a) Lathe
(b) Electric motor
(c) Punching machine
(d) Gearbox

Which of the following methods can be used for manufacturing 2 meter long seamless metallic tubes?

1. Drawing **2. Extrusion**

3. Rolling **4. Spinning**

Select the correct answer using the codes given below

Codes:

(a) 1 and 3 (b) 2 and 3

(c) 1, 3 and 4 (d) 2, 3 and 4

Compound die performs

(a) Two or more operations at one station in one stroke

(b) Two or more operations at different stations in one stroke

(c) high frequency sound wave

(d) High frequency eddy current

In drawing operation, proper lubrication is essential for which of the following reasons?

1. To improve die life
2. To reduce drawing forces
3. To reduce temperature
4. To improve surface finish

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 1, 3 and 4 only

(c) 3 and 4 only (d) 1, 2, 3 and 4

The thickness of the blank needed to produce, by power spinning a missile cone of thickness 1.5 mm and half cone angle 30°, is

(a) 3.0 mm (b) 2.5 mm

(c) 2.0 mm (d) 1.5 mm

The mode of deformation of the metal during spinning is

(a) Bending

(b) Stretching

(c) Rolling and stretching

(d) Bending and stretching.

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