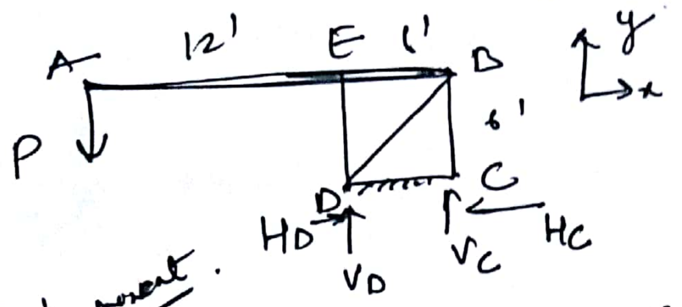
Que-1

~~BSM approach~~

FBD'

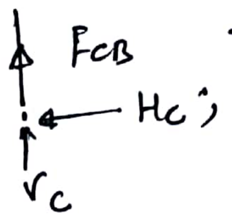


Taking moment about $\Sigma M_B = 0$; ~~$V_D =$~~ $V_C + V_D = 5000$; ΣF_y — ①

$\Sigma F_x = 0$;

$H_C = H_D$ — ②

@ point (B) (C).

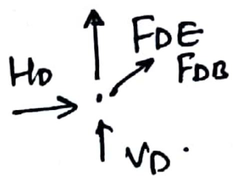


$-F_{CB} = V_C$

$H_C = 0$;

$H_D = 0$;

@ point (D).



$\Sigma F_x = 0$; $F_{DB}\cos 45 + H_D = 0$;

$\boxed{F_{DB} = 0}$

$\Sigma F_y = 0$; $F_{DE} + \overset{0}{\cancel{F_{BD}}}\sin 45 + V_D = 0$;

$\boxed{F_{DE} = -V_D}$.

moment about point (B)

$\Sigma M_B = 0$; $5000 \times 18 - V_D \times 6 + \cancel{H_D} \times 6 - \cancel{H_C} \times 6 = 0$;

$\boxed{V_D = +15000}$.

$\boxed{V_C = -10{,}000\ lb}$

$\boxed{F_{DE} = -15000\ lb}$

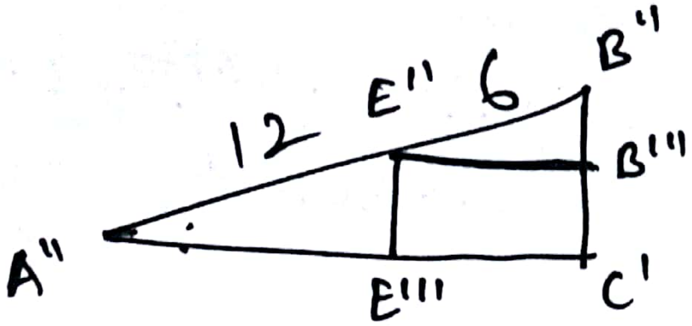
$\boxed{F_{CB} = 10{,}000\ lb}$.

$$\delta_{BC} = \frac{F_{BC}\,l}{AE} = \frac{10{,}000 \times 6 \times 12}{1.0 \times 30 \times 10^6}$$

$$= \frac{.72}{30} = 0.024\ in.$$

$$\delta_{DE} = \frac{-15{,}000 \times 6 \times 12}{2 \times 30 \times 106} = 0.018\ in$$

from $\underline{\Delta}$ $\underline{A''B''C'}$



$$\frac{B''B'''}{B''C'} =$$

$$\frac{B''B'''}{B''C'} = \frac{6}{18} = \frac{1}{3}$$

$$3\,B''B''' = B''C'$$

$$B''C' = 3 \times (0.0243 + 0.018)$$

$$\boxed{B''C' = 0.1269 \text{ in}}$$

OR

$$B'''C' = 2B''B''' = 2(18+24)/18 = 0.102$$

$$AA' = BC' = B''C' - BB'$$

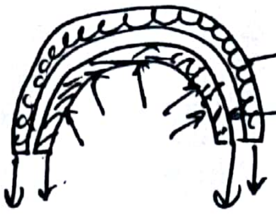
$$\boxed{AA' = 0.1026 \text{ in}}$$

$$A''A = B_1B' = 0.024 \text{ in}$$

Que-2

Axisymmetric problem.

FBD



clearance = 0.5 mm.

$t_{cu} = 75$ mm

$W_{cu} = W_{st} = 75$ mm

$t_{st} = 25$ mm

$D_m = 4.8$ m.

$\varepsilon = \frac{\sigma}{E}$ σ; εE

$\frac{\delta}{(d/2)} = \frac{\sigma}{E}$ $\sigma_c = \frac{Pd}{2t}$

σ_c – Circumferential stress

$\sigma_c = \frac{Pd}{2t}$

$\delta_r = \frac{Pd^2}{4Et}$ — (A).

$F_c = 70$ kN/m of circumference

$P_{ic} = \frac{70 \times 10^3 N}{0.075}$

$P_{ic} = 933.34$ MPa

Tangential force exists only when $\delta_{cu} > 0.5$ mm.

Tangential force on copper will be due to diffn of:

$\delta_a = (\delta_{cu} - 0.5)$;

$\delta = \delta_{cu} - 0.5$ — (I)

$\delta_{cu} = \left(\frac{\Delta P d^2}{4 E_{cu} t_{cu}}\right)$ refer equation (A)
└ (II)

Steel: $\Delta P = (P_i - P_o)$.
$(P_i > P_o)$
↓ cu ↓ steel.

$\delta_{st} = \frac{P_o \cdot d^2}{4 E_{st} t_{st}}$ — (3).

from equation (I), (II) & (III)

$\frac{P_o \cdot d^2}{4 \times 205 \times 10^9 \times 0.025} = \frac{(P_i - P_o) d^2}{4 \times 117 \times 10^9 \times 0.075} - 0.5$

$\frac{P_o}{205 \times 0.025} = \frac{P_i - P_o}{117 \times 0.025} - 0.5$

$P_o = 63275$ (N/m²).

$F_c = \Delta P \cdot A \rightarrow (r \times b)$.

$F_c = (933.34 \times 10^4 - 63275) \times 2.4 \times 0.075$

$F_c = 156.62$ kN