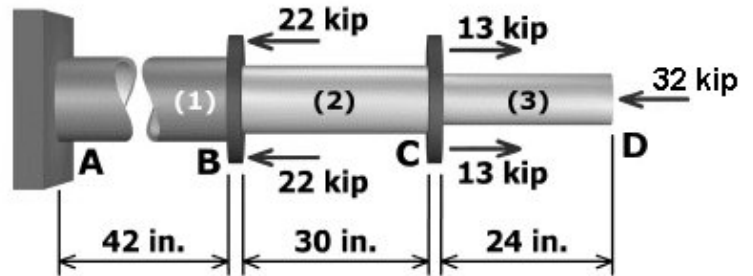


A hollow steel [$E = 30,000$ ksi] tube (1) with an outside diameter of 2.75 in. and a wall thickness of 0.25 in. is fastened to a solid aluminum [$E = 10,000$ ksi] rod (2) that has a 2-in. diameter, and a solid 1.375-in. diameter aluminum rod (3). The bar is loaded as shown. Determine the deflection of joint D with respect to the fixed support at A.

Show steps clearly. Include units and box the final answer.



$$N_{AB} = 44 - 26 + 32 \text{ (c)} = 50 \text{ kips (c)}$$

$$N_{BC} = -26 + 32 \text{ (c)} = 6 \text{ kips (c)}$$

$$N_{CD} = 32 \text{ (c)} = 32 \text{ kips (c)}$$

$$\delta = \frac{NL}{AE}$$

$$\delta_{AB} = \frac{-50000(42)}{(30 \times 10^6) \left(\frac{\pi}{4}\right) (2.75^2 - 2.25^2)} = -0.03565 \text{ in.}$$

$$\delta_{BC} = \frac{-6000(30)}{(10 \times 10^6) \left(\frac{\pi}{4}\right) (2^2)} = -0.00573 \text{ in.}$$

$$\delta_{CD} = \frac{-32,000(24)}{(10 \times 10^6) \left(\frac{\pi}{4}\right) (1.375^2)} = -0.051721 \text{ in.}$$

$$\delta_{AD} = \delta_{AB} + \delta_{BC} + \delta_{CD} = \boxed{-0.093 \text{ in.}}$$