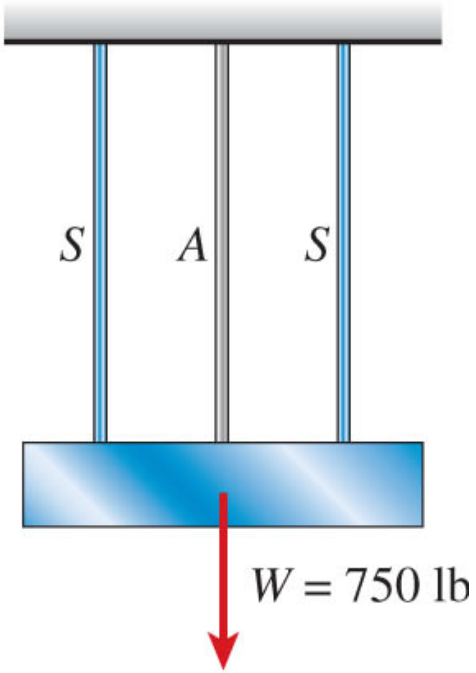
材料力學　作業 5

學號：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿　姓名：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

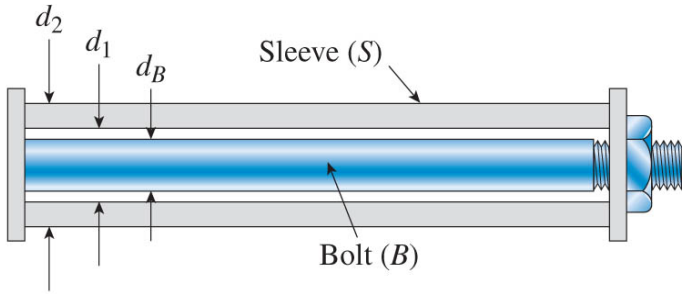
2.5-3 A rigid bar of weight $W = 3560\,\text{N}$ hangs from three equally spaced wires, two of steel and one of aluminum (see figure). The diameter of the wires is 32 mm. Before they were loaded, all three wires had the same length.

What temperature increase ΔT in all three wires will result in the entire load being carried by the steel wires? (Assume $E_s = 205\,\text{GPa}$, $\alpha_s = 12\times10^{-6}/^\circ C$, and $\alpha_a = 24\times10^{-6}/^\circ C$.)



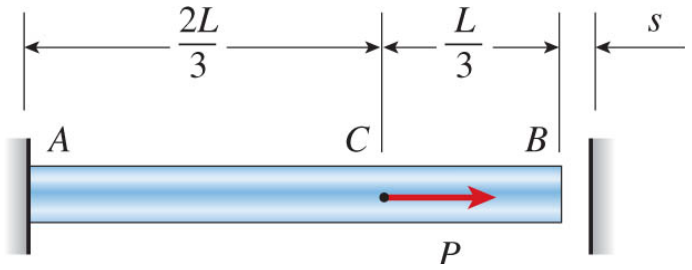
2.5-8 A brass sleeve *S* is fitted over a steel bolt *B* (see figure), and the nut is tightened until it is just snug. The bolt has a diameter $d_B = 25$ mm, and the sleeve has inside and outside diameters $d_1 = 26$ mm and $d_2 = 36$ mm, respectively.

Calculate the temperature rise ΔT that is required to produce a compressive stress of 25 MPa in the sleeve. (Use material properties as follows: for the sleeve, $\alpha_S = 21\times10^{-6}/^\circ C$ and $E_S = 100$ GPa; for the bolt, $\alpha_B = 10\times10^{-6}/^\circ C$ and $E_B = 200$ GPa.) (*Suggestion*: Use the results of Example 2-8.)

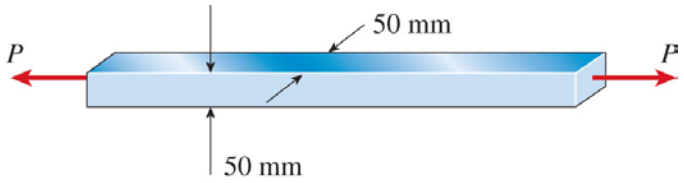


2.5-14 A bar *AB* having length *L* and axial rigidity *EA* is fixed at end *A* (see figure). At the other end, a small gap of dimension *s* exists between the end of the bar and a rigid surface. A load *P* acts on the bar at point *C*, which is two-thirds of the length from the fixed end.

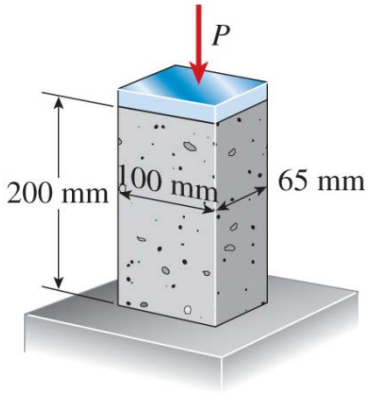
If the support reactions produced by the load *P* are to be equal in magnitude, what should be the size *s* of the gap?



2.6-1 A steel bar of square cross section (50 mm × 50 mm) carries a tensile load P (see figure). The allowable stresses in tension and shear are 125 MPa and 76 MPa, respectively. Determine the maximum permissible load P_{max}.



2.6-3 A standard brick (dimensions 200 mm × 100 mm × 65 mm) is compressed lengthwise by a force P, as shown in the figure. If the ultimate shear stress for brick is 8 MPa and the ultimate compressive stress is 26 MPa, what force P_{max} is required to break the brick?



2.6-7 During a tension test of a mild-steel specimen (see figure), the extensometer shows an elongation of 0.004 mm with a gage length of 50 mm. Assume that the steel is stressed below the proportional limit and that the modulus of elasticity $E = 210\,\text{GPa}$

(a) What is the maximum normal stress σ_{max} in the specimen?

(b) What is the maximum shear stress τ_{max}?

(c) Draw a stress element oriented at an angle of 45° to the axis of the bar and show all stresses acting on the faces of this element.