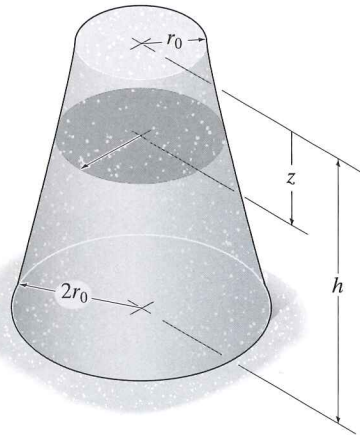**7.** If the concrete pedestal has a specific weight of γ, ermine the average normal stress developed in the estal as a function of z.

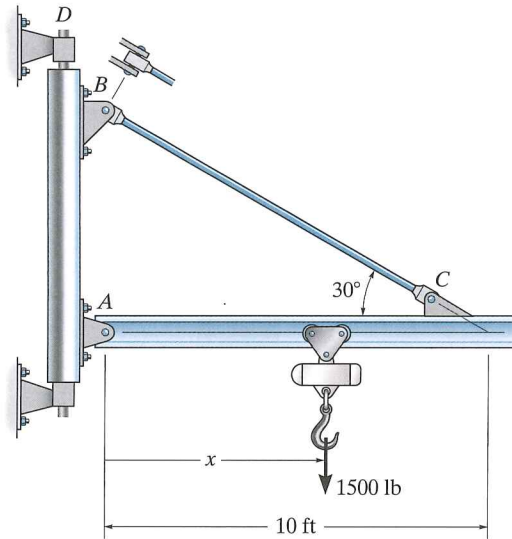**Prob. 1–57**

. The anchor bolt was pulled out of the concrete wall the failure surface formed part of a frustum and der. This indicates a shear failure occurred along the der BC and tension failure along the frustum AB. If hear and normal stresses along these surfaces have the nitudes shown, determine the force **P** that must have applied to the bolt.
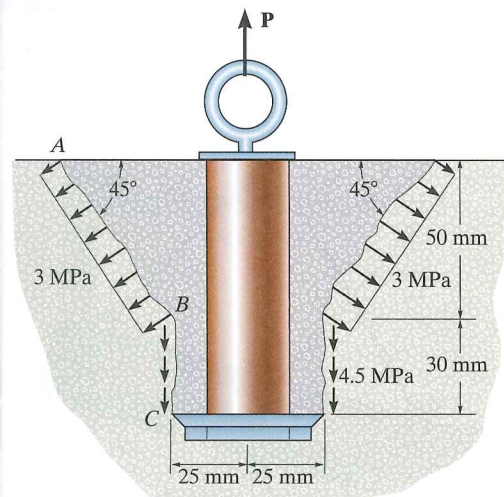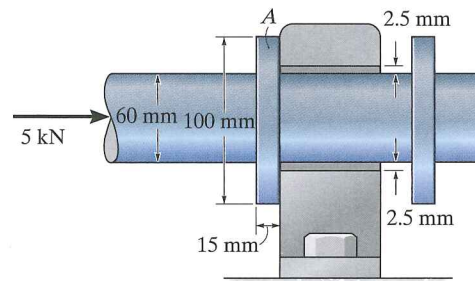

1–59. The jib crane is pinned at A and supports a chain hoist that can travel along the bottom flange of the beam, $1 \text{ ft} \leq x \leq 12 \text{ ft}$. If the hoist is rated to support a maximum of 1500 lb, determine the maximum average normal stress in the $\frac{3}{4}$-in. diameter tie rod BC and the maximum average shear stress in the $\frac{5}{8}$-in. -diamater pin at B.
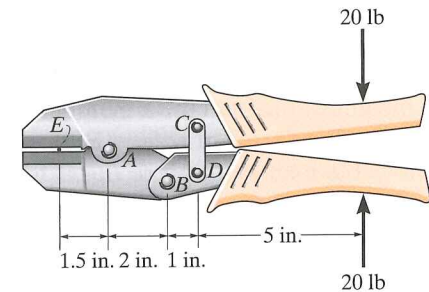

Prob. 1–59

*1–60. If the shaft is subjected to an axial force of 5 kN, determine the bearing stress acting on the collar A.

1–61. If the 60-mm diameter shaft is subjected to an axial force of 5 kN, determine the average shear stress developed in the shear plane where the collar A and shaft are connected.

1–62. The crimping tool is used to crimp the end of the wire E. If a force of 20 lb is applied to the handles, determine the average shear stress in the pin at A. The pin is subjected to double shear and has a diameter of 0.2 in. Only a vertical force is exerted on the wire.
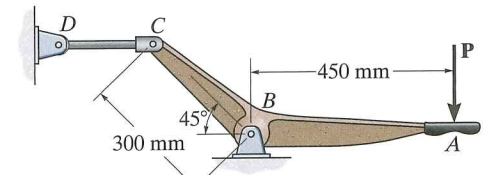
1–63. Solve Prob. 1–62 for pin B. The pin is subjected to double shear and has a diameter of 0.2 in.


Probs. 1–62/63

*1–64. A vertical force of $P = 1500$ N is applied to the bell crank. Determine the average normal stress developed in the 10-mm diamater rod CD, and the average shear stress developed in the 6-mm diameter pin B that is subjected to double shear.

1–65. Determine the maximum vertical force **P** that can be applied to the bell crank so that the average normal stress developed in the 10-mm diameter rod CD, and the average shear strees developed in the 6-mm diameter double sheared pin B not exceed 175 MPa and 75 MPa respectively.
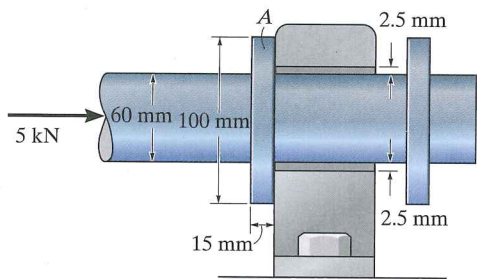
The jib crane is pinned at A and supports a chain that can travel along the bottom flange of the beam, $x \le 12$ ft. If the hoist is rated to support a maximum [0]0 lb, determine the maximum average normal stress [in the] $\frac{3}{4}$-in. diameter tie rod BC and the maximum average [shear] stress in the $\frac{5}{8}$-in. -diamater pin at B.
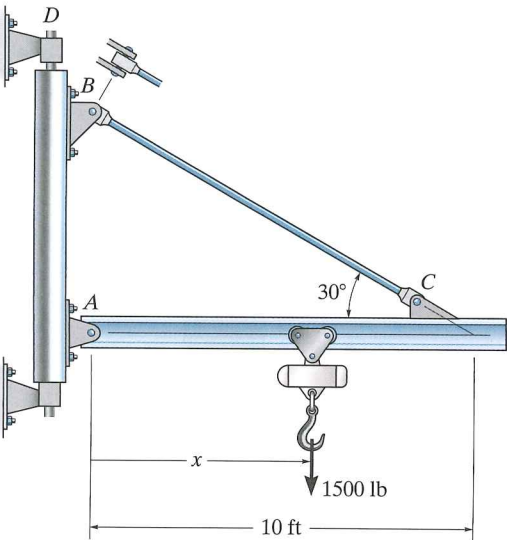
Prob. 1–59

. If the shaft is subjected to an axial force of 5 kN, [deter]mine the bearing stress acting on the collar A.
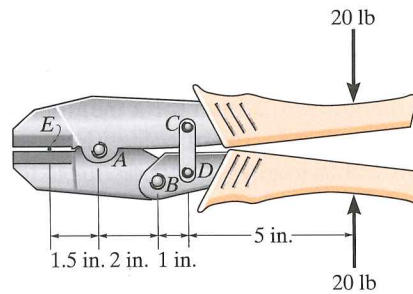
If the 60-mm diameter shaft is subjected to an axial [force] of 5 kN, determine the average shear stress developed [at the] shear plane where the collar A and shaft are [conne]cted.

Probs. 1–60/61

1–62. The crimping tool is used to crimp the end of the wire E. If a force of 20 lb is applied to the handles, determine the average shear stress in the pin at A. The pin is subjected to double shear and has a diameter of 0.2 in. Only a vertical force is exerted on the wire.
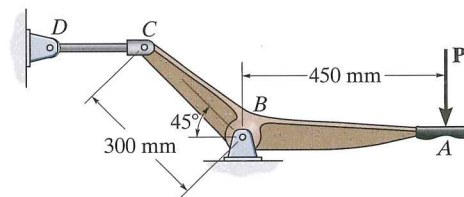
1–63. Solve Prob. 1–62 for pin B. The pin is subjected to double shear and has a diameter of 0.2 in.


Probs. 1–62/63

*1–64. A vertical force of $P = 1500$ N is applied to the bell crank. Determine the average normal stress developed in the 10-mm diamater rod CD, and the average shear stress developed in the 6-mm diameter pin B that is subjected to double shear.

1–65. Determine the maximum vertical force P that can be applied to the bell crank so that the average normal stress developed in the 10-mm diameter rod CD, and the average shear strees developed in the 6-mm diameter double sheared pin B not exceed 175 MPa and 75 MPa respectively.


Probs. 1–64/65

1–66. Determine the largest load $\mathbf{P}$ that can be applied to the frame without causing either the average normal stress or the average shear stress at section a–a to exceed $\sigma = 150$ MPa and $\tau = 60$ MPa, respectively. Member CB has a square cross section of 25 mm on each side.
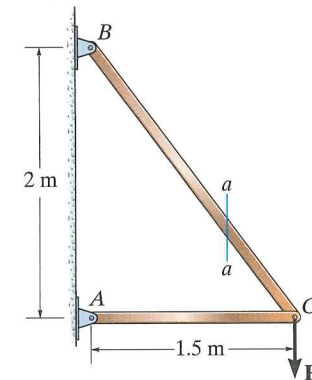
Prob. 1–66

1–67. The pedestal in the shape of a frustum of a cone is made of concrete having a specific weight of 150 lb/ft³. Determine the average normal stress acting in the pedestal at its base. *Hint:* The volume of a cone of radius r and height h is $V = \frac{1}{3}\pi r^2 h$.

*1–68. The pedestal in the shape of a frustum of a cone is made of concrete having a specific weight of 150 lb/ft³. Determine the average normal stress acting in the pedestal at its midheight, $z = 4$ ft. *Hint:* The volume of a cone of radius r and height h is $V = \frac{1}{3}\pi r^2 h$.
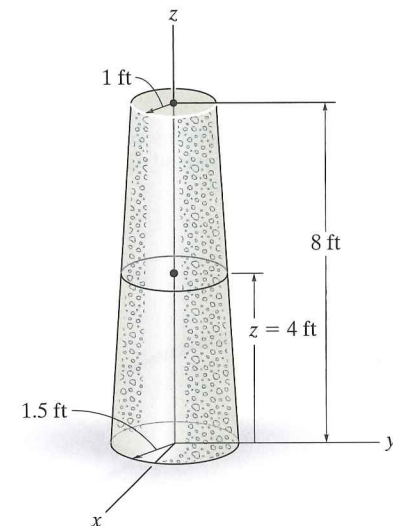

Probs. 1–67/68

PROBLEMS

1–69. Member B is subjected to a compressive force of 800 lb. If A and B are both made of wood and are $\frac{3}{8}$ in. thick, determine to the nearest $\frac{1}{4}$ in. the smallest dimension h of the horizontal segment so that it does not fail in shear. The average shear stress for the segment is $\tau_{allow} = 300$ psi.
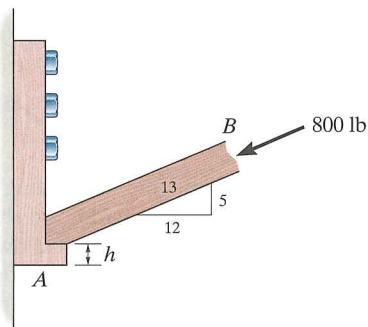

Prob. 1–69

1–70. The lever is attached to the shaft A using a key that has a width d and length of 25 mm. If the shaft is fixed and a vertical force of 200 N is applied perpendicular to the handle, determine the dimension d if the allowable shear stress for the key is $\tau_{allow} = 35$ MPa.
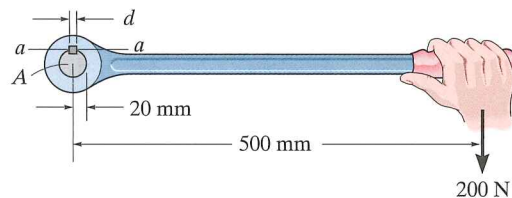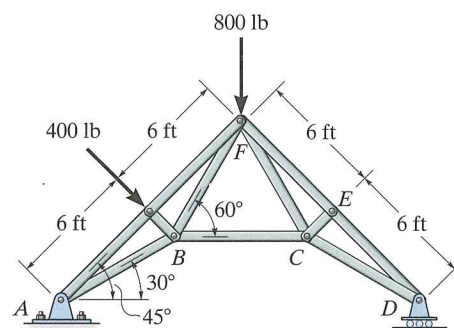

Prob. 1–70

1–71. The joint is fastened together using two bolts. Determine the required diameter of the bolts if the failure shear stress for the bolts is $\tau_{fail} = 350$ MPa. Use a factor of safety for shear of F.S. = 2.5.
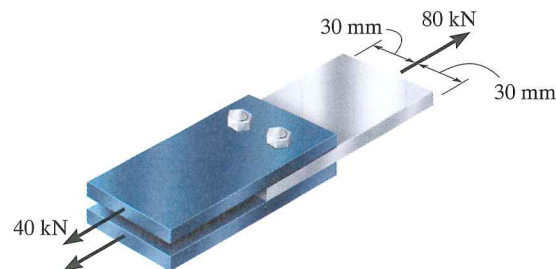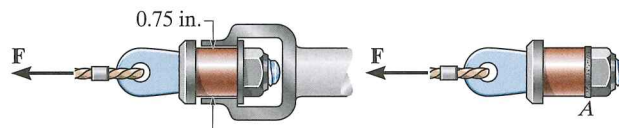

*1–72.** The truss is used to support the loading shown Determine the required cross-sectional area of member BC if the allowable normal strees is $\sigma_{allow} = 24$ ksi.
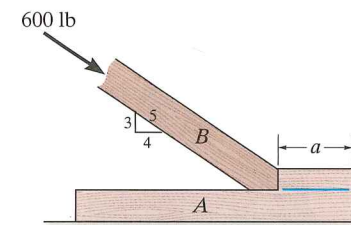

Prob. 1–72

1–73. The steel swivel bushing in the elevator control of an airplane is held in place using a nut and washer as shown in Fig. (a). Failure of the washer A can cause the push rod to separate as shown in Fig. (b). If the maximum average normal stress for the washer is $\sigma_{max} = 60$ ksi and the maximum average shear stress is $\tau_{max} = 21$ ksi, determine the force $\mathbf{F}$ that must be applied to the bushing that will cause this to happen. The washer is $\frac{1}{16}$ in. thick.
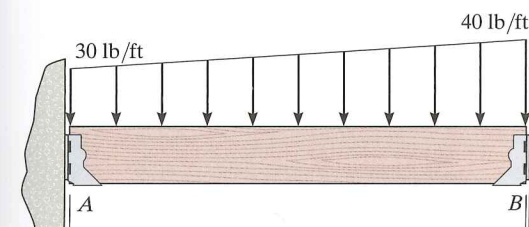

1–74. Member B is subjected to a compressive fo 600 lb. If A and B are both made of wood and are thick, determine to the nearest $\frac{1}{8}$ in. the smallest dimer of the support so that the average shear stress along th line does not exceed $\tau_{allow} = 50$ psi. Neglect friction.
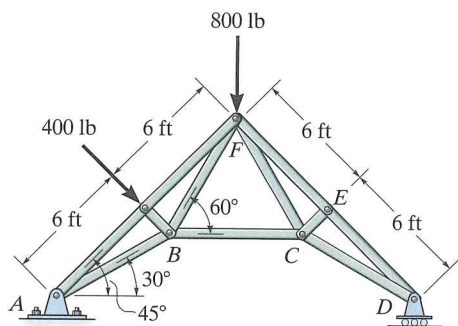

Prob. 1–74

1–75. The hangers support the joist uniformly, so th assumed the four nails on each hanger carry an portion of the load. If the joist is subjected to the l shown, determine the average shear stress in each the hanger at ends A and B. Each nail has a diameter of The hangers only support vertical loads.

*1–76.** The hangers support the joists uniformly, s it is assumed the four nails on each hanger car equal portion of the load. Determine the sm diameter of the nails at A and at B if the allowable for the nails is $\tau_{allow} = 4$ ksi. The hangers only su vertical loads.

1-74. Member B is subjected to a compressive force of 600 lb. If A and B are both made of wood and are 1.5 in. thick, determine to the nearest $\frac{1}{8}$ in. the smallest dimension a of the support so that the average shear stress along the blue line does not exceed $\tau_{allow} = 50$ psi. Neglect friction.

Prob. 1–74

1-77. The tension member is fastened together using *two* bolts, one on each side of the member as shown. Each bolt has a diameter of 0.3 in. Determine the maximum load P that can be applied to the member if the allowable shear stress for the bolts is $\tau_{allow} = 12$ ksi and the allowable average normal stress is $\sigma_{allow} = 20$ ksi.
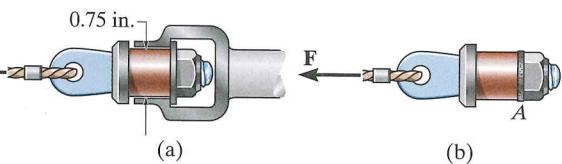

Prob. 1–77

2. The truss is used to support the loading shown. ermine the required cross-sectional area of member BC e allowable normal strees is $\sigma_{allow} = 24$ ksi.

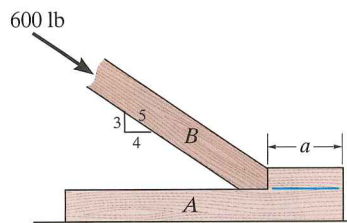**Prob. 1–72**

The steel swivel bushing in the elevator control of rplane is held in place using a nut and washer as shown g. (a). Failure of the washer A can cause the push rod parate as shown in Fig. (b). If the maximum average al stress for the washer is $\sigma_{max} = 60$ ksi and the mum average shear stress is $\tau_{max} = 21$ ksi, determine orce **F** that must be applied to the bushing that will this to happen. The washer is $\frac{1}{16}$ in. thick.
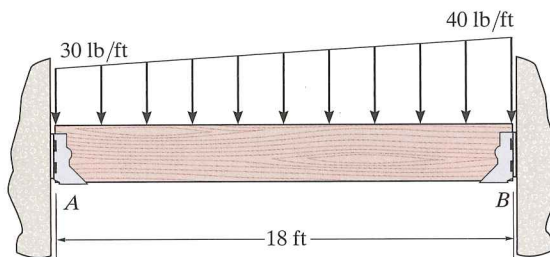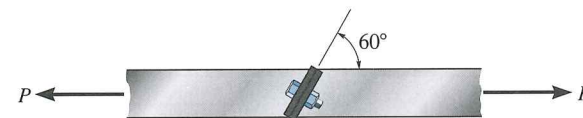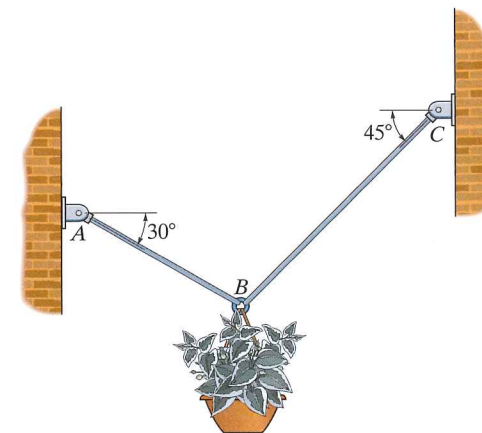

Prob. 1–73

1-75. The hangers support the joist uniformly, so that it is assumed the four nails on each hanger carry an equal portion of the load. If the joist is subjected to the loading shown, determine the average shear stress in each nail of the hanger at ends A and B. Each nail has a diameter of 0.25 in. The hangers only support vertical loads.

*1-76. The hangers support the joists uniformly, so that it is assumed the four nails on each hanger carry an equal portion of the load. Determine the smallest diameter of the nails at A and at B if the allowable stress for the nails is $\tau_{allow} = 4$ ksi. The hangers only support vertical loads.

Probs. 1–75/76

1-78. The 50-kg flowerpot is suspended from wires AB and BC. If the wires have a normal failure stress of $\sigma_{fail} = 350$ MPa, determine the minimum diameter of each wire. Use a factor of safety of 2.5.

1-79. The 50-kg flowerpot is suspended from wires AB and BC which have diameters of 1.5 mm and 2 mm, respectively. If the wires have a normal failure stress of $\sigma_{fail} = 350$ MPa, determine the factor of safety of each wire.

Probs. 1–78/79