APL105

Tutorial and Assignment 1

Assignment problems (1.27, 1.23, 1.32, 1.60, 1.41)

Due on 22-1-2024 (Lecture class)

1.3 Two solid cylindrical rods AB and BC are welded together at B and loaded as shown. Knowing that the average normal stress must not exceed 175 MPa in rod AB and 150 MPa in rod BC, determine the smallest allowable values of d_1 and d_2.

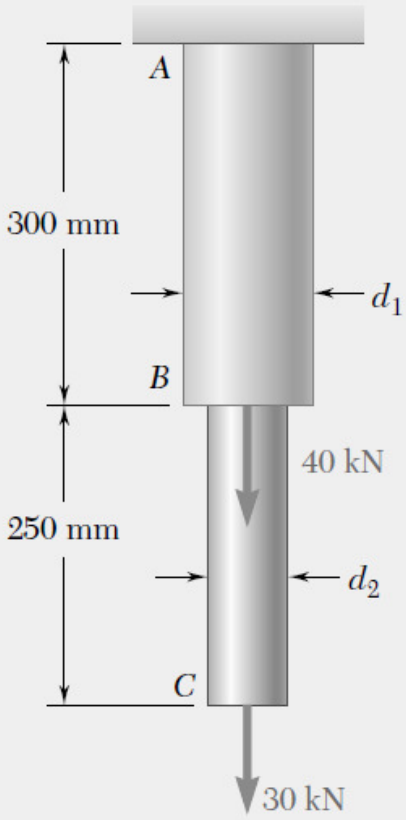

Fig. P1.3 and P1.4

1.7 Each of the four vertical links has an 8 × 36-mm uniform rectangular cross section, and each of the four pins has a 16-mm diameter. Determine the maximum value of the average normal stress in the links connecting (*a*) points *B* and *D*, (*b*) points *C* and *E*.

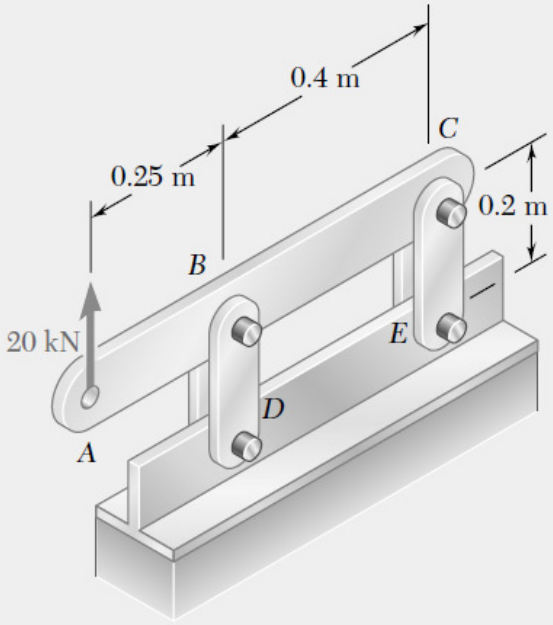

Fig. P1.7

1.27 For the assembly and loading of Prob. 1.7, determine (*a*) the average shearing stress in the pin at *B*, (*b*) the average bearing stress at *B* in member *BD*, (*c*) the average bearing stress at *B* in member *ABC*, knowing that this member has a 10 × 50-mm uniform rectangular cross section.

1.22 An axial load **P** is supported by a short W200 × 59 column of cross-sectional area $A = 7650$ mm^2 and is distributed to a concrete foundation by a square plate as shown. Knowing that the average normal stress in the column must not exceed 200 MPa and that the bearing stress on the concrete foundation must not exceed 20 MPa, determine the side a of the plate that will provide the most economical and safe design.

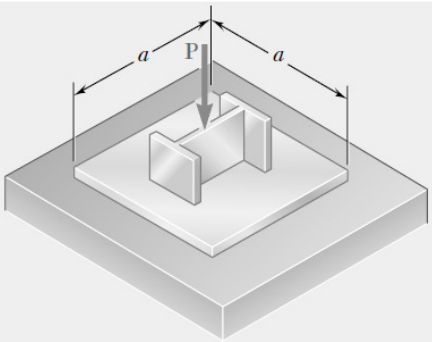

Fig. *P1.22*

1.23 Link AB, of width $b = 50$ mm and thickness $t = 6$ mm, is used to support the end of a horizontal beam. Knowing that the average normal stress in the link is −140 MPa, and that the average shearing stress in each of the two pins is 80 MPa, determine (*a*) the diameter d of the pins, (*b*) the average bearing stress in the link.

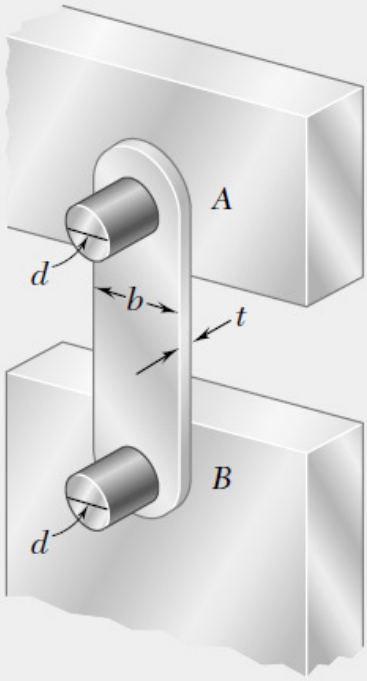

Fig. P1.23

1.31 The 6-kN load **P** is supported by two wooden members of uniform cross section that are joined by the simple glued scarf splice shown. Determine the normal and shearing stresses in the glued splice.

1.32 Two wooden members of uniform cross section are joined by the simple scarf splice shown. Knowing that the maximum allowable tensile stress in the glued splice is 500 kPa, determine (*a*) the largest load **P** that can be safely supported, (*b*) the corresponding shearing stress in the splice.

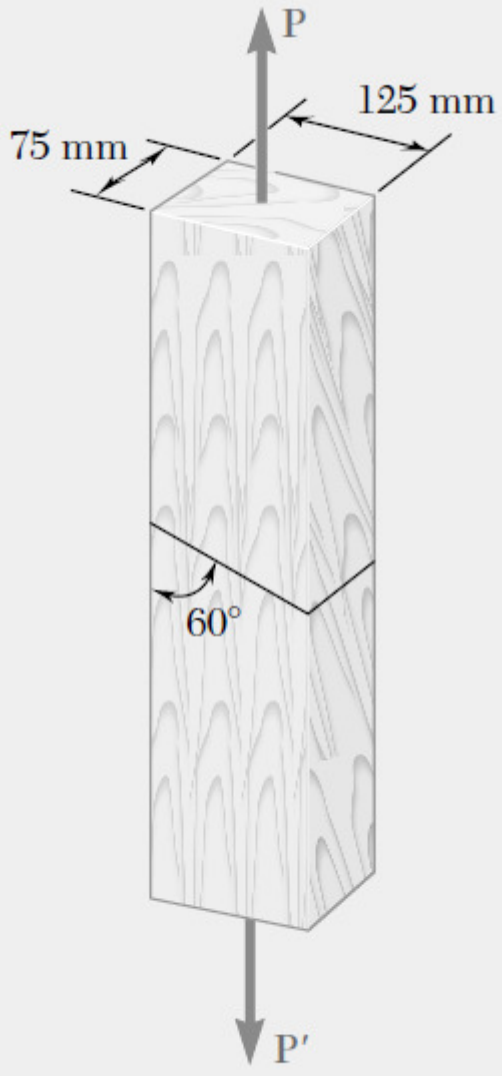

Fig. P1.31 and P1.32

1.67 Member *ABC*, which is supported by a pin and bracket at *C* and a cable *BD*, was designed to support the 16-kN load **P** as shown. Knowing that the ultimate load for cable *BD* is 100 kN, determine the factor of safety with respect to cable failure.

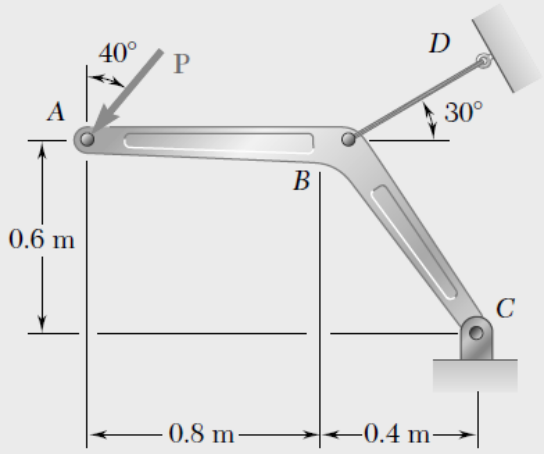

Fig. P1.67

1.60 Two horizontal 20-kN forces are applied to pin *B* of the assembly shown. Knowing that a pin of 20-mm diameter is used at each connection, determine the maximum value of the average normal stress (*a*) in link *AB*, (*b*) in link *BC*.

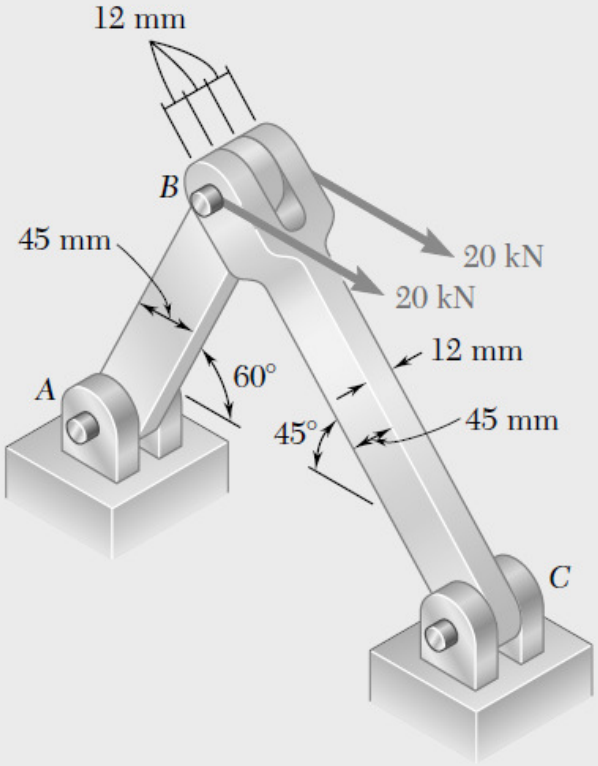

Fig. P1.60

1.41 The horizontal link BC is 6 mm thick and is made of a steel with a 450-MPa ultimate strength in tension. What should be the width w of the link if the structure shown is to be designed to support a load $P = 32$ kN with a factor of safety equal to 3?

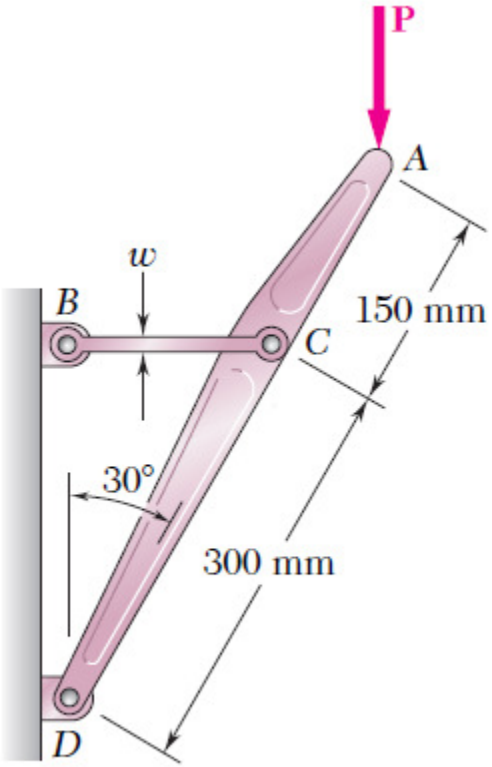

Fig. P1.40 and P1.41