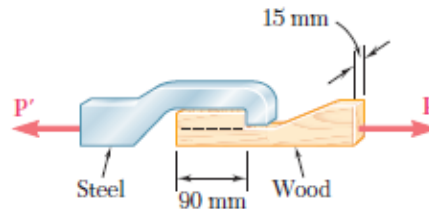
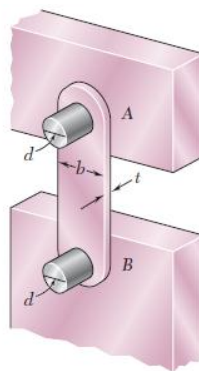


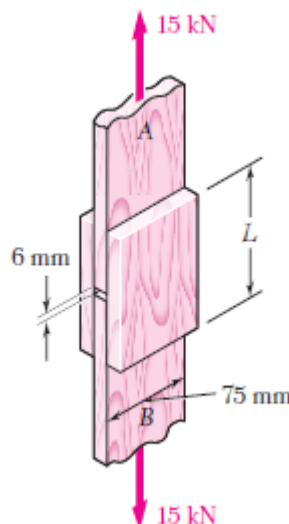
- 1- When the force  $P$  reached 8 kN, the wooden specimen shown failed in shear along the surface indicated by the dashed line. Determine the average shearing stress along that surface at the time of failure.



- 2- 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.

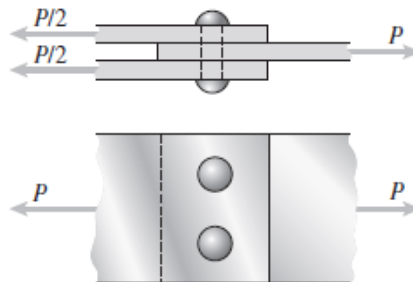


- 3- The wooden members  $A$  and  $B$  are to be joined by plywood splice plates that will be fully glued on the surfaces in contact. As part of the design of the joint, and knowing that the clearance between the ends of the members is to be  $6$  mm, determine the smallest allowable length  $L$  if the average shearing stress in the glue is not to exceed  $700$  kPa.

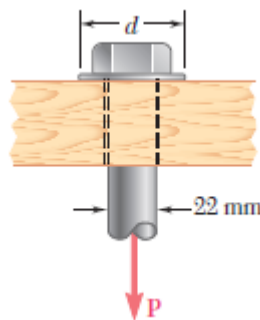


4- Three steel plates, each 16 mm thick, are joined by two 20-mm diameter rivets as shown in the figure.

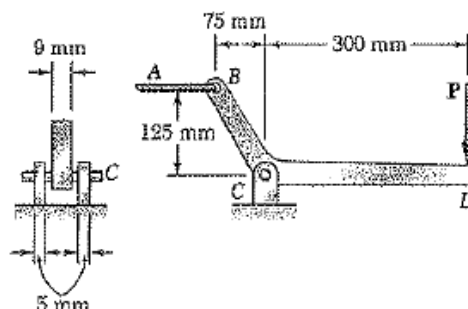
- (a) If the load  $P = 50$  kN, what is the largest bearing stress acting on the rivets?  
(b) If the ultimate shear stress for the rivets is 180 MPa, what force  $P_{ult}$  is required to cause the rivets to fail in shear? (Disregard friction between the plates.)



- 5- The load  $P$  applied to a steel rod is distributed to a timber support by an annular washer. The diameter of the rod is 22 mm and the inner diameter of the washer is 25 mm, which is slightly larger than the diameter of the hole. Determine the smallest allowable outer diameter  $d$  of the washer, knowing that the axial normal stress in the steel rod is 35 MPa and that the average bearing stress between the washer and the timber must not exceed 5 MPa.



- 6- A 6 mm diameter pin is used at connection C of the pedal shown. Knowing that  $P = 500$  N, determine (a) the average shearing stress in the pin, (b) the nominal bearing stress in the pedal at C, (c) the nominal bearing stress in each support bracket at C.



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- The diagram shows a frame structure with the following dimensions and forces:
- A horizontal member  $AC$  of length  $0.4\text{ m}$ .
  - A vertical member  $CE$  of height  $0.2\text{ m}$ .
  - A horizontal member  $BD$  of length  $0.25\text{ m}$  from point  $B$  to the left end.
  - A vertical force of  $20\text{ kN}$  is applied upwards at the left end of member  $AC$ .
  - Points  $A$ ,  $B$ , and  $C$  are on the top member, while  $D$  and  $E$  are on the bottom member.
  - Members  $AB$  and  $CD$  are vertical, and members  $BD$  and  $CE$  are horizontal.