



King Fahd University of Petroleum & Minerals
College of Engineering Sciences
Mechanical Engineering Department

Chapter 8 –Design of nonpermanent Joints

Due Date – 25th April - 2021

Problem 1 (25 Marks)

Design a hard steel (screw and nut) lubricated power screw for raising and lowering a load of 25 kN using a square – thread with major diameter of 40 mm, pitch of 6 mm with triple threads and a plain bronze thrust collar of 60 mm ($f_c=0.08$) (Assume maximum friction).

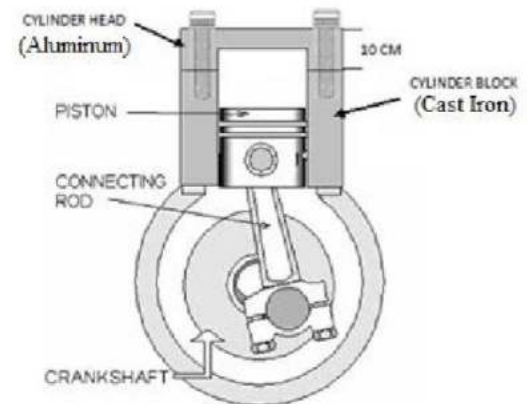
- Find the torque for raising and lowering the load. Is the design self-locking? If not, please change the design accordingly
- Find the largest axial and shear body stresses. Also find the bending stresses
- With a safety factor of 2, a designer has chosen the DE approach to design the power screw with $S_y = 260$ MPa. Is this a suitable option?

Problem 2 (20 Marks)

A single square-thread power screw has an input power of 3 kW at a speed of 1 rev/s. The screw has a diameter of 40 mm and a pitch of 8 mm. The frictional coefficients are 0.14 for the threads and 0.09 for the collar, with a collar friction radius of 50 mm. Find the axial resisting load F and the combined efficiency of the screw and collar.

Problem 3 (30 Marks)

A single cylinder air compressor head sees forces that range from 0 to 18.5 kN at each cycle. The cylinder head is 100 mm thick aluminum, and the cylinder block is cast iron. To fix the compressor head on the block it is proposed to use fully threaded M6 x 1 cap screws of rolled threads, class 5.8 with a fully corrected endurance limit of 127 MPa and $E=207$ GPa. Assume an effective length of 160 mm with a permanent connection.

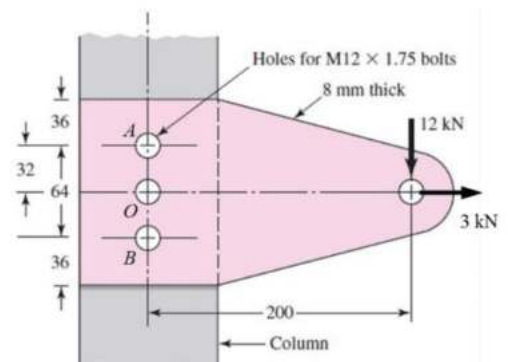


- Find k_b , k_m and C – assume a fully threaded screw
- Calculate the number of screws (N) needed for a load safety factor of 1.2
- Find fatigue factor of safety using Goodman. Based on these results, the danger of failure is by static or fatigue loading?

Problem 4 (25 Marks)

The AISI 1020 hot-rolled steel bracket shown below is bolted to a column with 3 ISO 5.8 bolts with $L = 32$ mm.

- Draw a free body diagram and show all forces acting on each bolt determine the most critical bolt
- Find factor of safety against shearing of bolt – is it safe ?



All dimensions are in millimeters