

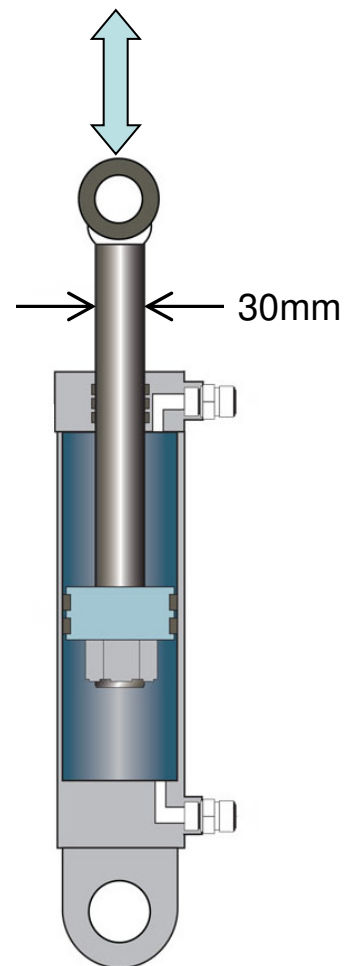
## MEEG3311 Homework 5 – Chapter 7

### 5.1

The double acting hydraulic cylinder shown here actuates the arm of a backhoe. The axial force on the piston rod varies between 200 kN pushing to 200 kN pulling under fully loaded operation. The rod material is AISI 1080 steel, quenched and tempered at 800C.

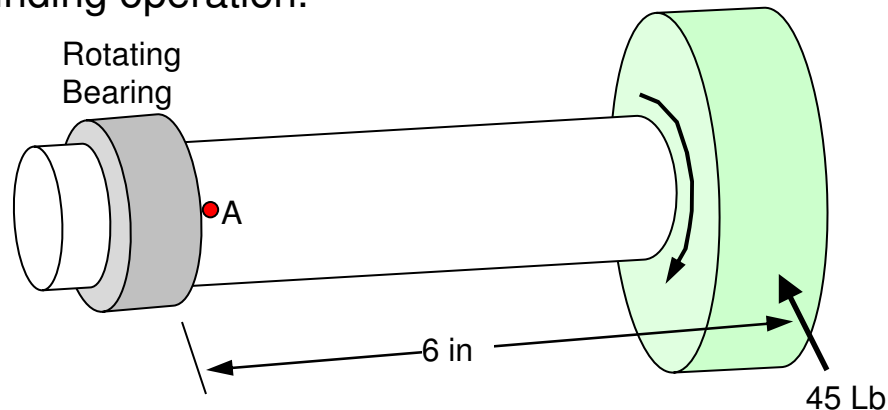
If the rod has a diameter of 30mm, how many cycles can it be expected to operate before failing from fatigue?

[Assume that all the modifying factors are equal to one.]



## 5.2

A solid steel shaft (AISI 1020, Q&T 870°C) with 1/2" diameter is used to turn a grinding wheel that hangs out from a bearing. It is loaded by a bending force of 45 Lbs at the wheel during a production grinding operation.



- Assuming that there is only a radial force on the wheel (no friction at the contact where the grinding takes place), determine the maximum stress on the shaft right where it leaves the rotating bearing (near point A).
- As the shaft rotates, point A alternately sees tension and compression. Given that the surface of the 1/2" shaft is ground and we want only a 0.1% failure rate, how many rotations could this shaft endure? [That means include the modifying factors.]
- Draw the S-N diagram for this case, and show the operating point.
- If each grinding operation contacts the wheel for 5 seconds, and the shaft is turning at 900 RPM, how many parts could be ground before the shaft might fail?
- What should the grinding force be reduced to for the shaft to have infinite life?