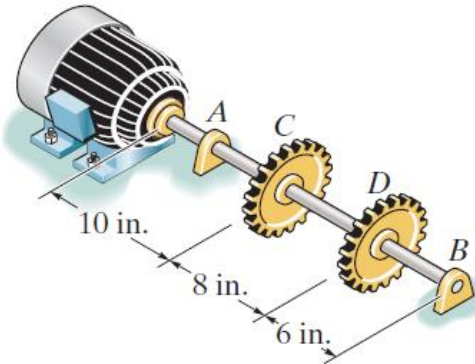


Tech ID or Star ID: \_\_\_\_\_

Do one of the two problems shown below (the second problem is on the back).  
Show your work (you will not receive any credit if all you have is a final answer, right or wrong).

1. The motor shown below in the figure supplies (in a clockwise manner) 40 hp to the solid shaft as it rotates at 20 Hz. The 304 stainless steel shaft has a diameter of 1.5 inches and is supported on smooth bearings at A and B, allowing free rotation of the shaft. The gears C and D are fixed to the shaft and remove (in a counterclockwise manner) 25 hp and 15 hp, respectively. Determine the angle of twist of gear C with respect to gear D.



2. The tubular shaft of the motor shown below has an outer diameter of 20 mm and a wall thickness of 2.5 mm and is made of a material with an allowable shear stress of  $\tau_{\text{allow}} = 75 \text{ MPa}$ . Determine the maximum allowable power (in kW) that can be supplied when the shaft is operating at 1,500 rpm.

