

An operating gearbox has 200 hp at its input shaft while 190 hp are delivered to the output shaft. The gearbox has a steady state surface temperature of 140 F.

1. Sketch this system, showing all heat and work transfers  
   along with their correct sign.
2. Write the 2nd Law for this system. Begin with the general  
   statement of the 2nd Law and cancel terms that can be  
   neglected.
3. Determine the entropy production rate. How would this change  
   if the surface temperature were hotter? Why does this make sense?

Hints:

Remember: 1 hp = 2545 Btu/hr