

Thermodynamics An Engineering Approach 8th

A cold storage facility is being designed to operate at 10 F. The refrigeration need of the facility is estimated to be 500 tons. A single stage Ammonia refrigeration system is being proposed. The condensation will be through a water condenser, which in turn is cooled by a cooling tower. The cooling tower is designed/selected to supply the cooling water at 80 F to the condenser. Ambient condition can be considered to be at 90 F and 50% RH. Take the approach temperature for the heat exchangers to be 10 F. Take the pressure rise in the cooling tower pump and fan to be 20 psi and 5" of water respectively. The efficiency of compressors is 92%. If you need other data make reasonable assumptions.

1. Calculate the COP and the performance parameter (kW/ton) of the refrigeration cycle.
2. Calculate the flow rate of the refrigerant in the cycle.
3. Calculate the motor size for the compressors and the daily cost to run the compressor at an electric cost of \$0.12/kWh)
4. Calculate the capacity of cooling tower in tons of refrigeration
5. Calculate the water and air flow rates in the cooling tower
6. Calculate the pumping and fan power
7. Calculate the make-up water flow rate to the cooling tower
8. An alternative to make the system more efficient is to design the system with an intercooler. Select an appropriate pressure for the intercooler (will need a bit of research!) and estimate the performance of the system.
9. For both single stage and two stage systems select make and model of appropriate compressors.