

10.213 Homework
10/6/99

Problem 12 Due 10/13

Freon 134a is to be used in a refrigerator that operates with an evaporator temperature of -15°F and a condenser temperature of 80°F . Saturated liquid refrigerant from the condenser flows through an expansion valve into the evaporator. From the evaporator, the refrigerant emerges as a saturated vapor.

- a) For a cooling rate of 5 Btu/s , what is the circulation rate of the refrigerant?
- b) By how much would the circulation rate be reduced if the throttle valve were replaced by a turbine in which the refrigerant expands isentropically?
- c) Suppose the cycle of a) is modified by the inclusion of a countercurrent heat exchanger between the condenser and the throttle valve in which heat is transferred to vapor returning from the evaporator. If the liquid from the condenser enters the exchanger at -15°F and leaves at 70°F , what is the circulation rate of the refrigerant?
- d) For each of a), b), and c), determine the coefficient of performance for isentropic compression of the vapor.