
Problem 1:

Consider an ideal dual-loop heat-powered refrigeration cycle using ammonia as the working fluid, as shown on the board. Saturated vapor at 40°C leaves the boiler and expands in the turbine to the condenser pressure. Saturated vapor at -16°C leaves the evaporator and is compressed to the condenser pressure. The ratio of the flows through the two loops is such that the turbine produces just enough power to drive the compressor. The two exiting streams mix together and enter the condenser. Saturated liquid leaving the condenser at 20°C is then separated into two streams in the necessary proportions. Determine:

- (a) The ratio of mass flow rate through the power loop to that through the refrigeration loop.

(b) $\frac{\dot{Q}_L}{\dot{Q}_{IN}}$

Problem 2:

A small heat pump unit is used to heat water from a hot-water supply. Assume that the unit uses ammonia and operates on the Carnot refrigeration cycle. The evaporator temperature is 15°C and the condenser temperature is 50°C . If the amount of hot water needed is 0.1 kg/s , then:

- (a) Draw the ammonia cycle in a T-s diagram.
- (b) Determine the amount of energy saved by using the heat pump instead of directly heating the water from 15°C to 50°C .
- (c) Find the mass flow rate in the ammonia cycle.