

Design Project: Refrigeration System

(50 pts)

This design project addresses ABET Student Objectives, specifically Outcome 2:

“an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors”

Design a refrigeration system that will work with an insulated space like the cabinet of a household refrigerator with an inside capacity of 20 ft^3 (or $\sim 0.6 \text{ m}^3$) between T_1 and T_2 where T_1 is the temperature of the inside space and T_2 is the temperature of the outside environment. ~~The cabinet has a heat loss of 10% of the cooling capacity of the evaporator. The duty cycle (ratio of ‘on’ to ‘off’ time) of the unit should not exceed 50%.~~

$T_1 = 40 \text{ }^\circ\text{F} - 2 \times$ letters in your last name, e.g., Smith would use $30 \text{ }^\circ\text{F}$.

$T_2 = 70 \text{ }^\circ\text{F} + 2 \times$ letters in your first name, e.g, Betty would use $80 \text{ }^\circ\text{F}$.

Assume only conduction heat transfer ($\dot{Q} = -kA \frac{dT}{dx}$ with $k = 1.2 \text{ W/m K}$) which occurs through the walls of the cabinet. You will have to specify the inside dimensions of the cabinet.

Use any refrigerant you wish. Most will use R-134a because the property tables are in the text however there are many other refrigerants available through the Internet.

You will need to calculate the temperatures, pressures, mass flow rate, COP, etc. Draw the Ts diagram and sketch the system. You may do your work in the SI system but report your results in the USCS system (English units).

List all assumptions that you make for analysis of this design project. Do your own work.
Plagiarism will not be tolerated.

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