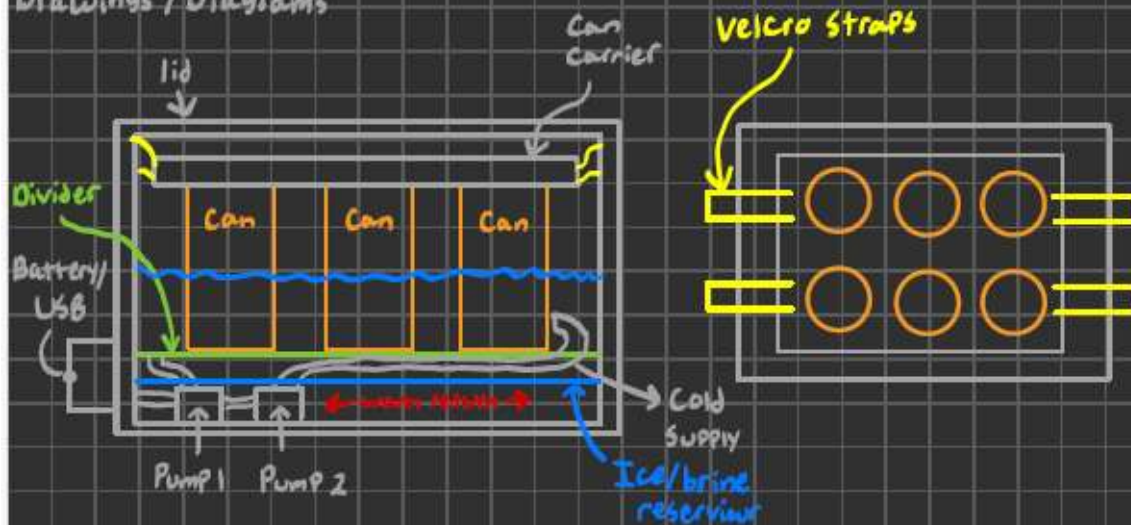


Final Project

Purpose:

Determine whether the proposed cooler can cool 6 12-oz drink cans from an initial temp of 85°C to a final temp of 40°C in less than 5 mins. The analysis will determine the required heat removal, overall heat transfer coeff, coolant velocity, Pump flow rate, and ice requirement. The heat transfer between the circulating water and ice will also be considered so that water isn't assumed to cool instantaneously.

Drawings / Diagrams



$$T_{bev} \sim R_{conv,i} \sim R_{Al} \sim R_{conv,o} \sim T_{water} \sim R_{conv,ice} \sim T_{ice}$$

Sources:

1. Bayazitoglu, Y., and Ozisik., A Textbook for Heat Transfer Fundamentals
2. MET 340 Class notes
3. Preliminary project report
4. Manufacturer specifications for selected 240 L/hr Pumps

Design Considerations:

The beverage is approximated using the properties of water. All 6 Cans are assumed to begin at approx. the same temp. The can is assumed as a cylinder, with the side and both ends exposed to the circulating bath. The aluminum wall is thin and highly conductive, so its conduction resistance is assumed to be small compared with the convection resistances. The salted ice water bath is designed to operate near 18°F . Preliminary beverage side convection coeff of $210 \text{ W}/(\text{m}^2 \cdot \text{K})$ is used. The pumps create forced convection around the cans, while the acrylic divider helps guide the flow across the can surfaces.