

The JETS Challenge

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Challenge 74 – The Soda/Pop Challenge

Problem:

All soda/pop machines must include a heater to keep the cans of softdrink from freezing during the winter months. The equation to find Q, the needed heater capacity, is

$$Q = U \cdot A \cdot (T_i - T_o)$$

where U (Btu / hr-ft²-°F) is determined by the thickness and insulation properties of the walls, A (ft²) is the exposed outside surface area (walls and top) of the vending machine and T_i and T_o are the inside and outside temperatures (°F) respectively.

Determine the capacity of the heater required inside a 3 foot by 2 foot by 6 foot vending machine with U=0.08 Btu / hr-ft²-°F when the inside temperature is 36°F and the outside temperature is -12°F.

Solution:

$$\text{Area} = 2 \times (3 \times 6) + 2 \times (2 \times 6) + 3 \times 2$$

$$= 36 + 24 + 6$$

$$= 66 \text{ ft}^2$$

$$T_i = 36^\circ$$

$$T_o = -12^\circ$$

$$U = .08 \text{ Btu/hr-ft}^2\text{-}^\circ\text{F}$$

$$Q = (0.08) (66) (36 - -12)$$

$$= 253.44 \text{ Btu/hr.}$$