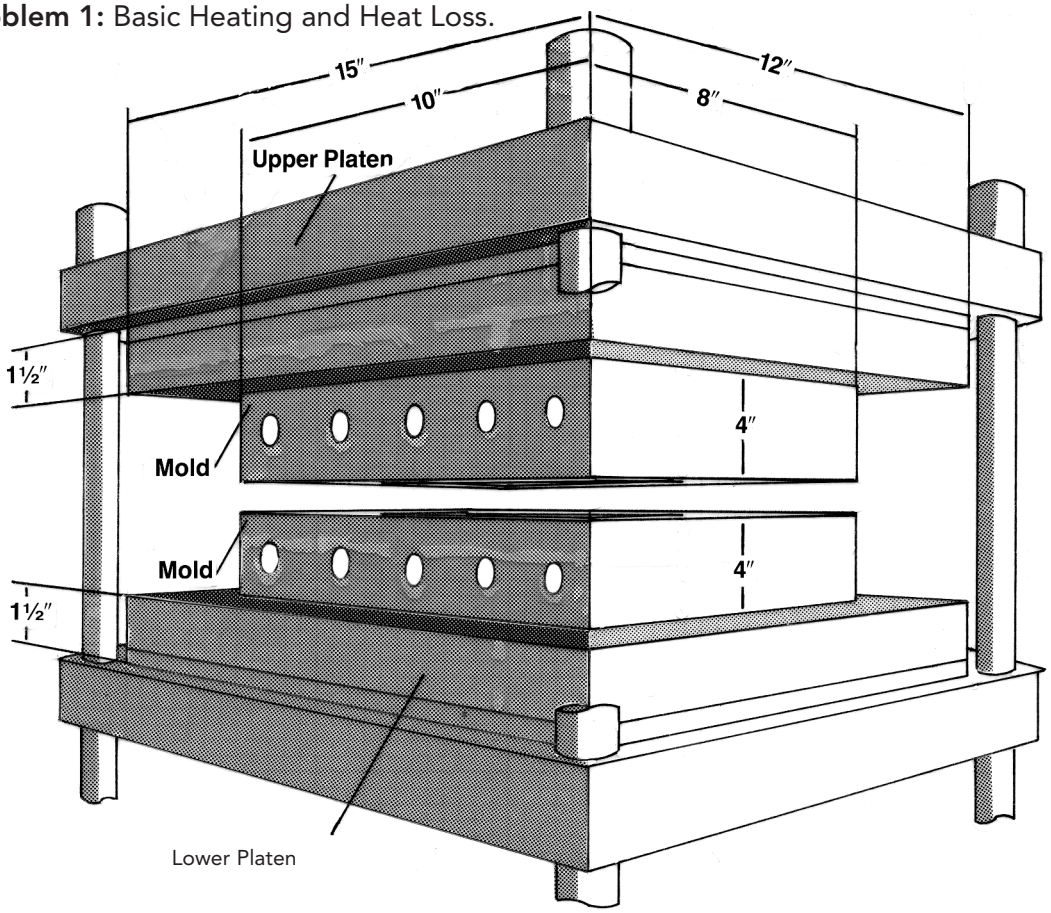
Technical

Wattage Calculation Formulas

Problem 1: Basic Heating and Heat Loss.



A steel mold is being used to form polyethelyne parts. Each hour, 90 ounces of nylon is introduced to the mold. The mold itself measures 10″ x 8″ x 4″. The mold is attached between two stainless steel platens, each measuring 15″ x 12″ 1½″ thick. The platens are insulated from the press mechanism with ½″ thick insulation. Operating temperature of the mold is 400˚F and is required to reach this temperature in 1 hour with an ambient temperature of 70˚F.

1) From Table 1, page 145: Specific heat of steel - .12/BTU/lb ˚F
2) From Table 1, page 145: Specific heat of stainless steel - .12/BTU/lb ˚F
3) From Table 2, page 146: Specific heat of polyethelyne - .55/BTU/lb ˚F
4) From Graph 1, page 150: Heat losses curves – A + B @ 400˚F
5) From Table 1, page 145: Converting cubic inches into pounds (density lb/cu. in.)

Formula A: Wattage required for heat-up

To heat mold $\frac{(10'' \times 8'' \times 4'') = 320 \text{ cu.in.} \times 2 \times .284 = 181.7 \text{ (lbs)} \times .12 \text{ BTU/lb } ^\circ\text{F} \times (400 - 70)^\circ\text{F}}{3.412 \times 1} =$ 2,110 watts

To heat Platens $\frac{(15'' \times 12'' \times 1\frac{1}{2}'') = 270 \text{ cu.in.} \times 2 \times .286 = 154.5 \text{ (lbs)} \times .12 \text{ BTU/lb } ^\circ\text{F} \times (400\text{-}70)\ ^\circ\text{F}}{3.412 \times 1} =$ 1,800 watts

To heat Polyethelyne $\frac{90}{16} = \frac{5.6 \text{ (lbs)} \times .55\text{BTU/lb } ^\circ\text{F} \times (400\text{-}70)\ ^\circ\text{F}}{3.412 \times 1} =$ 300 watts

Compensation Factor 20% (2,110 + 1,800 + 300) = 840 watts

Total wattage required for Heat-up = **5,050 watts**

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