Heat Requirement Calculations

***Operating heat** requirements will include one or more of the following calculations. Any additional losses particular to the application should also be estimated and included.*

1. **Wattage to counteract losses from open liquid surfaces:** See Graph 3 for loss rates of water and oils.
   Total liquid surface area (sq. ft.) × Loss rate at operating temperature (watts/sq. ft.) = Watts
2. **Wattage to counteract container or platen surface losses,** either insulated (See Graph 1) or uninsulated (See Graph 2).
   Total surface area (sq. ft.) × Loss rate at operating temperature (watts/sq. ft.) = Watts
3. **Wattage required to heat material transferred in and out of the system.**
   (Metal dipped in heated tanks, air flows, make-up liquids, etc.)

$$\frac{\text{Weight of material to be heated (lbs)} \times \text{Specific Heat (Btu/lb °F)} \times \text{Temperature rise (°F)}}{\text{3.412 btu/watt hr.} \times \text{Heat-up time (hr.)}} = \text{Watts}$$

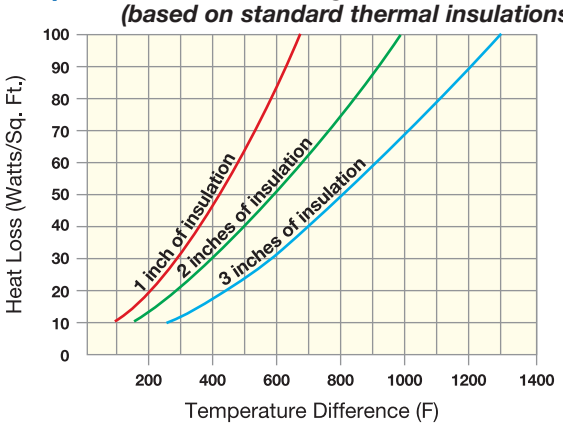
4. **Heat-up of racks of containers, etc. transferred in and out of the system:**

$$\frac{\text{Weight of items to be heated (lbs)} \times \text{Specific Heat (Btu/lb °F)} \times \text{Temperature rise (°F)}}{\text{3.412 btu/watt hr.} \times \text{Heat-up time (hr.)}} = \text{Watts}$$

Specific Heat: The heat necessary to increase the temperature of all other substances has been referred to water as a standard. The ratio of the amount of heat required to increase the temperature of one pound of any substance by one degree to the amount necessary to increase one pound of water is known as the specific heat of that substance.

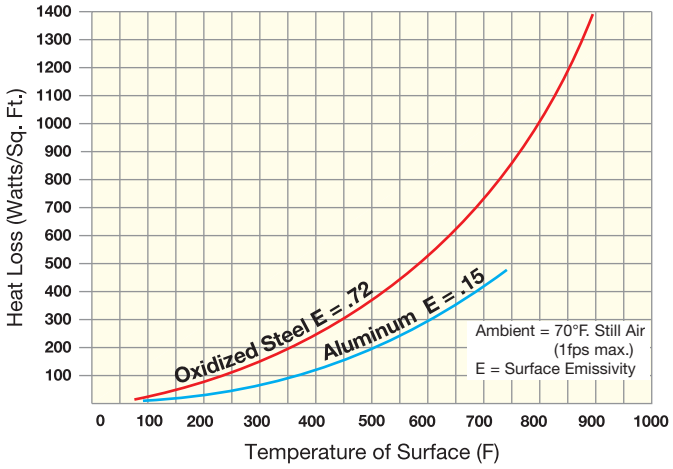
Heat Loss Information

Graph 1 ***Heat Losses through Insulated Walls (based on standard thermal insulations)***



Figures are for vertical surfaces. Multiply by 120% for a horizontal top surface and by 60% for a horizontal bottom surface.

Graph 2 ***Heat Losses from Uninsulated Metal Surfaces***



Graph 3 ***Heat Losses from the Surface of Water and Oil***