

Energy Tips



Steam



Motors



Compressed Air

Cover Heated, Open Vessels

Open vessels that contain heated liquids often have a high heat loss due to surface evaporation. Both energy and liquid losses are reduced by covering open vessels with insulated lids. Table 1 provides an estimate of the evaporative heat loss per square foot of uncovered vessel surface area for various water and dry ambient air temperatures. It is assumed that the ambient air is dry with no wind currents. A fan pulling air over the uncovered tank could more than double the heat losses.

Heat Loss Detail

- Eliminating internal heat gains will also result in electrical energy savings if the open tanks are located within a conditioned space.
- Heat losses are a strong function of both wind velocity and ambient air humidity. A wind velocity of 3 miles per hour will more than double the rate of heat loss from a tank.
- Radiation heat transfer is a secondary source of tank surface heat losses. Radiation losses increase from 90 Btu/hr-ft² at a liquid temperature of 110° F to 290 Btu/hr-ft² at 190° F.

Table 1. Evaporative Heat Loss from Water in Open Tanks, Btu/hr-ft²

Liquid Temperature, °F	Ambient Air Temperature, °F				
	65	75	85	95	105
110	244	222	200	177	152
130	479	452	425	397	369
150	889	856	822	788	754
170	1,608	1,566	1,524	1,482	1,440
190	2,900	2,845	2,790	2,737	2,684

Note: Table 1 is extracted from "Steam Efficiency Improvement" by the Boiler Efficiency Institute at Auburn University

Example

A rinse tank is four feet wide and ten feet long. It is maintained at a constant temperature of 170° F. Determine the evaporative heat loss from the tank if the ambient temperature is 75° F.

$$\text{Area of Evaporating Surface} = 4 \text{ ft} \times 10 \text{ ft} = 40 \text{ ft}^2$$

Total Heat Loss for

$$\text{Uncovered Liquid Surface} = 1,566 \text{ Btu/hr-ft}^2 \times 40 \text{ ft}^2 = 62,640 \text{ Btu/hr}$$

Cover the Tank with an Insulated Top

Assume that the rinse tank is heated during two shifts per day, five days per week, and 50 weeks per year. What are the annual energy savings that may be attained by covering the tank? What is the heating cost reduction in a plant where the cost of steam is \$6.50/MMBtu? Assume that covering the rinse tank with an insulated lid effectively reduces the heat losses from the liquid surface to a negligible value.

$$\begin{aligned} \text{Annual Energy Savings} &= 62,640 \text{ Btu/hr} \times 2 \text{ shifts/day} \times 8 \text{ hrs/shift} \times 250 \text{ days/yr} \\ &= 250 \text{ MMBtu/yr} \end{aligned}$$

$$\text{Heating Cost Reduction} = 250 \text{ MMBtu/yr} \times \$6.50/\text{MMBtu} = \$1,625/\text{yr}$$

Suggested Actions

- Conduct a survey to determine the number of open vessels that contain heated liquid within your plant. For each tank, determine the operating schedule, liquid temperature, ambient temperature, and the square feet of exposed area.
- Estimate the annual heat loss from the uncovered tanks and determine the potential annual fuel cost savings.
- Evaporation and heat losses can be reduced by lowering the liquid temperature, reducing the exposed liquid area, minimizing flow of air over the tank, or by installing an insulated cover.
- Obtain cost quotations for insulated covers. Install covers when they are economically justified.

Steam Tip Sheet information adapted from an EnergyTIPS fact sheet that was originally published by the Industrial Energy Extension Service of Georgia Tech and reviewed by the DOE BestPractices Steam Technical Subcommittee. For additional information on steam system efficiency measures, contact the OIT Clearinghouse at (800) 862-2086.



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