TANK DESIGN WORKSHEET

DESIGN CRITERIA

Location	Tank maintain temp. (Tm)	Minimum ambient temperature (Ta)	Delta temp. (ΔT = Tm – Ta)	Start-up temperature	Process operating temperature	System limit temperature	Max. intermittent exposure temp.
◯ indoors ◯ outdoors							
Example Outdoors	80°F	–20°F	100°F	0°F	200°F	500°F	200°F

Insulation type and thickness	Tank wall material	Tank wall thickness	Fluid in tank	Area classification	Area T-rating	Chemical exposure
	◯ metal ◯ plastic			◯ nonhazardous ◯ hazardous CID2 ◯ hazardous CID1		◯ none ◯ mild inorganics ◯ organics/corrosives
Example Cal sil 1.5”	Metal	0.25”	Heavy oil	Hazardous CID2	T2 (300°C)	Organics/corrosives

CALCULATION OF TANK HEAT LOSS

nVent provides a wide selection of heat-tracing solutions for tanks and vessels. For detailed information about tank heating products, refer to the Tank Heating design guide (H56887).

$Q_T = Q_V + Q_S + Q_A$

Where:

Q_T = Total heat loss of the tank

Q_V = Heat loss through the insulated body of the tank

Q_S = Heat loss through the tank support mechanism (slab, legs, saddle, or other base support)

Q_A = Heat loss through accessories such as manholes, handholds, ladders, or handrails

Calculation of Q_V, heat loss through insulated tank body:

Geometry of tank	Formula for surface area
Cylindrical	π x D x h plus ends
Truncated cone	π x (D + d) x S/2 plus ends

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Calculation of surface area _____ (A_{body}) = πDH

Add ends if required _____ (A_{end}) = πD2/4 or
(A_{end}) = (πD2/4) x 2

Total insulated surface area (ft2) _____ A_V ($A_V = A_{body} + A_{ends}$) (ft2)

Note: If different areas of the tank surface have different types of insulation or different thicknesses of insulation, a different (qv) heat loss rate and (f) insulation adjustment factor should be calculated for each area and the total heat losses should be added. Q_V is the total heat loss through the insulated portions of the tank wall.

$Q_V = A_V$ x qv x f = _____

Calculate Q_S, the heat loss through the base support of the tank:

Type of support (Concrete slab or earth foundation, legs, concrete saddles or uninsulated skirt) _____

Calculation of support heat loss _____

Q_S = Heat Loss of the base support x the quantity of base supports (as provided in H56887). _____ (watts)

The next step is to calculate Q_A, the heat loss through the accessories (manholes, handholds, ladders, handrails) of the tank. See Tank Heating design guide (H56887), and calculate Q_A, the heat loss through the accessories:

Type of accessory _____

Calculation of accessory heat loss _____ (watts)

Q_A = (Heat loss variable is provided in H56887). _____ (watts)

Calculation of total heat loss

$Q_T = Q_V + Q_S + Q_A$ _____ (watts) Outdoor application

$Q_T = 0.9 \times (Q_V + Q_S + Q_A)$ _____ (watts) Indoor application

nVent recommends a 20% safety factor for tank heat loss design.

Final design heat loss

$Q_F = Q_T$ x 1.20 _____ (watts)

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PRODUCT SELECTION

Tank heating applications can be quite varied. For this reason, nVent offers a range of technologies to optimize your tank and vessel heat-tracing system.

Numerous nVent products can be used to maintain temperatures of tanks. See Tank Heating design guide (H56887) for information on product selection. Pay particular attention to the maximum exposure temperature and the system limit temperature. The maximum exposure temperature is the highest temperature to which the heating cable will be exposed. Heating cables can be damaged by temperatures in excess of those the cables are designed to handle. The system limit temperature is the highest temperature to which the heating cables may expose the system. The tank or tank contents could be damaged by excessively high temperatures.

Once suitable products are selected based on temperatures, the decision is often based on economics. It is important to consider both product cost and the labor required to install the products.

Pad heater _____ Q_p (Watts/unit)

Pads required = Q_F/Q_p _____

Heating cable _____ $P_{heating\ cable}$ (watts/ft) at T_m (maintain temperature)

Note: See Section 6 to determine if P_{adj} should be used in place of $P_{heating\ cable}$

$P_{adj} = f_{adj} \times P_{heating\ cable}$

Feet of heating cable required = _____ Q_F / P_{adj} (or $P_{heating\ cable}$ if $f_{adj} = 1.0$)

See the Tank Heating design guide (H56887) for information on installing the heating cable on the tank. If aluminum tape is used for self-regulating heating cable installation, or if the heating cable is to be installed on a plastic tank, be sure to use the above formula to account for the change in power output of the self-regulating heating cable. Values for f_{adj} can be found in the Tank Heating design guide (H56887), Table 2. Also see the Tank Heating design guide (H56887), Table 3 for the circuit length adjustment factors for self-regulating heating cables.

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