How to Determine Heat Trace Cable Requirements

Heat Loss

Heat loss is the amount of heat given up to the surrounding atmosphere through a combination of conduction, convection, and radiation. The parameters required to determine total heat losses on an application may include several of the following:

- Temperature to be maintained
- Lowest expected ambient temperature
- Type, size, and run-length of pipe or tubing
- Type and thickness of thermal insulation to be used
- Losses through the vessel wall and the insulation
- Flow rate

Calculating Heat Loss from Insulated Pipe

1. Calculate the ΔT, or temperature difference. Subtract the lowest ambient temperature from the operating temperature.
2. Using the ΔT calculated in step 1, and the insulation thickness, refer to **Tables 1-A through 1-E—Heat Loss for Pipes (pages 6-5 and 6-6)**, to determine the heat loss in watts per linear foot of pipe.
3. Depending on the type of insulation used in the application, multiply result from step 2 by the appropriate factor from **Table 2—Insulation Factor (page 6-6)**. The resulting number is the heat loss expressed in watts per linear foot of pipe to be made up by the heat tracer.

Determine the Correct Heat Trace Cable

Determine the cable most appropriate for your system based on the temperature to be maintained, environment, length of the run, and the voltages available. There are Tempco heating cables available for most heat tracing applications.

If the watts per foot rating of the cable selected is more than the heat loss per foot, then a straight run may be used.

If the watts per foot rating of the cable selected is less than the heat loss per foot, your options are:

a. Use a higher wattage cable.

b. Use multiple straight runs.

c. Spiral wrap the cable on the pipe.

d. Use insulation with a higher insulation factor or thickness.

Calculating Heat Loss for Valves and Supports

To determine the heat loss multiplication factor for valves, refer to **Table 4—Heat Loss Multiplication Factors for Valves (page 6-7)**. The heat loss factor is based on a typical gate valve with insulation coverage to include the body, flange, and bonnet of the valve.

To determine adjusted multiplication factors for other types of valves and supports, use the following conversion factors:

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Gate valve	1.0	**Ball valve**	0.7
Globe valve	0.95	**Butterfly valve**	0.60
Pipe supports	0.50		

Determine the Total Amount of Heat Trace Required

Add the length of cable required for each valve and support to the length of cable required for the total pipe within your system.

Sample Calculation

Engineering Example Specifications

Operating Temperature: 55°F

Minimum Ambient Temperature: -20°F

Pipe Size: 4" steel pipe

Pipe Length: 200 ft.

Valve: 1 Gate Valve

Insulation Thickness and Type: 1" of Calcium Silicate

Voltage: 120 or 240 volts

PROCEDURE

1. **Determine the heat loss.**
   a. Difference between low ambient and operating temperature: 55°F – (-20°F) = ΔT
   ΔT = 75°F
   b. Determine the heat loss by referring to **Table 1-A - Heat Loss for Pipes**. For ΔT = 75°F, a 4" diameter pipe with 1" thick insulation will have a Heat Loss Factor of 7.6 W/ft.
2. **Determine the adjusted heat loss for calcium silicate insulation** (heat loss chart is based on fiberglass) by referring to **Table 2 - Insulation Factor** (page 6-6). Adjustment = 7.6 W × 1.47 = 11.17 W/ft. Adjusted Heat Loss
3. **Select correct heating cable (by voltage and wattage)** required to replace a heat loss of 11.17 W/ft. Use one straight run of 12 W/ft. or three straight runs of 4 W/ft.
4. **Determine the heat loss of the valve gate and supports.**
   Refer to **Table 4 - Heat Loss Multiplication Factors for Valves** (page 6-7). For a 4" diameter pipe, the heat loss multiplication factor is 2.92.
   Valve heat loss factor = 11.17 W/ft. × 2.92 = 32.62 W
5. **Determine the cable requirements for the valve.**
   Divide valve heat loss by W/ft. of selected cable. Length of cable required for valve:
   32.62 W/ft. ÷ 12 W = 2.72 ft.
6. **Determine total cable requirements.**
   a. Cable required for pipe:
   1 run x 200 ft. = 200 ft.
   b. Cable required for valve = 2.72 ft.
   c. Total: 200 ft. + 2.72 ft. = 203 ft.
   Round this number (203) up to the nearest number evenly divisible by the module (module length = 4 ft.), i.e. 204 ft.
   d. Add module length (4 ft.) for cold leads for termination:
   204 ft. + 4 ft. = 208 ft.
   Total feet of cable required = 208 ft. of 12 W/ft. heating cable.