Pipe and Valve Temperature Maintenance: The Basic Steps

Heat Loss
Heat loss is the amount of heat given up to the surrounding atmosphere through a combination of conduction, convection, and radiation. Required parameters to determine total heat losses on a given pipe or vessel include several of the following:

- the temperature to be maintained;
- the lowest expected ambient temperature;
- type, size, and run-length of pipe or tubing;
- the type and thickness of thermal insulation to be used;
- heat loss from the surface of the material or vessel;
- losses through the vessel wall and the insulation;
- thermal properties (specific heat) of the materials being heated;
- flow rate;
- dimensions and weight of the vessel and material being heated;
- heat carried away by products being processed through the heated area;
- specified heat-up time;
- type and number of valves and supports.

Pipe Temperature Maintenance
To determine the actual heat loss from piping valves, supports, etc. that must be replaced by the heating cable(s), simply include the following steps in your calculations:

1. Determine ΔT (the difference between low ambient and operating temperature) by subtracting the low ambient temperature from the temperature to be maintained.
2. Using the temperature difference ΔT calculated in Step 1 and the insulation thickness to be used, refer to the "Heat Loss Chart for Pipes" (page 15) to determine the heat loss in watts per lineal foot of pipe.
3. Depending on the type of insulation to be used in your application, multiply your result from Step 2 by the appropriate factor from the "Insulation Factor Chart" (page 16). The resulting number is the heat loss expressed in watts per lineal foot of pipe to be made up by the heat tracer.
4. 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 Brisk-Heat CAB heating cables available for most heat-tracing applications. Refer to the "Specifications and Ratings Comparison Chart" section (pages 35-39) for the cable best suited for your application.
5. 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, you should:
   a. use a higher wattage cable, or
   b. use multiple straight runs, or
   c. spiral-wrap the cable on the pipe, or
   d. use insulation with a higher insulation factor, or
   e. use thicker insulation.
6. Multiple straight runs are preferred over spiraling in most applications because fewer power points along the pipe are required and installation is easier.
7. If spiraling is used, determine the wrapping factor by dividing the watts per lineal foot of heat loss (from Step 3 above) by the wattage rating of the selected heat tracer. A wrap factor of less than 1.0 indicates that a straight run of cable will provide adequate heat. For ease of installation, it is also recommended that multiple straight runs be used for wrapping factors of more than 2.0
8. Determine the pitch distance for the pipe size being used by finding the wrapping factor in the "Spiral Pitch Table", (page 22) that is closest to the one calculated.

It is also necessary to calculate valve and pipe support heat loss by following the steps listed below:

1. To determine the heat loss multiplication factor for valves, refer to the "Heat Loss Factor for Valves" chart (page 16). Multiply the heat loss per foot of the pipe (Step 3 above) which feeds to and from the valve by the multiplication factor for the corresponding pipe size from the chart. This heat loss figure is based on a typical gate valve with insulation coverage to include the body, flange, and bonnet of the valve. If pipe supports are part of the system, the heat loss calculation for each support should be made in the same manner as for a valve.

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

Gate valve	1.0
Ball valve	.7
Globe valve	.95
Butterfly valve	.60
Pipe supports	.50

2. Determine the length of cable required for each valve and/or support by dividing the heat loss in watts per foot by the wattage rating of the selected cable.
3. Next, add the length of cable required for each valve and support to the length of cable required for the total pipe within your system.
4. After you determine the total length of cable required for your pipe, then take this figure and round it upward to the nearest figure divisible by the module length (usually 4 feet). Add 4 feet for cold lead. This final figure is the total required for the length of pipe in your system.
5. Pressure-Sensitive Adhesive Tape (PSAT) is recommended in lieu of metallic clamps for securing the heating cable(s) to the pipe(s) and valve(s). The PSAT should be applied over the cable and around the pipe every 12 inches. If plastic or fiberglass pipe is part of your system, or if process temperature maintenance is involved requiring improved heat transfer, we recommend the use of AAT 260 tape. On plastic and fiberglass pipe, the AAT 260 tape should be placed between the pipe and cable. The tape may be placed over the cable or between the cable and pipe for process temperature maintenance.
6. To determine the amount of heat-transfer tape and/or pressure-sensitive tape within your system, refer to the "Tracing Adhesive Tape Table" on page 23.

Pipe and Valve Temperature Maintenance: Sample Problem

Specifications and essential data:
Operating temperature: 55°F
Low ambient temperature: -20°F
Pipe size: 4 in. steel pipe
Pipe length: 200 ft
Valve: 1 gate valve
Insulation thickness and type: 1-in. calcium silicate
Voltage: 120 or 240V

1. Determine heat loss.
   a. Difference between low ambient temperature and operating temperature:
      55°F - (-20°F) = ΔT
      ΔT = 20°F + 55°F = 75°F
   b. Determine the heat loss by referring to the "Heat Loss for Pipes" chart for ΔT = 75°F, 4-in. diameter pipe, with 1-in. thick insulation. Heat loss factor using 1-in. thick fiberglass insulation = 7.6 W/ft
2. Determine the adjusted heat loss for calcium silicate insulation (heat loss chart is based on fiberglass).
   a. Refer to "Insulation Factor Chart" (page 16) Adjustment = 7.6 W x 1.47 adjustment factor = 11.17 W/ft
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 gate valve and supports.
   a. Refer to "Heat Loss Factor for Valves" (page 16) for a 4-in. diameter pipe. The heat loss multiplication factor is 2.92.
      Valve heat loss factor = 11.17 W/ft x 2.92 = 32.62 W
5. Determine the cable requirements for the valve.
   a. Divide valve heat loss by W/ft of selected cable. Length of cable for valve: 32.62 ÷ 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 = 203.00 ft

   Round this number (203.00) up to the nearest number evenly divisible by the module length (module length = 4 ft).
   203.00 ⇧ = 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 (For exact cable type, see the cable specifications beginning on page 35).
7. Determine the total amount of pressure-sensitive adhesive tape required (refer to the "Tracing Adhesive Tape Requirement Table", page 23).
   Total pipe = 200 ft ÷ 100 ft = 2 x 2.02 rolls for 4 in. pipe = 4.04 rolls
   This rounds upward to the next highest whole number, or 5 rolls.