Electric Heat Tracing

INSTALLATION PROCEDURES
Electric Heat Tracing

Illustration A: Typical Heat Tracing Installation

1. Power cable.
2. Circuit switch with indication lamp (padlockable).
   (if applicable)
3. Thermostat (if applicable)
   With Terminator ZT (EEx ed) it is possible to connect two heating cables into the thermostat.
4. Junction box.
   Maximum 3 heat tracers through junction box support base fitting and 2 power cables through side entries of enclosure. For junction boxes supplied without support base fittings, the maximum is 4 total tracers plus power cables.
5. Heating cable.
6. Voltage Indication Lamp (VIL).
   (if applicable)
7. End termination
   ET-6 and ET-60 for BSX, RSX, VSX
   ET-8 and ET-80 for KSX, HTSX, HPT and FP

Notes . . .
1. All heat-traced lines must be thermally insulated.
2. Due to the risk of electrical shock, arcing and fire caused by product damage or improper usage installation or maintenance, a ground-fault protection device is required for all heat tracing circuits. Bond the metal sheath/braid of the heat tracing cable to a suitable earth terminal.
3. Thermostatic control is recommended for all freeze protection and temperature maintenance heat tracing applications.
INSTALLATION PROCEDURES

Site Practice . . .

1. Provide protective clothing, and other protective equipment needed to isolate employees from potential arc flash and shock hazards identified in the analysis.

2. Provide training to employees for understanding the purpose/function of the electrical heat tracing and the electrical power supply/control equipment, and how to recognize and avoid the hazards associated with operation and maintenance.

3. Apply safe work practices including the following:
   - Identify the circuit or equipment to be de-energized and all possible sources of electrical energy supplies to the specific circuit or equipment.
   - Disconnect both legs of the power supply cable at the circuit breakers, disconnect switches, and any other applicable points.
   - Apply lockout/tagout devices according to established procedures.
   - Visually verify that the circuit disconnect devices are open prior to connecting power cable to heat tracers.
   - Test for absence of voltage with an approved voltmeter (where the voltmeter is tested on a known circuit voltage prior to and immediately following application).
   - For protection against accidental energizing of supply conductors, apply temporary jumpers rated for the available fault duty between each supply conductor and ground.

Complete Electric Heat Tracing System . . .

Types of Heating Cables1 . . .

1. Self-Regulating Heating Cables:
   - **BSX™** (refer to Form TEP0067U)
     - CE 1725 G & D Ex e II T5 or T6 DEMKO 02ATEX0132424, IECEx UL 06.0013 Ex e II T5 or T6
   - **RSX™** 15 (refer to Form TEP0048U)2
     - CE 1725 G & D Ex e II T4 to T6 KEMA 07ATEX0179, IECEx KEM 07.0052 Ex e II T4 to T6
   - **HTSX™** (refer to Form TEP0074U)
     - CE 1725 G & D Ex e II T2 or T3 DEMKO 02ATEX0120790, IECEx UL 06.0004 Ex e II T2 or T3
   - **KSX™** (refer to Form TEP0072U)
     - CE 1725 G & D Ex e II T3 to T6 II 2 D Ex ID A21 IP66/IP67 T200°C to T85°C FM 07ATEX0027, IECEx FMG 06.0009 Ex e II T3 to T6,
       Ex ID A21 IP66/IP67 T200°C to T85°C
   - **VSX™** (refer to Form TEP0008U)
     - CE 1725 G & D Ex e II T3 DEMKO 02ATEX0152667, IECEx UL 05.0008 Ex e II T3

2. Power-Limiting Heating Cable:
   - **HPT™** (refer to Form TEP0011U)
     - CE 1725 G & D Ex e II T2 to T6 II 2 D Ex ID A21 T300°C to T85°C FM 07ATEX0028, IECEx FMG 06.0006 Ex e II T2 to T6

3. Parallel Constant Watt Heating Cable:
   - **FP** (refer to Form TEP0016U)3
     - CE 1725 G & D Ex e II T3 to T6 II 2 D Ex ID A21 IP66/IP67 T200°C to T85°C FM 07ATEX0016, IECEx FMG 06.0008 Ex e II T3 to T6,
       Ex ID A21 IP66/IP67 T200°C to T85°C

4. Series Constant Watt Heating Cables:
   - **TES™** (refer to Form TEP0063U)
     - CE 1725 G & D Ex e II T2 to T6 LCIE 00ATEX0014X
   - **TESH™** (refer to Form TEP0070U)
     - CE 1725 G & D Ex e II T2 to T6 LCIE 00ATEX0014X

Notes . . .

1. Refer to the heating cable product specification sheets for temperature ratings as limited by the manufacturer.
2. For foundation heating with RSX, refer to Form TEP0059.
3. For foundation heating with FP, refer to Form TEP0079.
Electric Heat Tracing

Read and carefully follow all installation procedures when installing a Thermon electric heat tracing system. Product certifications and performance of heat tracing system is dependant upon proper installation with certified Thermon components.

The system must be installed in accordance with the regulations EN IEC 60079-14 and IEC 62086-2 for hazardous areas (where applicable). The system installation must also comply with all local and national electrical codes.

Applications . . .

1. Electric heat tracing cables are used for freeze protection and/or temperature maintenance of piping, tanks and instrumentation.

2. Heat tracing cables may be installed in ordinary (nonclassified) and hazardous (classified) locations depending on the specific cable options and approvals. See ‘Types of Heating Cables’ on page 2.

Receiving, Storing and Handling . . .

1. Identify the heating cable to ensure the proper type and quantity have been received. The cable model number will be visible on parallel heating cables (on braided cables, the information is printed on the jacket below the braid); factory-fabricated series circuits will have an imprinted I.D. tag with pertinent data. Compare information on heating cable with packing slip and purchase order to verify receipt of correct shipment. For date of production, contact Thermon.

2. Visually inspect materials for damage incurred during shipment. Report damages to the carrier for settlement.

3. Store in a dry place. Keep ends of heating cable dry and sealed before and during installation

Caution: Do not connect power to heating cable while it is still on the reel or in a shipping carton.

Before Installing Cable . . .

1. Before removing the heating cable from the reel, an insulation resistance test should be conducted. The cable should be tested with a test voltage of at least 500 Vdc. However, for polymer insulated heating cables, 2500 Vdc is recommended. The minimum acceptable level should not be less than 20 megohms. All test results should be documented. Testing should occur at the following stages of installation.
   • While the cable is still on the reel
   • After installing heating cable
   • After installation of thermal insulation
   • Prior to connecting cable to power
   • As part of a routine maintenance program

2. Be sure all piping and equipment to be traced is completely installed, pressure tested and painted (if applicable)

3. Surface areas where heat tracing is to be installed must be reasonably clean. Remove dirt, rust and scale with a wire brush and oil and grease films with a suitable solvent.

Initial Installation . . .

1. Begin temporary installation at the proposed end-of-circuit location and lay out heating circuit on the pipe, allowing extra cable for the power connection and for any splice locations. Refer to Illustration B for temporary installation.

2. Make heating cable allowances for valves, flanges, elbows and supports as per the applicable drawings, refer to pages 4 and 5 of these installation procedures.

Notes . . .

1. Termination kits to fabricate heat tracing circuits are not addressed in these installation procedures. Refer to the specific installation instructions included with the kits.

2. For foundation heating, see installation instructions Form 10A081.

3. Minimum bending radius of heating cable is 32 mm (except HPT is 57 mm, FP is 19 mm, TESH is 5 x OD).
Installation on Elbows, Supports and Flanges . . .

1. Install heating cable in accordance with Illustrations C, D and E below. Secure heating cable to piping using attachment tape rated at the application temperature.

2. Elbows: Locate the cable on the outside radius of an elbow to provide sufficient heat to compensate for the added piping material. Secure the cable to the pipe on each side of the elbow with attachment tape.

**Caution:** Do not use metal pipe straps or tie wire to attach heating cable. Use approved attachment tape only.

3. Pipe Supports: of diameter ≥ 2” require additional heating cable, allow two times the length of the pipe support plus an additional 8 cm of heating cable. (In process temperature maintenance systems the pipe supports must be isolated from the pipes. In winterizing systems, Thermon highly recommends to isolate the pipe supports from the pipes)

4. Flanges: Allow cable to be looped around pipe on each side of and adjacent to the flange. Heating cable must maintain contact with flange when bending around pipe flanges to compensate for additional heat loss.

**Note:** Flange allowance will vary based on method of insulating flange and adjacent piping.
Electric Heat Tracing

Installation on Valves and Pumps . . .

1. Install heating cable in accordance with Illustrations F and G below. Secure heating cable to piping using attachment tape rated at the application temperature.

2. Additional cable is required to provide extra heat at valves, pumps and miscellaneous equipment to offset the increased heat loss associated with these items. Refer to Table 1 for estimated cable requirements for installation on typical valves and pumps.

3. Install heating cable on valves and pumps utilizing a looping technique (this allows the valve or pump to be removed if required). Crossing series heating cable over itself should be avoided.

4. Refer to the product specifications sheet for minimum bend radius for the specific cable type. Do not exceed bend radius when completing installation.

Table 1: Valve and Pump Allowances

<table>
<thead>
<tr>
<th>Pipe Size in (mm)</th>
<th>Screwed (m)</th>
<th>Flanged (m)</th>
<th>Welded (m)</th>
<th>Screwed (m)</th>
<th>Flanged (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ (12)</td>
<td>.5 (15)</td>
<td>1 (30)</td>
<td>0</td>
<td>1 (30)</td>
<td>2 (61)</td>
</tr>
<tr>
<td>¾ (19)</td>
<td>.75 (.23)</td>
<td>1.5 (.46)</td>
<td>0</td>
<td>1.5 (.46)</td>
<td>3 (.91)</td>
</tr>
<tr>
<td>1 (25)</td>
<td>1 (.30)</td>
<td>2 (.61)</td>
<td>1 (.30)</td>
<td>2 (.61)</td>
<td>4 (1.22)</td>
</tr>
<tr>
<td>1¼ (32)</td>
<td>1.5 (.46)</td>
<td>2 (.61)</td>
<td>1 (.30)</td>
<td>3 (.91)</td>
<td>4.5 (1.37)</td>
</tr>
<tr>
<td>1½ (40)</td>
<td>1.5 (.46)</td>
<td>2.5 (.76)</td>
<td>1.5 (.46)</td>
<td>3 (.91)</td>
<td>5 (1.52)</td>
</tr>
<tr>
<td>2 (50)</td>
<td>2 (.61)</td>
<td>2.5 (.76)</td>
<td>2 (.61)</td>
<td>4 (1.22)</td>
<td>5.5 (1.68)</td>
</tr>
<tr>
<td>3 (80)</td>
<td>2.5 (.76)</td>
<td>3.5 (1.07)</td>
<td>2.5 (.76)</td>
<td>5 (1.52)</td>
<td>7 (2.13)</td>
</tr>
<tr>
<td>4 (100)</td>
<td>4 (1.22)</td>
<td>5 (1.52)</td>
<td>3 (1.91)</td>
<td>8 (2.44)</td>
<td>10 (3.05)</td>
</tr>
<tr>
<td>6 (150)</td>
<td>7 (2.13)</td>
<td>8 (2.44)</td>
<td>3.5 (1.07)</td>
<td>14 (4.27)</td>
<td>16 (4.88)</td>
</tr>
<tr>
<td>8 (200)</td>
<td>9.5 (2.90)</td>
<td>11 (3.35)</td>
<td>4 (1.22)</td>
<td>19 (5.79)</td>
<td>22 (6.71)</td>
</tr>
<tr>
<td>10 (250)</td>
<td>12.5 (3.81)</td>
<td>14 (4.27)</td>
<td>4 (1.22)</td>
<td>25 (7.62)</td>
<td>28 (8.53)</td>
</tr>
<tr>
<td>12 (300)</td>
<td>15 (4.57)</td>
<td>16.5 (5.03)</td>
<td>5 (1.52)</td>
<td>30 (9.14)</td>
<td>33 (10.06)</td>
</tr>
<tr>
<td>14 (350)</td>
<td>18 (5.49)</td>
<td>19.5 (5.94)</td>
<td>5.5 (1.68)</td>
<td>36 (10.97)</td>
<td>39 (11.89)</td>
</tr>
<tr>
<td>16 (400)</td>
<td>21.5 (6.55)</td>
<td>23 (7.01)</td>
<td>6 (1.83)</td>
<td>43 (13.11)</td>
<td>46 (14.02)</td>
</tr>
<tr>
<td>18 (450)</td>
<td>25.5 (7.77)</td>
<td>27 (8.23)</td>
<td>6.5 (1.98)</td>
<td>51 (15.54)</td>
<td>54 (16.46)</td>
</tr>
<tr>
<td>20 (500)</td>
<td>28.5 (8.69)</td>
<td>30 (9.14)</td>
<td>7 (2.13)</td>
<td>57 (17.37)</td>
<td>60 (18.29)</td>
</tr>
<tr>
<td>24 (600)</td>
<td>34 (10.36)</td>
<td>36 (10.97)</td>
<td>8 (2.44)</td>
<td>68 (20.73)</td>
<td>72 (21.95)</td>
</tr>
<tr>
<td>30 (750)</td>
<td>40 (12.19)</td>
<td>42 (12.80)</td>
<td>10 (3.05)</td>
<td>80 (24.38)</td>
<td>84 (25.60)</td>
</tr>
</tbody>
</table>

Illustration F: Typical Valve Detail

Illustration G: Typical Pump Detail
Completing the Installation . . .

1. Begin final cable attachment by securing the end-of-circuit termination kit and working back toward the power supply. Power connections, splice connections, and end-of-circuit termination kits are specified for each type of heat tracer — substitutions are not allowed.

- Flexible heating cables are to be installed using attachment tape rated at the application temperature. Circumferential bands of tape should be installed at maximum 30 cm intervals to keep the cable in proper contact with the pipe. Refer to Table 2 below for the number of rolls of attachment tape required based on the pipe diameter\(^1\).

- If applicable, refer to installation details provided with the project drawings or contact Thermon for additional information regarding installation.

2. In addition to the circumferential tape requirements, a continuous covering of aluminum foil tape may be required when:

- Spray or foam urethane\(^2\) thermal insulation will be applied.
- Heat tracing nonmetallic piping.
- Design requirements dictate the use of aluminum tape to improve heat transfer.

3. Complete splice connections (if required) in accordance with the installation instructions provided with the splice kit.

Illustration H: Heating Cable vs. Sensor Location

4. Install power connection kit in accordance to the detailed installation instructions provided with the kit. Power connection kits are provided for pipe mounting or for wall mounting.

5. While making the power connection kits, but before making the final connection to power, repeat the megger test. The cable should be tested with a test voltage of at least 500 Vdc. However, for polymer insulated heating cables, 2500 Vdc is recommended. The minimum acceptable level should not be less than 20 megohms.

6. For ambient controlled power, the heating circuit should be connected directly to the switched power feed wiring.

7. For pipewall sensing thermostatic control, the heating circuit is to be connected in series with the control contacts with a maximum load of 16A. The pipewall sensing thermostat may require more than one support point.

8. Secure temperature sensor (if required) to pipe utilizing attachment tape. Locate temperature sensor as shown in Illustration H.

Notes . . .

1. Table 2 assumes circumferential bands every 12” (30 cm) along the length of the process piping.
2. Verify exposure temperature of heating cable versus curing temperature of insulation.

<table>
<thead>
<tr>
<th>Pipe Size (in)</th>
<th>½”-1” (40)</th>
<th>1¼” (80)</th>
<th>1½” (100)</th>
<th>2” (150)</th>
<th>3” (200)</th>
<th>4” (250)</th>
<th>6” (300)</th>
<th>8” (400)</th>
</tr>
</thead>
<tbody>
<tr>
<td>360’ (109.7)</td>
<td>260’ (79.2)</td>
<td>220’ (67.0)</td>
<td>180’ (54.9)</td>
<td>150’ (45.7)</td>
<td>120’ (36.6)</td>
<td>90’ (27.4)</td>
<td>70’ (21.3)</td>
<td>60’ (18.2)</td>
</tr>
</tbody>
</table>
Circuit Protection Requirements . . .

1. Over-current protection (typically circuit breakers) is required for each branch circuit. This protection must isolate all power conductors from the supply.

2. For typical installations (with TT and TN grounding systems), a means of protection against earth faults is required that includes a residual-current protective device for each branch circuit. For fixed-level ground-fault circuit interrupters (such as GFCI circuit breakers), a minimum 30 mA trip level is recommended. The preferred trip level for adjustable devices is 30 mA above any inherent capacitive leakage characteristic of the heater as specified by the heat tracing supplier. Where conditions of maintenance and supervision ensure that only qualified persons will service the installed systems, and continued circuit operation is necessary for the safe operation of the equipment or processes, earth-fault detection without interruption is acceptable if alarmed in a manner to assure an acknowledged response.

3. For IT grounding systems, a means of protection against earth faults is required that includes an electrical insulation monitoring device that shall disconnect the supply whenever the electrical resistance is not greater than 50 ohms/volt of rated voltage.

Thermal Insulation . . .

1. Before installing thermal insulation, megger testing should be conducted. The cable should be tested with a test voltage of at least 500 Vdc. However, for polymer insulated heating cables, 2500 Vdc is recommended. The minimum acceptable level should not be less than 20 megohms.

2. The need for properly installed and well-maintained thermal insulation cannot be overemphasized. Without insulation, heat losses are generally too high to be offset by a conventional heat tracing system.

3. In addition to piping and in-line equipment such as pumps and valves, all heat sinks must be properly insulated. This includes pipe supports, hangers, flanges and, in most cases, valve bonnets.

4. Regardless of the type or thickness of insulation used, a protective barrier should be installed. This protects the insulation from moisture intrusion, physical damage and helps ensure the proper performance of the heat tracing system. Seal around all penetrations through the thermal insulation.

5. Apply “Electric Heat Tracing Caution” labels to the insulation vapor barrier on 3 m (10’) intervals or as required by code or specification. The labels are supplied with Thermon connection kits.

Final Inspection and Documentation . . .

1. After the installation of the thermal insulation and weather barrier but BEFORE ENERGIZING THE HEATING CIRCUIT, the megohmmeter test should be repeated. This should call attention to any damage to the heating cable that may have occurred during the insulation installation.

2. It is recommended that the circuit be temporarily energized so that the volts, amps, pipe temperature and ambient temperature may be recorded. Take the values after 15 minutes of energizing. This information may be of value for future reference and should be maintained for the historical operating data log.

3. Stabilized design can be used for self-regulating heating cables to assign a lower T-class through the use of the Thermon CompuTrace software or Thermon Engineering.

4. Stabilized design can be used for power-limiting and constant watt heating cables without a limiting device to determine the T-class through the use of the Thermon CompuTrace software or Thermon Engineering.

5. The maximum temperatures provided by Thermon’s CompuTrace software and by Thermon engineering are calculated to the methods and requirements of IEC 62086-2 and IEC 60079-30-2.

6. If stabilized design is used, the end user must record the system parameters and the area T-class, and keep these records for the time the heating cable is in operation.

7. Inspect system on a regular basis at least once per year. Record all information after conducting test. If the system fails any test, refer to Thermon’s Maintenance and Trouble Shooting Guide for assistance. De-energize circuits affected and make the necessary repairs immediately.

8. Verify the setting of the maximum control device, if provided to limit the T-rating for the circuit design, to insure it limits the maximum surface temperature to be in compliance with clause 4.4.3 of IEC 60079-30-1.

Maintenance and Repair . . .

1. Refer to form TEP0066-Electric Heat Tracing Maintenance and Trouble Shooting Guide.