BBS MEMO

Ohio Board of Building Standards February 18, 2015 6606 Tussing Road, P.O. Box 4009, Reynoldsburg, Ohio 43068-9009

Plumbing Heat Tape and the Codes

This information is provided to give general guidance for the proper use and installation of electric resistance element piping freeze protection know as, heat tape, electric heat trace, or heat tracing tape. The general requirements listed below are excerpted from the OBC, OPC, OMC, NEC, NEC Handbook, IECC and IPC commentaries regarding its use and installation for freeze protection of piping located outside conditioned spaces.

OPC Section 305, *Protection of Pipes and Plumbing Systems Components, 305.6 Freezing Water, Soil and Waste Pipes*, prohibits piping from be installed outside of a building, in attics, or crawl spaces, concealed in outside walls, or in any other place subjected to freezing temperatures, unless adequate provision is made to "protect such pipes from freezing by insulation or heat or both."

The Plumbing Code Commentary for this section states that, "Where piping is not directly adjacent to heated spaces in a building, electric resistance heat tapes or cables can be used to supply heat to the piping, except in concealed spaces. Plastic piping requires self-limiting type heat tape to prevent overheating of the pipe." The Plumbing Code commentary states (page 3-8) that "there must always be a heat source along with an appropriate insulation thickness in order to protect pipes from freezing conditions. **Insulation by itself (without a heat source) cannot protect a pipe from freezing**." Therefore, it mentions heat tape as being a viable alternative, and that the code provides no guidelines for insulating the pipes without the use of heat trace tape to ensure that piping will not be exposed to freezing.

NEC article 427 classifies heat tape, or heat trace tape, as a resistance heating element. NEC 427 III. Resistance Heating Elements sections 427.14 through 427.23(A) & (B) and 427, VII (427.55 to 427.57) apply as installation requirements for this source of freeze protection.

The OBC, OPC, Plumbing Code commentary, OMC, NEC Handbook, and the IECC have been referenced to produce the following list of compliant installation requirements:

OPC

- Both water supply **and sanitary pipe** require protection per OPC 305.
- The Plumbing Code Commentary on Section 305.6 explains the heated pipe must be insulated to a minimum of R-3 (per IECC 403.3) or be 1 ½" thick per (per IECC 503.2.8) since a heating appliance is being applied to water supply and waste pipes, thus producing mechanical system piping.

OBC

- OBC 114 and NEC 427.10 & .11: the heat trace tape product to be listed and labeled for the building type in which it is being installed and the pipe material to which it is applied. If listed only for manufactured homes or dwelling units, it shall not be used in other occupancy types.
- OBC 108.2.9: heat trace tape system's (heat trace tape, heater, and controls) product manufacturer's installation instructions (which must include the insulation installation) must be provided to the building, electrical, and plumbing inspectors.

NFPA 70 (NEC)

- NEC 427.12: external surfaces of pipeline exceeding 140°F must be guarded, isolated, or insulated.
- NEC 427.13 and 427.20: the location of each heating element must be marked/identified at each service end of the non-heating leads, and must not to exceed 20'-0" spacing. The I.D. marker is required to be legibly marked within 3" of each end of non-heating leads and include the catalog number and the rating of the volts and watts or volts and amps. Each separately heated pipe system is required to be identified.
- NEC 427.14: the heating element cannot be secured to the pipe by the thermal insulation.
- NEC 427.15: the heating element must remain in direct contact with the pipe, or means shall be provided to prevent overtemperature unless the heating element is such that its temperature limitations will not be exceeded.
- NEC 427.16: the heating element cannot bridge expansion joints without provisions for expansion and contraction.
- NEC 427.17: heat tape is required to have compatible flexibility for the type of pipes being heated.

- NEC 427.18:
  - Power supply non-heating leads must be a minimum of 6″ within the junction box.
  - Non-heating leads are required to be within approved and suitable raceways.
  - Non-heating interconnections must be made with insulated connectors identified as suitable.
- NEC 427.19: splices and terminations outside the thermal insulation are required to be within a box or fitting per NEC 110.14 and 300.15.
- NEC 427.22: heat trace tape is required to be provided with a ground fault equipment protection (GFEP) circuit breaker.
  - Electric heating equipment must be listed and have a grounded conductive covering compliant with paragraphs (A) and B) of this article.
- NEC 427, VII: there must be a readily accessible disconnect of the "indicating" type having a positive lock-out in the open position.
  - Attachment plugs of cord and plug connected equipment from within the crawl space or attic cannot be the disconnecting means (NEC article 400.8) nor are these cords permitted to go through the floor or ceiling.
  - A readily accessible location for a disconnect does not include the crawl space (defined in NEC 100 and OMC chapter 2).
- NEC 210.63 and 210.8(A)(4): a GFCI protected electrical receptacle outlet must be provided in the crawl space within 25 feet of each heat tape element for servicing of the device.
- NEC 220: the total load of all heat trace tape elements must be included in the submitted electrical load calculations for one to three family dwelling units.

RCO

- 1103.1 and IECC 403.1 (1-, 2-, and 3-family) requires thermostat control, which complies with NEC 427.56
  - The design documents must identify the applicable type of control selected from the three listed in this NEC article and comply accordingly.
  - Controls serving as the disconnecting means (if having a lockable off position) shall be readily accessible, i.e. not be in the crawl space or attic.
- 1305.1.4 and or OMC section 306.4: the passageway to the heating appliance shall be a minimum of 30″ high and 22″ wide, and no more than 20 feet long, and a light fixture shall be provided at or near the appliance.
- 1305.1.4.1: in 1-, 2-, or 3-family dwellings, the heating device cannot not be less than 6″ from the exposed ground of the crawl space.

IECC

- 503.2.4: requires thermostat control compliant with NEC 427.56 (for OBC compliant structures):
  - The design documents must identify the applicable type of control selected from the three listed in this NEC article and comply accordingly.
  - Controls serving as the disconnecting means (if having a lockable off position) must be readily accessible, i.e. not be in the crawl space or attic.

INSPECTIONS:

- The electrical inspector must verify compliance with the heat tape system manufacturer's installation instructions (NEC 427.14 through 427.23, and 427, VII) and the approved construction documents.
- Plumbing & electrical inspectors must verify the plumbing and heat tape installation before the heat tape is insulated.
- Plumbing inspector must verify compliance with OPC 305.6 and that the heat tape installation has not caused noncompliance with other sections of the plumbing code.
- The building/mechanical inspector must inspect the installation of the pipe insulation over the heat tape.

From a practical standpoint, plumbing freeze alarm, heat tape system failure notification devices, and any type of heat trace tape system thermostat controls should be within view by the occupants and maintenance personnel in the occupiable space. Since crawls spaces and attics are not frequently observed and monitored, without these devices the only notification of system failure is the odor of leaking effluent, a flooded crawl space leaking through the perimeter building "skirt", or water stains in the ceiling below the attic.

All of this can be avoided by following the D.O.E. recommendation of having a conditioned/closed crawl space at:
http://energy.gov/sites/prod/files/2014/01/f6/1_1d_ba_innov_unventedconditionedcrawlspaces_011713.pdf