Uponor, Inc.
5925 148th Street West
Apple Valley, MN 55124
Toll Free: (800) 321-4739
Phone: (952) 891-2000
Fax: (952) 891-1409
www.uponor-usa.com

This specification is a manufacturer-specific proprietary product specification using the proprietary method of specifying applicable to project specifications and master guide specifications. Optional text is indicated by brackets [ ]; delete optional text in final copy of specification. Specifier notes typically precede specification text; delete notes in final copy of specification. Trade/brand names with appropriate symbols typically are used in specifier notes; symbols are not used in specification text. Metric conversion, where used, is soft metric conversion.

This specification is for hydronic snow and ice melting systems. These products are manufactured by Uponor and marketed under the name Uponor Snow and Ice Melting System. Revise the section number and title below to suit project requirements, specification practices and section content. Refer to CSI *2004 MasterFormat* for other section numbers and titles.

SECTION 23 83 16
RADIANT-HEATING HYDRONIC PIPING
(SNOW AND ICE MELTING SPECIFICATION — PEX-AL-PEX)

PART 1 GENERAL

1.01 SUMMARY

Specifier Note: The work covered by this section includes materials required to supply, install and pressure test crosslinked polyethylene/aluminum/crosslinked polyethylene (PEX-AL-PEX) tubing manufactured by Uponor as shown on drawings or as specified. For the purpose of this specification, Uponor is hereby referred to as the PEX tubing manufacturer.

A. Section Includes: Hydronic snow and ice melting systems for various slab constructions and control strategies, using PEX-AL-PEX, manufactured by Uponor under the name Multi-layer Composite (MLC) tubing (formerly MultiCor®) and applicable fittings.

Specifier Note: Article below may be omitted when specifying manufacturer's proprietary products and recommended installation. Retain References Article when specifying products and installation by an industry reference standard. If retained, list standard(s) referenced in this section. Indicate issuing authority name, acronym, standard designation and title. Establish policy for indicating edition date of standard referenced. Conditions of the Contract or Division 1 References Section may establish the edition date of standards. This article does not require compliance with standard. It is a listing of all references used in this section.

1.02 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. ASTM International

1. ASTM F1281 Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe

C. International Conference of Building Officials (ICBO) Evaluation Services

1. Evaluation Report No. 5298

D. International Code Council (ICC)

1. International Mechanical Code

E. Plastics Pipe Institute (PPI):

1. Technical Report TR-3 Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials
2. Technical Report TR-4 Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Piping and Fitting Compounds

F. Southern Building Code Congress International, Inc. (SBCCI)

1. SBCCI PST and ESI 9829

G. International Conference of Building Officials (ICBO)

1. Uniform Mechanical Code

H. Uponor

1. Snow and Ice Melting Design Manual, 3rd edition
2. MLC Tubing (formerly MultiCor) Installation Guide
3. Uponor System Design Software (USDS) or Advanced Design Suite™ (ADS) Software

Specifier Note: Article below should be restricted to statements describing design or performance requirements and functional (not dimensional) tolerances of a complete system. Limit descriptions to composite and operational properties required to link components of a system together and to interface with other systems.

1.03 SYSTEM DESCRIPTION

A. Design Requirements

1. Standard Grade hydrostatic pressure ratings from Plastics Pipe Institute in accordance with TR-3 as listed in TR4. The following four standard grade hydrostatic ratings are required.
    a. 200 degrees F (93 degrees C) at 100 psi (689 kPa)
    b. 180 degrees F (82 degrees C) at 125 psi (862 kPa)
    c. 140 degrees F (71 degrees C) at 160 psi (1102 kPa)
    d. 73 degrees F (23 degrees C) at 200 psi (1379 kPa)

B. Performance Requirements: Provide hydronic snow and ice melting system that is manufactured, fabricated and installed to comply with regulatory agencies and authorities with jurisdiction, and maintain performance criteria stated by the PEX tubing manufacturer without defects, damage or failure.

Specifier Note: Article below includes submittal of relevant data to be furnished by Contractor before, during or after construction. Coordinate this article with Architect's and Contractor's duties and responsibilities in Conditions of the Contract and Division 1 Submittal Procedures Section.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

C. Shop Drawings

1. Provide installation drawings indicating tubing layout, manifold locations, sensor placement(s) and manifold schedules with details required for installation of the system.

2. Provide mechanical schematic indicating heat source, mechanical piping and accessories from heat source to manifolds, circulators, fluid tempering controls. Indicate supply fluid temperatures and flow rates to manifolds.

D. Samples: Submit selection and verification samples of piping.

E. Quality Assurance/Control Submittals: Submit the following.

1. Test Reports: Upon request, submit test reports from recognized testing laboratories.

2. Documentation: Submit the following.

a. Manufacturer's certificate indicating products comply with specified requirements.

b. Manufacturer's design for the installation.

c. Documentation indicating the installer is trained to install the manufacturer's products.

F. Closeout Submittals: Submit the following.

1. Warranty documents specified herein.

2. Operation and maintenance data.

3. Manufacturer's field reports specified herein.

4. Final as-built tubing layout drawing.

Specifier Note: Article below should include statements of prerequisites, standards, limitations and criteria that establish an overall level of quality for products and workmanship for this section. Coordinate article below with Division 1 Quality Assurance Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Use an installer with demonstrated experience on projects of similar size and complexity and possessing documentation proving successful completion of snow and ice melting design/installation training by the PEX tubing manufacturer.

Specifier Note: Paragraph below should list obligations for compliance with specific code requirements particular to this section. General statements to comply with a particular code are typically addressed in Conditions of the Contract and Division 1 Regulatory Requirements Section. Avoid repetitive statements.

B. Regulatory Requirements and Approvals: Provide hydronic snow and ice melting system that complies with the following requirements:
    1. International Mechanical Code (IMC)
        a. ICBO Evaluation Service Evaluation Report No. 5298
    2. Southern Building Code Congress International (SBCCI)
        a. SBCCI PST and ESI 9829
    3. Uniform Mechanical Code (UMC)
C. Certifications: Provide letters of certification as follows.
    1. Installer is trained by the PEX tubing manufacturer to install the snow and ice melt system.
    2. Installer uses skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed tradesperson.

Specifier Note: Retain paragraph below if pre-installation meeting is required.

D. Pre-installation Meetings
    1. Verify project requirements, substrate conditions, concrete pour schedules, PEX tubing manufacturer's installation instructions and warranty requirements.
    2. Review project construction timeline to ensure compliance or discuss modifications as required.
    3. Interface with other trade representatives to verify areas of responsibility.
    4. Establish the frequency and construction phrase the project engineer intends for site visits and inspections by the PEX tubing manufacturer's representative.

Specifier Note: Article below should include specific protection and environmental conditions required during storage. Coordinate article below with Division 1 Product Requirements Section.

1.06 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1 Product Requirement Section.
B. Comply with manufacturer’s ordering instructions and lead-time requirements to avoid construction delays.
C. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.
D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
    1. Store PEX-AL-PEX tubing in cartons or under cover to avoid dirt or foreign material from entering the tubing.

2. Do not expose PEX-AL-PEX tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover the tubing that is exposed to direct sunlight.

Specifier Note: Coordinate article below with Conditions of the Contract and with Division 1 Closeout Submittals (Warranty) Section. Use this article to require special or extended warranty or bond covering the work of this section.

1.07 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights owner may have under contract documents.

1. Warranty covers the repair or replacement of any tubing or fittings proven defective.

2. Warranty may transfer to subsequent owners.

Specifier Note: Coordinate subparagraph below with manufacturer's warranty requirements.

3. Warranty Period for PEX Tubing: 30-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained Uponor Home Comfort Team (HCT) contractor.

4. Warranty Period for Manifolds and Fittings: 5-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained Uponor HCT contractor.

5. Warranty Period for Controls and Electrical Components: 2-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained Uponor HCT contractor.

6. If a factory-trained Uponor HCT contractor does not install the system, then the most recent limited warranty published by the PEX tubing manufacturer takes precedence.

Specifier Note: List requirements applicable to startup of the various systems. Include requirements for instruction of owner's personnel in the operation of equipment and systems.

1.08 SYSTEM STARTUP

A. [Specify system start-up requirements.]

1.09 OWNER'S INSTRUCTIONS

A. Instruct owner's personnel about operation and maintenance of installed system. Provide manufacturer's installation, operation and maintenance instructions for installed components within the system.

PART 2 PRODUCTS

Specifier Note: Retain article below for proprietary method specification. Add product attributes, performance characteristics, material standards and descriptions as applicable. Use of such phrases

as "or equal" or "or approved equal" or similar phrases may cause ambiguity in specifications. Such phrases require verification (procedural, legal and regulatory) and assignment of responsibility for determining "or equal" products.

2.01 HYDRONIC SNOW AND ICE MELTING SYSTEM

Specifier Note: Paragraph below is an addition to CSI *SectionFormat*. Retain, edit or delete paragraph below to suit project requirements and specifier practice.

A. Manufacturer: Uponor, Inc.

1. Contact: 5925 148th Street West, Apple Valley, MN 55124; Telephone: (800) 321-4739, (952) 891-2000; Fax: (952) 891-1409; Website: www.uponor-usa.com.

Specifier Note: Edit Article below to suit project requirements. If substitutions are permitted, edit text below. Add text to refer to Division 1 Project Requirements (Product Substitutions Procedures) Section.

2.02 PRODUCT SUBSTITUTIONS

A. All products, components, etc., specified herein are manufactured by and/or available from the PEX tubing manufacturer.

B. Alternative equipment manufacturers must submit required data for all electrical, mechanical, structural, engineering, etc. revisions for an equivalent system for approval 15 days prior to bid opening.

C. Alternative equipment manufacturers must submit completed snow and ice melt design layout to the project engineer for approval. Plagiarism of another manufacturer's design is unacceptable.

Specifier Note: Specify materials to be furnished. This article may be omitted and the materials can be included with the description of a manufactured unit, equipment, component or accessory.

2.03 HYDRONIC SNOW AND ICE MELTING SYSTEM MATERIALS

A. Tubing

1. Material: Crosslinked polyethylene (PEX) manufactured by PEX-b method.
2. Material Standard: Manufactured in accordance with ASTM F1281 and tested for compliance by an independent third-party agency.
3. Pressure Ratings: Standard Grade hydrostatic design and pressure ratings as issued by the Plastics Pipe Institute (PPI), a division of the Society of the Plastics Industry (SPI).
4. Minimum Bend Radius
    a. [⅝ inch has a minimum radius of 4.0 inches.]
    b. [¾ inch has a minimum radius of 5.0 inches.]
    c. [1 inch has a minimum radius of 6.0 inches.]
5. Uponor MLC tubing does not allow the diffusion of oxygen molecules through the tubing wall.
6. Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F1281 as indicated.
    a. [⅝ inch (15.88mm)]

b. [¾ inch (19.05mm)]

c. [1 inch (25.4mm)]

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists manifold requirements for residential and light commercial applications. Delete this article if this type of manifold is not utilized.

B. Manifolds (residential and light commercial, valved brass)

1. For system compatibility, use 1¼-inch manifolds with dezincification resistant brass material, offered by the respective PEX tubing manufacturer.
2. Use manifold mounting brackets offered by the respective PEX tubing manufacturer.
3. Manifolds must feature manual flow balancing capability within the manifold body for balancing unequal loop lengths across the manifold.
4. Manifolds support ⅝ inch MLC tubing only.
5. Each manifold location should have the ability to vent air manually from the system.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists valved copper manifold requirements for commercial applications. Delete this article if this type of manifold is not utilized.

C. Manifolds (commercial, valved copper)

1. For system compatibility, use 2-inch valved copper manifolds manufactured from Type L copper material, offered by the respective PEX tubing manufacturer.
2. Install valved copper manifolds primarily for wall-hung or boxed applications.
3. Use manifolds with an isolation valve or a combination isolation/balancing valve on each outlet.
4. Use manifolds that support ⅝ inch or ¾ inch MLC tubing.
5. Ensure manifold end cap offers tapping for ⅛ inch FNPT and ½ inch FNPT for vent and drain.
6. Install supply and return piping to the manifold in a reverse-return configuration to ensure self-balancing.
7. If the supply and return piping is in direct-return configuration, install and balance flow setters on the return leg of each manifold to the mains.

D. Fittings

1. For system compatibility, use fittings offered by the PEX tubing manufacturer.
2. Uponor QS-style Compression Fittings
    a. Fitting assembly manufactured from UNS C3600 series brass material.
    b. The fitting assembly consists of a barbed insert, a compression ring and a compression nut. The barbed insert is manufactured with an o-ring to facilitate air pressure testing.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice.

E. Supply and Return Piping to the Manifolds (above-ground piping)

1. Properly size supply and return distribution piping for the given volume and velocities required at system design.
2. Use suitable distribution piping material (i.e., MLC tubing, metric dimensional Wirsbo hePEX™, type M copper or black iron piping) for all supply fluid temperatures in systems with ferrous components.
    a. When using MLC tubing, do not exceed 200 degrees F (93 degrees C) at 100 psi (689 kPa).
    b. When using 32mm through 63mm dimensioned Wirsbo hePEX tubing, do not exceed 194 degrees F (90 degrees C) at 58 psi (400 kPa).
3. Do not expose MLC tubing and metric dimensional Wirsbo hePEX tubing to direct sunlight or install near overhead fluorescent lighting. If either tubing is exposed, install suitable pipe insulation around the exposed tubing.
4. Use fittings compatible with piping material. Fittings must transition from distribution piping to system manifolds.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice.

F. Supply and Return Piping to the Manifolds (below-ground piping)

1. Properly size supply and return distribution piping for the given volume and velocities required at system design.
2. Use suitable distribution piping material (i.e., MLC tubing, metric dimensional Wirsbo hePEX, type K copper or black iron piping) for all supply fluid temperatures in systems with ferrous components.
    a. When using MLC tubing, do not exceed 200 degrees F (93 degrees C) at 100 psi (689 kPa).
    b. When using 32mm through 63mm dimensioned Wirsbo hePEX tubing, do not exceed 194 degrees F (90 degrees C) at 58 psi (400 kPa).
3. If copper or black iron piping is embedded in concrete or soil, insulate or protect with sleeves.
4. Use fittings compatible with piping material. Fittings must transition from distribution piping to system manifolds.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice.

G. Supply Fluid Temperature Control (constant idle control strategy)

1. Use this control strategy for snow-melt systems that require a heated slab maintained above freezing throughout the season.
2. Design the control strategy and install the components to meet or exceed the system performance requirements as stated in the system design.
3. The tubing manufacturer supplies or recommends the fluid temperature controls and sensors for the hydronic snow and ice melting system.

4. Temper the supply fluid temperature to the snow and ice melt panel by means of a variable speed injection pump controlled by the Uponor proMIX™ 201.
5. The proMIX 201 has the ability to reset the supply fluid temperature as it relates to outdoor temperature. Install the outdoor temperature sensor (S4) on the north face of the building out of direct sunlight.
6. Use the Uponor 501s SetPoint Controller to control the slab temperature.
    a. Install the sensor from the 501s SetPoint Controller in a conduit midway between the PEX tubing in the system and at 1 inch (25mm) below the surface of the slab.
    b. Install an access panel at the location the sensor wire departs the snow-melt slab. This access panel is required for any possible future maintenance requirements.
7. When there is a call for snow melt from the 501s:
    a. The proMIX 201 energizes the system circulator (P1).
    b. The proMIX 201 operates the variable speed injection pump (P4).
    c. The proMIX 201 initiates the boiler call for heat.
8. Install a 24VAC transformer to power the circuit between the 501s SetPoint Controller and the Mix Demand terminal of the proMIX 201.
9. Install the outdoor sensor (S4), the system supply sensor (S1), the boiler return sensor (S3) and the slab sensor (S7) for proper operation of the control.
10. The proMIX 201 and the 501s do not have the ability to sense moisture on the surface of the slab.
11. Refer to the Uponor 501s SetPoint Controller and the Uponor proMIX 201 Installation Manuals for testing, start up and application drawings.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice.

H. Supply Fluid Temperature Control (semi-automatic control strategy)

1. Use this control strategy for snow-melt systems that require manual on/off operations and/or timed operations.
2. Design the control strategy and install the components to meet or exceed the system performance requirements as stated in the system design.
3. The tubing manufacturer supplies or recommends the fluid temperature controls and sensors for the hydronic snow and ice melting system.
4. Temper the supply fluid temperature to the snow and ice melt panel by means of a variable speed injection pump controlled by the Uponor proMIX 212.
5. The proMIX 212 has the ability to reset the supply fluid temperature as it relates to outdoor temperature. Install the outdoor temperature sensor (S4) on the north face of the building out of direct sunlight.
6. The Uponor Snow Melt Enable Kit:
    a. Designed to work specifically with the Uponor proMIX 212 for on/off and timed snow-melt operations.

b. Contains an Enable Module for remote access for on/off control of the snow-melt system.

7. Run time is programmed in the proMIX 212 for between 30 minutes to eighteen 18 hours.
    a. Run time can be stopped anytime through the Enable Module or the proMIX 212.
8. The proMIX 212 has the ability to idle the snow-melt slab at a given temperature and accelerate to a higher slab temperature during snow-melting mode.
9. When there is a call for snow melt:
    a. The proMIX 212 energizes the system circulator (P2).
    b. The proMIX 212 operates the variable speed injection pump (P5).
    c. The proMIX 212 initiates the boiler call for heat.
10. Install the outdoor sensor (S4), the snow melt supply sensor (S2), the snow melt return sensor (S5), the boiler return sensor (S3) and the slab sensor (S7) for proper operation of the control.
    a. Install the slab sensor (S7) in a conduit midway between the PEX tubing in the system and at 1 inch (25mm) below the surface of the slab.
    b. Install an access panel at the location the sensor wire departs the snow-melt slab. This access panel is required for any possible future maintenance requirements.
11. The proMIX 212 does not have the ability to sense moisture on the surface of the slab.
12. Refer to the Uponor proMIX 212 Installation Manual for testing, start up and application drawings.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice.

I. Supply Fluid Temperature Control (semi-automatic control strategy with single-boiler reset)
    1. Use this control strategy for snow-melt systems that require manual on/off operations and/or timed operations with a requirement for single boiler temperature reset.
    2. Design the control strategy and install the components to meet or exceed the system performance requirements as stated in the system design.
    3. The tubing manufacturer supplies or recommends the fluid temperature controls and sensors for the hydronic snow and ice melting system.
    4. Temper the supply fluid temperature to the snow and ice melt panel by means of a variable speed injection pump controlled by the Uponor SYSTEMpro™ 311.
    5. The SYSTEMpro 311:
        a. Resets the supply fluid temperature to the snow-melt system as it relates to outdoor temperature.
        b. Resets the boiler supply fluid temperature as it relates to outdoor temperature.

1) Install the outdoor temperature sensor (S4) on the north face of the building out of direct sunlight.

6. The Uponor Snow Melt Enable Kit.
    a. Designed to work specifically with the Uponor SYSTEMpro 311 for on/off and timed snow-melt operations.
    b. Contains an Enable Module for remote access for on/off control of the snow-melt system.
7. Run time is programmed in the SYSTEMpro 311 for between 30 minutes to 17 hours.
    a. Run time can be stopped anytime through the Enable Module or the SYSTEMpro 311.
8. The SYSTEMpro 311 has the ability to idle the snow-melt slab at a given temperature and accelerate to a higher slab temperature during snow-melting mode.
9. When there is a call for snow melt.
    a. The SYSTEMpro 311 activates the system circulator (P1).
    b. The SYSTEMpro 311 activates the variable speed injection pump (P4).
    c. The SYSTEMpro 311 initiates the boiler call for heat.
10. Install the outdoor sensor (S4), the snow melt supply sensor (S1), the snow melt return sensor (S5), the boiler supply sensor (S3) and the slab sensor (S7) for proper operation of the control.
    a. Install the slab sensor (S7) in a conduit midway between the PEX tubing in the system and at 1 inch (25mm) below the surface of the slab.
    b. Install an access panel at the location the sensor wire departs the snow-melt slab. This access panel is required for any possible future maintenance requirements.
11. The SYSTEMpro 311 does not have the ability to sense moisture on the surface of the slab.
12. Refer to the Uponor SYSTEMpro 311 Installation Manual for testing, start up and application drawings.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice.

J. Supply Fluid Temperature Control (automatic control strategy)
    1. Use this control strategy for snow-melt systems that require full automatic control of idle and snow-melt operations.
    2. Design the control strategy and install the components to meet or exceed the system performance requirements as stated in the system design.
    3. The tubing manufacturer supplies or recommends the fluid temperature controls and sensors for the hydronic snow and ice melting system.
    4. Temper the supply fluid temperature to the snow and ice melt panel by means of a variable speed injection pump controlled by the Uponor SNOWpro™ 411.

5. The SNOWpro 411 has the ability to reset the supply fluid temperature as it relates to outdoor temperature. Install the outdoor temperature sensor (S4) on the north face of the building out of direct sunlight.
6. Run time shall be programmed in the SNOWpro 411 for between 30 minutes to 17 hours or to infinity. The control operates in snow-melt mode as long as there is moisture present on the sensor.
7. The Uponor Snow and Ice Detector monitors the presence of moisture on the sensor (snow-melt mode) and slab temperature.
8. The SNOWpro 411 has the ability to idle the snow-melt slab at a given temperature and automatically accelerates to a higher slab temperature during snow-melting mode.
    a. The SNOWpro 411 will automatically switch from snow-melt mode to idle mode once the snow and ice detector indicates the lack of moisture on the sensor.
9. When there is a call for snow melt, the SNOWpro 411:
    a. Activates the system circulator (P1).
    b. Activates the variable speed injection pump (P4).
    c. Initiates the boiler call for heat.
    d. Activates the boiler circulator (P3).
10. Install the outdoor sensor (S4), the snow-melt system supply sensor (S1), the snow melt return sensor (S5), the boiler return sensor (S3), and the snow and ice detector (S8) for proper operation of the control.
11. Refer to the Uponor SNOWpro 411 Installation Manual for testing, start up and application drawings.

2.04 ACCESSORIES

A. Use accessories associated with the installation of the snow and ice melting system as recommended by or available from the PEX tubing manufacturer.

PART 3 EXECUTION

Specifier Note: Article below is an addition to the CSI *SectionFormat*. Revise article below to suit project requirements and specifier's practice.

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including the following.
    1. Uponor Snow and Ice Melting Design Manual
    2. Uponor Radiant Floor Installation Handbook

Specifier Note: Specify actions to physically determine that conditions are acceptable to receive primary products of the section.

3.02 EXAMINATION

A. Site Verification of Conditions
    1. Verify that site conditions are acceptable for installation of the snow-melt system.

2. Do not proceed with installation of the snow-melt system until unacceptable conditions are corrected.

Specifier Note: Coordinate article below with manufacturer's recommended installation requirements.

3.03 INSTALLATION

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists requirements for thermally isolated slab-on-grade installation. Delete this article if this type of installation is not utilized.

A. Slab-on-grade Construction with Edge and Under-slab Insulation

1. When using high-density foam insulation board, install the tubing by stapling the tubing to the insulation board with Uponor Foam Staples.
2. The structural engineer determines the vertical compressive strength of the high-density foam insulation board. The snow-melt design determines the required insulation resistance value (R-value).
3. Install the vertical edge insulation along the perimeter of the slab and down to a depth equal to the bottom of the horizontal under-slab insulation.
4. The submitted snow-melt design specifies the tubing on-center distance(s) and loop lengths. On-center distances will not exceed 12 inches (305mm).
5. Do not install tubing closer than 6 inches (152mm) from the edge of the heated slab.
6. Install the tubing at a consistent depth below the surface elevation as determined by the project engineer. Tubing installation will ensure sufficient clearance for all control joint cuts.
7. Expansion joints.
    a. In areas where tubing must cross metal expansion joints that occur in the concrete, the tubing shall pass below the metal expansion joints.
    b. Fibrous expansion joints may be penetrated following the PEX tubing manufacturer's and structural engineer's recommendation.
8. Metal or plastic bend supports will be used to support the tubing when departing from the slab in a 90 degree bend.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists requirements for laterally thermal isolation slab-on-grade installation. Delete this article if this type of installation is not utilized.

B. Slab-on-grade Construction with Edge Insulation Only

1. Fasten the tubing to flat wire mesh or reinforcing bar in accordance with the PEX tubing manufacturer's installation recommendations.
2. Install the vertical edge insulation along the perimeter of the slab and down to a minimum of 12 inches (305mm) below the slab depth.
3. The structural engineer determines the vertical compressive strength of the high-density foam insulation board. The snow-melt design determines the required insulation resistance value (R-value).

4. The submitted snow-melt design specifies the tubing on-center distance(s) and loop lengths. On-center distances will not exceed 12 inches (305mm).
5. Do not install tubing closer than 6 inches (152mm) from the edge of the heated slab.
6. Install the tubing at a consistent depth below the surface elevation as determined by the project engineer. Tubing installation will ensure sufficient clearance for all control joint cuts.
7. Expansion joints.
    a. In areas where tubing must cross metal expansion joints that occur in the concrete, the tubing shall pass below the metal expansion joints.
    b. Fibrous expansion joints may be penetrated following the PEX tubing manufacturer's and structural engineer’s recommendation.
8. Metal or plastic bend supports will be used to support the tubing when departing from the slab in a 90 degree bend.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists requirements for slab over existing construction installation. Delete this article if this type of installation is not utilized.

C. Slab Over Existing Slab Construction with Edge and Under-slab Insulation
    1. When using high-density foam insulation board, install the tubing by stapling the tubing to the insulation board with Uponor Foam Staples.
    2. The structural engineer determines the vertical compressive strength of the high-density foam insulation board. The snow-melt design determines the required insulation resistance value (R-value).
    3. Install the vertical edge insulation along the perimeter of the slab and down to a depth equal to the bottom of the horizontal under-slab insulation.
    4. The submitted snow-melt design specifies the tubing on-center distance(s) and loop lengths. On-center distances will not exceed 12 inches (305mm).
    5. Do not install tubing closer than 6 inches (152mm) from the edge of the heated slab.
    6. Install the tubing at a consistent depth below the surface elevation as determined by the project engineer. Tubing installation will ensure sufficient clearance for all control joint cuts.
    7. Fibrous expansion joints may be penetrated following the PEX tubing manufacturer's and structural engineer’s recommendation.
    8. Metal or plastic bend supports will be used to support the tubing when departing from the slab in a 90 degree bend.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists requirements for cap pour over pre-stressed plank installation. Delete this article if this type of installation is not utilized.

D. Cap Pour Over Pre-cast Plank Construction with Edge and Under-slab Insulation
    1. When using high-density foam insulation board, install the tubing by stapling the tubing to the insulation board with Uponor Foam Staples.

2. The structural engineer determines the vertical compressive strength of the high-density foam insulation board. The snow-melt design determines the required insulation resistance value (R-value).
3. Install the vertical edge insulation along the perimeter of the slab and down to a depth equal to the bottom of the horizontal under-slab insulation.
4. The submitted snow-melt design specifies the tubing on-center distance(s) and loop lengths. On-center distances will not exceed 12 inches (305mm).
5. Do not install tubing closer than 6 inches (152mm) from the edge of the heated slab.
6. Install the tubing at a consistent depth below the surface elevation as determined by the project engineer. Tubing installation will ensure sufficient clearance for all control joint cuts.
7. Fibrous expansion joints may be penetrated following the PEX tubing manufacturer's and structural engineer’s recommendation.
8. Metal or plastic bend supports will be used to support the tubing when departing from the slab in a 90 degree bend.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists requirements for slab over a steel deck installation. Delete this article if this type of installation is not utilized.

E. Slab Over Steel Deck Construction with Under-deck Insulation

1. Fasten the tubing to flat wire mesh or reinforcing bar in accordance with the PEX tubing manufacturer's installation recommendations.
2. The submitted snow-melt design specifies the tubing on-center distance(s) and loop lengths. On-center distances will not exceed 12 inches (305mm).
3. Do not install tubing closer than 6 inches (152mm) from the edge of the heated slab.
4. Install the tubing at a consistent depth below the surface elevation as determined by the project engineer. Tubing installation will ensure sufficient clearance for all control joint cuts.
5. Expansion joints.
    a. In areas where tubing must cross metal expansion joints that occur in the concrete, the tubing shall pass below the metal expansion joints when practical.
    b. Fibrous expansion joints may be penetrated following the PEX tubing manufacturer's and structural engineer’s recommendation.
6. Install Insulation beneath the deck by using either fastened high-density board or foam sprayed-on insulation.
    a. The snow-melt design determines the required insulation resistance value (R-value).
7. Install the vertical edge insulation along the perimeter of the slab and down to a depth equal to the bottom of the horizontal under-slab insulation.
8. Metal or plastic bend supports will be used to support the tubing when departing from the slab in a 90 degree bend.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists requirements for pavers over a compacted bed installation. Delete this article if this type of installation is not utilized.

F. Pavers Over a Compacted Bed Construction with Edge and Under-slab Insulation

1. When using high-density foam insulation board, install the tubing by stapling the tubing to the insulation board with Uponor Foam Staples.
2. The structural engineer determines the vertical compressive strength of the high-density foam insulation board. The snow-melt design determines the required insulation resistance value (R-value).
3. Install the vertical edge insulation along the perimeter of the slab and down to a depth equal to the bottom of the horizontal under-slab insulation.
4. The submitted snow-melt design specifies the tubing on-center distance(s) and loop lengths. On-center distances will not exceed 9 inches (229mm).
5. Do not install tubing closer than 6 inches (152mm) from the edge of the heated slab.
6. Install the tubing in a 3 inch (76mm) compactable soil/sand bed. The fill over the PEX tubing must be void of any sharp material. The pavers are then installed over the compacted soil bed.
7. Metal or plastic bend supports will be used to support the tubing when departing from the slab in a 90 degree bend.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists requirements for an asphalt installation using a compactable soil/sand bed. Delete this article if this type of installation is not utilized.

G. Asphalt Construction with Edge and Under-slab Insulation

1. When using high-density foam insulation board, install the tubing by stapling the tubing to the insulation board with Uponor Foam Staples.
2. The structural engineer determines the vertical compressive strength of the high-density foam insulation board. The snow-melt design determines the required insulation resistance value (R-value).
3. Install the vertical edge insulation along the perimeter of the slab and down to a depth equal to the bottom of the horizontal under-slab insulation.
4. The submitted snow-melt design specifies the tubing on-center distance(s) and loop lengths. On-center distances will not exceed 9 inches (229mm).
5. Do not install tubing closer than 6 inches (152mm) from the edge of the heated slab.
6. Install the tubing in a 3 inch (76mm) compactable soil/sand bed. The fill over the PEX tubing must be void of any sharp material. The asphalt is then installed over the compacted soil/sand bed.
7. Metal or plastic bend supports will be used to support the tubing when departing from the slab in a 90 degree bend.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists requirements for a stairs installation. Delete this article if this type of installation is not utilized.

H. Poured-in-place Stair Construction

1. Fasten the tubing to flat wire mesh or reinforcing bar in accordance with the PEX tubing manufacturer's installation recommendations.
2. The submitted snow-melt design specifies the tubing on-center distance(s) and loop lengths. On-center distances will not exceed 9 inches (229mm).
3. Install the tubing parallel to the step tread.
4. Install the supply side of the loop along the step's edge. Install the tubing will be within 3 inches (76mm) of the step's edge.
5. If under-slab insulation is used, the structural engineer determines the vertical compressive strength of the high-density foam insulation board. The snow-melt design determines the required insulation resistance value (R-value).
6. Install the vertical edge insulation along the perimeter of the slab and down to a depth equal to the bottom of the horizontal under-slab insulation.
7. Install the tubing at a consistent depth below the surface elevation as determined by the project engineer.
8. Metal or plastic bend supports will be used to support the tubing when departing from the slab in a 90 degree bend.

Specifier Note: Retain, edit or delete paragraph below to suit project requirements and specifier practice. Article lists requirements for use of glycol/water solution in the system.

I. Glycol/Water Solution

1. PEX tubing manufacturer recommends premixed glycol/water solutions.
    a. PEX tubing manufacturer allows site-mixed solutions if mixed to the proper concentration before entering the system.
    b. Mix the glycol/water solution to proper concentration levels to protect the system freezing during operation shutdown.
    c. System circulators must operate continuously for a minimum of 30 days after the system is filled to ensure the glycol and water does not separate in a static system.
2. Do not use ethylene glycol due to toxicity issues. The PEX tubing manufacturer recommends the use of inhibited propylene glycol for hydronic radiant floor heating systems. Refer to the boiler manufacturer’s recommendations.

Specifier Note: Specify the tests and inspections required for installed or completed work.

3.04 FIELD QUALITY CONTROL

A. Site Tests

1. To ensure system integrity, pressure test the system before covering tubing in concrete or when other trades are working in the vicinity of the tubing.
2. Test all electrical controls in accordance with respective installation manuals.

Specifier Note: Specify the final actions required to prepare installed equipment or other completed work to properly function or perform.

3.05 ADJUSTING

A. Balancing Across the Manifold

1. Balance all loops across each manifold for equal flow resistance based on actual loop lengths and total manifold flow.
2. Balancing is unnecessary when all loop lengths across the manifold are within 3 percent of each other in length. Install the supply and return piping to the manifold in a reverse-return configuration to ensure self-balancing.

B. Balancing between manifolds is accomplished with a flow control device installed on the return piping leg from each manifold when direct return piping is used for the supply and return mains.

C. Adjust all boiler and system controls after the system has stabilized to ensure proper operation in accordance with the system design.

Specifier Note: Specify the final actions required to clean installed equipment or other completed work to properly function or perform. Coordinate article below with Division 1 Execution Requirements (Cleaning) Section.

3.06 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Repair or replace damaged installed products.

C. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

D. Remove construction debris from project site and legally dispose of debris.

Specifier Note: Specify requirements of the installer or manufacturer to demonstrate or train the owner's personnel in the operation and maintenance of equipment.

3.07 DEMONSTRATION

A. Demonstrate operation of hydronic snow and ice melting system to owner's personnel.

B. Advise the owner's representative about the type and concentration of glycol/water solution used in the hydronic snow and ice melting system.

1. The owner monitors the solution effectiveness through an established maintenance program as outlined by the glycol manufacturer.

Specifier Note: Specify provisions for protecting work after installation but prior to acceptance by the owner. Coordinate article below with Division 1 Execution Requirements Section.

3.08 PROTECTION

A. Protect installed work from damage caused by subsequent construction activity on the site.

END OF SECTION