

**Section 23 83 16**  
**Radiant-Heating Hydronic Piping**  
**(REHAU Snow and Ice Melting Systems)**

*This draft specification is for hydronic snow and ice melting systems using PEXa pipe. REHAU supplies these systems under the name REHAU Snow and Ice Melting Systems.*

*This draft specification is provided only as an aid in architect's/engineer's development of the final specification and is not intended as a substitute for sound architectural/engineering judgment. The architect/engineer shall be responsible to convert this draft specification into a final specification that meets the functional and aesthetic needs of their client, as well as to comply with all applicable codes.*

**Part 1 - General**

1.01 Summary

- A. Snow and ice melting systems (SIM), where shown on the Drawings and Schedules, shall be hydronic, and shall include the following:
  - 1. Crosslinked polyethylene (PEXa) piping.
  - 2. Stainless steel distribution manifold(s) with balancing and flow control valves where required.
  - 3. Pipe-to-manifold compression nut or cold-expansion and compression-sleeve fittings.
  - 4. Cold-expansion and compression-sleeve fittings.
  - 5. Pipe fasteners as approved by the manufacturer of the PEXa piping.
  - 6. Controls.

Supervision and field engineering required for the complete and proper function of the system.

1.02 Related Sections

- A. Section 23 21 00 – Hydronic Piping and Pumps
- B. Section 23 52 00 – Heating Boilers

1.03 References

- A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.
- B. ASTM – American Society for Testing and Materials
  - 1. ASTM D2765 – Standard Test Method for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics
  - 2. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
  - 3. ASTM F2657 – Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing
  - 4. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 5. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
  - 6. ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.
- C. CSA – Canadian Standards Association
  - 1. CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
  - 2. CSA B214 – Installation Code for Hydronic Heating Systems.
- D. DIN – German Institute for Standardization (Deutsches Institut für Normung)

1. DIN 4726 – Plastic Piping Used in Warm Water Floor Heating (Warmwasser-Fußbodenheizungen und Heizkörperanbindungen - Rohrleitungen aus Kunststoffen).
- E. ISO – International Organization for Standardization
1. ISO 9001 – Quality Management Systems – Requirements.
- F. ULC – Underwriters' Laboratories of Canada
1. CAN/ULC S102.2 – Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials.
  2. CAN/ULC S101 – Standard Methods of Fire Endurance Tests of Building Construction and Materials.
- G. PPI – Plastic Pipe Institute
1. PPI TR-3– Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.
- H. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

#### 1.04 Definitions

Crosslinked polyethylene, or PEX, is a modified polyethylene material which has undergone a change in the molecular structure using a chemical or a physical process whereby the polymer chains are permanently linked to each other.

This specification requires PEX to be designated as PEXa and be manufactured by the high-pressure peroxide method.

#### 1.05 Submittals

- A. Comply with Section 01 33 00, Submittal Procedures. Approval and/or acceptance of all submittals is required prior to fabrication.
- B. Product Data: Submit manufacturer's Technical Manual, submittal forms, catalog cuts, brochures, specifications, and installation instructions. Submit data in sufficient detail to indicate compliance with the contract documents.
1. Submit manufacturer's instructions for installation.
  2. Submit data for equipment, fittings, fasteners and associated items necessary for the installation of the piping and manifolds.
- C. Submit computer-generated SIM system design indicating heat flux, pipe sizing, spacing, flow rates and temperatures. SIM design calculations shall be performed on pipe manufacturer's software.
- D. Drawings: Provide plans drawn to scale for all installation areas.
1. Indicate dimensions, descriptions of materials, general construction, component connections, anchorage methods and installation procedures.
  2. Indicate design, schematic layout of system, including equipment, critical dimensions and piping/slab penetration details as well as details for protecting exposed PEX piping.
- E. Certification:
1. Submit independent certification results for the piping systems from an accredited independent testing laboratory.
  2. The design shall be approved by a professional appropriately licensed in the jurisdiction where the installation will take place, as being complete and accurate.
  3. Fittings shall be third-party certified to applicable referenced standards as part of the manufacturer's PEX piping system.

- F. Maintenance Instructions: Submit product instructions for any maintenance required or recommended by manufacturer.

#### 1.06 Quality Assurance

- A. Comply with Section 01 43 00, Quality Assurance.
- B. Manufacturer: Must be a company specializing in the Work of this Section with a minimum of 10 years documented experience.
- C. Pipe shall be manufactured in a facility whose quality management system is ISO 9001 certified.
- D. Crosslinked polyethylene (PEXa) pipe shall conform and be certified to ASTM F876, F877 and CSA B137.5, and shall have the PPI TR-3 listing. Pipes with an oxygen diffusion barrier shall conform to the requirements for oxygen permeability DIN 4726 and shall also have the PPI TR-3 listing.

#### 1.07 Delivery, Storage, And Handling

- A. Comply with Section 01 60 00, Product Requirements.
- B. Deliver and store piping and equipment in shipping containers with labeling in place.
  - 1. Pipe shall be kept in original packaging until required for installation.
- C. Store piping and equipment in a safe place, dry, enclosed, under cover, in a well-ventilated area.
  - 1. Do not expose pipe to ultraviolet light beyond exposure limits recommended by manufacturer.
  - 2. Protect piping and manifolds from entry of contaminating materials. Install suitable plugs in open pipe ends until installation.
  - 3. Where possible, connect pipes to assembled manifolds to eliminate possibility of contaminants and cross-connections.
  - 4. Piping shall not be dragged across the ground or other surfaces and shall be stored on a flat surface with no sharp edges.
- D. Protect materials from damage or chemical contamination by other trades.
- E. Pipe, manifolds and fittings shall be protected from oil, grease, paint, direct sunlight and other elements as recommended by manufacturer.

#### 1.08 Warranty

- A. Provide manufacturer's standard written warranty.
  - 1. The radiant heating pipe manufacturer shall warrant the crosslinked polyethylene piping to be free from defects in material and workmanship for a period of twenty-five (25) years.
  - 2. Cold-expansion compression-sleeve fittings shall be warranted to be free from defects in material and workmanship for a period of twenty-five (25) years.
  - 3. All manifolds, distribution headers, thermostats and actuators shall be warranted to be free from defects in material and workmanship for a period of one (2) years starting at completion of successful pressurized water tests immediately following system installation.

### Part 2 - Products

#### 2.01 Acceptable Manufacturer

- A. REHAU, 1501 Edwards Ferry Road, NE; Leesburg, VA 20176; email: rehau.mailbox@rehau.com; website: www.na.rehau.com; upon whose products and equipment these specifications are based.
- B. No Substitutions allowed.

## 2.02 Piping

- A. Snow and ice melt system pipe shall be high-density crosslinked polyethylene manufactured using the high-pressure peroxide method with a minimum degree of crosslinking of 70-89% when tested in accordance with ASTM D2765, Method B (PEXa). Pipe shall conform to ASTM F876, ASTM F877 and CSA B137.5.
- B. Pipe shall be rated for operation of 100 psi gauge pressure at 180°F temperature (690 kPa @ 82°C), and 80 psi gauge pressure at 200°F temperature (550 kPa @ 93°C).
- C. The pipe shall have a co-extruded oxygen diffusion barrier capable of limiting oxygen diffusion through the pipe to less than 0.32 mg/m<sup>2</sup>/day at 104°F (40°C) water temperature, in accordance with DIN 4726.
- D. Pipe shall be certified by PPI to standard TR-3, with applicable plumbing and mechanical code certifications.
- E. Bend Radius:
  - 1. The minimum bend radius for cold bending of the pipe shall be not less than five (5) times the outside diameter.
  - 2. Bends with a radius less than this shall require the use of a bending template as supplied by the pipe manufacturer, and/or hot air.
- F. Compliant to the following standards:
  - 1. ANSI/UL 263 through certification listings with Underwriters Laboratories, Inc. (UL).
    - a. UL Design No. L588 — 1 hour wood frame floor/ceiling assemblies
    - b. UL Design No. K917 — 2 hour concrete floor/ceiling assemblies
    - c. UL Design No. U383 — 1 hour wood stud/gypsum wallboard wall assemblies
    - d. UL Design No. V461 — 1 hour steel stud/gypsum wallboard wall assemblies
- G. Pipe to have a Flame Spread Index and a Smoke Developed Index listing to ASTM E84 (in U.S.) or CAN/ULC S102.2 (in Canada). This listing may require the pipe to be installed in a rated insulation material or an approved steel support channel. Confirm manufacturer requirements and/or local codes for specific installation guidelines.

## 2.03 Fittings

- A. Fittings shall be third-party certified to applicable standards ASTM F877 and CSA B137.5 as part of the manufacturer's PEX piping system, with independent listings from NSF and/or CSA as applicable.
- B. Pipe-to-manifold fittings shall be compression nut manufactured of nickel-plated brass with a barbed insert and a split compression ring or cold-expansion insert manufactured of nickel-plated brass with a PEX-a compression-sleeve manufactured in accordance with ASTM F877.
- C. Cold-expansion and compression-sleeve or PEX reinforcing ring fittings shall be manufactured of PPSU (black) in accordance with ASTM D6394 and compression sleeves manufactured of PEX-a crosslinked polyethylene in accordance with ASTM F877 and shall be approved by the piping manufacturer to be part of a proven cataloged system.
- D. Fittings embedded within the thermal mass or encased behind walls or ceilings shall be cold-expansion compression-sleeve fittings certified to ASTM 877. Where required by the manufacturer, fittings shall be protected from external environmental conditions.

## 2.04 Manifolds

- A. Distribution manifolds shall be manufactured of stainless steel or copper and be supplied by the piping manufacturer as a proven cataloged part of the manufacturer's system.

- B. Stainless Steel manifolds shall be produced from extruded stainless steel round pipe with tapped holes for connections and be pre-assembled by the manufacturer. 100% of manifolds used shall have been air tested by the manufacturer with no indication of leaks.
- C. Balancing Manifolds:
  - 1. Where required by design, stainless steel balancing manifolds shall be equipped with integral visual flow gauges, circuit balancing and flow control valves, isolation valves with integral thermometer housings, and air vent/fill ports.
  - 2. Each circuit valve shall be supplied with a manual actuating handle for filling/purging operation.
- D. Copper manifolds
  - 1. Copper manifolds shall be manufactured from Type L copper.
  - 2. Copper and/or brass outlets shall be high-temperature brazed into headers.
  - 3. Outlets in copper headers shall be made using the T-drill process according to ASTM F2014.

## 2.05 Controls

- A. Automatic SIM Detector and Melting Controls
  - 1. SIM control shall use low-voltage devices to monitor outdoor ambient, slab, fluid supply and/or return temperatures, as well as an automatic snow and ice detector to detect moisture in the SIM zone.
  - 2. SIM control shall be capable of maintaining a set temperature in a SIM slab or thermal mass, with adjustable settings for Idle and Melting mode.
  - 3. Connection to output devices shall be as per the recommended installation of the SIM control, as part of a proven cataloged system.
- B. Manual SIM Detector Controls
  - 1. SIM control shall use low-voltage devices to monitor outdoor ambient and slab or thermal mass temperatures. SIM control to have a timed on/off switch that is turned on by system operator then shuts system off after a pre-set time interval.
  - 2. SIM control shall be capable of maintaining a set temperature in a SIM slab or thermal mass, with adjustable settings for Idle and Melting mode.
  - 3. Connection to output devices shall be as per the recommended installation of the SIM control, as part of a proven cataloged system.
- C. Note to Specifier: There are several control strategies that may apply to your specific project. Applications for hydronic SIM control systems can be automatic or manual. You should consider your requirements and add control specifications to this section as required. Automatic SIM detector control is recommended, as this type of control will automatically start and stop the SIM system to prevent or limit accumulation of snow and ice on the slab without human input and protect the slab or thermal mass by regulating the rate of heat transfer/temperature change. Please be aware of the need for features such as SIM idling and both warm and cold weather cut off to save energy.

## 2.06 Markings

- A. Pipe shall carry the following markings every three (3) feet (0.9 meters): Manufacturer's name or trademark, nominal size, PEXa 3206 (material designation) SDR9 (standard dimension ratio), ASTM F876/ F877 / F1960, CSA B137.5, NSF-pw, U.P. Code, 160 psi @ 73.4°F / 100 psi @ 180°F / 80 psi @ 200°F, POTABLE TUBING, manufacturing date and footage mark.
- B. Cold expansion PEXa compression-sleeves and fittings shall be marked with manufacturer's designation, production code, and certification markings.
- C. Packaging
- D. Coiled pipe shall be shipped in protective packaging marked with product name and size.

- E. Straight lengths shall be packed in plastic bags.
- F. Fittings shall be shipped in protective packaging marked with product name and size.
- G.

### Part 3 - Execution

#### 3.01 Acceptable Installers

- A. As a minimum, installation shall be performed by qualified laborers trained by the manufacturer in the procedures of PEX SIM systems and appropriately licensed for the jurisdiction where the installation will take place.

#### 3.02 Examination

- A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Beginning of installation means acceptance of existing conditions.

#### 3.03 Preparation

- A. Coordinate with related trades and manufacturer's recommendations with regard to installation in conjunction with:
  1. Reinforcing wire mesh or rebar.
  2. Precast or existing concrete sub-grade.
  3. Asphalt or other hot mix.
  4. Patio pavers.
  5. Preparation of space for manifold installation.
  6. Mounting outdoors or in an unheated indoor environment.

#### 3.04 Installation

- A. Install in accordance with manufacturer's published installation manual and/or published guidelines and final drawings.
- B. Mount manifolds in the locations previously prepared or in previously installed cabinets, if used. Manifolds shall be mounted as level as possible.
- C. Route piping in an orderly manner, according to layout and spacing shown in final drawings. All installation notes shown on the drawings shall be followed.
- D. At connections and fittings, use a PEX pipe cutter to ensure square and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants. Where fittings are installed within the thermal mass, they shall be wrapped in tape approved by the manufacturer.
- E. Pipe shall be dispensed using a suitable uncoiling device. Remove twists prior to securing pipe. Pipe shall lie flat on an even plane. Finished grade of a thermal mass shall be a minimum of 3/4 in (19 mm) above the top of PEX heating pipes. Fasten piping at no more than 3 ft (90 cm) intervals, being careful not to twist the pipe. In thin concrete slabs, secure piping every 2 ft (60 cm). Use only fasteners supplied or approved by the manufacturer of the PEX pipe.
- F. Piping that shall pass through expansion joints shall be covered in protective polyethylene convoluted sleeving (flexible conduit) extending 15 in (38 cm) on each side of the joint. Sleeving shall be secured on pipe to prevent movement during installation of thermal mass.

- G. Where piping exits the thermal mass, a protective conduit shall be placed around the pipe, with the conduit extending a minimum of 6 in (15 cm) into the floor and exiting by a minimum of 6 in (15 cm). For penetrations at manifolds, use rigid PVC bend guides secured in place to prevent movement.
- H. At the time of installation of each circuit of pipe, connect the pipe to the correct manifold outlet and record pipe length for balancing. If manifold is not installed, cap the end of the pipe and label the pipe's circuit numbers along with S for supply and R for return. Connect pipes to manifold as soon as possible and record circuit lengths. Circuits shall be labeled to indicate circuit length and serviced area.
- I. The installer shall confirm minimum and maximum exposure temperatures for the substrate material (thermal mass) and shall ensure proper SIM operating temperatures.

### 3.05 Field Quality Control

- A. Filling, Testing & Balancing: Tests of hydronic heating systems shall comply with authorities having jurisdiction, and, where required, shall be witnessed by the building official.
- B. Pressure gauges used shall show pressure increments of 1 psig and shall be located at or near the lowest points in the distribution system.
- C. Air Test
  - 1. Charge the completed, yet unconcealed pipes with air at a minimum of 40 psig.
  - 2. Do not exceed 150 psig. When air pressure testing with polymer fittings do not exceed 120 psi (825 kPa).
  - 3. Use soap solution to check for leakage at manifold connections.
- D. Water Test
  - 1. Purge air from pipes.
  - 2. Charge the completed, yet unconcealed pipes with water.
  - 3. Take necessary precautions to prevent water from freezing.
  - 4. Check the system for leakage, especially at pipe joints.
- E. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psig for 30 minutes.
  - 1. As the piping expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.
  - 2. At the end of the 30-minute preliminary test, pressure shall not fall by more than 8 psig from the maximum, and there shall be no leakage.
- F. After successfully performing the preliminary test, perform the main pressure test immediately.
  - 1. The main pressure test shall last 2 hours.
  - 2. The test pressure shall be restored and shall not fall more than 3 psig after 2 hours.
  - 3. No leakage shall be detected.
- G. Pressure shall be maintained and monitored during installation of the thermal mass.
  - 1. If any leak is detected during installation of thermal mass, leak shall be found immediately and the area cleared for repair using manufacturer's approved repair coupling.
  - 2. Retest before covering repair.
- H. Complete inspection and furnish test reports supplied by the manufacturer of the system.
- I. All low-voltage equipment shall be tested. The following 3 items should be checked at a minimum:
  - 1. Inputs
  - 2. Outputs
  - 3. Sequence of Operations

3.06 Cleaning

- A. Clean exposed surfaces upon completion of installation using clean, damp cloth. No cleaning agents are allowed.
- B. Comply with manufacturer's recommendations.

3.07 Protection

- A. Protect installation throughout construction process until date of final completion.
- B. Replace components that cannot be repaired.

END OF SECTION