

ICC-ES Evaluation Report

ESR-1529

Effective date: August 1, 2011

This report is subject to re-examination in one year.

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DIVISION: 23 00 00—Heating Ventilating and Air-Conditioning (HVAC)
Section: 23 21 13—Heating and Cooling Piping

REPORT HOLDER:

UPONOR INC.
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 APPLE VALLEY, MINNESOTA 55124
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EVALUATION SUBJECT:

UPONOR/WIRSBO hePEX™ TUBING, AND UPONOR AQUAPEX® TUBING, AND FITTINGS FOR RADIANT HEATING SYSTEMS

1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2012, 2009, and 2006 International Fuel Gas Code® (IFGC)
- 2012, 2009 and 2006 International Mechanical Code® (IMC)
- 2012, 2009 and 2006 International Residential Code® (IRC)
- 2009, and 2006 IAPMO Uniform Mechanical Code*

*Uniform Mechanical Code® is a registered trademark of IAPMO.

Properties evaluated:

- Temperature and pressure ratings
- Physical properties

2.0 USES

The Uponor AQUAPEX® tubing, Wirsbo hePEX™ tubing, and fittings as identified in this report are used in radiant heating systems, where water is the transfer fluid, under IMC Chapter 12, IRC Chapter 21, and IAPMO UMC Chapter 12.

3.0 DESCRIPTION
3.1. General:

Radiant heating systems consist of a network of loops, loop mats, or loop modules of cross-linked polyethylene (PEX) tubing conveying hot water or water/glycol mixture in walls, ceilings, and under floors for heating purposes.

3.2. Tubing:

3.2.1. General: The tubing complies with ASTM F 876, and is produced from cross-linked polyethylene compound. The tubing is pressure-rated for 100 psi (551 kPa) at 180°F (82°C), for a standard dimension ratio (SDR) of 9. The standard dimension ratio is the ratio of tube outside-diameter to wall thickness.

3.2.2. Uponor AQUAPEX® Tubing: Uponor AQUAPEX tubing is available in nominally ³/₈-, ¹/₂-, ⁵/₈-, and ³/₄-inch-diameter (10, 13, 16 and 19 mm) sizes and in 300- to 1,000-foot-long (91.4 to 304.8 m) coils.

3.2.3. Uponor/Wirsbo hePEX™ Tubing: Uponor/Wirsbo hePEXplus tubing is identical to the Uponor/Wirsbo AQUAPEX tubing except for the inclusion of a barrier layer. The Uponor/Wirsbo hePEX tubing is available in nominally ⁵/₁₆-, ³/₈-, ¹/₂-, ⁵/₈-, and ³/₄-inch-diameter (8, 10, 13, 16 and 19 mm) sizes and in 250- and 1,000-foot-long (76.2 and 304.8 m) coils.

3.2.4. Uponor Radiant Rollout Mat: Factory assembled network of active Radiant loops connected to in-slab reverse/ return Header assembly. Comprised of either ¹/₂- or ⁵/₈- inch hePEX plus or AQUAPEX tubing factory connected with EP fittings.

3.2.5. Uponor in-slab reverse/ return header radiant module design: field assembled network of active radiant loops connected to in-slab reverse return header assembly. Comprised of ¹/₂-, ⁵/₈-, or ³/₄- inch hePEX plus or AQUAPEX tubing, field connected with EP fittings.

3.3. Fittings:

3.3.1. General: Three types of fittings are recognized: ProPEX insert fittings, brass compression-type fittings, and QS20 brass compression-type fittings. The fittings are illustrated in Figure 1, and are identified as described in Section 7.1.2 of this report.

3.3.2. ProPEX Fittings: ProPEX® fittings are insert-type fittings manufactured of either brass or sulfone plastic, and are used with an external PEX compression ring. The fittings are available in nominally ³/₈-, ¹/₂-, ⁵/₈-, and ³/₄ inch diameter (10, 13 and 19 mm) sizes. The ProPEX® fittings comply with ASTM F 1960.

3.3.3. Compression-type Fittings: Brass compression-type fittings are supplied in ³/₈-, ¹/₂-, ⁵/₈-, and ³/₄ inch diameter (10, 13 and 19 mm) sizes, and consist of a nut, compression ring and insert. The compression fittings, when used with Uponor AQUAPEX or Uponor/Wirsbo hePEX tubing, comply with ASTM F 877.

3.3.4. QS20 Compression-type Fittings: QS20 brass compression-type fittings are $\frac{5}{16}$ inch (8 mm) in diameter, are for use with $\frac{5}{16}$ -inch-diameter (8 mm) Uponor/Wirsbo hePEX tubing, and consist of a nut, compression ring and insert. The fittings, when used with $\frac{5}{16}$ -inch-diameter (8 mm) Uponor/Wirsbo hePEX tubing, comply with ASTM F 877.

4.0 INSTALLATION

4.1. General:

Installation and design of the heating system for each type of construction must be in accordance with this report, the manufacturer's published installation instructions and IMC Chapter 12, IRC Chapter 21, or IAPMO UMC Chapter 12, as applicable; and are subject to approval by the code official having jurisdiction. The system must be installed by Uponor North America-trained installers. Active radiant loops must be formed from continuous lengths of tubing, from manifold or in-slab header assembly supply to the return. Radiant loops, mat assemblies, and modules must be connected to the hot water source through manifolds, which allow the flow to the radiant loops, mats, or modules to be regulated. Tubing and fittings must not be installed or stored in locations exposed to direct sunlight. Tubing and fittings must be protected from physical damage with an oversized flexible sleeve at structural mass penetrations and when the tube is uncovered. Annular spaces between sleeves and tubing must be filled or caulked in an approved manner. The tubing must be installed using mounting brackets and installation hardware, which are provided with the product, in accordance with the manufacturer's published installation instructions. The manufacturer's published installation instructions must be furnished to the code official upon request. The tubing must be maintained at the proposed operating pressure during placement of concrete, or during backfilling when used in buried applications. Clearances from heat-producing equipment must be in accordance with chapter 5 of the *International Fuel Gas Code*[®], or chapter 8 of the IAPMO UMC, as applicable. The outside tube diameter is the nominal diameter plus $\frac{1}{8}$ inch (3.2 mm). When the system is embedded in concrete, tubing must be covered by a minimum of $\frac{3}{4}$ inch (19.1 mm) of concrete, and installation must comply with Chapter 12 of the *International Mechanical Code*[®] (IMC). When tubing is installed over polystyrene boards, the boards must comply with Chapter 26 of the *International Building Code*[®] (IBC) or Chapter 3 of the *International Residential Code*[®] (IRC), as applicable. Minimum bending radius is eight times the outside diameter of the PEX tubing. Horizontally laid pipe must be secured in such a manner that temperature induced expansion and contraction are accommodated.

When the tubing is installed in a poured gypsum underlayment or in a lightweight concrete poured over a wood subfloor, the tubing must be stapled to the wood subfloor, or be installed using mounting brackets and installation hardware which are provided with the product, in accordance with the manufacturer's published installation instructions. Batt insulation must be installed beneath the floor in the joist cavity. See Figure 2.

When the tubing is located between the joists beneath a wood framed floor, aluminum heat-emission plates can be installed over the tubing. The tubing must be inserted into the plates, which are stapled to the underside of the wood subfloor. Batt insulation must be installed directly beneath the aluminum plates in the joist cavity. See Figure 3. As an alternative, when the tubing is located between the joists beneath a wood framed subfloor, the tubing must be suspended beneath the subfloor with plastic clips. The tubing must not come in direct contact with the wood

subfloor. Batt insulation must be installed in the joist cavity with a 2 inch to 3 inch (51 mm to 76 mm) air gap beneath the subfloor. See Figure 4.

4.2. Fittings:

The fittings described in Section 3.3 are the only fittings that may be used in the radiant heating systems described in this report. The fittings must be attached to tubing in strict accordance with the Uponor Inc. published installation instructions. Additionally, the ProPEX fittings must be installed in the end of the tubing by expanding the tube and the external PEX compression ring using a tool supplied by Uponor Inc. The insert end of the fitting must then be inserted into the expanded end of the tubing, and within a short period of time the tubing and ring contract around the fitting.

4.3. Inspection:

The system must be pressure-tested for leaks before installation of the covering as noted in IMC Chapter 12, or IRC Chapter M21, or IAPMO UMC Chapter 12, as applicable. The leak test must be witnessed by the code official or the code official's designated representative. During placement of cover over the tubing, the tube must be maintained at the greater of $1\frac{1}{2}$ times the working pressure of the radiant heating system or 100 psi (689.4 kPa).

5.0 CONDITIONS OF USE

Uponor/Wirsbo hePEX tubing, Uponor AQUAPEX tubing, and fittings described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1. Products are manufactured, identified and installed in accordance with this report, the applicable code and the manufacturer's published installation instructions. Manufacturer's published installation instructions must be furnished to the code official upon request. If conflict exists between this report and the manufacturer's published installation instructions, this report governs.
- 5.2. Details of the design and installation of the heating system must be submitted to the code official for approval. Installation shall be performed by installers trained by Uponor Inc. The maximum pressure and temperature shall not exceed the pipe rating.
- 5.3. Clearances from heat-producing equipment must be in accordance with Chapter 5 of the *International Fuel Gas Code*[®], or Chapter 8 of the IAPMO UMC, as applicable.
- 5.4. Each installation must be pressure-tested for leaks in the presence of the code official or the code official's designated representative, as noted in Section 4.2 of this report.
- 5.5. During placement of cover over the tubing, the tube must be maintained at the greater of $1\frac{1}{2}$ times the working pressure or 100 psi (689.4 kPa).
- 5.6. When installation is in fire-resistive assemblies, evidence of compliance with IBC Chapter 7 (penetrations) as applicable, must be provided to the code official for approval.
- 5.7. The use of the tubing in hydronic systems is limited to applications using potable water as the transfer fluid.

5.8. The products are manufactured in Apple Valley, Minnesota, under a quality control program with inspections by NSF International (AA-633).

6.0 IDENTIFICATION

6.1. Tubing:

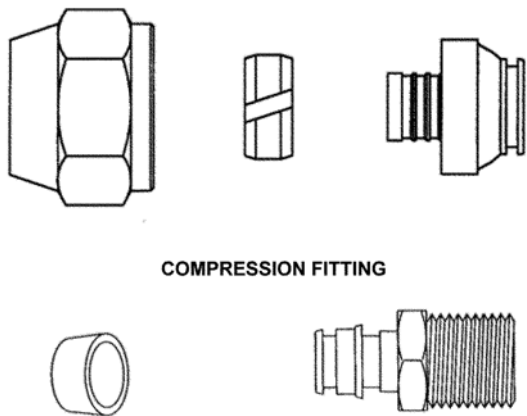
The tubing is marked at intervals of 3 feet (914 mm) with the product designation (Uponor/Wirsbo hePEX™ or Uponor AQUAPEX®), nominal tube size, standard dimension ratio (SDR 9), temperature and pressure ratings [100 psi at 180F (689 kPa at 82C)], “ASTM F 876,” ASTM F 877 designations, production code, name of the inspection agency (NSF International), and the evaluation report number (ESR-1529).

6.2. Fittings:

ProPEX fittings are marked with the nominal size, name of inspection agency (NSF International), product code and “ASTM F 1960.” The PEX compression ring for ProPEX fittings is marked with the nominal size and “ASTM F 1960.” Brass compression fittings, QS20 fittings and compression rings are marked with the nominal size and “ASTM F 877.” Fittings and compression rings are also marked with the Wirsbo trademark:



Packaging for the fittings include the Uponor Inc. company name, product name, model number and evaluation report number (ESR-1529).



COMPRESSION FITTING

PROPEX FITTING AND PEX RING

FIGURE 1—FITTINGS

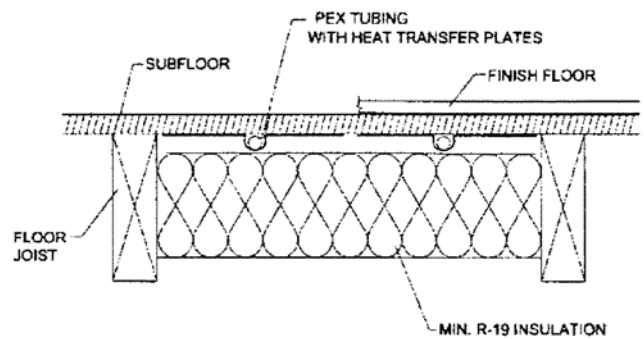


FIGURE 3—HEAT EMISSION PLATES DETAIL

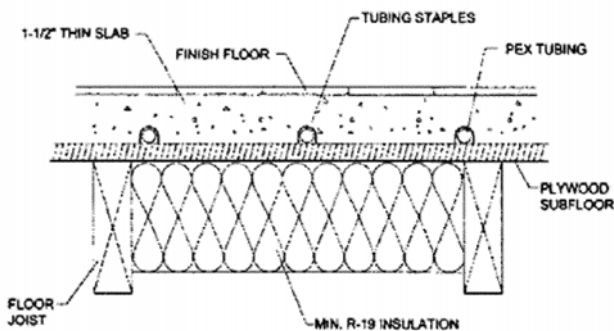


FIGURE 2—POURED UNDERLAYMENT DETAIL

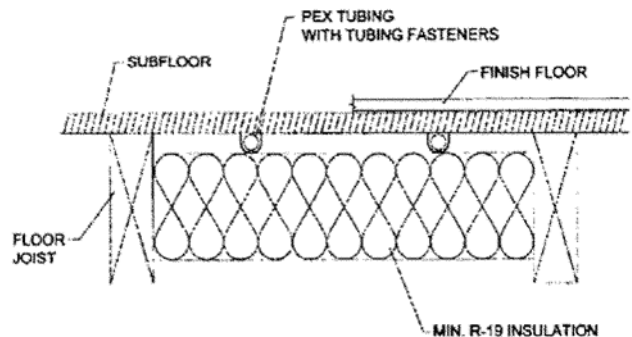


FIGURE 4—JOIST HEATING DETAIL

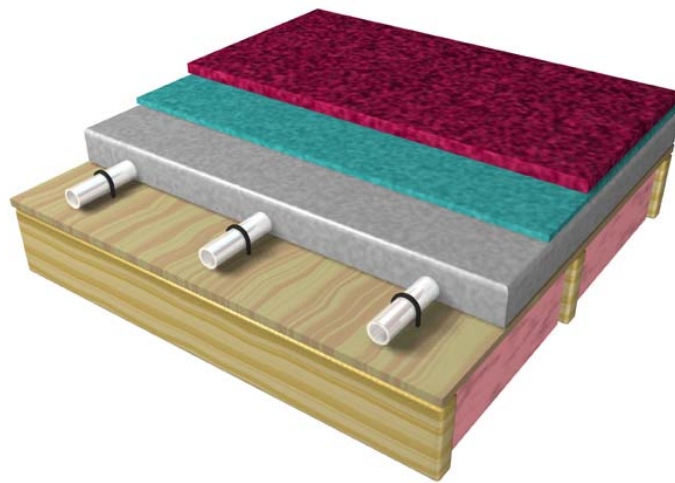


FIGURE 5

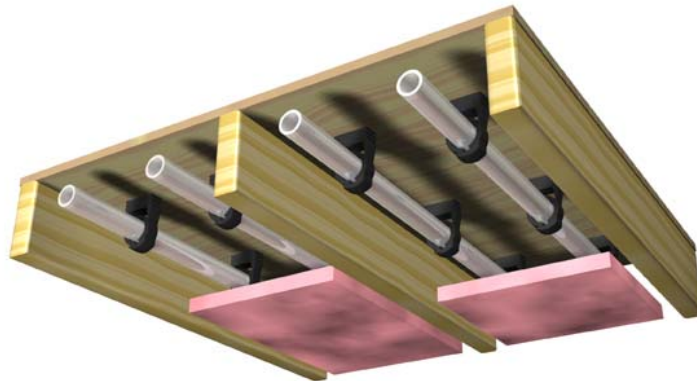


FIGURE 6

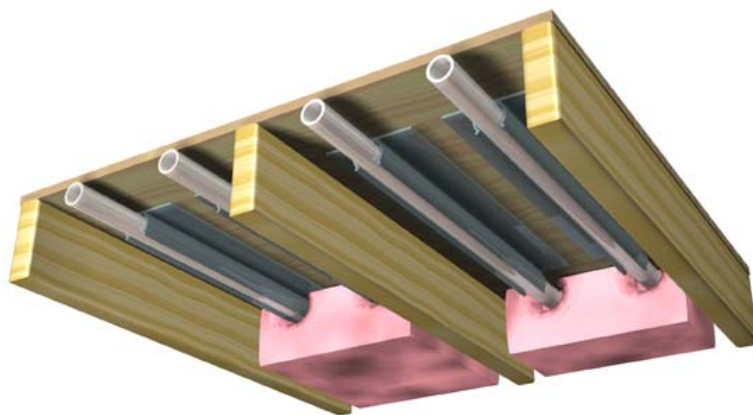


FIGURE 7