

ICC-ES Evaluation Report

ESR-1099

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

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DIVISION: 22 00 00—PLUMBING
Section: 22 11 16—Domestic Water Piping
**DIVISION: 23 00 00—HEATING, VENTILATING AND AIR
CONDITIONING (HVAC)**
Section: 23 21 13—Hydronic Piping
REPORT HOLDER:
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EVALUATION SUBJECT:
**AQUAPEX™, PRESSURE RATED TUBING, ProPEX™,
AND COMPRESSION TYPE FITTINGS**
1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2009 *International Plumbing Code*® (IPC)
- 2009 *International Building Code*® (IBC)
- 2009 *International Residential Code*® (IRC)
- 2009 *International Mechanical Code*® (IMC)
- 1997 *Uniform Building Code*™ (UBC)
- 1997 *ICBO Uniform Mechanical Code* (ICBO UMC)
- 1997 *Standard Plumbing Code*® (SPC)
- 2009 *IAPMO Uniform Plumbing Code** (IAPMO UPC)
- 2009 *IAPMO Uniform Mechanical Code** (IAPMO UMC)

Properties evaluated:

- Temperature and pressure ratings
- Physical properties
- Drinking water system component—health effects

2.0 USES

The Uponor AQUAPEX™ cross-linked polyethylene (PEX) tubing and fittings described in this report are for use in potable hot- and cold-water distribution, water service and radiant heating systems.

3.0 DESCRIPTION
3.1 Tubing:

The AQUAPEX™ tubing is produced from cross-linked polyethylene compound complying with ASTM F 876. AQUAPEX™ (Natural) PEX 5106 SDR9 uncoated tubing is available in nominally 1/4- to 3-inch-diameter (6 to 76 mm) sizes. AQUAPEX™ (White) PEX 5006 and AQUAPEX™ (Red and Blue) SDR9 coated tubing is available in nominally 1/2- to 2-inch-diameter (13 to 51 mm) sizes.

3.2 Fittings:

Two types of fittings are recognized: ProPEX fittings, and brass compression-type fittings. The fittings are illustrated in Figure 1, and are identified as described in Section 7.2 of this report.

3.2.1 ProPEX fittings: ProPEX fittings are insert-type fittings made of either brass or engineered plastic (EP) that are used with an external PEX compression ring. The fitting is installed in the end of PEX tubing by expanding the tube and the external PEX compression ring with a tool supplied by Uponor North America. The insert end of the fitting is then inserted into the expanded end of the tubing, and within a short period of time the tubing and ring contract around the fitting. ProPEX fittings are available in nominally 3/8-, 1/2-, 5/8-, 3/4-, 1- and 1 1/2-inch-diameter (10, 13, 16, 19, 25 and 38 mm) sizes. The ProPEX brass fittings are also available in a nominal 2-inch (51 mm) diameter. The nominally 3/8-, 1/2-, 5/8-, 3/4-, 1-, 1 1/4-, 1 1/2- and 2-inch-diameter (10, 13, 16, 19, 25, 32, 38 and 51 mm) ProPEX fittings comply with ASTM F 1960.

3.2.2 Brass Compression-type Fittings: Uponor North America brass compression-type fittings consist of a nut, compression ring and insert. Compression-type fittings are available in nominally 3/8-, 1/2-, 5/8-, 3/4-, and 1-inch-diameter (10, 13, 16, 19 and 25 mm) sizes. The compression fittings comply with ASTM F 877 when used with the Uponor North America tubing described in this report.

4.0 INSTALLATION
4.1 General:

All systems must be installed by Uponor North America-trained installers in accordance with the manufacturer's published installation instructions, which are provided with the product. Installation must conform to the requirements of the applicable code, and is subject to approval by the code official having jurisdiction.

***Uniform Plumbing Code and Uniform Mechanical Code are copyrighted publications of the International Association of Plumbing and Mechanical Officials, 5001 East Philadelphia Street, Ontario, California 91716.**

4.2 Water Distribution:

Horizontally laid pipe must be secured in such a manner that temperature-induced expansion and contraction are accommodated.

4.3 Water Service:

The installation must comply with applicable codes and the manufacturer's published installation instructions. If the tubing is laid in a trench, the bottom of the trench must be cut smooth and must be free of lumps and rocks. The tubing must be installed underground in a manner that ensures external loads will not subsequently cause a decrease in the vertical dimension of the cross section of the tubing that exceeds 5 percent of the outside diameter. The tubing must be installed to provide an allowance for contraction of the line due to temperature change prior to backfilling. For applications requiring direct burial, dezincification resistant brass ProPEX fittings (DZR) or equivalent must be used in accordance with the manufacturer's installation handbook. In areas with poor soil conditions (plastic clays), the trench bottom must be prepared using granular material to provide a stable base. Potable water service tubing must not be located in, under or above cesspools, septic tanks, septic tank drainage fields or pits.

4.4 Radiant Heating Systems:

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, ICBO UMC Chapter 12 or IAPMO UMC Chapter 12, as applicable; and are subject to approval of the code official having jurisdiction. 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. When tubing is installed over polystyrene boards, the boards must comply with IBC Section 2603 or IRC Section R316, as applicable. 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. Batt insulation must be installed beneath the floor in the joist cavity (Figure 3).

The system may be installed in either concrete or wood floors. When the system is embedded in concrete floors, a moisture barrier must first be laid over a concrete base slab a minimum of 3¹/₂ inches (89 mm) thick. Underfloor insulation and reinforcing mesh are then placed on the slab. The tubing must be uncoiled and attached to the mesh using soft steel wire. A concrete topping must then be laid over the tubing. When embedment is in concrete, installation, including minimum concrete cover, must comply with IBC Section 1906.3 or UBC Section 1906.3, as applicable.

When the tubing is installed within a wood-framed floor assembly without an existing deck, the floor joists must be cross-battened at 12 inches (305 mm) on center. Aluminum heat-emission plates are then nailed or stapled in place between the battens. The tubing is then uncoiled and pressed into place in the heat emission plates. The floor deck is then nailed to the joists in a conventional manner.

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 (Figure 4). As an alternative, when 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 into 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 (Figure 5).

When the tubing is installed in wood-framed ceilings, the aluminum heat-emission plates are nailed or stapled in place along the rafters or along wood supports placed perpendicular to the ceiling rafters. The tubing is then uncoiled and pressed into place in the heat-emission plates.

Horizontally laid pipe must be secured in such a manner that temperature-induced expansion and contraction are accommodated.

4.5 Inspection:

4.5.1 Water Distribution and Water Service Piping: Installed tubing must be pressure-tested and inspected as required by Section 606.6 of the IPC and Section 103.5 of the IAPMO UPC.

4.5.2 Radiant Heat Piping: The tubing must be pressure-tested for leaks before installation of covering, as noted in IRC Section M2103.4, IMC Section 1208, ICBO UMC Section 1208 or IAPMO UMC Section 1207.0, as applicable. The leak test must be witnessed by the code official or the code official's designated representative. During placement of the cover over tubing, the tube must be maintained at the greater of 1¹/₂ times the proposed operating pressure or 100 psi (689.41 kPa).

5.0 CONDITIONS OF USE

The AQUAPEX™ (natural, white, red and blue) tubing and fittings described in this report comply with, or are acceptable 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. The manufacturer's published installation instructions must be furnished to the code official upon request. If a conflict exists between this report and the manufacturer's published installation instructions, this report governs.
- 5.2** When installation is in fire-resistive assemblies, evidence of compliance with UBC Section 709 (walls and partitions), UBC Section 710 (floor/ceiling or roof/ceiling), and IBC Section 713 (penetrations), as applicable, must be provided to the code official for approval.
- 5.3** The tubing and fittings must be protected from exposure to direct sunlight. Tubing and fittings must be protected from physical damage with an oversized flexible corrugated sleeve at structural mass penetrations and when the tube is uncovered. Annular spaces between sleeves and pipes must be filled or tightly caulked in an approved manner.
- 5.4** Clearances from heat-producing equipment must be in accordance with Section 503.10.5 of the 2009 *International Fuel Gas Code*®, Section M1306 of the IRC, Section 304.6 of the 1997 ICBO UMC or Section 802.10.5 of the IAPMO UMC, as applicable.

- 5.5 The tubing must be maintained at the proposed operating pressure during placement of concrete, or prior to backfilling when used in buried applications.
- 5.6 Minimum bending radius is six times the outside tube diameter of the PEX tube. The outside diameter is the nominal diameter plus 1/8 inch (3 mm).
- 5.7 The use of the tubing in hydronic systems is limited to applications using potable water as the transfer fluid.
- 5.8 AQUAPEX™ (natural, white, red and blue) tubing systems are manufactured in Apple Valley, Minnesota, under a quality control program with inspections by NSF International (AA-633).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES PMG LISTING Criteria for PP, PEX, PEX-AL-PEX, and PP-AL-PP Piping, Tube and Fittings Used in Radiant Heating and Water Supply Systems (LC1004), dated November 2009.

7.0 IDENTIFICATION

7.1 Tubing:

The tubing is marked at minimum intervals of 5 feet (1524 mm) with the following:

- Uponor North America company name
- Product name (AQUAPEX™)

- Nominal tube size
- Material designation (PEX 5006, 5106 or 5206)
- Potable water designation, when applicable
- Standard dimension ratio (SDR9)
- Temperature and pressure ratings
- ASTM F 876/F 877 designation
- Production code
- The name of the inspection agency (NSF International)
- The evaluation report number (ESR-1099)

7.2 Fittings:

ProPEX fittings are marked with the Uponor North America trademark (see Figure 2), name of inspection agency, nominal size, potable water marking, production code, and “ASTM F 1960.”

Brass compression-type fittings are marked with the Uponor North America trademark, name of the inspection agency, nominal size, potable water marking, and “ASTM F 877.”

Packaging for the fittings bears the Uponor Company name, product name, model number and the evaluation report number (ESR-1099).



FIGURE 1—UPONOR WIRSBO FITTINGS



FIGURE 2—UPONOR NORTH AMERICA TRADEMARK

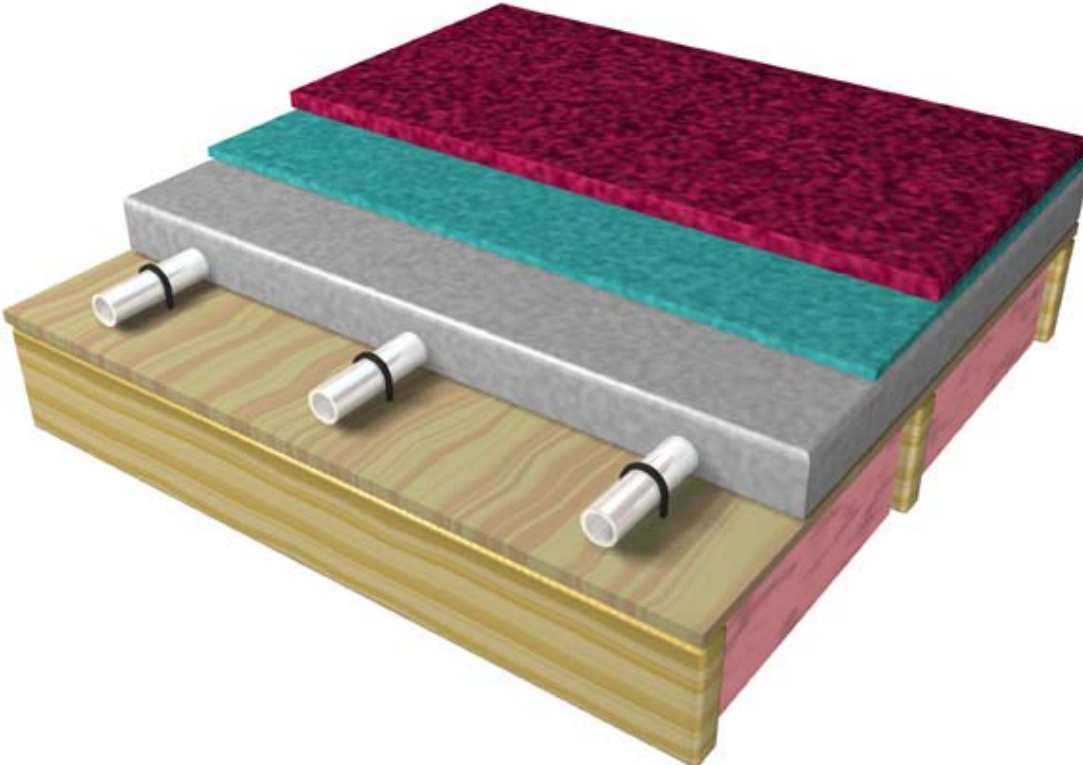


FIGURE 3

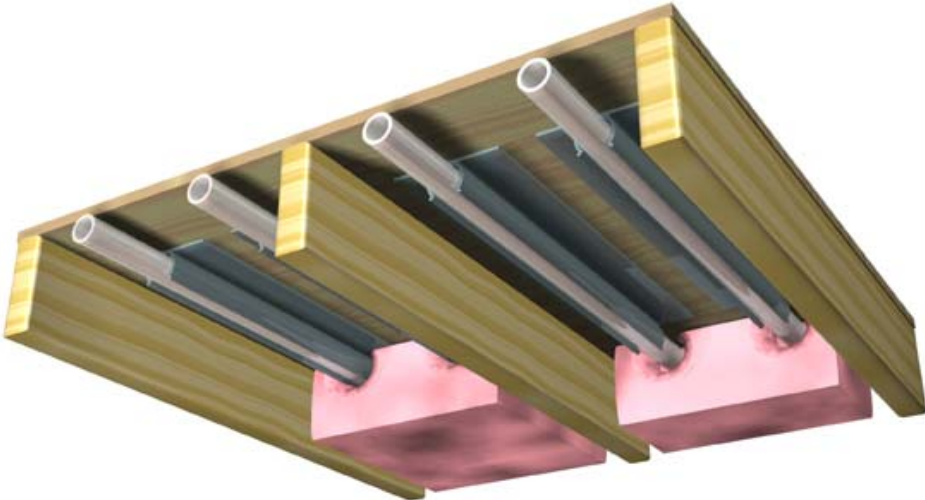


FIGURE 4

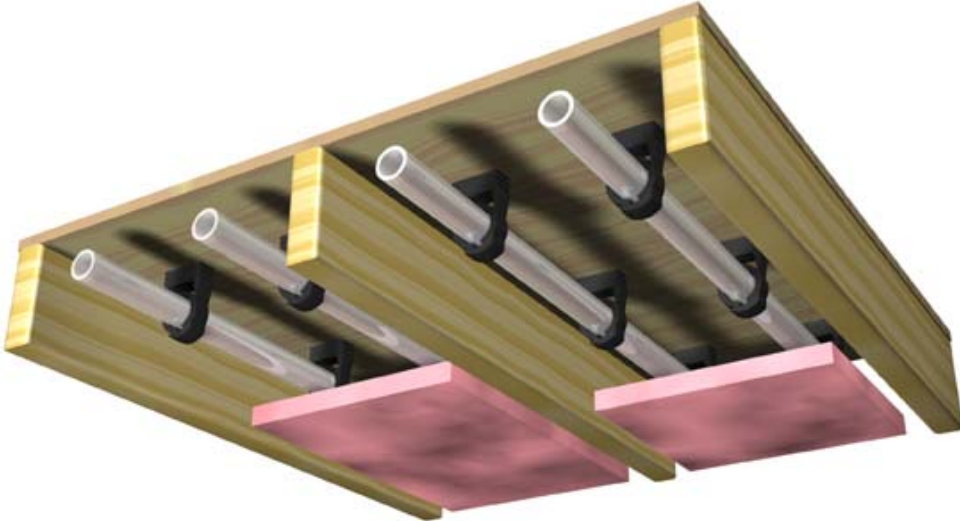


FIGURE 5