LEGACY REPORT

ER-5542*
Reissued March 1, 2004

ICC Evaluation Service, Inc.
www.icc-es.org

Business/Regional Office ■ 5360 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
Regional Office ■ 900 Montclair Road, Suite A, Birmingham, Alabama 35213 ■ (205) 599-9800
Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

Legacy report on the 1997 ICBO *Uniform Mechanical Code*™, the 2000 IAPMO *Uniform Mechanical Code and the 2000 *International Mechanical Code*™**

DIVISION: 15—MECHANICAL
Section: 15180—Heating and Cooling Piping

ROTH PEXc TUBE AND FITTINGS FOR RADIANT PANEL HEATING SYSTEMS

ROTH INDUSTRIES, INC.
77 CIRCUIT DRIVE
NORTH KINGSTOWN, RHODE ISLAND 02852

ROTH WERKE GMBH
AM SEERAIN
D-35232 DAUTHPETAL
GERMANY

BECKER PLASTICS GMBH
AM BANHOF 3
45711 DATTELN
GERMANY

1.0 SUBJECT

Roth PEXc Tube and Fittings for Radiant Panel Heating Systems.

2.0 DESCRIPTION

2.1 Radiant Floor Heating:

2.1.1 General: Roth PEXc tube and fittings are used in radiant heating systems in residential and commercial applications under Chapter 12 of the ICBO *Uniform Mechanical Code*™ (UMC), Chapter 12 of the IAPMO *Uniform Mechanical Code** (IAPMO UMC) and Chapter 12 of the *International Mechanical Code*™ (IMC).

Radiant heating systems consist of separate loops of PEX tubing conveying hot water under floors for heating purposes. Ends of the tubing loops are connected to the hot water source through manifolds that allow the flow in individual loops to be regulated.

2.1.2 Materials:

2.1.2.1 Tubing: Roth PEXc tubing is produced from polyethylene compound that has been cross-linked and complies with ASTM F 876-01. The tubing is available coated or uncoated, and is "natural" in color. The tubing is available in nominal $^3/_8$-inch, $^1/_2$-inch, $^5/_8$-inch, $^3/_4$-inch and 1-inch (10 mm, 13 mm, 16 mm, 19 mm and 25 mm) sizes and in 300- to 2,000-foot-long (91.4 to 609.6 m) coils.

The products are pressure-rated for 100 psi (689 kPa) at 180°F (82°C), for a standard dimension ratio (SDR) of 9. SDR is the ratio of tube outside-diameter to wall thickness.

2.1.2.2 Fittings: Brass compression fittings in nominal $^3/_8$-inch, $^1/_2$-inch, $^5/_8$-inch, $^3/_4$-inch and 1-inch (10 mm, 13 mm, 16 mm, 19 mm and 25 mm) sizes are supplied by Roth Industries, Inc., and consist of a nut, a compression ring and an insert, as illustrated in Figure 1. Fittings shall be attached to tubing in strict accordance with this report and the Roth Industries, Inc., installation instructions. When installed in accordance with this report, the fittings comply with ASTM F 877-01.

2.1.3 Installation: Installation and design of the heating system for each type of floor construction must conform to Chapter 12 of the UMC, Chapter 12 of the IAPMO UMC or Chapter 12 of the IMC, and to the manufacturer's instructions, and is subject to approval by the building official.

All circuits shall be formed from continuous lengths of tubing from manifold supply to return. No splices are allowed. Installation varies according to the type of construction. The system may be installed in either concrete or wood floors. When the system is embedded in concrete, tubing shall be covered a minimum of $^3/_4$ inch (19.1 mm) and installation must comply with Section 1906.3 of the *Uniform Building Code*™ (UBC) or Section 1906.3 of the *International Building Code*® (IBC). When the tubing is installed over foam plastic insulation, the boards must comply with Section 2602 of the UBC or Section 2603 of the IBC. Typical installations are illustrated in Figures 2 through 6.

When the tubing is located in a wood-framed floor 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. See Figures 4 and 7.

Tubing may also be installed from underneath, and fastened to the underside of flooring boards with either clips supplied by Roth Industries, Inc., or with $1^1/_4$-inch-long (31.7 mm) staples spaced at 12 inches (305 mm) on center. As an

alternative, the tubing may be placed in aluminum heat-emission plates having two grooves for the tubing. The aluminum plates are attached to the flooring with three rows of $^5/_8$-inch-long (15.1 mm) staples spaced at 6 inches (152 mm) on center. When installed in wood-framed ceilings, the aluminum heat-emission plates must be attached to the ceiling rafters with two rows of $^5/_8$-inch-long (15.9 mm) staples spaced at 6 inches (152 mm) on center. The tubing is then uncoiled and pressed into place in the heat-emission plates.

Mounting brackets and installation hardware are provided by the manufacturer. Horizontally laid pipe must be secured in such a way that temperature-induced expansion and contraction are accommodated. Minimum bending radius is six times the outside tube diameter. Hot bending of tubing is not recommended. The outside diameter is the nominal diameter plus $^1/_8$ inch (3.2 mm). Tube must be protected from exposure to direct sunlight, and must be protected from physical damage with an oversized flexible corrugated sleeve at structural mass penetrations and where the tube is uncovered. Tubing must not be placed within 12 inches (305 mm) of any recessed lighting fixture or within 6 inches (152 mm) of any gas appliance vent. Loops must always be formed from continuous lengths of tubing. Tubing loops are a maximum of 200 feet (60.96 m) long for $^3/_8$-inch (10 mm) sizes, a maximum of 300 feet (91.44 m) long for $^1/_2$-inch (13 mm) sizes, a maximum of 400 feet (121.92 m) long for $^5/_8$-inch (16 mm) sizes and a maximum of 500 feet (152.4 m) long for $^3/_4$-inch (19 mm) or 1-inch (25 mm) sizes.

2.1.4 Inspection: The tubing must be pressure-tested for leaks prior to installation of the covering, as noted in Section 1208 of the UMC, Section 1207 of the IAPMO UMC or Section 1208 of the IMC. The leak test must be witnessed by the building official. During placement of the cover over the tubing, the tube must be maintained at the proposed operating pressure.

2.2 Identification:

2.2.1 Tubing: The tube is marked every 3 feet (914 mm) with the Roth Industries, Inc., name, nominal tube size, material designation (PEXc), standard dimension ratio (SDR 9), temperature and pressure rating [180°F/100 psi (82°C/689 kPa)], ASTM F 876/F 877 designation, production code, name of the inspection agency (NSF International), and the evaluation report number (ER-5542).

2.2.2 Fittings: Compression fittings are marked with the Roth company name, the name of the quality control agency (NSF International), the nominal size, the manufacturing date and the designation "F 877."

3.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for PEX, PB and PEX-AL-PEX Tube and Fittings Used in Radiant Heating and Water Distribution Systems (AC122), dated April 2002; quality control manuals; product information; and installation instructions.

4.0 FINDINGS

That the Roth Industries, Inc., PEXc tube and fittings described in this report comply with the 1997 ICBO *Uniform Mechanical Code*™, the 2000 IAPMO *Uniform Mechanical Code and the 2000 *International Mechanical Code*™, subject to the following conditions:**

4.1 Products are manufactured, identified and installed in accordance with this report and the manufacturer's instructions. The manufacturer's instructions shall be furnished to the building official upon request.

4.2 Details on the design and installation of the heating system are submitted to the building official for approval.

4.3 Each tubing installation is inspected and tested by the building official prior to covering.

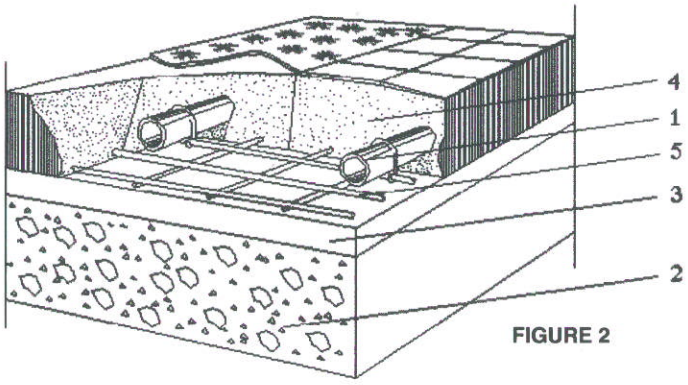
4.4 The tubing is maintained at the proposed operating pressure during placement of concrete.

4.5 When installation is in fire-resistive assemblies, evidence of compliance with UBC Section 709 (walls and partitions) or UBC Section 710 (floor/ceiling or roof/ceiling) and IBC Section 719, as applicable, must be provided to the building official for approval.

4.6 The tubing is manufactured in Datteln, Germany, and the fittings are manufactured in Dautphetal, Germany, under a quality control program with inspections by NSF International (AA-633).

This report is subject to re-examination in two years.

FIGURE 1—ROTH COMPRESSION FITTING FOR RADIANT HEATING SYSTEMS

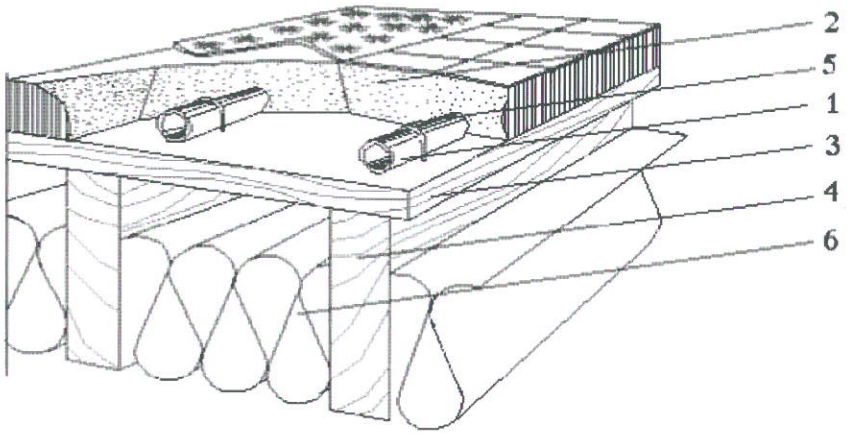


1. Roth PEX tubing
2. Base
3. Insulation
4. Concrete
5. Mesh or rebar

Note: Tubing can also be installed in sand base under concrete (no insulation over tubing)

FIGURE 2

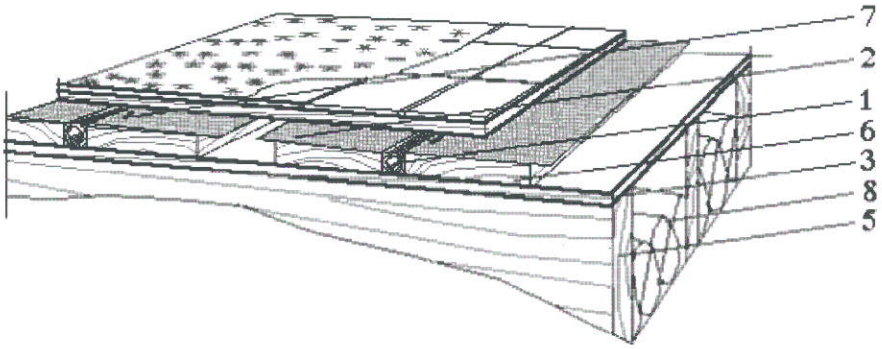
*IAPMO *Uniform Mechanical Code* is a copyrighted publication of the International Association of Plumbing and Mechanical Officials, 5001 East Philadelphia Street, Ontario, California 91761, USA.



1. Roth PEX Tubing
2. Poured underlayment
3. Subfloor
4. Floor joist
5. Tubing fastener
6. Insulation

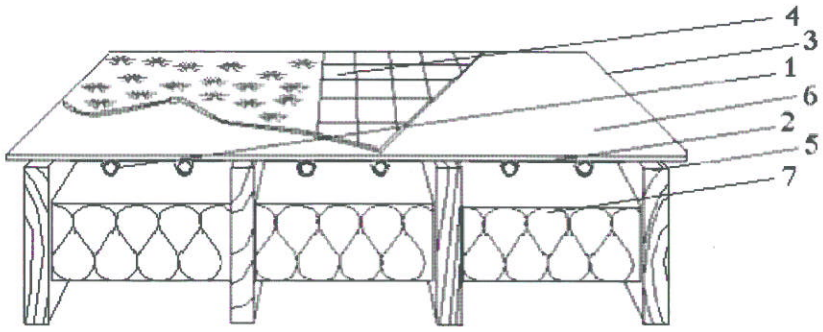
Note: Subfloor (and construction below) could also be an existing slab floor

FIGURE 3—OVERPOUR INSTALLATION



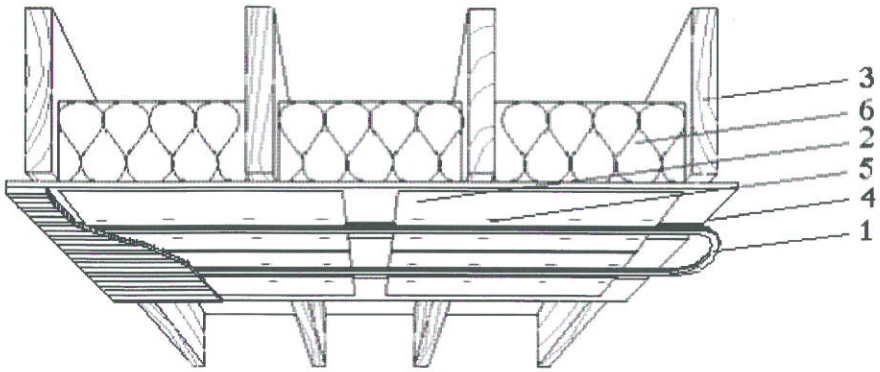
1. Roth PEX tubing
2. Aluminum heat–emission plates
3. Subfloor (or existing floor)
4. Finished floor
5. Floor joist
6. Furring strips
7. Staple
8. Insulation

FIGURE 4—SUSPENDED FLOOR, INSTALLATION FROM ABOVE



1. Roth PEX tubing
2. Heat–emission plates
3. Flooring board of approved type
4. Floor Covering
5. Floor joist
6. Staple for panels or clip for tubing (from underneath)
7. Insulation

FIGURE 5—SUSPENDED FLOOR, INSTALLATION FROM UNDERNEATH



1. Roth PEX tubing
2. Aluminum heat–emission plates
3. Ceiling joist
4. Furring strips
5. Staple
6. Insulation

FIGURE 6—CEILING HEATING

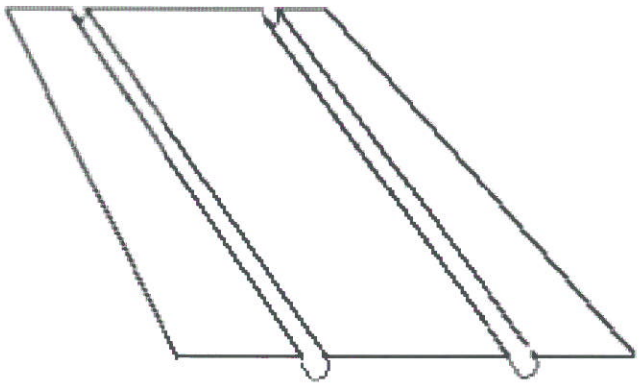


FIGURE 7—THE PANEL CAN BE STAPLED BETWEEN JOISTS TO FLOORING BOARD FROM UNDERNEATH