Installation Standard
For
COMPOSITE PEX-AL-PEX HOT AND PE-AL-PE COLD
WATER-DISTRIBUTION SYSTEMS

IS 28-2005

1.0 SCOPE

1.1 This standard shall govern the installation of composite piping in potable hot and cold water distribution systems within and under buildings and shall apply only to PEX-AL-PEX and PE-AL-PE piping meeting the requirements of ASTM F 1281 and ASTM F 1282 and fittings meeting the requirements of ASTM F 1974. Installation, materials, and inspection should comply with the current edition of the Uniform Plumbing Code published by the International Association of Plumbing and Mechanical Officials, and shall also comply with this standard and manufacturer's installation recommendations.

NOTE: *The following sections of the Uniform Plumbing Code shall apply to composite PEX-AL-PEX and PE-AL-PE tubing.*

310.0	Workmanship
313.0	Protection of Piping, Materials, and Structures
316.1	Types of Joints
316.2.3	Plastic Pipe to Other Materials
Chapter 6	Water Supply and Distribution

Chapter 2*	DEFINITIONS
ASTM	American Society for Testing and Materials
IAPMO	International Association of Plumbing and Mechanical Officials
PEX-AL-PEX	Crosslinked Polyethylene-Aluminum-Crosslinked Polyethylene
PE-AL-PE	Polyethylen Aluminum–Polyethylene
UPC	Uniform Plumbing Code as published by IAPMO

2.0 PRODUCT REQUIREMENTS

2.1 Materials and Fittings

2.1.1 Materials. Materials shall comply with the following requirements:

Materials	ASTM Standard
Crosslinked Polyethylene-Aluminum-Crosslinked Polyethylene (PEX-AL-PEX)	F 1281
Polyethylene-Aluminum-Polyethylene (PE-AL-PE)	F 1282
Metal Insert Fittings for PEX-AL-PEX and PE-AL-PE composite pipe	F 1974

2.1.2 Piping. PEX-AL-PEX composite pipe shall comply with ASTM F 1281. PE-AL PE composite pipe shall comply with ASTM F 1282.

2.1.3 Fittings. Fittings shall be metal insert type and shall comply with ASTM F 1974. Fittings are limited to the following types:

(a) Insert fittings or compression type fittings; and
(b) Special listed fittings of other types. Connections to galvanized pipe or fittings shall be specifically designed for that purpose.

NOTE 1: *Manufacturers of fittings shall recommend assembly procedures.*

2.2 Markings

2.2.1 Piping. Composite piping shall be legibly marked at intervals of not more than 5 ft. (1.5 m) with at least the following:

(a) Manufacturer's name or trademark;
(b) ASTM F 1281(PEX-AL-PEX) or F 1282 (PE-AL-PE);
(c) Piping size;
(d) Material type – PEX-AL-PEX or PE-AL-PE;
(e) Pressure ratings for water and the temperature for which the temperature rating is valid;
(f) Mark of an acceptable certification agency; and
(g) Manufacturer's date and material code. [UPC 301.1.2]

The elevated temperature and pressure ratings for PEX-AL-PEX and PE-AL-PE in accordance with ASTM F 1281 and ASTM F 1282 are:

2.2.2

PEX-AL-PEX (orange colored)	200 psi	125 psi
	at 73ºF	at 180ºF
PEX-AL-PE (blue colored)	200 psi	100 psi
	at 73ºF	at 180ºF

Fittings. Fittings shall be marked with at least the following:
(a) Manufacturer's name or trademark or other acceptable markings; and
(b) The mark of an acceptable certification agenc; and
(c) If size permits, ASTM F 1974. [UPC 301.1.2]

2.2.3 Position of Markings. When practical, markings shall be visible for inspection. Markings shall be visible prior to installation.

2.3 Protection of Piping

2.3.1 Abrasion. Piping passing through metallic studs, joists, or hollow masonry walls shall be protected from abrasion or sharp edges by elastomeric or plastic sleeves, grommets, conical shaped punch holes or other approved means.

2.3.2 Puncture. Steel plate protection, minimum 18 gauge, shall be installed when the tubing is within 1 in. (25 mm) of the nailing surface. [UPC 313.9]

2.4 Exposed Piping

2.4.1 General – Where exposed tubing may be subjected to mechanical damage it must be protected.

2.4.2 Freezing. In areas where the system must be drained to protect the system from freezing, horizontal lines shall be graded to drain.

2.4.3 Storage. Piping shall be stored in a way to protect the system from mechanical damage (slitting, puncturing, etc.). Piping should be stored undercover to keep it clean and avoid long term exposure to sunlight. Consult piping manufacturer for recommended limits for outside storage.

2.5 Thermal Expansion

2.5.1 General. The linear expansion rate for PEX-AL-PEX and PE-AL-PE is 1.56 in. (39.6 mm) per 100 ft. (30m) of tube per 100°F (55°C) change in temperature. No accommodation for thermal expansion is required.

2.5.2 Clearance. Bored holes and sleeves shall provide adequate clearance between the piping and structure to allow for free longitudinal movement.

2.6 Hangers and Supports

2.6.1 Vertical Piping. Vertical piping shall be supported at every floor. Piping shall have a mid-story guide.

2.6.2 Horizontal Piping. Horizontal piping shall be supported according to the following Table 1.

Table 1
Support Spacing

Nominal Diameter	Spacing
1/2", 3/4", and 1"	8' 2" (2489 mm)

2.6.3 Hangers and Anchors. Piping shall not be anchored rigidly to a support, but shall be secured with hangers or straps that provide for a degree of movement and that prevent damage to the tubing. Do not use hangers or straps with sharp or abrasive edges. Do not use hangers that pinch the piping. [UPC 314.0]

2.7 Inspection and Testing

A. Inspection. All tubing shall be properly seated on to the fitting per the manu-facturer's instructions. For crimp fittings, each crimped joint shall be checked. Buckled, gouged, or obviously damaged pipe shall not be used. Consult manu-facturer's recommendations for repair procedures.

B. Testing. Upon completion of a section or of the entire hot and cold water supply system it shall be tested and proved tight under a water pressure or air test not less than the working pressure under which it is to be used. The water used for tests shall be obtained from a potable source. The system shall withstand the test without leaking for a period of not less than fifteen (15) minutes.

2.8 Joints and Connections

2.8.1 Procedure. Piping should be cut with a pipe cutter designed specifically for composite pipe. Piping shall be cut square, i.e. perpendicular to the length. No other cutting methods shall be used and care must be taken to remove any excess material, flashing, or burrs.

2.8.2 Tools. Fitting manufacturer's recommended tool shall be used with the composite insert fitting systems. For specific procedures, follow the manufacturer's recommendations.

2.8.3 Transition Joints

2.8.3.1 Fittings. Transitions for composite tubing to metal piping or valves shall be made only with transition fittings intended for that purpose.

2.8.4 Joints. Joints shall not be allowed in piping installed in or under a concrete slab resting on grade unless for repair within a building

structure. All repair joints must be properly protected with a heat shrink sleeve. All slab penetrations shall be sleeved.

2.9 Pressure Relief Valves

2.9.1 PEX–AL–PEX Piping. PEX-AL-PEX piping used for temperature and/or pressure relief valve drain lines shall be graded to the outlet end and shall be supported at a maximum of 8 ft. 2 in. (2489 mm) interval horizontally. Vertical piping shall be supported at every floor. Vertical piping shall have a mid-story guide.

2.10 Installation

2.10.1 Bends. Piping shall be installed by bending the composite pipe by hand to a minimum radius of 5 times the nominal pipe diameter. External bend supports or sleeves are not required as the composite piping is rigid after bending.

2.10.2 Damage. Kinked, buckled, gouged, or other obvious damaged pipe shall not be used.

2.10.3 Finish Nipples. Finish nipples shall be connected to drop ear fittings to prevent rotation. Finish nipples shall not be PEX.

2.10.4 Hose Bibs. The piping directly connected to any hose bib shall be so anchored that the load on the hose bib will not strain the composite piping.

2.10.5 Heated Joints. An open flame shall not be applied to PEX-AL-PEX or PE-AL-PE piping when brazing, soldering, or welding joints.

2.10.6 Working Pressure and Temperature. Long term working pressures for the PEX-AL-PEX shall not exceed a maximum of 125 psi (860 kPa) and the long term working temperature shall not exceed 180°F (82°C). Long term working pressures for the PE-AL-PE shall not exceed a maximum of 100 psi (690 kPa) and the long term working temperature shall not exceed 180°F (82°C).

2.10.7 Exposure to Sunlight. Only UV stabilized composite piping can be subjected to direct sunlight after installation and can be installed on the surface of the building. Composite pipe contains an ultraviolet (UV) inhibitor to withstand limited exposure to UV light. Manufacturer's recommends placing the unused portion of a coil back in the product's box rather than storing in the sunlight while not in use.

2.10.8 Water Heater Connections. PEX-AL-PEX or PE-AL-PE piping shall not be installed within the first eighteen inches (18) (457 mm) of piping connected to a water heater. [UPC 604.13.2]

2.10.9 Water Hammer Arrestors. A composite hot water system will withstand repeated pressure surges, well in excess of its rated pressure. The Uniform Plumbing Code requires a means of attenuating water hammer. Consequently, water hammer arrestors shall be required when solenoid valves or other quick closing devices are used in the system. In designing for such situations, it is advisable to consult the pipe or fittings manufacturer for recommended surge pressure limits. Water hammer and surge pressure calculations are reviewed in Chapter 7, AWWA Manual M-11. [UPC 609.10]

2.11 Sizing

2.11.1 Method. Piping shall be sized in accordance with UPC Section 610.0.

When UPC Appendix A is applicable, use Table A2. Add equivalent lengths from Table A3 when determining developed length.

Maximum velocities through PEX-AL-PEX and PE-AL-PE copper alloy fittings shall be limited to eight (8) feet per second (fps) (2.4 mps) in cold water and five (5) feet per second (fps) (1.52 mps) in hot water. [UPC 610.0]

Table 2

Flow Rate U.S. GPM	1/2"		3/4"		1"	
	Head Loss Psi/c.ft.	Velocity Ft./s	Head Loss Psi/c.ft.	Velocity Ft./s	Head Loss Psi/c.ft.	Velocity Ft./s
0.1	0.02	0.2	0.002	0.07	0.001	0.04
0.2	0.1	0.4	0.01	0.1	0.002	0.08
0.3	0.2	0.6	0.02	0.2	0.005	0.1
0.4	0.3	0.7	0.03	0.3	0.009	0.2
0.5	0.5	0.9	0.04	0.3	0.01	0.2
0.6	0.6	1.1	0.05	0.4	0.02	0.3
0.7	0.9	1.3	0.07	0.5	0.02	0.3
0.8	1.1	1.5	0.09	0.5	0.03	0.3
0.9	1.4	1.7	0.1	0.6	0.04	04
1.0	1.6	1.8	0.1	0.7	0.05	0.4
2.0	5.9	3.7	0.5	1.3	0.2	0.9
3.0	12.5	5.5	1.0	2.0	0.4	1.3
4.0	21.3	7.3	1.8	2.6	0.6	1.7
5.0			2.7	3.3	0.9	2.1
6.0			3.8	4.0	1.3	2.5
7.0			5.0	4.6	1.7	3.0
8.0			6.4	5.3	2.2	3.4
9.0			8.0	5.9	2.7	3.8
10.0			9.7	6.6	3.3	4.2
11.0			11.6	7.2	3.9	4.6
12.0			13.6	7.9	4.6	5.0
13.0					5.3	5.5
14.0					6.1	5.9
15.0					6.9	6.3
16.0					7.8	6.3
17.0					8.7	6.7
18.0					9.7	7.1
19.0					10.7	7.6
20.0					11.8	8.0

Table 3
Developed Length

Sizes, Inches	Type of Fittings	Equivalent Length of Pipe (Feet)
1/2	Couplings	2
	Adapters	2
	Elbows	7.5
	Tees (Branch Flow)	8
	Tees (On the Run)	2.5
3/4	Couplings	2
	Adapters	2
	Elbows	8.5
	Tees (Branch Flow)	10.5
	Tees (On the Run)	2.5
1	Couplings	2
	Adapters	2
	Elbows	9
	Tees (Branch Flow)	11
	Tees (On the Run)	2.5