



CSI: 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

Product certification system:

The ICC-ES product certification system includes testing samples taken from the market or supplier's stock, or a combination of both, to verify compliance with applicable codes and standards. The system also involves factory inspections, and assessment and surveillance of the supplier's quality system.

Products: AQUAPEX® Pressure Rated Tubing, ProPEX® Ring, ProPEX® Fittings and Compression Type Fittings

Listee: Uponor, Inc.  
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Apple Valley, Minnesota 55124  
[www.uponor-usa.com](http://www.uponor-usa.com)

Compliance with the following codes:

2024, 2021, 2018, 2015, 2012 and 2009 *International Plumbing Code*® (IPC)  
2024, 2021, 2018, 2015, 2012 and 2009 *International Building Code*® (IBC)  
2024, 2021, 2018, 2015, 2012 and 2009 *International Residential Code*® (IRC)  
2024, 2021, 2018, 2015, 2012 and 2009 *International Mechanical Code*® (IMC)  
2024, 2021, 2018, 2015, 2012 and 1997 *National Standard Plumbing Code*® (NSPC)  
2024, 2021, 2018, 2015, 2012 and 2009 *Uniform Plumbing Code*® (UPC)\*  
2024, 2021, 2018, 2015, 2012 and 2009 *Uniform Mechanical Code*® (UMC)\*  
2022, 2019, 2016, 2013 and 2010 *California Plumbing Code* (CPC)  
2022, 2019, 2016, 2013 and 2010 *California Mechanical Code* (CMC)  
2023, 2020 and 2017 *City of Los Angeles Plumbing Code*  
2023, 2020 and 2017 *City of Los Angeles Mechanical Code*  
2023, 2021, 2017 and 2007 *Code of Massachusetts Regulation 248 CMR 10.00: Uniform State Plumbing Code*  
2023, 2021 and 2017 *Massachusetts State Building Code 780 CMR Ninth Edition: Chapter 28*

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Compliance with the following standards:

ASTM F876-2024b, Standard Specification for Crosslinked Polyethylene (PEX)  
ASTM F877-2024, Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems

ASTM F1960-2024, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing  
ASTM E84-2024, Standard Test Method for Surface Burning Characteristics of Building Materials  
ASTM E119-2024, Standard Test Methods for Fire Tests of Building Construction and Materials  
CSA B137.5-2023, Crosslinked polyethylene (PEX) tubing systems for pressure applications  
CAN-ULC S102.2 (Ed. 8), Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies  
CAN-ULC S101 (Ed. 5), Standard Method of Fire Endurance Tests of Building Construction and Materials  
NSF/ANSI 14-2023, Plastics Piping System Components and Related Materials  
NSF/ANSI/CAN 61-2024, Drinking Water System Components – Health Effects  
ICC-ES LC1004 (Approved November 2009, Editorially revised 2010), Listing Criteria for PP, PEX, PEX-AL-PEX, and PP-AL-PP Piping, Tube and Fittings Used in Radiant Heating and Water Supply Systems

#### Identification:

**Tubing:** AQUAPEX® Pressure Rated Tubing must be marked at minimum intervals of 5 feet (1524 mm) with the following: Uponor, Inc. company name, product name (AQUAPEX®), nominal tube size, material designation (PEX 5006, PEX 5106 or 5206, 5306), potable water designation (when applicable), standard dimension ratio (SDR9), temperature and pressure ratings, ASTM F 876/F877 designation, production code, the name of the inspection agency (NSF International) and either the ICC-ES evaluation report number (ESR-1099) or the ICC-ES PMG listing mark.

#### Fittings:

ProPEX® fittings are marked with the Uponor, Inc. trademark (see Figure 2), nominal size, potable water marking, production code, and “ASTM F1960.”

Brass compression-type fittings are marked with the Uponor, Inc. trademark, nominal size, “ASTM F877.” Potable water fittings are marked with a potable water marking.

Packaging for the fittings bears the Uponor company name, product name, model number, and the ICC-ES evaluation report number or the ICC-ES PMG listing mark.

#### Installation:

**General:** All systems must be installed 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.

Uponor ProPEX® fittings are a manufactured connection and therefore may be installed in concealed spaces without the need for access panels.

Horizontal support spacing may be extended to 8 feet when a continuous pipe support product, such as Uponor’s PEX-a Pipe Support, is used.

**Water Distribution:** Horizontally laid pipe must be secured in such a manner that temperature-induced expansion and contraction are accommodated. Pre-sleeved Uponor AQUAPEX® pipe in sizes ½” and ¾” may be embedded in concrete without insulation.

**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 ProPEX® fittings (EP or LF Brass), 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.

**Radiant Systems:** Installation and design of the heating system for each type of construction must be in accordance with this listing, the manufacturer’s published installation instructions, and IMC Chapter 12, IRC Chapter 21, or UMC Chapter 12, as applicable; and are subject to approval of the code official having jurisdiction. Active radiant loops must be joined by approved permanent-type

fittings or 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 or chilled 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 3½ inches (89 mm) thick. Under-floor insulation and reinforcing mesh are then placed on the slab. The tubing must be uncoiled and attached to the mesh using soft steel wire or plastic cable tie. 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 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 to be located between the joists beneath a wood framed floor, aluminum heat-emission plates can be screwed or nailed in place. The tubing is then pressed into the heat-emission plates. 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 to be installed in wood-framed ceilings, the aluminum heat-emission plates are screwed or nailed 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.

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 or Section 802.10.5 of the UMC, as applicable.

**Return-air Plenums:** Combustible piping and fittings may be installed in areas required to be of noncombustible construction. Uponor AQUAPEX® Pressure Rated Tubing, PEX-a Pipe Supports (uninsulated and insulated), ProPEX® Ring, and ProPEX® fittings were tested to ASTM E84 and/or ULC S102.2 and were found to have a flame-spread index (FS) rating of not more than 25 and a smoke-developed index (SD) rating of not more than 50 when tested. Compression Type Fittings are of non-combustible brass material and approved for ASTM E84 and/or ULC S102.2 applications. Uponor piping systems, with and without Uponor PEX-a Pipe Support products have been evaluated for installation in either horizontal or vertical orientations in return-air plenums. Ratings apply when tubing is field insulated with fiberglass or polyolefin insulation meeting the following requirements: Wall Thickness: min. ½"; Nominal Density: 4.0-4.5 pcf; Insulation Flamespread Rating: 20FS, 50 SD Max.; Recommended Insulation Product: Manson "Alley-K". Alternate Insulation for use with Uponor piping system shall be listed in compliance with these flamespread rating per either ASTM E84 and/or CAN/ULC S102.2.

When a maximum ¾-inch nominal diameter tubing is installed with a minimum of 18-inch spacing between adjacent runs of tubing, insulation is not required to meet the E84 flame-spread index (FS) rating of not more than 25 and a smoke-developed index (SD) rating of not more than 50. No spacing requirements between adjacent runs is needed when a maximum of 3-inch nominal diameter with a maximum ½-inch wall thickness pipe products and accessories is installed with a rated ½-inch pipe insulation.

**Fire Resistive Assembly Rating:** Combustible piping and fittings may be installed in areas required to be of noncombustible construction. Uponor AQUAPEX® Pressure Rated Tubing, PEX-a Pipe

Supports (uninsulated and insulated), ProPEX® Ring, ProPEX® Fitting and Compression Type Fittings were tested to ASTM E119 and/or ULC S101 per the following assemblies:

**Vertical Wall Assembly Listings:** Uponor AquaPEX® pipe (natural, red, blue); Pre-Insulated AquaPEX® pipe: 1/2 in. to 4 in. nominal diameter; maximum 4.85 lbs/ft. length of cavity. Uponor ProPEX® EP fittings: 3.33 lbs. maximum per cavity; ProPEX® CPVC adapters: maximum 5 fittings per cavity. Uponor PEX Rail / Polyethylene (post-consumer products) fasteners: 1.53 lbs. maximum per cavity.

**Horizontal Concrete Floor/Ceiling Assembly Listing:** Uponor AquaPEX® pipe (natural, red, blue): 1/2 in. to 2 in. nominal diameter, maximum 14 in.<sup>3</sup> of tubing per ft.<sup>3</sup> of concrete.

**Horizontal Wood Joist Floor/Ceiling Assembly Listing:** Uponor AquaPEX® pipe (natural, red, blue); Pre-Insulated AquaPEX® pipe: 1/2 in. to 2 in. nominal diameter, maximum 0.63 lb. of tube per ft. length of cavity, maximum plastic manifolds and fittings of 0.1 lbs per ft. length of cavity.

**Horizontal Hanbro Steel Joist with Concrete Assembly Listing:** Uponor AquaPEX® pipe (natural, red, blue); Pre-Insulated AquaPEX® pipe: 1/2 in. to 2 in. nominal diameter, maximum of 8.7 lbs per 100 sq. ft. of ceiling area, including engineered plastic, brass fittings and end plugs in the ceiling plenum.

Uponor AquaPEX® pipe (natural, red, blue): 1/2 in. to 5/8 in. nominal diameter, minimum 10 in. on center, maximum 6 lbs per 100 sq. ft. of floor area in the concrete floor.

#### Models:

**Tubing:** The AQUAPEX® tubing is produced from cross-linked polyethylene compound complying with ASTM F876 and CSA B137.5. AQUAPEX® (White) PEX 5106 SDR9 uncoated tubing is available in nominally 1/4- to 3-inch diameter (6 to 76 mm) sizes. AQUAPEX® Reclaimed Water (Purple) PEX 5006 is available in nominally 1/2 inch to 2 inch (13 to 51 mm) sizes. AQUAPEX® (Red or Blue) PEX 5306 SDR 9 coated tubing is available in nominally 1/2 to 1 – inch diameter (13 to 25 mm) sizes.

**Fittings:** Two types of fittings are recognized: ProPEX® EP (Engineered Polymer) or ProPEX® Brass fittings and brass compression-type fittings. The fittings are illustrated in Figure 1.

**ProPEX® fittings:** ProPEX® fittings are insert-type fittings made of either brass or 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 Inc. or Milwaukee Tool. 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, 1 1/4, 1 1/2, 2, 2 1/2, and 3 inches diameter (10, 13, 16, 19, 25, 32, 38, 51, 64 and 76 mm) sizes. The nominally 3/8, 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2, 2, 2 1/2, and 3 inches diameter (10, 13, 16, 19, 25, 32, 38, 51, 64 and 76 mm) ProPEX® fittings comply with ASTM F1960.

**Brass Compression-Type Fittings:** Uponor 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 F877 when used with the Uponor, Inc. tubing described in this listing.

**Rings: ProPEX® Rings comply with ASTM F1960 and** are available in nominally 3/8, 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2, 2, 2 1/2, and 3 inches diameter (10, 13, 16, 19, 25, 32, 38, 51, 64 and 76 mm) sizes.

#### Inspection:

**Water Distribution and Water Service Piping:** Installed tubing must be pressure-tested and inspected as required by Chapter 6 of the IPC or the requirements of the UPC, as applicable.

**Radiant Heat Piping:** The tubing must be pressure-tested for leaks before installation of covering, as noted in IRC, IMC, or the UMC as applicable. The leak test must be witnessed by the code official or the code official's designated representative.

## Conditions of Listing:

1. Details on the design and installation of the hydronic system must be submitted to the code official for approval.
2. The tubing must be maintained at the proposed operating pressure during placement of concrete cover for a hydronic piping system.
3. The tubing installation must be pressure-tested for leaks in the presence of the code official or the official's designated representative.
4. When installation is in fire-resistive assemblies, evidence of compliance with IBC (penetrations), must be provided to the code official for approval.
5. The potable water connections must be protected against backflow from the hydronic heating system.
6. The tubing must not be used as a source of electrical ground.
7. Minimum bending radius is six times the outside tube diameter of the PEX tube. The outside diameter is the nominal diameter plus  $\frac{1}{8}$  inch (3.2 mm).
8. The tubing is limited to applications using potable water, reclaimed water or suitable heating/cooling mixture as the transfer fluid.
9. The tubing and fittings must be protected from exposure to direct sunlight. Tubing and fittings must be protected from physical damage with an oversized 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.
10. Clearances from heat-producing equipment must be in accordance with the *International Fuel Gas Code*®, the IRC or the UMC, as applicable.
11. AQUAPEX® (white, red, blue and purple) tubing systems under a quality control program with inspections by ICC-ES.

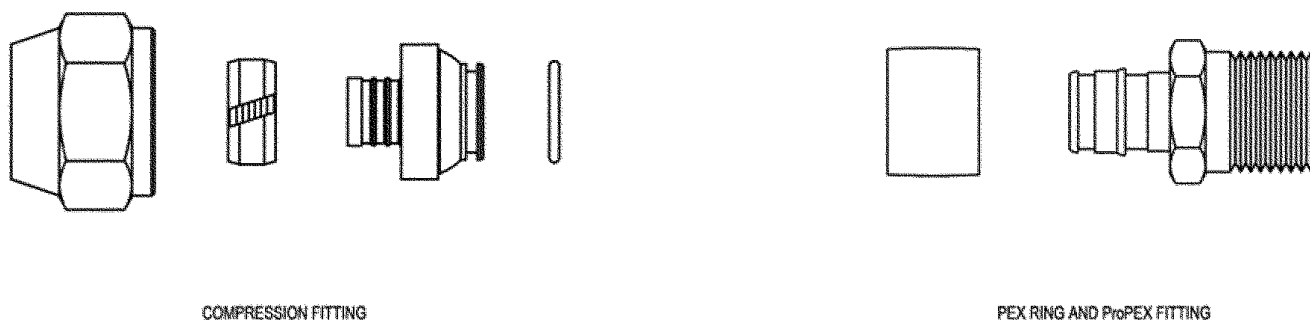


FIGURE 1—UPONOR FITTINGS

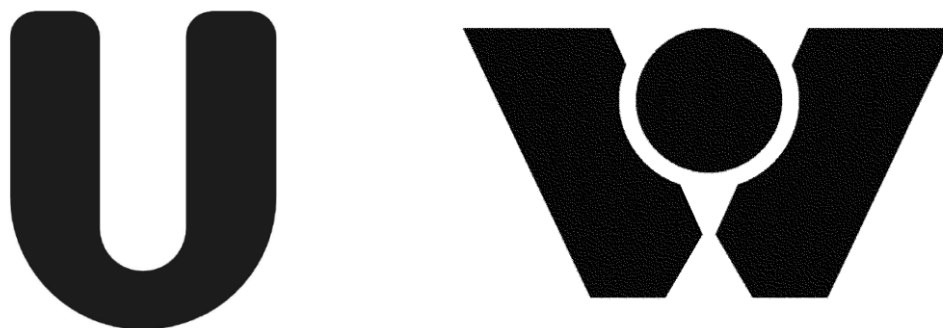


FIGURE 2—UPONOR, Inc. TRADEMARKS



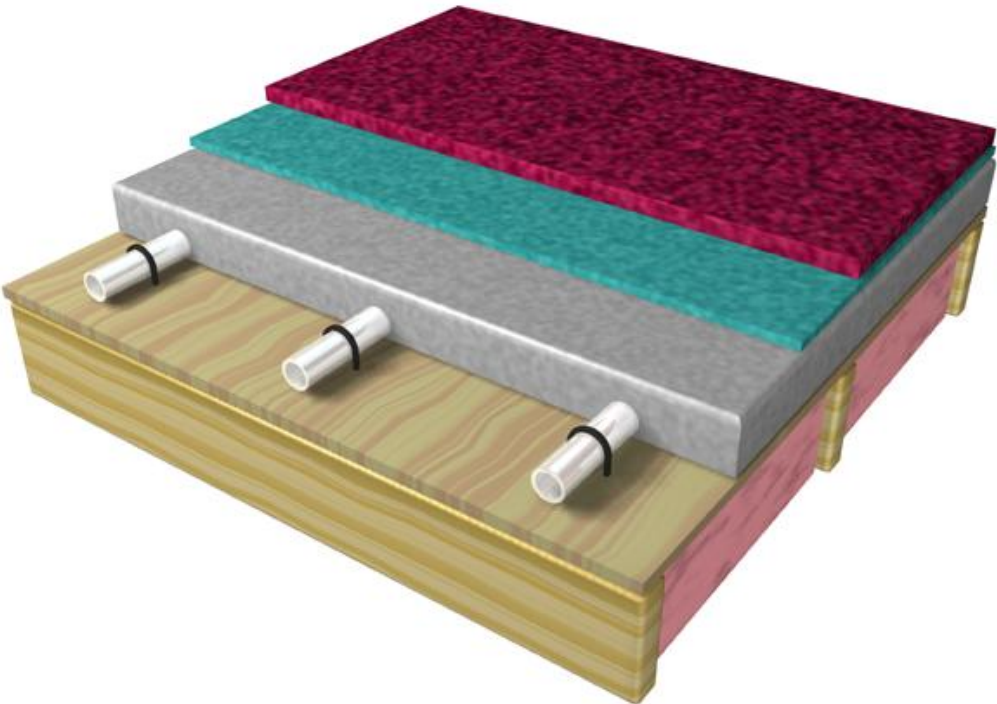


FIGURE 3

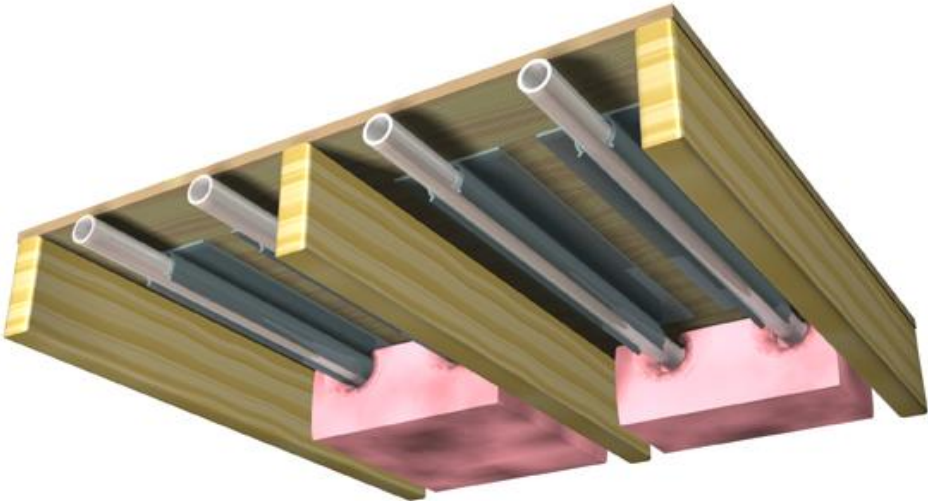


FIGURE 4

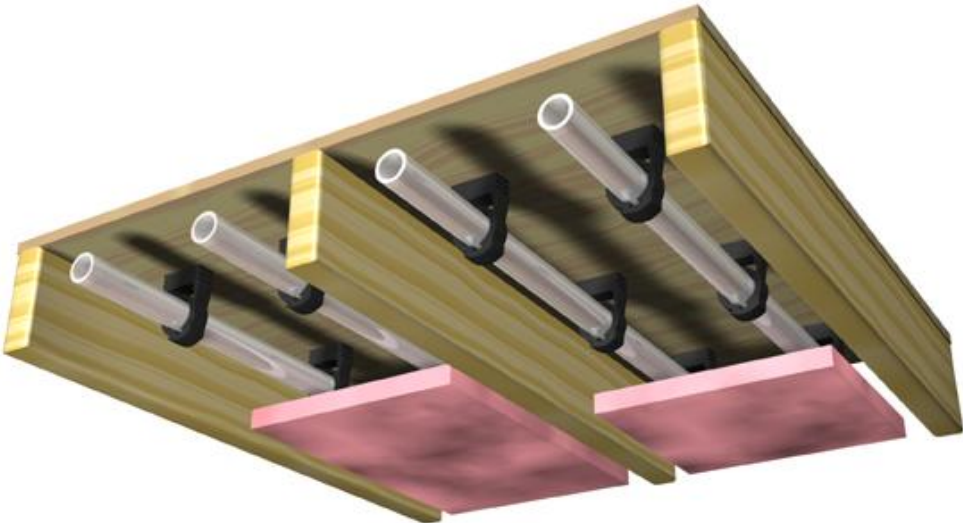


FIGURE 5

**For IPC Jurisdictions****MINIMUM SIZE OF WATER METERS, MAINS AND DISTRIBUTION PIPING  
BASED ON WATER SUPPLY FIXTURE UNIT VALUES (w.s.f.u.)**

METER AND SERVICE PIPE (inches)	DISTRIBUTION PIPE (inches)	MAXIMUM DEVELOPMENT LENGTH (feet)									
		40	60	80	100	150	200	250	300	400	500
Pressure Range 30 to 39 psi											
$\frac{3}{4}$	$\frac{1}{2}$ <sup>a</sup>	2.5	2	1.5	1.5	1	1	0.5	0.5	0	0
$\frac{3}{4}$	$\frac{3}{4}$	9.5	7.5	6	5.5	4	3.5	3	2.5	2	1.5
$\frac{3}{4}$	1	32	25	20	16.5	11	9	7.8	6.5	5.5	4.5
1	1	32	32	27	21	13.5	10	8	7	5.5	5
$\frac{3}{4}$	$1\frac{1}{4}$	32	32	32	32	30	24	20	17	13	10.5
1	$1\frac{1}{4}$	80	80	70	61	45	34	27	22	16	12
$1\frac{1}{2}$	$1\frac{1}{4}$	80	80	80	75	54	40	31	25	17.5	13
1	$1\frac{1}{2}$	87	87	87	87	84	73	64	56	45	36
$1\frac{1}{2}$	$1\frac{1}{2}$	151	151	151	151	117	92	79	69	54	43
2	$1\frac{1}{2}$	151	151	151	151	128	99	83	72	56	45
1	2	87	87	87	87	87	87	87	87	87	86
$1\frac{1}{2}$	2	275	275	275	275	258	223	196	174	144	122
2	2	365	365	365	365	318	266	229	201	160	134
2	$2\frac{1}{2}$	533	533	533	533	533	495	448	409	353	311

METER AND SERVICE PIPE (inches)	DISTRIBUTION PIPE (inches)	MAXIMUM DEVELOPMENT LENGTH (feet)									
Pressure Range 40 to 49 psi		40	60	80	100	150	200	250	300	400	500
$\frac{3}{4}$	$\frac{1}{2}$ <sup>a</sup>	3	2.5	2	1.5	1.5	1	1	0.5	0.5	0.5
$\frac{3}{4}$	$\frac{3}{4}$	9.5	9.5	8.5	7	5.5	4.5	3.5	3	2.5	2
$\frac{3}{4}$	1	32	32	32	26	18	13.5	10.5	9	7.5	6
1	1	32	32	32	32	21	15	11.5	9.5	7.5	6.5
$\frac{3}{4}$	$1\frac{1}{4}$	32	32	32	32	32	32	32	27	21	16.5
1	$1\frac{1}{4}$	80	80	80	80	65	52	42	35	26	20
$1\frac{1}{2}$	$1\frac{1}{4}$	80	80	80	80	75	59	48	39	28	21
1	$1\frac{1}{2}$	87	87	87	87	87	87	87	78	65	55
$1\frac{1}{2}$	$1\frac{1}{2}$	151	151	151	151	151	130	109	93	75	63
2	$1\frac{1}{2}$	151	151	151	151	151	139	115	98	77	64
1	2	87	87	87	87	87	87	87	87	87	87
$1\frac{1}{2}$	2	275	275	275	275	275	275	264	238	198	169
2	2	365	365	365	365	365	349	304	270	220	185
2	$2\frac{1}{2}$	533	533	533	533	533	533	533	528	456	403

(continued)

**MINIMUM SIZE OF WATER METERS, MAINS AND DISTRIBUTION PIPING  
BASED ON WATER SUPPLY FIXTURE UNIT VALUES (w.s.f.u.)**

METER AND SERVICE PIPE (inches)	DISTRIBUTION PIPE (inches)	MAXIMUM DEVELOPMENT LENGTH (feet)									
Pressure Range 50 to 60 psi		40	60	80	100	150	200	250	300	400	500
$\frac{3}{4}$	$\frac{1}{2}$ <sup>a</sup>	3	3	2.5	2	1.5	1	1	1	0.5	0.5
$\frac{3}{4}$	$\frac{3}{4}$	9.5	9.5	9.5	8.5	6.5	5	4.5	4	3	2.5
$\frac{3}{4}$	1	32	32	32	32	25	18.5	14.5	12	9.5	8
1	1	32	32	32	32	30	22	16.5	13	10	8
$\frac{3}{4}$	$1\frac{1}{4}$	32	32	32	32	32	32	32	32	29	24
1	$1\frac{1}{4}$	80	80	80	80	80	68	57	48	35	28
$1\frac{1}{2}$	$1\frac{1}{4}$	80	80	80	80	80	75	63	53	39	29
1	$1\frac{1}{2}$	87	87	87	87	87	87	87	87	82	70
$1\frac{1}{2}$	$1\frac{1}{2}$	151	151	151	151	151	151	139	120	94	79
2	$1\frac{1}{2}$	151	151	151	151	151	151	146	126	97	81
1	2	87	87	87	87	87	87	87	87	87	87
$1\frac{1}{2}$	2	275	275	275	275	275	275	275	275	247	213
2	2	365	365	365	365	365	365	365	329	272	232
2	$2\frac{1}{2}$	533	533	533	533	533	533	533	533	533	486

METER AND SERVICE PIPE (inches)	DISTRIBUTION PIPE (inches)	MAXIMUM DEVELOPMENT LENGTH (feet)									
Pressure Range Over 60		40	60	80	100	150	200	250	300	400	500
$\frac{3}{4}$	$\frac{1}{2}$ <sup>a</sup>	3	3	3	2.5	2	1.5	1.5	1	1	0.5
$\frac{3}{4}$	$\frac{3}{4}$	9.5	9.5	9.5	9.5	7.5	6	5	4.5	3.5	3
$\frac{3}{4}$	1	32	32	32	32	32	24	19.5	15.5	11.5	9.5
1	1	32	32	32	32	32	28	28	17	12	9.5
$\frac{3}{4}$	$1\frac{1}{4}$	32	32	32	32	32	32	32	32	32	30
1	$1\frac{1}{4}$	80	80	80	80	80	80	69	60	46	36
$1\frac{1}{2}$	$1\frac{1}{4}$	80	80	80	80	80	80	76	65	50	38
1	$1\frac{1}{2}$	87	87	87	87	87	87	87	87	87	84
$1\frac{1}{2}$	$1\frac{1}{2}$	151	151	151	151	151	151	151	144	114	94
2	$1\frac{1}{2}$	151	151	151	151	151	151	151	151	118	97
1	2	87	87	87	87	87	87	87	87	87	87
$1\frac{1}{2}$	2	275	275	275	275	275	275	275	275	275	252
2	2	365	368	368	368	368	368	368	368	318	273
2	$2\frac{1}{2}$	533	533	533	533	533	533	533	533	533	533

For SI: 1 inch = 25.4, 1 foot = 304.8 mm.

a. Minimum size for building supply is  $\frac{3}{4}$ -inch pipe.



**For UPC Jurisdictions****Fixture Unit Table for Determining Water Pipe and Meter Sizes**

Inch	mm
1/2	15
3/4	20
1	25
1-1/4	32
1-1/2	40
2	50
2-1/2	65

Meter and Street Service, Inches	Building Supply and Branches, Inches	Maximum Allowable Length in Feet (meters)														
		40 (12)	60 (18)	80 (24)	100 (30)	150 (46)	200 (61)	250 (76)	300 (91)	400 (122)	500 (152)	600 (183)	700 (213)	800 (244)	900 (274)	1000 (305)
Pressure Range – 30 to 45 psi (207 to 310 kPa)**																
3/4	1/2***	6	5	4	3	2	1	1	1	0	0	0	0	0	0	0
3/4	3/4	16	16	14	12	9	6	5	5	4	4	3	2	2	2	1
3/4	1	29	25	23	21	17	15	13	12	10	8	6	6	6	6	6
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
3/4	1-1/4	36	33	31	28	24	23	21	19	17	16	13	12	12	11	11
1	1-1/4	54	47	42	38	32	28	25	23	19	17	14	12	12	11	11
1-1/2	1-1/4	78	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1	1-1/2	85	84	79	65	56	48	43	38	32	28	26	22	21	20	20
1-1/2	1-1/2	150	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2	1-1/2	151	129	129	110	80	64	53	46	38	32	27	23	21	20	20
1	2	85	85	85	85	85	85	82	80	66	61	57	52	49	46	43
1-1/2	2	220	205	190	176	155	138	127	120	104	85	70	61	57	54	51
2	2	370	327	292	265	217	185	164	147	124	96	70	61	57	54	51
2	2-1/2	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133
Pressure Range – 46 to 60 psi (317 to 414 kPa)**																
3/4	1/2***	7	7	6	5	4	3	2	2	1	1	1	0	0	0	0
3/4	3/4	20	20	19	17	14	11	9	8	6	5	4	4	3	3	3
3/4	1	39	39	36	33	28	23	21	19	17	14	12	10	9	8	8
1	1	39	39	39	36	30	25	23	20	18	15	12	10	9	8	8
3/4	1-1/4	39	39	39	39	39	39	34	32	27	25	22	19	19	17	16
1	1-1/4	78	78	76	67	52	44	39	36	30	27	24	20	19	17	16
1-1/2	1-1/4	78	78	78	78	66	52	44	39	33	29	24	20	19	17	16
1	1-1/2	85	85	85	85	85	85	80	67	55	49	41	37	34	32	30
1-1/2	1-1/2	151	151	151	151	128	105	90	78	62	52	42	38	35	32	30
2	1-1/2	151	151	151	151	150	117	98	84	67	55	42	38	35	32	30
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	83	80
1-1/2	2	370	370	340	318	272	240	220	198	170	150	135	123	110	102	94
2	2	370	370	370	370	368	318	280	250	205	165	142	123	110	102	94
2	2-1/2	654	640	610	580	535	500	470	440	400	365	335	315	285	267	250
Pressure Range – Over 60 psi (414 kPa)**																
3/4	1/2***	7	7	7	6	5	4	3	3	2	1	1	1	1	1	0
3/4	3/4	20	20	20	20	17	13	11	10	8	7	6	6	5	4	4
3/4	1	39	39	39	39	35	30	27	24	21	17	14	13	12	12	11
1	1	39	39	39	39	38	32	29	26	22	18	14	13	12	12	11
3/4	1-1/4	39	39	39	39	39	39	39	39	34	28	26	25	23	22	21
1	1-1/4	78	78	78	78	74	62	53	47	39	31	26	25	23	22	21
1-1/2	1-1/4	78	78	78	78	78	74	65	54	43	34	26	25	23	22	21
1	1-1/2	85	85	85	85	85	85	85	85	81	64	51	48	46	43	40
1-1/2	1-1/2	151	151	151	151	151	151	130	113	88	73	51	51	46	43	40
2	1-1/2	151	151	151	151	151	151	142	122	98	82	64	51	46	43	40
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
1-1/2	2	370	370	370	370	360	335	305	282	244	212	187	172	153	141	129
2	2	370	370	370	370	370	370	370	340	288	245	204	172	153	141	129
2	2-1/2	654	654	654	654	654	650	610	570	510	460	430	404	380	356	329

\*\* Available static pressure after head loss.

\*\*\* Building supply, not less than three-quarter (3/4) inch (20 mm) nominal size.

**For IECC Section C404.4 Compliance**

**TABLE C403.11.3**  
**MINIMUM PIPE INSULATION THICKNESS (in inches)<sup>a, c</sup>**

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (inches)				
	Conductivity Btu • in./[h • ft <sup>2</sup> • °F) <sup>b</sup>	Mean Rating Temperature, °F	< 1	1 to < 1½	1½ to < 4	4 to < 8	≥ 8
> 350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 – 0.30	150	2.5	2.5	2.5	3.0	3.0
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20 – 0.26	50	0.5	1.0	1.0	1.0	1.5

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

a. For piping smaller than 1½ inches and located in partitions within conditioned spaces, reduction of these thicknesses by 1 inch shall be permitted (before thickness adjustment required in footnote b) but not to a thickness less than 1 inch.

b. For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:

$$T = r [(1 + t/r)^{K/k} - 1]$$

where:

$T$  = minimum insulation thickness,

$r$  = actual outside radius of pipe,

$t$  = insulation thickness listed in the table for applicable fluid temperature and pipe size,

$K$  = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu • in/h • ft<sup>2</sup> • °F) and

$k$  = the upper value of the conductivity range listed in the table for the applicable fluid temperature.

c. For direct-buried heating and hot water system piping, reduction of these thicknesses by 1½ inches (38 mm) shall be permitted (before thickness adjustment required in footnote b) but not to thicknesses less than 1 inch.

**For California Green Standards Building Section A5.207.6 Compliance**

**TABLE A5.207.6-A**  
**PIPE INSULATION THICKNESS**

FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)					
			Runouts up to 2	1 and less	1.25-2	2.50-4	5-6	8 and larger
			INSULATION THICKNESS REQUIRED (in inches)					
Space heating systems (steam, steam condensate and hot water)								
Above 350	0.32-0.34	250	1.5	2.5	2.5	3.0	3.5	3.5
251-350	0.29-0.31	200	1.5	2.0	2.5	2.5	3.5	3.5
201-250	0.27-0.30	150	1.0	1.5	1.5	2.0	2.0	3.5
141-200	0.25-0.29	125	0.5	1.5	1.5	1.5	1.5	1.5
105-140	0.24-0.28	100	0.5	1.0	1.0	1.0	1.5	1.5
Service water-heating systems (recirculating sections, all piping in electric trace tape systems and the first 8 feet of piping from the storage tank for nonrecirculating systems)								
Above 105	0.24-0.28	100	0.5	1.0	1.0	1.5	1.5	1.5
Space cooling systems (chilled water, refrigerant and brine)								
40-60	0.23-0.27	75	0.5	0.5	0.5	1.0	1.0	1.0
Below 40	0.23-0.27	75	1.0	1.0	1.5	1.5	1.5	1.5