uponor

PLUMBING SYSTEMS

Uponor Professional Plumbing Installation Guide

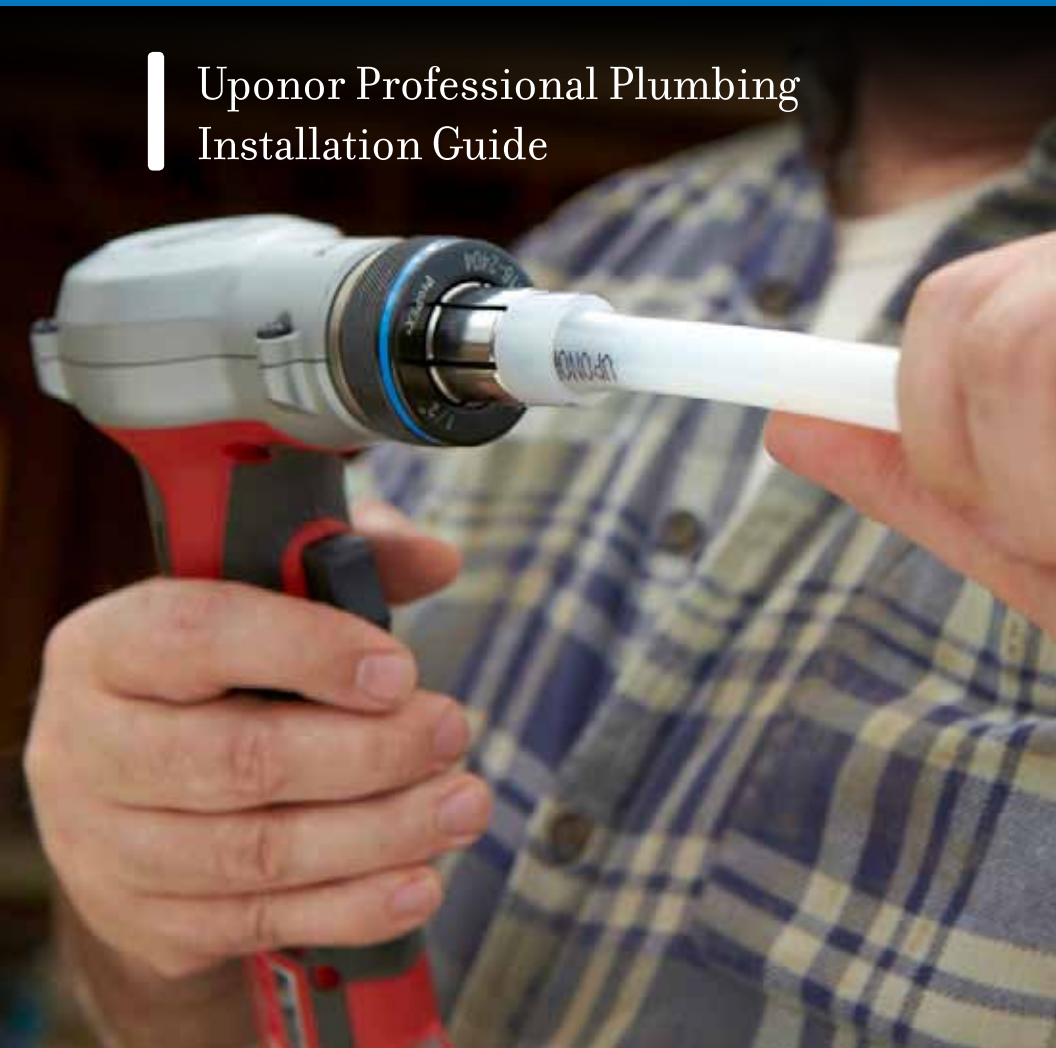


Table of Contents

Section 1: The Uponor Plumbing System 1
Applications 1
Ratings, Standards, Listings and Codes 2
Ratings 2
Recirculation Systems 2
Standards 3
Listings 4
Codes 4
Material Designation Code 4
Piping Identification 4
Print Stream Identification 5

Section 2: Working with Uponor PEX Piping 7
Uncoiling PEX Piping 7
Bending PEX Piping 7
Common Components 7
Bend Supports 7
Drop Ear Bend Supports 7
Reforming Kinked Piping 8
Thawing Frozen Piping 9
Storing and Handling Guidelines 9

Section 3: Making ProPEX® Connections 11
General ProPEX Connection Tips 11
Milwaukee® ProPEX Expansion Tools 12
With Auto Rotation (Standard Milwaukee Heads) 12
Without Auto Rotation (Standard Uponor Heads) 12
ProPEX 201 Corded Expander Tool 14
ProPEX Hand Expander Tool 16
Making ⅜" ProPEX Connections 18
Important Tips for a Proper ⅜" ProPEX Connection 18
Proper Expander Tool and Head Maintenance 18
Disconnecting a ProPEX Brass Fitting 19
Troubleshooting ProPEX Connections 21
Fittings Won't Seal 21
Expansion is Difficult 22
Expansion Head Slips Out of Piping When Making Expansions 22
ProPEX Ring Slides Down Piping During Expansion 22

More Than the Recommended Number of Expansions are Needed to Make a Connection . . . 22
Cold-weather Expansions . . . 22
Uponor ProPEX Lead-free (LF) Brass Fittings . . . 22
Fittings by Others . . . 23

Section 4: Water Service Phase . . . 25

Handling and Repairs . . . 25
Trench Bottom Preparation . . . 25
Good Soil Conditions . . . 25
Poor Soil Conditions . . . 25
Piping Embedment . . . 26
Installation . . . 26
Handling and Repairs . . . 26
Horizontal Directional Drilling (HDD) . . . 27
Trace Wire . . . 27
Joining Methods and Fittings . . . 28
Water Service Disinfection . . . 28

Section 5: Installation Methods . . . 29

Installing Uponor AquaPEX Piping During Ground Work . . . 29
Installing Uponor AquaPEX Piping in Frame Construction . . . 30
Piping Runs . . . 30
Recessed Light Fixtures . . . 30
Uponor Logic Plumbing System . . . 31
Piping Supports: General Guidelines . . . 32
Piping Supports: Horizontal Runs . . . 32
Piping Supports: Vertical Runs . . . 33
Uponor PEX-a Pipe Support . . . 33
Important Tips . . . 33
ASTM E84 Requirements for PEX-a Pipe Support . . . 34
Strapping . . . 36
Bundling . . . 36
Controlling Expansion and Contraction . . . 36
Anchor Points . . . 37
Expansion and Contraction: Cold-water Risers . . . 37
Expansion and Contraction: Hot-water Risers . . . 37
Fire-resistant Standards . . . 39
Firestop Listings . . . 39

Surface Burning Characteristics
(Return-air Plenums ASTM E84 and CAN/ULC-S102.2) 40
United States – ASTM E84 41
Canada – CAN/ULC-S102.2 42
ProPEX Out-of-the-Wall Support System 44
Drop Ear LF Brass Elbows 45
Metal Straight-through Supports 45
Grommets 45
Steel-plate Protectors 45
Water Hammer Arrestors 45
Shower Valve Connections 46
Hose Bibs 46
ProPEX Copper Tub Ells 46
ProPEX Copper Stub Ells 46
Washing Machine Outlet Box 47
Ice Maker Outlet Box 47
Straight and Angle Stop Valves 48
EP Straight and Angle Stop Valves 48
Chrome-plated Brass Compression Stop Valves (Straight and Angle) 48
Directions for Use 48
Uponor AquaPEX Risers 49
Lav Risers 49
Closet Risers 49
Termiticide or Pesticide Treatment 50

Section 6: Pressure Testing 51

Residential Applications 51
Commercial Applications 51
Importance of Conditioning PEX-a Pipe 51
Conditioning and Sustained Pressure Testing Procedure 52
Water System Disinfection 52

This installation guide is published for building officials, plumbing professionals and contractors interested in Uponor professional plumbing systems. This manual describes general installation recommendations that use Uponor AquaPEX®[1] piping products. Local code requirements should be followed.

Note: The Uponor plumbing system can include Uponor AquaPEX White, Blue or Red piping as well as AquaPEX Reclaimed Water (purple) piping, Pre-sleeved AquaPEX piping and Pre-insulated AquaPEX piping. For readability, this document will refer to Uponor AquaPEX piping when information applies to any or all forms of Uponor AquaPEX piping.

Uponor has used reasonable efforts in collecting, preparing and providing quality information and material in this manual. However, system enhancements may result in modification of features or specifications without notice. For the most current technical information, go to the Uponor website at www.uponorpro.com.

Uponor is not liable for installation practices that deviate from this manual or are not acceptable practices within the mechanical trades. Refer to the Uponor Residential Fire Safety System Installation Guide to install Uponor AquaPEX piping in Uponor Fire Safety Systems.

Please direct any questions regarding the suitability of an application or a specific design to your local Uponor representative. For the name of your local representative, please call toll free 800.321.4739.

[1]Uponor AquaPEX® is a registered trademark of Uponor, Inc. and Uponor Ltd. ProPEX® is a registered trademark of Uponor, Inc. ProPEX™ is a trademark of Uponor Ltd.

Section 1
The Uponor Plumbing System

The Uponor Plumbing System consists of the following Uponor PEX piping and Uponor plumbing components:

- Uponor AquaPEX® Red, White and Blue Piping
- Uponor AquaPEX Reclaimed Water (Purple) Piping
- Pre-insulated Uponor AquaPEX Piping
- Pre-sleeved Uponor AquaPEX Piping
- Uponor PEX-a Pipe Support
- ProPEX® Engineered Polymer (EP) Fittings
- ProPEX Lead-free* (LF) Brass Fittings
- ProPEX EP Multiport Tees
- Manifolds
- Supports
- Finishes

PEX is an acronym for crosslinked polyethylene. The "PE" refers to the raw material used to make PEX (polyethylene), and the "X" refers to crosslinking the polyethylene across its molecular chains. The molecular chains are linked into a three-dimensional network that makes PEX remarkably durable within a wide range of temperatures and pressures.

Uponor manufactures PEX piping using the Engel method, a hot-crosslinking process. The actual crosslinking takes place during the extrusion process when the base polyethylene is above its crystal-melting temperatures. Classified within the industry as PEX-a piping, Engel-method PEX is superior to other types of PEX — resulting in consistent, uniform and evenly crosslinked PEX. Uponor AquaPEX also demonstrates a great resistance to chemical-dissolving agents. This unique structure is stable and inert, and it is unaffected by chemicals commonly found in plumbing and heating systems.

*Per NSF Annex G, lead-free products contain not more than 0.25% weighted average lead content on wetted surfaces.

Applications

Uponor AquaPEX piping is versatile and has a broad range of uses:

- Potable Hot- and Cold-water Distribution
- Water Service
- Hydronic Radiant Heating and Cooling (radiant floor, ceiling, baseboard and radiator connections)
- Snow and Ice Melting Systems
- Turf Conditioning Systems
- Fire Protection Systems
- Water Reclamation Systems

Ratings, Standards, Listings and Codes

Our extensive listings and history of system testing ensures you that Uponor AquaPEX piping is suitable for use in many types of residential and commercial structures, including, but not limited to the following:

- Homes
- Townhomes
- Schools
- Daycare Centers
- Theatres
- Churches
- Nursing Homes
- Hotels
- Restaurant
- Gymnasiums
- Hospitals
- Apartments

Ratings

Uponor AquaPEX piping has standard grade hydrostatic stress and pressure ratings in accordance with all four temperatures and pressures listed in Table 1 of ASTM F876. Uponor AquaPEX piping is tested in accordance with Plastics Pipe Institute (PPI) TR-3 and is listed in PPI TR-4. The Standard Grade hydrostatic ratings are:

- 200°F/93.3°C at 80 psi
- 180°F/82.2°C at 100 psi
- 73.4°F/23°C at 160 psi

The Hydrostatic Stress Board of PPI issues these pressure and temperature ratings. Uponor AquaPEX White piping has an additional rating of 120°F/48.9°C at 130 psi in accordance with UL1821 for ½" through 2" piping used in multipurpose fire protection systems.

Recirculation Systems

Based on our extensive history of use and testing, Uponor provides the following guidelines for using Uponor PEX piping and corresponding fitting systems in domestic hot-water recirculating systems.

- Uponor AquaPEX is suitable for use in:
  - Recirculation systems operating up to 140ºF (60ºC)
  - Timed, sensor-activated or self-activated recirculation systems operating at temperatures not exceeding 140ºF (60ºC)
  - Continuous recirculation systems operating at temperatures not exceeding 140ºF (60ºC)

    Note: Uponor does not promote the use of continuous recirculation due to excessive energy waste.

Standards

Uponor AquaPEX piping, ProPEX EP fittings, ProPEX LF brass fittings, EP multiport products, EP valves and copper valved manifolds are manufactured and tested to the standards listed in **Table 1-1**.

Standard	Specification
ASTM F876	Standard Specification for Cross-linked Polyethylene (PEX) Piping
ASTM F877	Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
ASTM F1960	Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Piping
ASTM F2023	Standard Test Method for Evaluating the Oxidative Resistance of Cross-linked Polyethylene (PEX) Piping and Systems to Hot Chlorinated Water
ASTM F2657	Standard Test Method for Outdoor Weathering Exposure of Cross-linked Polyethylene (PEX) Piping
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Firestop Systems
CAN/CSA B137.5	Crosslinked Polyethylene (PEX) Piping Systems for Pressure Applications
CAN/CSA B214	Installation Code for Hydronic Heating Systems
CAN/ULC-S102.2	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies
CAN/ULC-S101	Standard Methods of Fire Endurance Tests of Building; Construction and Materials
CAN/ULC-S115	Standard Method of Fire Tests of Firestop Systems
CAN/ULC/ORD-C199P	Combustible Piping for Sprinkler Systems
ANSI/NSF Standard 14	Plastics Piping System Components and Related Materials
ANSI/NSF Standard 61	Drinking Water System Components — Health Effects
AWWA C904	Cross-Linked Polyethylene (PEX) Pressure Pipe, ½" (12mm) through 3" (76mm) for Water Service
ANSI/UL 263	Standard for Safety for Fire Tests of Building Construction and Materials
UL 1821	Standard for Safety for Thermoplastic Sprinkler Pipe and Fittings for Fire Protection Service (NFPA 13D applications only)

Table 1-1: Standards

Listings

- cNSFus-fs
- cNSFus-rfh
- cNSFus-pw
- cQAIus
- UL
- CSA
- WH
- ETL
- PPI-TR-4
- ICC-ES
- IAPMO
- BMEC
- CCMC

Note: Obtain listings at:
www.qai.org
www.ul.com
www.nsf.org

Codes

- ICC
- IPC
- IMC
- IRC
- UPC
- UMC
- NSPC
- HUD
- UFGS
- NPC of Canada
- NBC of Canada

Note: Check with your local Uponor representative for code compliance in your area.

Material Designation Code

Uponor AquaPEX White piping has a material designation code of PEX 5106. Uponor AquaPEX Red and Blue piping has a material designation code of PEX 5206. Material designation codes are tested in accordance with and defined by ASTM F876. Each digit in the code is further explained below.

First Digit

The first digit in the material designation code is for chlorine resistance tested in accordance with ASTM F2023. A digit 5 indicates the PEX piping has been tested and meets the requirements for minimum chlorine resistance at end-use conditions 100% of the time at 140°F (60°C). A 5 digit is the highest classification for chlorine resistance.

Second Digit

The second digit is for demonstrated UV resistance of PEX material when tested in accordance with ASTM F2657. A digit of 1 indicates the PEX piping has a UV resistance of 30 days; a digit of 2 has a UV resistance of 90 days.

Third and Fourth Digits

The third and fourth digits are for hydrostatic design stress (HDS) as tested in accordance with the Plastics Pipe Institute (PPI) Technical Report TR-4. A digit of 06 indicates the PEX piping has an HDS of 73°F (23°C) at 630 psi.

Piping Identification

The labeling (print line) on Uponor AquaPEX piping provides several identifications.
For example, Uponor AquaPEX 2" piping reads as follows:

UPONOR AquaPEX® PEX 5106
2 IN UB04130415 SDR9 NSF B137.5
POTABLE/cNSFus-pw c UL us

U.P.Code CCMC 13529-R (ASTM F876/F877/F2023) (ASTM F1960/F2080) cWHIus FS25/SD50 WITH 1/2IN FG INSULATION ICC ESR-1099 ANSI/AWWA C904

cQAIus P321 ULC/ORD-C199P IAPMO UES 0253 ASTM E84 and CAN/ULC-S102.2 HUD MR1269d/160PSI 73.4°F / 100PSI 180°F / 80PSI 200°F

UPONOR-PEX-a TUBING *UB04130415 **xxxxx

Print Stream Identification

Print Stream on Piping	Explanation
UPONOR AquaPEX®	Brand Name
PEX 5106	ASTM F2023 and ASTM F2657 I/A/W ASTM F876
2 IN	Pipe Size (i.e. 2")
UB04130415	Manufacturing Code to Audit Material Source (USA, Material Type, Extruder No., Year, Month, Day)
SDR9	Standard Dimension Ratio of 9
B137.5 POTABLE	Potable Water Listing by CSA
cNSFus-pw	Potable Water Listing by NSF
	Listings by UL
U.P.Code	Uniform Plumbing Code Marking
CCMC 13529-R	Canadian Construction Materials Centre Evaluation Report 13529-R
ASTM F876/F877/F2023	ASTM Pipe Standards
ASTM F1960/F2080/F1807/F2098	ASTM Fitting Standards
cWHIus FS25/SD50	Warnock Hersey Listing for 25/50 FS/SD Plenum Rating
ICC ESR-1099	ICC Evaluation Services Report ESR-1099
ANSI/AWWA C904	American Water Works Association Standard for Water Service
cQAIus P321	QAI Listing for 25/50 FS/SD Plenum Rating
130PSI 120°F UL 1821	UL Standard for NFPA 13D Fire Protection Service
ULC/ORD-C199P	ULC Standard for Combustible Sprinkler Piping
IAPMO UES 0253	IAPMO Evaluation Services Report ER-0253
ASTM E84	Standard Test Method for Surface Burning Characteristics -U.S.
CAN/ULC-S102.2	Standard Test Method for Surface Burning Characteristics -CA
HUD MR1269d	HUD Material Release Report 1269d
160PSI 73.4°F / 100PSI 180°F / 80PSI 200°F	Hydrostatic Ratings from PPI I/A/W ASTM F876
UPONOR-PEX-a TUBING	Type of Crosslinking (PEX-a)
UB04130415	Manufacturing Code to Audit Material Source (USA, Material Type, Extruder No., Year, Month, Day)
xxxxxx	Footage Marker in Increments of 5-feet

Table 1-2: Print Stream Identification

Section 2
Working with Uponor PEX Piping

Uncoiling PEX Piping

An Uponor uncoiler is recommended for convenient uncoiling when the piping is not in the "Punch n' Pull" packaging.

Bending PEX Piping

The minimum bend radius of Uponor AquaPEX piping is six (6) times the outside diameter. Bend supports are available for ⅜", ½", ¾" and 1" piping and may be used to facilitate 90-degree rigid bends. Large-diameter PVC conduit can be used to facilitate 90-degree bends in larger-diameter Uponor AquaPEX piping.

To alleviate stress on ProPEX connections and fittings, follow minimum distance requirements from penetrations and supports.

Note: When minimum distance cannot be achieved with a bend support, use a ProPEX Elbow.

Common Components

Bend Supports

- To alleviate stress on ProPEX connections and fittings, install bend supports when minimum distances per **Table 2-1 on page 8** cannot be met.
- When minimum distances cannot be achieved with a bend support, use a ProPEX Elbow.
- Use Uponor bend supports to hold the piping in a 90-degree bend. It is common to use bend supports when exiting a slab to control the direction of the piping out of the slab.
- Snap-on bend supports are available in metal and plastic for ⅜", ½" and ¾" PEX.
- PVC conduit supports are available for ⅜" to 1" PEX piping as an alternative to the snap-on bend supports.

Drop Ear Bend Supports

- Drop Ear Bend Supports provide a rigid, connection-free, 90-degree exit from a standard 2" x 4" (or larger) stud wall or floor.
- Nail the flange to the front edge of the stud for support. A horizontal brace is required to position the Drop Ear Bend Support between two studs.
- Drop Ear Bend Supports are available in metal and plastic for ⅜" and ½" PEX.

Figure 2-1: Support for 90-degree Bend

Figure 2-2: Drop Ear Bend Supports

	Minimum Distances with Bend Support			Minimum Distances without Bend Support	
	A	B	C	D	E
½"	R 2.5	5"	5"	10"	6"
¾"	R 3.8	8"	8"	16"	12"
1"	n/a	n/a	n/a	22"	18"

Table 2-1: Minimum Distances with and without Bend Support

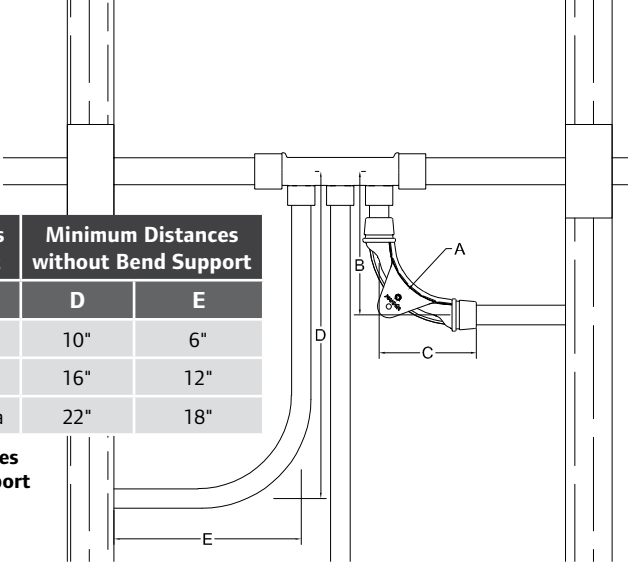


Figure 2-3: Reforming Kinked Piping

Reforming Kinked Piping

If the piping is kinked and hinders flow, repairs can be made easily, see **Figure 2-3**.

1. Make sure the system is not pressurized.
2. Straighten the kinked portion of the piping.
3. Heat the kinked area to approximately 265ºF/129.4ºC with an electric heat gun (approximately 450 watts of power). Apply the heat evenly until the piping returns to its original size and shape. **Do not use an open flame.**
4. Let the repaired Uponor AquaPEX piping cool undisturbed to room temperature. When the piping returns to its opaque appearance, the repair is complete.

Caution: Temperature of the piping surface must not exceed 338ºF/170ºC. Do not apply direct flame to Uponor AquaPEX piping. Uponor AquaPEX piping repaired according to these recommendations will return to its original shape and strength. If the piping is sliced, punctured or otherwise damaged beyond the capacity of the crosslinked memory, install a ProPEX coupling. Uponor AquaPEX piping cannot be welded or repaired with adhesives.

Note: You may temporarily affix adhesive tape to PEX piping or EP fittings during installation. However, to protect the integrity of the system, the tape should not be permanent. Remove the tape and residual adhesive after completing the installation.

Thawing Frozen Piping

Uponor AquaPEX can withstand extreme freeze-thaw cycles better than other piping materials. The crosslinking of the piping allows it to expand and absorb much of the expansion energy from the freezing process. No piping product is freeze-proof, but Uponor AquaPEX piping is extremely resistant to freeze damage.

If freezing occurs, the contractor should advise the end user to correct the lack of insulation or heat to eliminate the problem from reoccurring. Should Uponor AquaPEX piping experience an ice blockage, thaw the piping using one or more of these methods:

- Pour hot water over the affected portion of piping.
- Wrap hot towels around the affected portion of piping.
- Place a small portable heating unit in the area to heat the space and thaw the ice blockage from the piping.
- Slowly heat the affected area with a hair dryer. Rub a hand over the area while heating to ensure the piping does not get too hot.

Figure 2-4: CPVC vs. PEX Freeze Test

Storing and Handling Guidelines

Although not comprehensive, the following highlights the most common guidelines when storing and handling Uponor AquaPEX and ProPEX EP fittings:

- Do not store outdoors.
- Keep in the original packaging until time of installation.
- Install Uponor systems according to the installation instructions. Failure to follow the instructions and installation guidelines in this manual can compromise the performance of the system.
- Do not use where temperatures and pressures exceed ratings.
- Do not use or store Uponor AquaPEX White pipe or EP fittings where they will be exposed to direct sunlight for more than 30 days.
- Do not use or store Uponor AquaPEX Red or Blue pipe where it will be exposed to direct sunlight for more than 60 days.

Continued on next page

Storing and Handling Guidelines cont.

- Do not weld, glue or use adhesives or adhesive tape.[1]
- Do not apply open flame.
- Do not install within six inches of any gas appliance vents. One exception is double-wall B-vents, which have a minimum clearance of one inch.
- Do not install within 12 inches (over or under) of any recessed light fixture unless protected with suitable insulation.
- Do not install directly below fluorescent light fixtures, unless protected with suitable insulation.
- Do not use to convey natural gas.
- Do not solder, braze, weld, or fusion-weld within 18 inches of any Uponor AquaPEX pipe or EP fitting in the same water line. Sweat connections must be made prior to making the ProPEX connection.
- Do not install Uponor AquaPEX pipe between the tub/shower valve and tub spout.
- Do not use Uponor AquaPEX pipe for an electrical ground.
- Do not spray on or allow organic chemicals, strong acids or strong bases to come into contact with Uponor AquaPEX pipe or EP fittings.
- Do not use petroleum or solvent-based paints, greases or sealants on Uponor AquaPEX pipe or EP fittings.
- Use only approved and appropriate firestop materials with Uponor AquaPEX pipe.
- Do not allow rodents, insects or other pests to come into contact with Uponor AquaPEX pipe or EP fittings.
- Do not subject to blunt impact.
- During remodeling or ceiling repair, take appropriate precautions to protect from damage.
- Do not install in soil environments contaminated with solvents, fuels, organic compounds, pesticides or other detrimental materials that may cause permeation, corrosion, degradation or structural failure. Where such conditions are suspected, perform a chemical analysis of the soil or groundwater to ascertain the acceptability for the specific installation. Check local codes for additional requirements.
- When using urethane foam insulation/sealant, ensure that you cover the EP fittings with a protective (polyethylene, foil, etc.) sleeve to prevent direct contact.
- Do not expose EP fittings to excessive bending loads (greater than 100 lbs.)

[1] You may temporarily affix adhesive tape to Uponor AquaPEX tubing during installation. However, to protect the integrity of the system, the tape should not be permanent. Remove the tape and residual adhesive after completing the installation.

Section 3
Making ProPEX Connections

Uponor ProPEX ASTM F1960 and CAN/CSA B137.5 cold-expansion fittings make solid, permanent, manufactured connections without the need for torches, glues, solder, flux or gauges. The unique shape memory of Uponor PEX-a piping forms a tight seal around the fitting, creating a strong, reliable connection.

This document shows how to make proper ProPEX connections using one of the following tools.

- Milwaukee® M12™ or M18™ Expansion Tools
- ProPEX 201 Corded Expander Tool
- ProPEX Hand Expander Tool

General ProPEX Connection Tips

- If the fitting does not slide into the piping all the way to the shoulder, immediately remove it from the piping and expand the piping one final time.

  Note: To avoid over-expanding the piping, do not hold the piping in the expanded position.

- The number of expansions in **Table 3-1** is the recommended number of expansions. Experience, technique and weather conditions influence the actual number of expansions. Fewer expansions may be necessary under certain conditions. The correct number of expansions is the amount necessary for the piping and the shoulder of the fitting to fit snugly together.
- Ensure the ProPEX Ring rests snugly against the fitting shoulder. If there is more than 1/16" (1mm) between the ring and the shoulder of the fitting, square cut the piping 2" to 3" (50.8 to 76.2mm) away from the fitting, and make another connection using a new ProPEX Ring and fitting (Uponor requires 3" (76.2mm) minimum for 1¼" to 2" pipe). Brass ProPEX fittings can be disconnected and reused. EP fittings must be discarded. Be sure to follow the recommended minimum distance between ProPEX fittings chart in **Table 3-2**.

Piping Size	Milwaukee ProPEX Tool		Uponor ProPEX Tool		
	M12	M18	Manual	100 & 150	201
3/8"	8	9	5	7	—
1/2"	5	6	4	4	—
3/4"	9	8	9	9H	—
1"	13	5	14	7H	—
1 1/4"	—	7	—	7H	—
1 1/2"	—	6	—	8H	—
2"	—	—	—	—	5H

Table 3-1: Recommended Number of Expansions for 3/8" to 2" Piping at 73.4ºF (23ºC)

Fitting Size	Cut Length of Pipe
1/2"	2 1/2"
3/4"	3 1/2"
1"	4 1/2"
1 1/4"	5 1/2"
1 1/2"	6 1/2"
2"	7 1/2"

Table 3-2: Minimum Distance Between ProPEX Fittings

Note: "H" in the table refers to Uponor H-series expander heads.

Making ProPEX Connections with Milwaukee ProPEX Expansion Tools

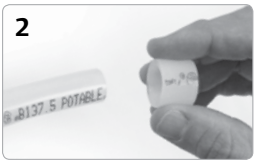
Note: All standard Uponor Expander Heads are compatible with the M12 and M18 tools. Uponor expander heads will not auto-rotate on the Milwaukee tools (only Milwaukee expansion heads will auto-rotate on the M12 and M18). H-heads are not compatible with Milwaukee tools and Milwaukee heads are not compatible with Uponor tools. Milwaukee heads are easily distinguished by color coding and the Milwaukee logo.

Important! Making expansions are slightly different when using a tool that features auto rotation. When making a ProPEX connection, be sure to follow the guidelines for the tool you are using in your application.

1. Square cut the PEX piping perpendicular to the length of the piping. Remove all excess material or burrs that might affect the fitting connection.

2. Slide the ProPEX Ring over the end of the piping until it reaches the stop edge. If using a ProPEX Ring without a stop edge, extend the ring over the end of the piping no more than 1⁄16" (1mm).

   Important! If making a 3⁄8" ProPEX Connection, you must first expand each side of the ring before placing it on the piping. Refer to **Making 3⁄8" ProPEX Connections on page 18** for further information.



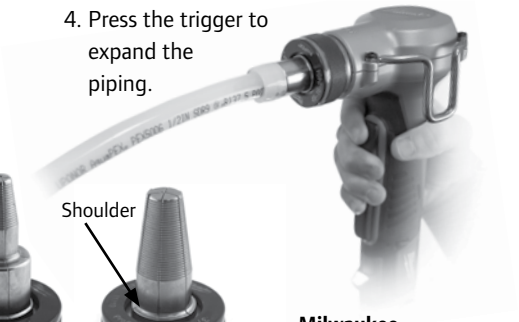
With Auto Rotation (Standard Milwaukee Heads)

3. Milwaukee ProPEX Expansion Tools come with built-in auto rotation. If using a Milwaukee expansion head, simply hold the piping and tool in place while holding the trigger to expand the piping. The head will automatically rotate to ensure the piping is evenly expanded. Continue expanding until the piping and ring are snug against the shoulder on the expander head. See **Table 3-1 on page 11** for the recommended number of expansions for each piping size.

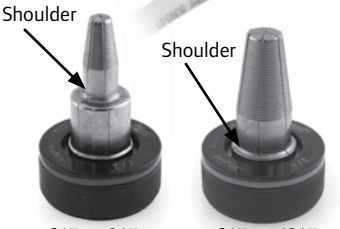
   Important! Do not force the pipe onto the expander head. Ensure that rotation of expander head is happening during each expansion.

Without Auto Rotation (Standard Uponor Heads)

4. Press the trigger to expand the piping.



Milwaukee M12 ProPEX Expansion Tool



3⁄8" to 1⁄2" **3⁄4" to 1 1⁄2"**
Milwaukee Expansion Heads

ProPEX EP Coupling

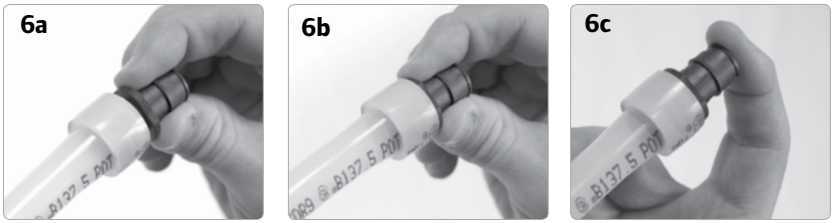
ProPEX EP Tee

5. Release the trigger, remove the head from the piping, rotate it ⅛ turn and slide the head back into the piping. Continue expanding and rotating until the piping and ring are snug against the shoulder on the expander head. See **Table 3-1 on page 11** for the recommended number of expansions.

   Important! Rotating the tool between expansions will provide smooth, even expansion of the piping. Failure to rotate the tool will cause deep grooves in the piping which can result in potential leak paths.

6. After the final expansion, immediately remove the tool and insert the fitting. Ensure the piping and ring seat against the shoulder of the fitting.

   Important! Only perform the neccessary number of expansions. Do not over expand the pipe. You should feel some resistance as the fitting goes into the piping. If you do not feel any resistance, the piping may be over expanded and will require additional time to shrink over the fitting.

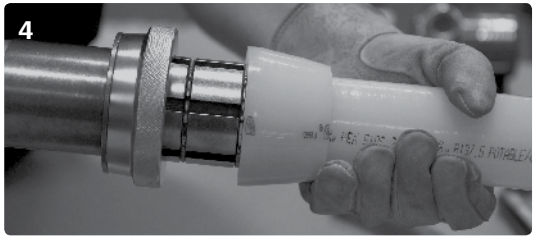


ProPEX Fitting Inserted into ½" Uponor PEX Piping. Make the Fitting with a Milwaukee M12 ProPEX Expansion Tool.

ProPEX Fitting Inserted into 1" Uponor PEX Piping. Make the Fitting with a Milwaukee M18 ProPEX Expansion Tool.

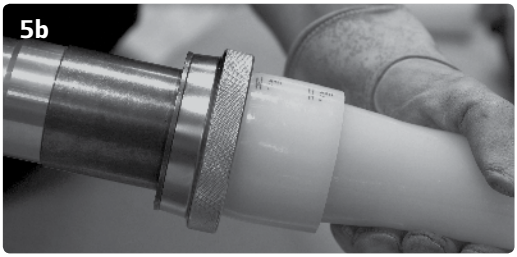
Making 2" ProPEX Connections with the ProPEX 201 Corded Expander Tool

1. Square cut the PEX piping perpendicular to the length of the piping. Remove all excess material or burrs that might affect the fitting connection.
2. Slide the ProPEX Ring over the end of the piping until it reaches the stop edge. If using a ProPEX Ring without a stop edge, extend the ring over the end of the piping no more than 1⁄16" (1mm).
3. Slide the expander head into the piping until it stops. Full expansions are necessary to make a proper connection.



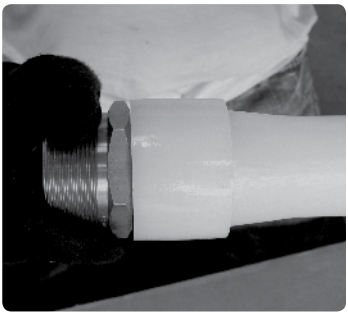
4. Press the trigger to expand the piping.
5. Release the trigger, remove the head from the piping, rotate it ⅛ turn and slide the head back into the piping. Continue expanding and rotating until the piping and ring are snug against the shoulder on the expander head. See **Table 3-1 on page 11** for the recommended number of expansions.

   Important! Rotating the tool between expansions will provide smooth, even expansion of the piping. Failure to rotate the tool will cause deep grooves in the piping which can result in potential leak paths.
6. After the final expansion, immediately remove the tool and insert the fitting. Ensure the piping and ring seat against the shoulder of the fitting.



ProPEX Fitting Inserted into 2" Uponor PEX Piping

ProPEX Tee Inserted into 2" Uponor PEX Piping

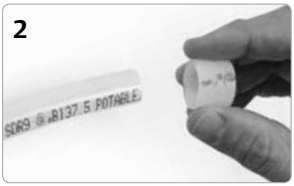


ProPEX 2" Brass Fitting Inserted into Uponor PEX-a Piping

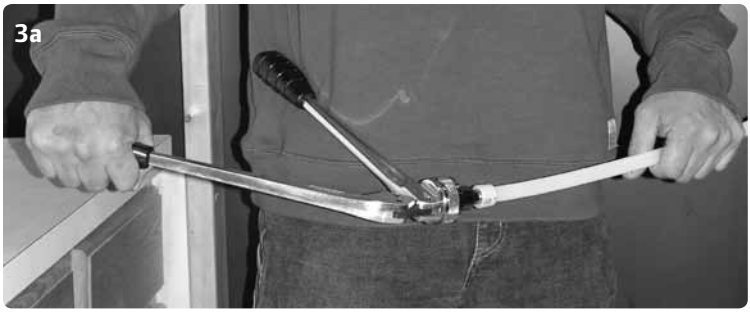
Making ProPEX Connections with the ProPEX Hand Expander Tool

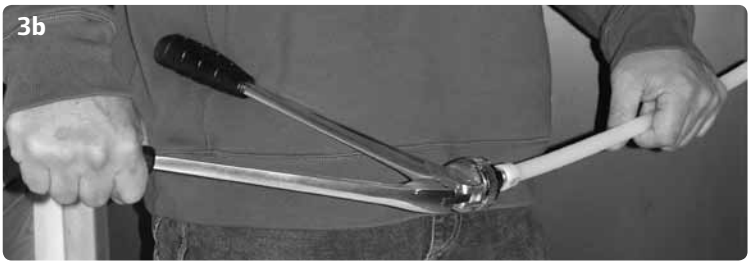
1. Square cut the PEX piping perpendicular to the length of the piping. Remove all excess material or burrs that might affect the fitting connection.
2. Slide the ProPEX Ring over the end of the piping until it reaches the stop edge. If using a ProPEX Ring without a stop edge, extend the ring over the end of the piping no more than 1/16" (1mm).

   Important! If making a 3/8" ProPEX Connection, you must first expand each side of the ring before placing it on the piping. Refer to **Making 3/8" ProPEX Connections on page 18** for further information.
3. Brace the free handle of the tool against your hip, or place one hand on each handle. Fully separate the handles and slide the expander head into the piping until it stops. Full expansions are necessary to make a proper connection. Bring the handles together to expand. Separate the handles, remove the head from the piping, rotate it 1/8 turn and slide the head back into the piping. Continue expanding and rotating until the piping and ring are snug against the shoulder



ProPEX Hand Expander Tool





ProPEX Hand Expander Tool

on the expander head. See **Table 3-1 on page 11** for the recommended number of expansions for each piping size.

Important! Rotating the tool between expansions will provide smooth, even expansion of the piping. Failure to rotate the tool will cause deep grooves in the piping which can result in potential leak paths.

4. After the final expansion, immediately remove the tool and insert the fitting. Ensure the piping and ring seat against the shoulder of the fitting.

   Important! You should feel some resistance as the fitting goes into the piping. If you do not feel any resistance, the piping may be over expanded and will require additional time to shrink over the fitting.

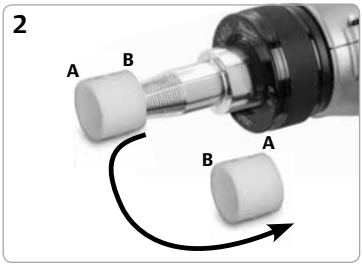
Insert ProPEX Fitting into ½" Uponor PEX-a Piping.

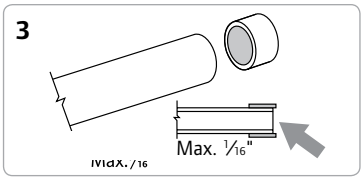
Making ⅜" ProPEX Connections

The ⅜" ProPEX Ring must be expanded once on each side to properly fit over the piping. Refer to the following instructions to make a ⅜" ProPEX connection.

1. Square cut the PEX piping perpendicular to the length of the piping. Remove all excess material or burrs that might affect the fitting connection.
2. Expand each side of the ⅜" ProPEX Ring once.
3. Slide the expanded ring over the end of the piping. Extend the end of the ring over the end of the piping no more than 1/16" (1mm).
4. After the ring is on the piping, continue with the regular steps for making a proper connection with your specific tool.

E6081128 Pipe Cutter (plastic)





Important Tips for a Proper ⅜" ProPEX Connection

- The thicker ⅜" ProPEX Ring shrinks over the fitting faster than larger-sized rings.
- When the temperature is below 40°F (4.4°C), fewer expansions are required.

Proper Expander Tool and Head Maintenance

- Use a lint-free cloth to apply a light coat of lubricant to the cone prior to making any ProPEX connections.
- If used regularly, apply the lubricant daily to the cone of the ProPEX Expander Tool (manual, air or battery) as well as the ProPEX Auto Rotation Adapter. Failure to keep these tools lubricated may result in improper connections.
- The handles of the ProPEX Hand Expander Tool will open and close smoothly if properly lubricated.

Caution: Excessive lubrication may result in improper connections. Only use a small amount of lubrication to keep the tool working properly.

- Keep all other parts of the tool free from lubricant.
- Once a month, soak the heads in degreasing agent to remove any grease from between the segments. Clean the cone using a clean, dry cloth.

- Store the tool and expander heads in the case. Store the tool with an expansion head in place to protect the cone. When storing the manual expander in its case, loosen expander head to ensure that the handles close completely. Remember to re-tighten the expander head before using the tool again.
- Store the tool in a dry location to prevent rust.
- Uponor offers the Tool Depot as a convenient way to service Uponor tools quickly and easily. Note this service is for Uponor tools only. For Milwaukee tools, contact your local distributor. For more information or for specific instruction on how to get your tool serviced, contact Uponor Technical Services toll free at 888.594.7726 or tooldepot@uponor.com. You can also visit www.uponorpro.com/tooldepot.

Disconnecting a ProPEX Brass Fitting

ProPEX brass and EP fittings are manufactured connections that can be concealed in walls, ceilings and floors. When necessary, ProPEX brass fittings can be disconnected.

Important! EP fittings cannot be reclaimed.

Refer to the following guidelines for disconnecting a ProPEX brass fitting.

1. Ensure the system is not pressurized.
2. Use a utility knife to carefully cut through the ProPEX Ring.

   Important! Do not heat the ring prior to cutting it. Take care to cut only the ring and not the piping or fitting. Gouges in the fitting may result in leaks. If you accidentally damage the fitting, you must discard it.
3. Remove the ProPEX Ring from the piping.

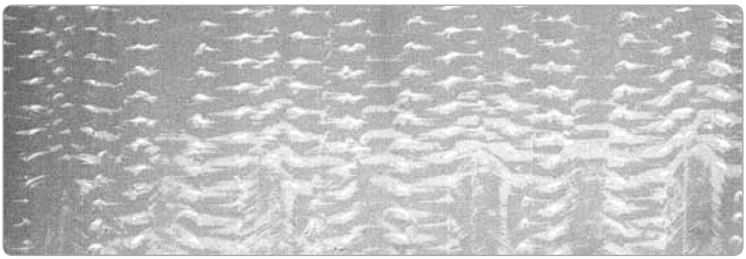
4. After removing the ring, apply heat directly around the fitting and piping connection. **Do not use open flame.** Gently work the piping back and forth while pulling slightly away from the fitting until the piping separates from the fitting.
5. After removing the fitting, measure 2"-3" minimum from the end of the piping (Uponor requires 3" minimum for 1¼"-2" pipe).
6. Square cut the piping at the proper marking.
7. Allow the fitting to cool before making the new connection.
8. Use a new ProPEX Ring and follow the steps to make a new connection.

Troubleshooting ProPEX Connections

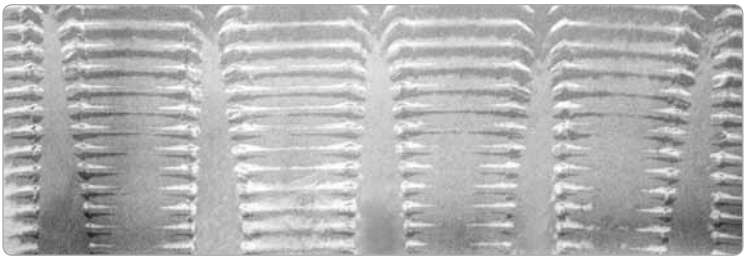
Trouble-free ProPEX installations begin with a tool that is maintained in proper working condition. If the tool or segment fingers are damaged, it is very difficult to make a proper connection. Refer to the following guidelines to assist with challenges in the field.

Fittings Won't Seal

- Make sure the expander head is securely tightened onto the tool.
- Ensure the segment fingers are not bent. If the head does not completely close when the drive unit is fully retracted or the handles of the manual tool are open, replace the head.
- Examine the tool for excess grease on the segment fingers. Remove excess grease prior to making connections.
- Check the fitting for damage. Nicks and gouges will cause the fitting to leak.
- Make sure the internal driver cone is not damaged or bent.
- Make sure the last expansion is not held in the expanded position before the fitting is inserted. You should feel some resistance as the fitting goes into the piping. If you do not feel any resistance, the piping may be over expanded and will require additional time to shrink over the fitting.
- Be sure to rotate the tool ⅛ turn after each expansion to avoid deep grooves in the piping which can result in potential leak paths.



Expansion with Proper Rotation



Expansion without Proper Rotation

Expansion is Difficult

- Make sure the internal cone is properly greased.

Expansion Head Slips Out of Piping When Making Expansions

- Ensure the piping and ProPEX Ring are dry.
- Make sure that grease is not getting into the piping.
- Examine the segment fingers to ensure they are not damaged or bent.

ProPEX Ring Slides Down Piping During Expansion

- Ensure your hands are clean while handling the piping. Any sweat or oils on your hands can act as a lubricant. Due to the smoothness of PEX, any form of lubricant can cause the ProPEX Ring to slide down the piping during expansion.
- If you anticipate the ProPEX Ring may possibly slide down, position the ring slightly farther over the end of the piping and make the first couple of expansions slowly. Once the ring and the piping begin to expand together, continue with the normal number and type of expansions.
- Place your thumb against the ProPEX Ring to help support it and feel for any movement. If caught early, you can slide the ring up the piping and expand as described in the previous bullet point.

More Than the Recommended Number of Expansions are Needed to Make a Connection

- Ensure the head is hand-tightened to the expander tool.
- Examine the segment fingers for damage.
- Be sure to completely cycle the tool on each expansion (i.e., close the manual tool handle or release the trigger).

Cold-weather Expansions

- Temperatures affect the time required for the piping and ring to shrink onto the fitting. The colder the temperature, the slower the contraction time.
- Warming ProPEX fittings and ProPEX Rings reduces contraction time. Put fittings and rings in your pockets prior to installation to keep them warm.
- Fewer expansions are necessary in temperatures below 40ºF (4.4°C).

Uponor ProPEX Lead-free* (LF) Brass Fittings

Uponor offers a complete line of LF brass transition fittings, valves, stub-outs, water-heater connectors and wall boxes.

- All Uponor LF brass products comply with NSF/ANSI 61 Annex G, NSF/ANSI 372 and conform to the lead-content requirements for “lead-free” plumbing as defined by the U.S. Safe Drinking Water Act, effective Jan. 4, 2014.

*Per NSF Annex G, lead-free products contain not more than 0.25% weighted average lead content on wetted surfaces.

- All Uponor LF brass fittings marked as NSFus-pw-G comply with the dezincification resistance (DZR) and stress-corrosion cracking (SCC) requirements of Sections 5.8.1 and 5.8.2 per the current NSF 14 Standard.
- Uponor's LF brass is approved for direct burial in soil per NSF/ANSI Standard 14 testing which established minimum performance criteria for DZR/SCC resistance for PEX fittings intended for potable water.
- When soldering LF brass fittings, Uponor recommends using a lead-free tinning flux or approved alternative flux suitable for use with the silicon family of metal alloy products.

Note: Do not press ProPEX brass fittings (e.g., copper press). When transitioning from PEX to other piping materials, follow the appropriate installation instructions for that product.

Fittings by Others

Uponor PEX-a piping can be used with any type of SDR9 PEX fitting, including compression fittings. Compression fittings must be installed with an insert stiffener to ensure that the pipe wall doesn't collapse under compression, compromising the connection.

Note that Uponor cautions the use of other manufacturer's PEX pipe with Uponor ProPEX Rings as well as using other's expansion rings with Uponor PEX-a pipe. Because of the lower degree and uniformity of crosslinking in PEX-b and PEX-c pipe, stress cracking of the PEX-b and PEX-c pipe wall can occur during expansion, compromising the strength of the fitting connection.

Additionally, the 25-year limited warranty for Uponor PEX-a systems is only valid when both Uponor PEX-a pipe and Uponor ProPEX fittings are used. Mixing the ProPEX Rings with other manufacturer's PEX pipe or other's expansion rings with Uponor PEX-a pipe will limit the warranty. For complete warranty details, refer to **www.uponorpro.com/warranties**.

Note: Uponor does not permit a press-type fitting to be used with ProPEX fitting adapters or sweat adapters. Brass material is not nearly as malleable as copper material, causing undo stress and affecting the integrity of the connection.

Section 4
Water Service Phase

Uponor AquaPEX piping meets the requirements of the ANSI/AWWA Standard C904, Crosslinked Polyethylene (PEX) ½ inch (12mm) through 3 inches (76mm) for Water Service.

Refer to the ANSI/AWWA Standard for information regarding the selection, use and proper application of PEX piping in water service.

Handling and Repairs

Although Uponor AquaPEX piping is highly resistant to kinking and abrasion, it is important to handle with care while installing the piping to prevent damage and possible failure. If damage occurs during installation, cut out and repair the area before backfilling.

To reform kinked piping, refer to **Section 2: Reforming Kinked Piping on page 8**. If damaged beyond the thermal memory capacity of the piping, use a ProPEX repair coupling that is suitable for direct burial.

Note: Do not reuse or reclaim EP fittings.

Trench Bottom Preparation

To achieve a satisfactory installation, it is essential that the soil provides stable and continuous support for the piping.

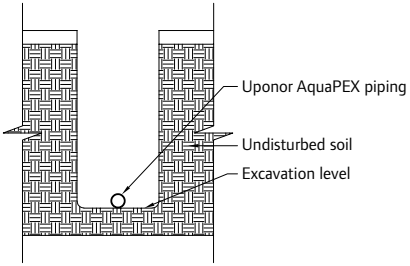


Figure 4-1: Good Soil Conditions — If the trench is dug smoothly, install the piping directly on the prepared bottom. The bottom must be flat with no hollows, lumps or rocks.

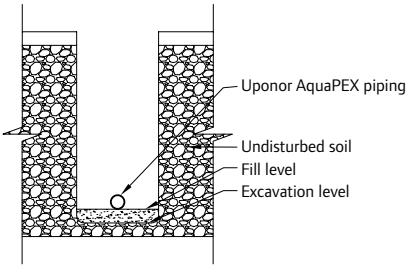


Figure 4-2: Poor Soil Conditions — With rocky, clay, muddy or other poor soil conditions, it may be necessary to prepare the trench bottom using granular material of such size and grading to provide a stable base. See local code for additional requirements.

Piping Embedment

Proper soil selection, placement and compaction are essential in the area around the piping. Backfill around the piping with sand or gravel that has a maximum particle size of ¾".

Compact the initial backfill around the piping to provide adequate piping support and prevent settling. It is particularly important to adequately compact the soil around the tap connection. It is recommended to pressurize the piping prior to backfilling to reveal any damage. In heavy vehicular traffic areas, compact backfill to 90% of maximum soil density.

Do not use highly plastic clays, silts, organic materials, or sharp or large rocks as backfill in the immediate vicinity of the piping. Compact the backfill from the subgrade to a level per local code that will cover the piping four to six inches to provide protection around the piping and to prevent settling that puts stress on the fittings and the piping.

For additional information about the proper installation practices of PEX piping in water-service applications, refer to AWWA C904.

Installation

Install Uponor AquaPEX piping underground in a manner that ensures external loads will not subsequently cause a decrease in the vertical dimension of the cross section of the piping that exceeds 5% of the outside diameter. Install Uponor AquaPEX piping in a snaking pattern with sufficient slack in the line to allow for contraction of the line due to temperature change prior to backfilling. The linear expansion rate for Uponor AquaPEX piping is approximately 1.1" per 10°F temperature change per 100 ft. of piping (27.94mm per 5.56°C temperature change per 30.48m of piping).

Note: Do not use blocking to support the piping or change the piping grade. Do not install potable water service piping in, under or above cesspools, septic tanks, septic-tank drainage fields or pits.

Caution: Do not install Uponor AquaPEX piping in soil environments contaminated with solvents, fuels, organic compounds, pesticides or other detrimental materials that may cause permeation, corrosion, degradation or structural failure of the piping. Where such conditions are suspected, perform a chemical analysis of the soil or groundwater to ascertain the acceptability of Uponor AquaPEX piping for the specific installation. Check local codes for additional requirements.

Handling and Repairs

Although Uponor AquaPEX piping is highly resistant to kinking and abrasion, it is important to handle with care while installing the piping to prevent damage and possible failure. If damage occurs during installation, cut out and repair the area before backfilling.

To reform kinked piping, see **Reforming Kinked Piping on page 8**. If the piping is damaged beyond its thermal-memory capacity, use a ProPEX Coupling. Do not reuse or reclaim EP fittings.

Horizontal Directional Drilling (HDD)

Horizontal directional drilling is used when trenching or excavation is not practical. A surface launched drilling rig provides a steerable, trenchless method of installing underground pipes along a shallow arc bore path, resulting in minimal impact to surrounding areas. It is suitable for a variety of soil conditions.

HDD is further categorized into the following types:

- Mini-HDD
  - Distances less than 600 ft.
  - Depths up to 15 ft.
  - Pipe diameters up to 12"
  - Equipment pullback capability of up to 20,000 lbs. and torque less than 950 ft.-lbs.
- Maxi-HDD
  - Distances greater than 600 ft.
  - Depths up to 200 ft.
  - Pipe diameters up to 48"
  - Equipment pullback capability of up to 100,000 lbs. and torque up to 80,000 ft.-lbs.

Criteria for Uponor PEX Piping in HDD Applications:

1. Only use Uponor PEX pipe as the "follow pipe".
2. Take precautionary steps to ensure piping does not come in contact with sharp objects.
3. Do not exceed the minimum bend radius of 6 times the piping O.D.
4. Pressure test installed piping to ensure the piping's integrity has not been compromised.

Reference Plastics Pipe Institute's Technical Report (TR) 46 "Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe" for HDD applications utilizing Uponor PEX-a piping.

SDR9 PEX-a 12-hour Pull		
Pipe Size	**Tensile Yield Design (safety) Factor**	**Allowable Tensile Load at 73°F/ 22.8°C- lbs (N)**
½"	0.4	128 (569)
¾"	0.4	248 (1,103)
1"	0.4	411 (1,828)
1¼"	0.4	615 (2,735)
1½"	0.4	859 (3,821)
2"	0.4	1,465 (6,516)
3"	0.4	3,169 (14,096)

Note: Allowable tensile load is determined by the method set fourth in ASTM F1804.

Table 4-1: Safe Pull Force

Trace Wire

Uponor recommends the use of trace wire to facilitate in the detection of underground pipe systems. Trace wire should be 14-gauge minimum solid copper with thermoplastic insulation suitable for direct burial. Refer to local code for further requirements.

Joining Methods and Fittings

Use ProPEX or approved compression fittings to connect piping to itself or to the corporation and curb stops. Approved manufactures are Ford Meter Box Company, Mueller Company, A.Y. McDonald Mfg. Co. and Philmac.

When using compression fittings with Uponor AquaPEX piping, a plastic or stainless-steel insert stiffener is required on the inside of the piping at the connection.

For applications requiring direct burial, use Uponor ProPEX EP or LF brass fittings for Uponor AquaPEX piping up to 2".

Water Service Disinfection

Uponor recommends flushing an AquaPEX plumbing system with clean, potable water. When system disinfection is required, Uponor AquaPEX piping should be disinfected in accordance with AWWA C651, Standard for Disinfecting Water Mains, or local codes.

Important: To prevent reduced service life of system components, disinfection solutions should not stand in the system longer than 24 hours. Flush the system with potable water after disinfection. Use a chlorine solution of 50 parts per million (ppm) for 24 hours or 200 ppm for three hours for disinfection.

Section 5
Installation Methods

The following section profiles potable-water installation techniques typically found in both residential and commercial buildings.

Installing Uponor AquaPEX Piping During Ground Work

- Uponor AquaPEX pipe may be directly embedded in concrete or buried in soil.
- Properly secure piping at intervals necessary to keep the piping from floating up during the pour.
- When installing fittings for in-slab applications, use only EP fittings. For under-slab applications, use EP or LF brass fittings.
- When passing through a concrete slab, ensure piping is protected and allows for movement, including expansion and contraction of piping. Minimum wall thickness of protective material shall be 0.025" (0.64mm). Approved protective material includes HDPE wrapping, closed-cell pipe insulation, PVC elbows and sleeves or equivalent. Ensure proper piping placement when exiting the slab.
- Maintain pressure on piping installed in a slab during the pour to facilitate leak detection.
- If the piping will be exposed to sunlight for more than 30 days, sleeve the piping to protect against damage.
- If the piping runs through an expansion joint, protect with a sleeve or dip below the joint. See **Figures 5-1 and 5-2.**

Caution: Uponor recommends using a ProPEX EP Coupling to repair piping damaged during a concrete pour. If a ProPEX EP Coupling is not available, use a ProPEX LF Brass Coupling wrapped with a protective polyethylene sleeve to prevent direct contact between the concrete and the brass coupling.

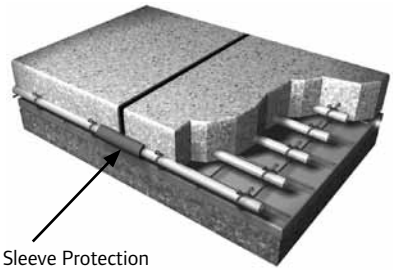


Figure 5-1: Sleeve Protection

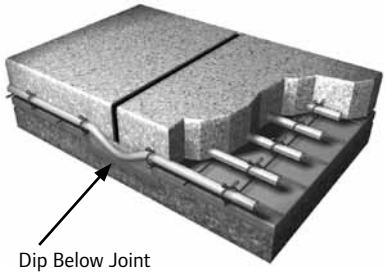


Figure 5-2: Dip Below Joint

Installing Uponor AquaPEX Piping in Frame Construction

Piping Runs

- Leave extra piping at the beginning and end of runs to simplify the connection to fittings, multiports and manifolds.
- Ensure runs are as direct as possible between fittings, multiports or manifolds and the fixtures they supply.
- Insulate hot- and cold-water piping runs where code requires or as necessary.
- For information about locations and techniques for drilling though load-bearing construction, consult your local building codes.
- In residential or non-return plenum applications, it is okay to bundle cold water piping runs together and/or hot water piping runs together with a suitable plastic material, unless prohibited by local code. Best practices recommend not bundling hot-water piping runs and cold-water piping runs together.
- Grommets are required when installing PEX pipe in steel-stud applications.

Caution: When installing in attics, install the piping below the insulation. Note the location of fittings in the attic space for inspection purposes during pressure testing.

Recessed Light Fixtures

When installing Uponor AquaPEX piping near recessed light fixtures, Uponor recommends the piping be a minimum of 12" away from a non I.C.-rated light fixture. When it is necessary to install closer than 12" away from a non I.C.-rated light fixture, follow these guidelines:

- If there is not enough room in the joist cavity to meet the 12" restriction, insulation around the piping is required.
- Use only insulation rated to withstand the temperature generated by the fixture.
- Insulate all piping that is within 12" of the recessed light with closed-cell polyethylene, polyolefin or other suitable pipe insulation for a distance of 12" on either side of the light fixture.
- Insulation is required anytime a UV light source is used (including fluorescent bulbs); be sure to protect piping from direct and indirect UV exposure.

Note: There are two types of recessed lights: Type I.C. (Insulation Contact), which allows direct contact with thermal insulation, and Type Non-I.C. (Non-insulation Contact), that requires a 3" minimal clearance from thermal insulation.

Uponor Logic Plumbing System

The Uponor Logic Plumbing System is an organized arrangement of Uponor AquaPEX piping, EP multiport tees, Pro-PEX fittings and out-of-the-wall systems offering rapid hot water delivery with superior flow characteristics.

For the installer, Uponor Logic minimizes the number of required fittings and connections by way of remote multiport tees, creating a water distribution system that is more efficient to install, reducing liability and increasing profitability.

Multiport tees are available in both flow-through and branch configuratons and do not require access.

Figure 5-3: EP Multiport Tees

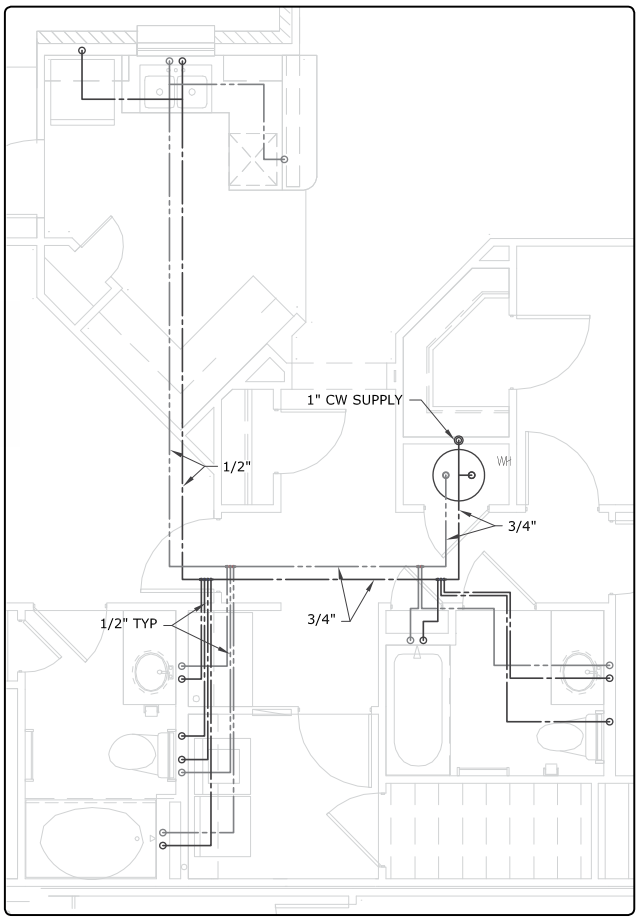


Figure 5-4: Uponor Logic Plumbing System with EP Multiport Tees

Piping Supports: General Guidelines

- Uponor recommends using plastic or metal piping supports designed for use with plastic piping.
- Do not use supports that will damage the piping. Inspect metal supports for sharp edges.
- Allow for the linear expansion rate of Uponor AquaPEX piping — approximately 1.1" (27.9mm) per 10°F (5.6°C) temperature change for every 100' of piping.
  - When installing piping runs, thermal expansion calls for an extra ⅛" to 3⁄16" of longitudinal clearance per foot of run. Do not allow piping to dip excessively between supports. Do not pull piping tight during installation.
- Allow adequate clearance between PEX piping and the structure (bored holes or sleeves) to allow piping to move freely due to thermal expansion and contraction.

Piping Supports: Horizontal Runs

Along horizontal runs, install supports every 32" (some local codes allow 48" for 1¼" and larger PEX pipe). If continuously supporting horizontal runs with Uponor PEX-a Pipe Support, refer to the following support spacing intervals:

- ½" to ¾" = 6'
- 1" and larger = 8'

Follow local code requirements when installing PEX piping in fire-resistive construction floors, ceilings, or walls.

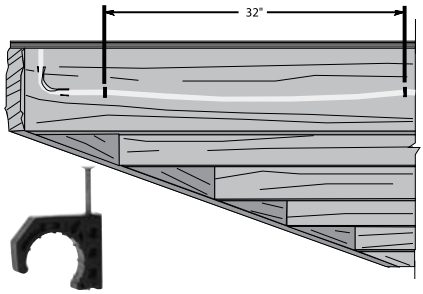


Figure 5-5: Pipe Talons for Horizontal Runs

	Pipe Size	International Plumbing Code (IPC)	Uniform Plumbing Code (UPC)	National Plumbing Code of Canada
Horizontal with PEX-a Pipe Support	½" - ¾"	6' (2m)	6' (2m)	6' (2m)
	1" - 2"	8' (2.6m)	8' (2.6m)	8' (2.6m)
Horizontal without PEX-a Pipe Support	½" - 1"	32" (0.8m) O.C.	32" (0.8m) O.C.	32" (0.8m) O.C.
	1¼" - 3"	32" (0.8m) O.C.	48" (1.22m) O.C.	32" (0.8m) O.C.
Vertical	All Pipe Sizes	Base of each floor; provide mid-story guide	Base of each floor; provide mid-story guide	Supported at base, and floor levels at alternate stories

Note: Use of support channel or Uponor PEX-a Pipe Support in conjunction with CTS hangers is an alternative to the 32" (0.8m) or 48" (1.22m) on-center support spacing requirements. Vertical support requirements for non-riser applications is every 4 to 5 feet.

Table 5-1: Support Spacing Requirements for Bare PEX-a Pipe as of 2012 Code Cycle

Piping Supports: Vertical Runs

- Along vertical risers, install supports at the base of each floor and mid-story guide.
- Vertical runs within a stud cavity shall be supported every 5'.

Figure 5-6: Metal Bend Support

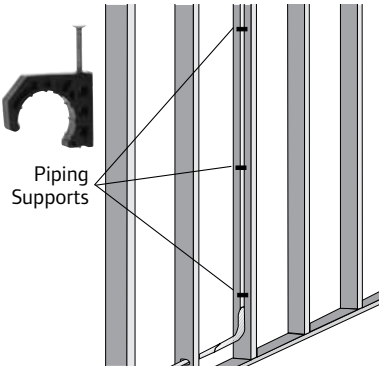


Figure 5-7: Pipe Talon Supports for Vertical Runs

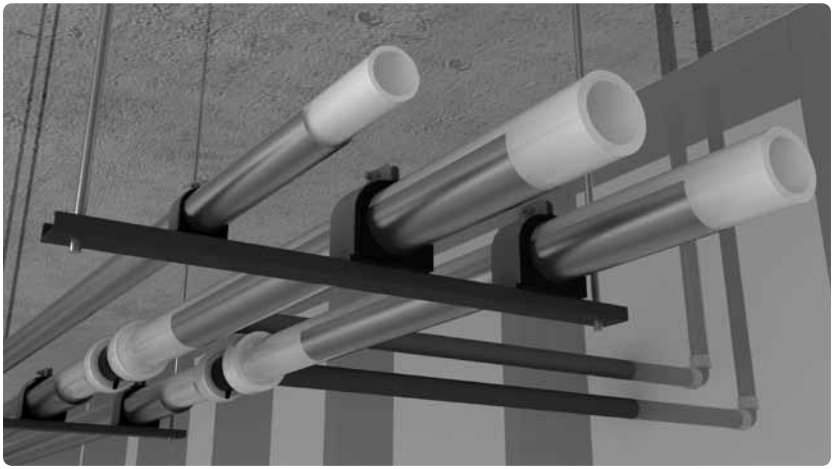


Figure 5-8: Uponor PEX-a Pipe Support in a Suspended Trapeze Application

Uponor PEX-a Pipe Support

PEX-a Pipe Support is a self-gripping, galvanized-steel channel for PEX piping. It provides continuous, uninterrupted support of PEX-a piping, allowing placement of hangers similar to that of metallic piping.

PEX-a Pipe Support can be insulated with typical CTS (copper tube size) pipe insulation. PEX-a Pipe Support is available in 9-ft. lengths in sizes from ½" to 2".

Important Tips

- Always follow local code for general piping support requirements.
- Insert piping into the PEX-a Pipe Support before hanging.
- When using a reciprocating or band saw to cut the PEX-a Pipe Support, either place the support flat side down to make a clean cut or place a scrap piece of piping into the support before cutting.

- When using a hand tool, such as tin snips, to cut the PEX-a Pipe Support, place the support flat side down and mark a line on the support to follow.
- When cutting a support, take care not to bend it.
- After cutting PEX-a Pipe Support, taper and smooth any sharp edges.
- In plenum applications, there are no spacing or insulation requirements between adjacent runs of Uponor PEX-a piping supported with Uponor PEX-a Pipe Support.
- Due to expansion characteristics of PEX-a piping, it is important to use 50-lb. cable ties or equivalent for securing the piping to the support channel.
- Extend PEX-a Pipe support a minimum of 1" past hanger or clamp.

ASTM E84 Requirements for PEX-a Pipe Support

For ASTM E84 plenum applications only, PEX-a Pipe Support sections shall be **no less than 48"** and the maximum distance between PEX-a Pipe Supports shall be 10" (10" allows for the installation of a 2" ProPEX EP Tee in-line). Refer to **Figure 5-10** for PEX-a Pipe Support installations in ASTM E84 applications.

Figure 5-9: PEX-a Pipe Support

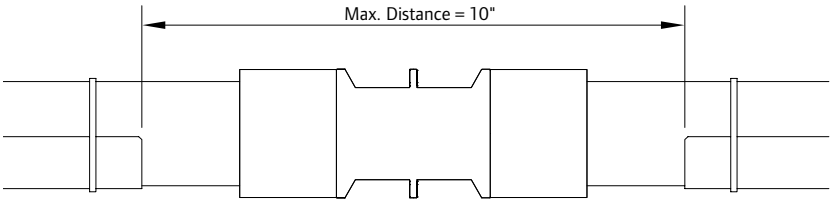


Figure 5-10: Maximum Distance Between PEX-a Pipe Supports in ASTM E84 Applications

Pipe Size	Max. Support Spacing (A)	Max. Cantilever (B)	Min. Overlap (C)	Min. Distance to Fitting (D)
1/2"	6'	18"	6"	1 1/4"
3/4"				1 3/4"
1"	8'			2 1/4"
1 1/4"				2 3/4"
1 1/2"				3"
2"				4"

Table 5-2: Uponor PEX-a Pipe Support

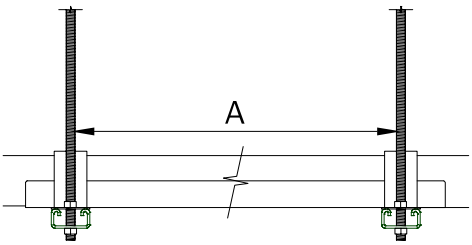


Figure 5-11: Maximum Support Spacing

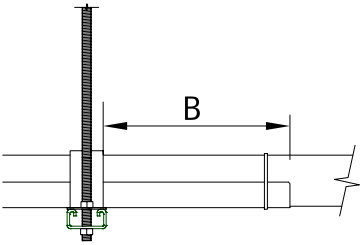


Figure 5-12: Maximum Cantilever

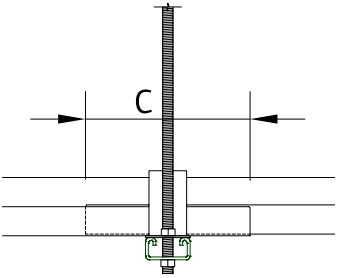


Figure 5-13: Minimum Overlap

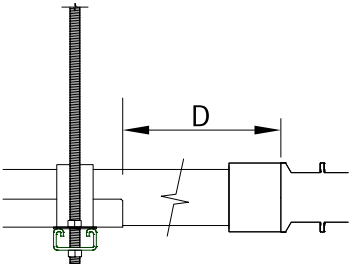


Figure 5-14: Minimum Distance to Fitting

Application	Maximum Distance
Clamps	Greater than 48" = 1 tie mid-span
Hangers	• Less than 48" = 2 ties equally spaced • Greater than 48" = 3 ties (1 mid-span and 1 on each end placed 2" from end of support)

*Strapping is required. Minimum 50 lb. tensile rating and suitable for application. (ie. UV, high temperature)

Table 5-3: Strapping Requirements for Uponor PEX-a Pipe Support

Strapping

- Approved strapping materials include:
  - Pipe talons
  - Clamps
  - Stand-off brackets
  - Nylon banding and cable ties (50 lb. min) suited for the application temperature
- Steel straps must be coated or have no sharp edges.
- Cable ties shall not be used for suspension alone.
- Piping shall be isolated from other MEP systems by means of insulation or stand-off brackets.

Bundling

Parallel runs of Uponor PEX may be bundled together given the following guidelines:

- Entire bundle must be supported at the required O.C. distances.
- Cable ties may be used to maintain a tight bundle of PEX.
- Cable ties may not be used as the sole means of supporting the bundle.
- Keep hot and cold bundles 6" apart if uninsulated.

Controlling Expansion and Contraction

- In suspended applications utilizing 1¼" and larger PEX piping, the thermal expansion shall be accounted for by the following means:
  - Uponor PEX-a Pipe Support
  - Expansion loop
  - Expansion arm*
  - Pipe offset

*ASPE recommends a minimum 30" expansion arm.

Uponor recommends the use of an expansion-compensating device at the following intervals:

- 65' for domestic hotwater systems
- 150' for domestic coldwater systems

Anchor Points

To account for expansion, anchor points must be used to restrict piping movement. Anchor points shall be constructed with materials that will provide rigidity to the support system and utilize a pipe clamp that will restrain the specific piping material.

When utilizing a strut-type hanger system, Uponor recommends the use of rubber-lined strut clamps to aid in the restriction of movement.

Use of PEX-a Pipe Support can reduce expansion by 50% or more if securely strapped and anchored at 65' for hot water and 150' for cold water systems.

Expansion and Contraction: Cold-water Risers

In cold-water applications, copper tube size (CTS) riser clamps are used to support the piping at the base of each floor. In conjunction with the riser clamps at the base of each story, a riser clamp shall be used at the top of every fourth story, limiting expansion and contraction to 40 feet. A mid-story guide is also required on every story to guide the piping. Uponor recommends the use of iron pipe size (IPS) clamps for mid-story guides as to not restrain the piping.

Expansion and Contraction: Hot-water Risers

For hot-water applications, copper tube size (CTS) riser clamps are used at the base of each story. In conjunction with the riser clamps at the base of each story, a riser clamp shall be used at the top of every other story, limiting the expansion and contraction of the piping to 20 ft. This translates to an expansion of about 1½" in 20 ft. of piping at a 70°F/38.9°C temperature rise (installed at 0°F/21.1°C and a service temperature of 140°F/60°C). In this application, the piping will snake slightly in areas where it is not constrained. A mid-story guide is also required on every story to guide the piping (see **Figure 5-16**).

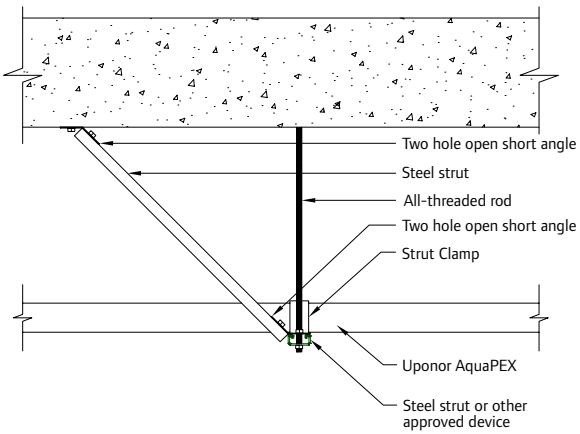


Figure 5-15: Fixed Point: Triangulated Strut System

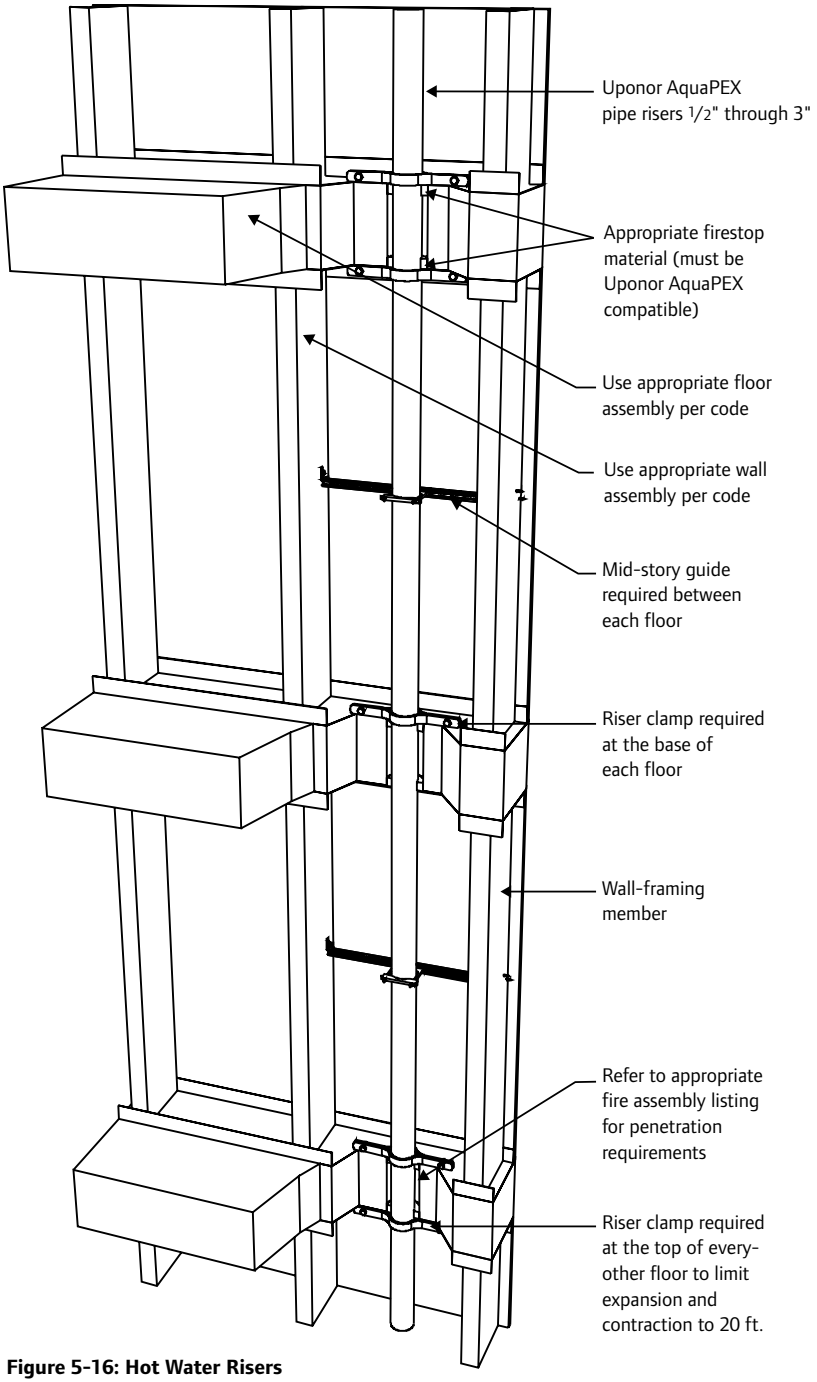


Figure 5-16: Hot Water Risers

Fire-resistant Standards

Uponor PEX has achieved the following fire-resistant construction ratings when tested in accordance with the applicable standards:

- ASTM E119/UL 263
- CAN/ULC-S101
- ASTM E814
- ASTM E84
- CAN/ULC-S115
- CAN/ULC-S102.2

For a complete list of fire-resistant standards, codes and listings, refer to the Uponor Plumbing Design Assistance Manual (PDAM).

Firestop Listings

Numerous firestop manufacturers have tested their products with PEX piping. These tests establish the installation procedures for installing the firestop around PEX piping at the penetration. The type of penetration (e.g., wall, floor or ceiling) determines how these test assembly sections are divided.

Not all caulks are approved for all penetrations. Be sure to seal the penetration in accordance with the appropriate test assembly, using the type firestop material recommended by the firestop manufacturer. Larger penetrations may not allow the use of some caulk-type of firestops — a wrap or collar assembly may be required. Refer to the respective firestop manufacturer for more information on appropriate applications of their products.

Commonly available firestop manufacturers:

- 3M™
- Hilti®
- RectorSeal®
- Holdrite®
- Passive Fire Protection Partners
- ProSet Systems®
- Specified Technologies Inc.

Figure 5-17: Firestops

Surface Burning Characteristics

(Return-air Plenums ASTM E84 and CAN/ULC-S102.2)

Uponor PEX-a piping systems comprised of Uponor PEX-a pipe, Uponor ProPEX rings, Uponor EP fittings, Uponor LF brass fittings and Uponor PEX-a Pipe Support products are listed for installation in return-air plenums as tested in accordance with ASTM E84 and/or CAN/ULC-S102.2.

ASTM E84	Flame Spread	Smoke Developed	Limitations
Nominal ½" to ¾" size	25 or less	50 or less	Adjacent pipe runs shall be located at least 18" apart.
2" maximum nominal size Uponor PEX-a Supported with Uponor PEX-a Pipe Support	25 or less	50 or less	Minimum length of PEX-a Pipe Support is 48". Maximum distance of 10" between PEX-a Pipe Support segments.
3" maximum nominal size Uponor PEX-a with ½" insulation	25 or less	50 or less	½" minimum thickness insulation as specified in **Table 5-6**.

Table 5-4: Surface Burning Characteristics – Uponor AquaPEX ASTM E84 Requirements

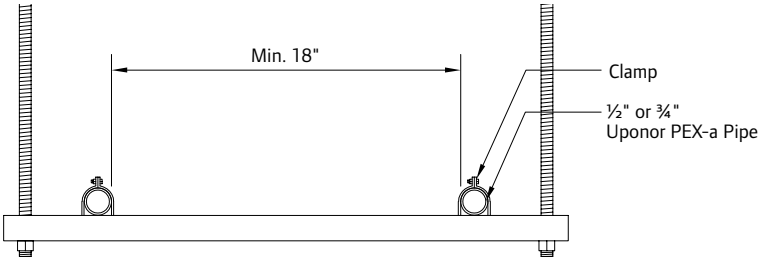
CAN/ULC-S102.2	Flame Spread	Smoke Developed	Limitations
½" nominal size	25 or less	50 or less	No spacing limitations.
¾" and 1" nominal sizes	25 or less	50 or less	Adjacent pipe runs shall be located at least 18" apart.
2" maximum nominal size (water-filled)	25 or less	50 or less	No spacing limitations.
3" maximum nominal size Uponor PEX-a with ½" insulation	25 or less	50 or less	½" minimum thickness insulation as specified in **Table 5-6**.
2" maximum nominal size Uponor PEX-a with ½" Armaflex insulation	25 or less	50 or less	No spacing limitations.

Table 5-5: Surface Burning Characteristics – Uponor AquaPEX CAN/ULC-S102.2 Requirements

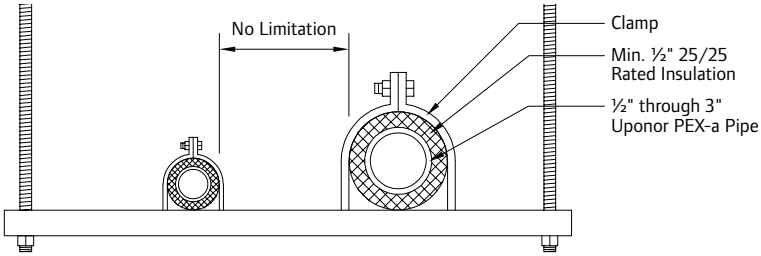
Products	ASTM E84 and CAN/ULC-S102.2		Density of Insulation
	Flame Spread	Smoke Developed	
½" Manson Alley-K Fiberglass Pipe Insulation	25 or less	50 or less	4.0 pcf
½" Armaflex Composite Pipe Insulation	25 or less	50 or less	3.0 pcf
½" Johns Manville Micro-Lok Fiberglass Pipe Insulation	25 or less	50 or less	3.3 pcf
½" Johns Manville Micro-Lok HP	25 or less	50 or less	3.5 pcf
½" Owens Corning VaporWick Pipe Insulation	25 or less	50 or less	4.0 pcf
½" Owens Corning Fiberglass Pipe Insulation	25 or less	50 or less	3.5 pcf
½" Knauf Earthwool Redi-Klad Pipe Insulation	25 or less	50 or less	3.8 pcf
½" GLT Pipe and Tank Insulation	25 or less	50 or less	4.5 pcf

Table 5-6: Specifications for Pipe Insulations in ASTM E84 and CAN/ULC-S102.2

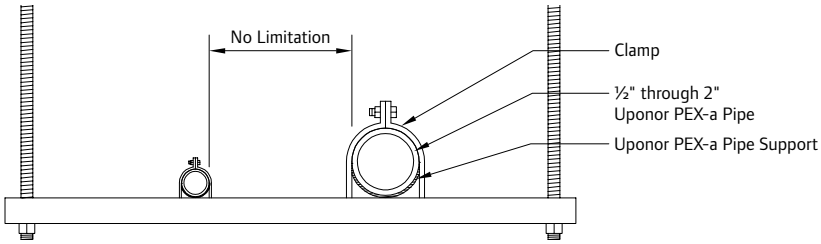
United States — ASTM E84



Guidelines: ½" through ¾" (uninsulated)
Limitations: Adjacent runs shall be located at least 18" apart.

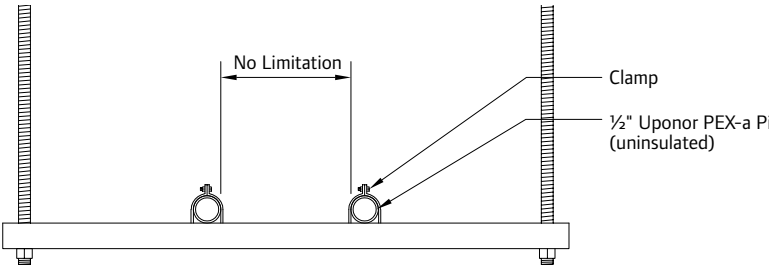


Guidelines: ½" through 3" (insulated)
Limitations: ½" minimum thickness insulation as specified in **Table 5-6**.

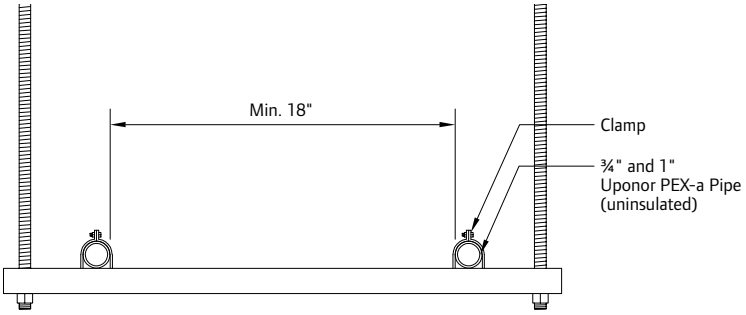


Guidelines: ½" through 2" (PEX-a Pipe Support)
Limitations: Minimum length of PEX-a Pipe Support is 48".
Maximum distance of 10" between PEX-a Pipe Support segments.

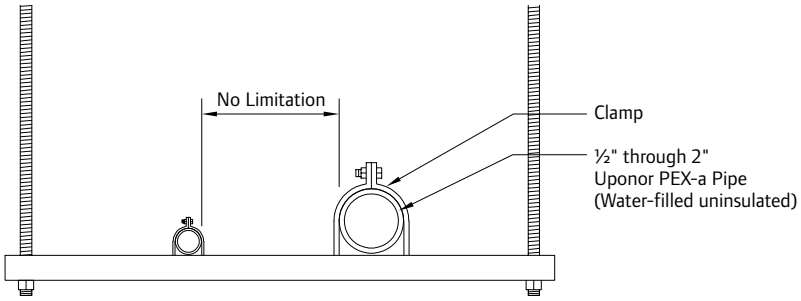
Canada — CAN/ULC-S102.2



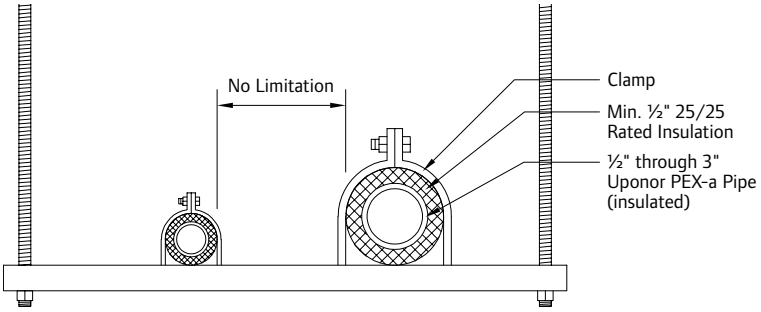
Guidelines: ½" (uninsulated)
Limitations: No spacing limitations.



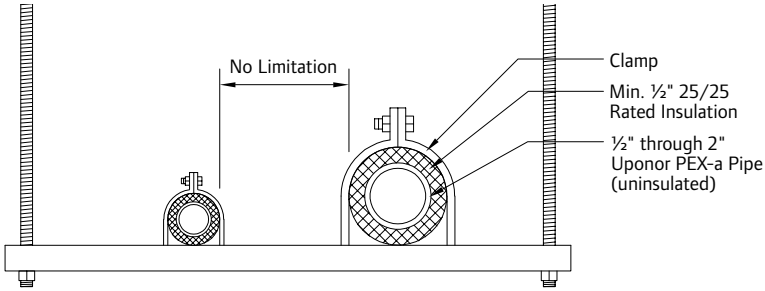
Guidelines: ¾" and 1" (uninsulated)
Limitations: Adjacent pipe runs shall be located at least 18" apart.



Guidelines: ½" through 2" (Water-filled)
Limitations: No spacing limitations.



Guidelines: ½" through 3" (insulated)
Limitations: ½" minimum thickness insulation as specified in **Table 5-6**.



Guidelines: ½" through 2" (Armaflex insulation)
Limitations: No spacing limitations.

ProPEX Out-of-the-Wall Support System

The ProPEX Out of the Wall Support System is a complete, easily installed system that makes exiting the wall with PEX easier than ever.

This system includes:

- PEX Wall Support Bracket with alternating ½" and ¾" holes
- ½" Plastic Bend Support
- ProPEX Escutcheon in chrome or white finish for ½" PEX piping
- The plastic bend support snaps into the mating wall support bracket, providing rigid support from all angles.
- The escutcheon allows you to make a ProPEX connection inside the sleeve and fully concealed.

Installation Example

1. Feed the Uponor AquaPEX piping through the wall opening (see **Figure 5-18**).
2. Measure 2" to 2 3/16" from the wall and mark the piping. **Note:** If you cut the piping at 2 3/16", this will allow enough length for additional adjustments, but may require re-cutting.
3. Square-cut the piping after measuring for the desired cut location.
4. Slide the ProPEX Escutcheon towards exposed piping. Then slide the flared sleeve over the exposed piping and position the escutcheon against the wall.
5. Slide on the ProPEX Ring until it hits the stop edge.
6. Ensure that you have properly aligned all components. If necessary, remove the escutcheon and sleeve; then re-cut the piping to the appropriate length.
7. Expand the ProPEX Ring and piping according to instructions.
8. Fully insert the stop valve into the expanded piping until the ring hits the stop of the valve.

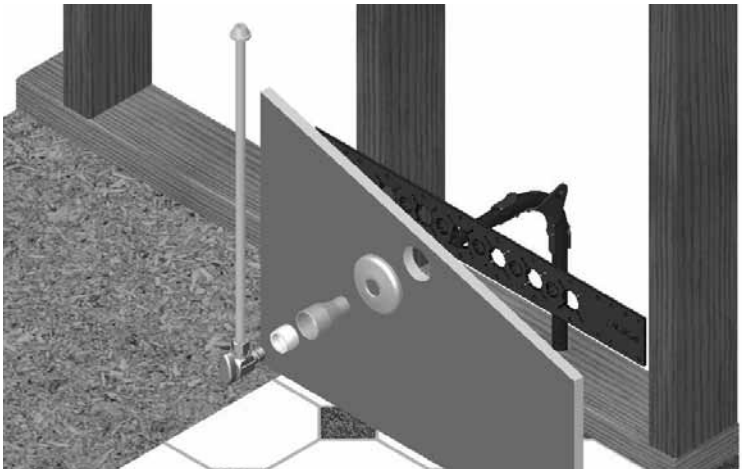


Figure 5-18: Installation Example of ProPEX Out-of-the-Wall Support System

Drop Ear LF Brass Elbows

The ProPEX Drop Ear LF Brass Elbow provides a rigid 90-degree bend and the ability to secure ⅜" through 1" Uponor AquaPEX piping where it exits a wall.

Figure 5-19: Drop Ear LF Brass Elbow for Rigid Bend

Metal Straight-through Supports

Uponor Straight-through Supports provide rigid support and the ability to secure Uponor AquaPEX piping as it exits a wood floor.

Figure 5-20: Straight-through Support

Grommets

Grommets suitable for steed stud applications shall be installed when Uponor AquaPEX pipe pass through steel framing. Grommets are not required for wood-frame applications.

Steel-plate Protectors

The Steel Plate Protector (F5700002) protects installed piping from possible damage (e.g., if piping is in danger of damage by drywall, paneling, trim screws or nails).

- Use these protectors to safeguard your installation during and after construction.
- If Uponor AquaPEX piping passes through hollow masonry walls or metal studs, always protect with suitable sleeves or grommets.

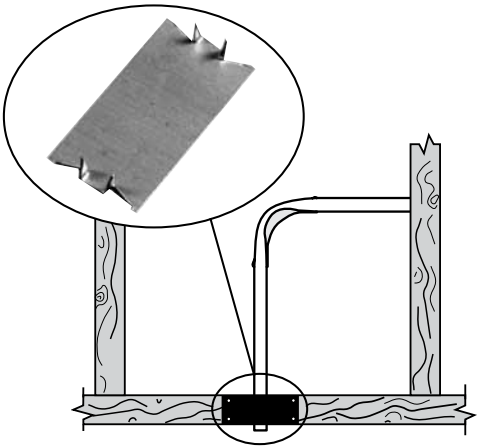


Figure 5-21: Steel-plate Protectors

Water Hammer Arrestors

Uponor AquaPEX piping withstands repeated pressure surges well beyond its rated pressure capacity.

- Uponor AquaPEX piping minimizes surge pressure (40% less than rigid pipes).
- Water hammer arrestors are only necessary if local code requires them.

Shower Valve Connections

Uponor AquaPEX piping is suitable for hot and cold inlets on the shower valve, as well as the supply to the showerhead. Refer to **Figure 5-22** for an illustration of valve connections.

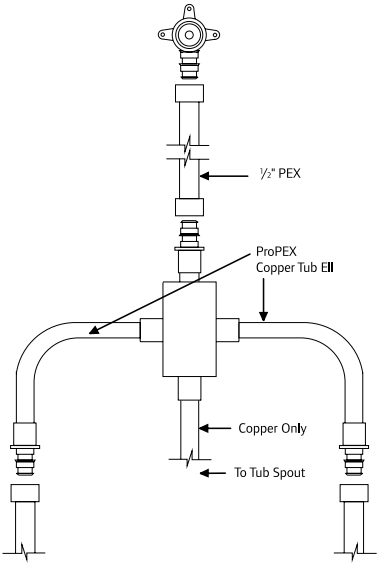


Figure 5-22: Valve Connection Example

Hose Bibs

- Connect Uponor AquaPEX piping to a standard hose bib using a ProPEX threaded or sweat adapter.
- Rigidly anchor the hose bib to prevent it from loosening.

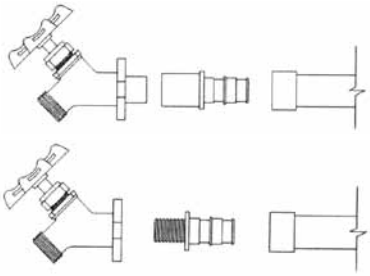


Figure 5-23: Standard Hose Bibs

ProPEX Copper Tub Ells

The ProPEX Copper Tub Ell provides a 90-degree transition from tub and shower valve to Uponor AquaPEX piping.

- Uponor offers this product in several sizes. Refer to the Uponor Product Catalog for a complete listing.

  Caution: Do not use Uponor AquaPEX piping to connect the tub and shower valve to the tub downspout as this may create excessive back pressure in the valve, causing it to remain slightly open.

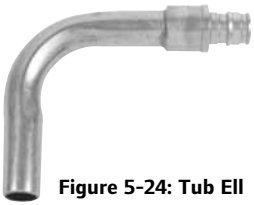


Figure 5-24: Tub Ell

ProPEX Copper Stub Ells

Uponor Copper Stub Ell provides a 90-degree transition from Uponor AquaPEX piping to copper.

- Uponor offers this product in several sizes. Refer to the Uponor Product Catalog for a complete listing.
- You may use a ProPEX Copper Stub Ell at the fixture to exit from the wall instead of a Drop Ear Bend Support.

Figure 5-25: Stub Ell

Figure 5-26: Washing Machine Outlet Box

Washing Machine Outlet Box

- Use the Uponor Washing Machine Outlet Box (LF5930500) to transition Uponor AquaPEX piping to washing machine valves.
- Connect Uponor AquaPEX piping to the valves using a ½" ProPEX connection.

Ice Maker Outlet Box

- Use the Uponor Ice Maker Outlet Box (LF5955025) or ProPEX In-line Ice Maker Tee (LF4455050) to supply the icemaker.
- Connect Uponor AquaPEX piping using a ½" ProPEX connection.

Refer to the Uponor Product Catalog for optional icemaker fittings.

Caution: Ice Maker Saddle Valves are not suitable for use with PEX piping. Uponor does not warrant their use on AquaPEX piping.

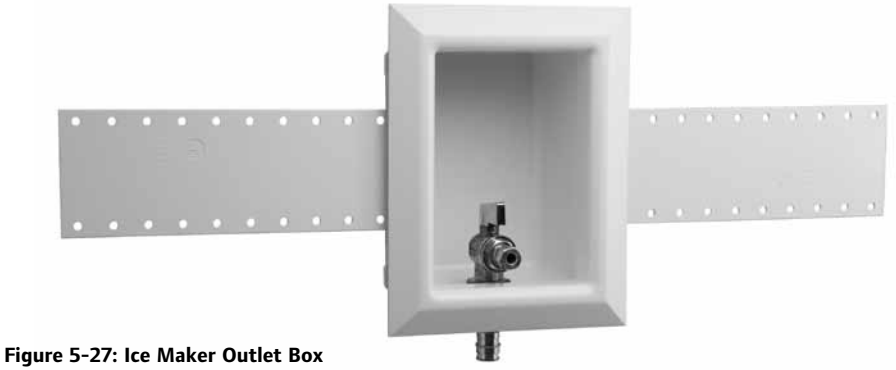


Figure 5-27: Ice Maker Outlet Box

Straight and Angle Stop Valves

Point of use at the fixture is the intended use of ProPEX straight and angle stop valves. These valves allow for direct transition from PEX piping to the riser. To review ProPEX connections, refer to **Section 3**. Uponor features the following types:

- EP Straight and Angle Stop Valves
- Chrome-plated LF Brass ProPEX Straight and Angle Stop Valves
- Chrome-plated LF Brass Compression Straight and Angle Stop Valves

EP Straight and Angle Stop Valves

EP Straight and Angle Stop Valves are constructed of durable engineered plastic and precision-cut ceramics. They resist chemical and mineral build-up, along with corrosion, pitting and scaling and they enable PEX-to-PEX and point-of-use shutoff at the fixture.

Figure 5-28: EP Straight and Angle Stop Valves

Chrome-plated LF Brass Compression Stop Valves (Straight and Angle)

Because Uponor AquaPEX piping has the same outside diameter as standard copper pipe, you can use standard compression straight and angle stop valves with Uponor AquaPEX piping. An insert stiffener is required. The insert is included with the stop valves from Uponor. You can also purchase inserts separately when needed.

Figure 5-29: Chrome-plated LF Brass Compression Stop Valves

Directions for Use

1. Square-cut the piping perpendicular to the piping length.
2. Place the nut and then the compression ring over the end of the piping.
3. Use the brass compression ring included with the stop valve.
4. Install the brass or stainless steel insert into the piping end. Be sure to set the insert completely against the end of the piping.
5. Slowly tighten the compression nut to the opposing thread.

   Note: Re-tighten all compression fittings after initial installation.
6. Wait 30 minutes to allow the piping to relax, and then re-tighten each fitting.

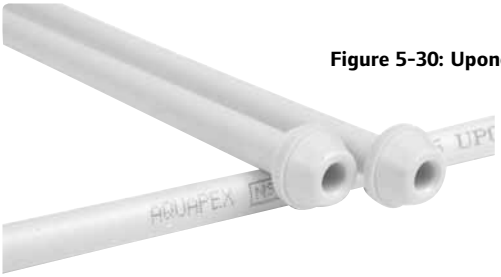


Figure 5-30: Uponor AquaPEX Risers

Uponor AquaPEX Risers

Install Uponor AquaPEX ⅜" outside diameter (OD) risers with Delrin-engineered plastic compression rings included with the risers. The risers are available in the following sizes:

- 12" Lav
- 20" Lav
- 30" Lav
- 36" Lav
- 12" Closet
- 20" Closet

Lav Risers

- Uponor AquaPEX Lav Risers are sold with a Delrin-engineered plastic compression ring. You can also purchase metal washers (sold separately).
- The metal washer assures that the riser is compatible with compression nuts of various opening sizes.
- If the Delrin-engineered plastic compression ring is used, do not use an insert. You will need a ¼" insert if a metal ring is substituted.
- Uponor AquaPEX Lav Risers are listed to NSF 14 and 61.

  Note: Uponor recommends using ¼" Uponor AquaPEX Riser Washers in hot-water applications.

Closet Risers

- Closet risers are compatible with off-the-shelf compression nuts.
- Closet risers are sold with a Delrin-engineered plastic compression ring.
- Closet risers are not sold with the metal washer. Do not use the metal washer to connect to closets.
- If a Delrin-engineered plastic compression ring is used, do not use an insert. If substituting a metal ring, a ¼" insert is required.

Note: Do not heat Uponor AquaPEX Risers to remove kinks. Do not install kinked or damaged risers.

See the Uponor Product Catalog for the various styles, part numbers and descriptions of all available Uponor plumbing products.

Termiticide or Pesticide Treatment

Liquid termiticides/pesticides are often applied to treat the soil below the concrete slabs of slab-on-grade structures. The treatment creates a barrier to prevent termites and pests from infiltrating the floor of the structure. PEX piping for plumbing applications is often installed within slabs or below slabs (in trenches in the soil) below the soil that is treated. Liquid termiticides/pesticides use a liquid solvent to carry the active ingredients. These solvents can be categorized as one of two types: organic solvent-based (also known as petroleum solvent-based) and water-based (water solvent-based).

The type of solvent used in a termiticide/pesticide will affect its ability to permeate through various materials. Organic-based termiticides/pesticides have largely disappeared from the North American marketplace for this application, and the majority of products available today are water-based. Water-based products are generally safer for the environment and pose less risk of infiltration into PEX piping.

Available data indicates the solvents used in liquid termiticides/pesticides will soak into the ground and/or evaporate before they can pass through the wall of polyethylene piping. The data also indicates these solvents are prevented from passing through the wall of polyethylene piping because of the large size of the water- or organic-solvent molecules, relative to the size of the molecules in the piping itself. Once liquid solvents have dissipated or evaporated, the solids that remain behind cannot permeate through the walls of polyethylene or PEX piping because of the molecular size.

Additional research shows that water-based termiticides/pesticides are of sufficiently large molecular size to completely prevent permeation through polyethylene and PEX piping. Instances of water-based termiticides/pesticides permeating through polyethylene or PEX piping are not known. Pesticides have not been found to be corrosive or have polymer degradation.

Although all research data and anecdotal evidence strongly suggest that there are no permeation issues with water-based termiticides/pesticides and PEX, caution is required to ensure safe installation of PEX piping and to prevent misapplication of the liquid termiticides/pesticides, especially to prevent pooling or puddling of these chemicals around PEX piping.

Caution: The misapplication of termiticides or pesticides between PEX piping and slab penetration protection devices could result in pooling or puddling of the products around the piping, a prohibited practice. The application of pesticides or termiticides between PEX piping and slab penetration protection devices is strictly prohibited.

Section 6
Pressure Testing

Residential Applications

- You must pressure test the system in accordance with local code requirements, but the recommended test pressure is at least 25 psi above working pressure or 100 psi. Slight fluctuations of pressure are normal due to ambient temperature changes.
- Test pressures above 160 psi will cause a slight radial expansion of the piping and a subsequent relaxation of the material, resulting in a reduction of test pressure. This is normal and does not indicate a leak.
- When using valved manifolds, open the valves on the manifold prior to pressure testing. Ensure the valves remain open until the pressure test is complete.

Commercial Applications

Importance of Conditioning PEX-a Pipe

Uponor recommends conditioning the system at 1.5 times the test pressure, or 120 psi. The following conditioning procedure is unique to PEX-a due to the high degree of crosslinking and associated thermal and elastic properties of the pipe.

When pressure is applied against the inner wall of PEX-a, the internal diameter (ID) of the pipe will slightly increase, causing the pressure to drop while the system equalizes. After a period of 30 minutes, the PEX-a piping will be sufficiently conditioned to start the pressure test.

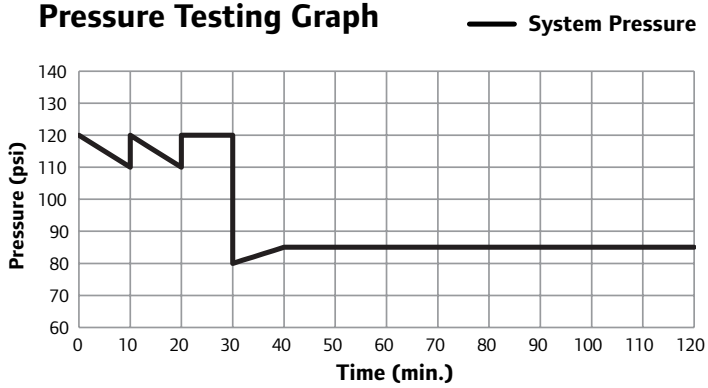


Figure 6-1: Pressure Testing Graph

Conditioning and Sustained Pressure Testing Procedure

1. Visually confirm all connections are properly made per Uponor installation guidelines.
2. Ensure that all components, fixtures and equipment not rated for the test pressure are isolated from the test system.
3. Ensure that all other thermoplastic piping materials are isolated from the test system.
4. Fill the system with potable water, air or a mixture of both.
5. Condition the system to 1.5 times the required test pressure for 30 minutes. This will require constant pumping or cycling the valve and compressor to maintain a pressure of 1.5 times the test pressure. If cycling the valve and compressor, apply additional pressure once the psi has dropped 10 lbs.
6. After conditioning the system for 30 minutes, quickly relieve excess pressure by opening the valve. Close the valve when the system has reached the desired test pressure.

   Note: Uponor recommends a test pressure of 80 psi (unless local code dictates higher pressures).
7. Once the valve is closed, confirm a slight rise in pressure (3 to 6 psi). This increase will occur as the pipe's internal diameter (ID) is shrinking from its conditioned state to equalize at the lower pressure.
8. Visually check for leakage and monitor the pressure for the duration specified by local code. (A typical pressure test can range from 2 to 24 hours).
9. If there is no reduction in pressure, the system is regarded as leak tight.

   Note: Slight fluctuations of pressure are normal due to ambient temperature changes, especially during long durations (e.g., 24 hours).
10. Flush the system as required by code.

Important: If using water to pressure test the system, purge all water from the system prior to the ambient air temperatures falling to 32˚F (0˚C). Failing to remove the water from the system can result in damage to the piping and associated equipment.

Water System Disinfection

Uponor recommends flushing an AquaPEX plumbing system with clean, potable water. When system disinfection is required, Uponor AquaPEX piping should be disinfected in accordance with AWWA C651, Standard for Disinfecting Water Mains, or local codes.

Important: To prevent reduced service life of system components, disinfection solutions should not stand in the system longer than 24 hours. Flush the system with potable water after disinfection. Use a chlorine solution of 50 parts per million (ppm) for 24 hours or 200 ppm for three hours for disinfection.

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