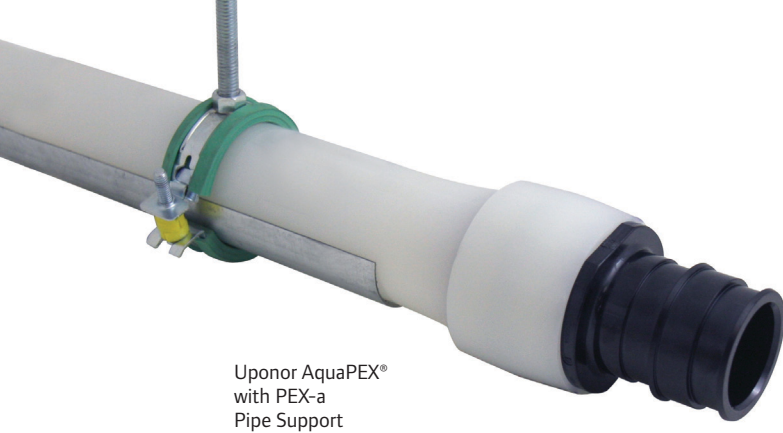




Uponor AquaPEX®
with PEX-a
Pipe Support



PLUMBING SYSTEMS

CANADA REFERENCE GUIDE



Commercial Plumbing Engineer Quick-reference Guide

This quick reference guide is designed for architects, building officials, engineers and mechanical contractors interested in Uponor Commercial Plumbing Systems.

It describes general installation recommendations that use Uponor

AquaPEX® crosslinked polyethylene (PEX-a) pipe and ProPEX™ fitting products.

Uponor is not liable for installation practices that deviate from this guide or are not acceptable practices within the mechanical trades, codes

or standards of practice. Always refer to local codes for additional requirements. For further assistance, refer to the Uponor Plumbing Design Assistance Manual (PDAM) or contact Uponor Technical Services at 888.994.7726 or design.ca@uponor.com.

Uponor AquaPEX (PEX-a) Pipe The Core of Uponor Plumbing Systems

Hydrostatic Temperature and Pressure Ratings

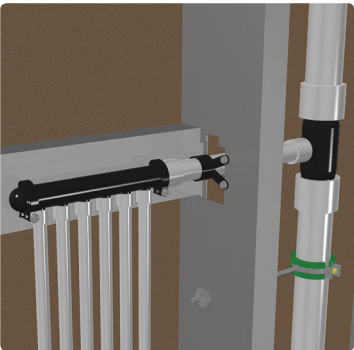
Uponor maintains standard-grade ratings for Uponor AquaPEX pipe as tested in accordance with PPI TR-3. Uponor PEX products have the following temperature and pressure ratings:

- 200°F (93°C) at 80 psi (551 kPa)
- 180°F (82°C) at 100 psi (689 kPa)
- 73.4°F (23°C) at 160 psi (1,103 kPa)

Excessive Short-term Temperature - Pressure Capacity:

- 210°F (99°C) at 150 psi (1,034 kPa) tested up to 720 hrs (ASTM F876) and 48 hr (CSA B137.5)

In accordance with Section 6.6 of ASTM F876, the minimum hydrostatic burst pressure for 1/2" pipe is 480 psi (3,309 kPa) at 73.4°F (23°C). For 3/4" pipe and larger, the minimum burst pressure is 475 psi (3,275 kPa) at 73.4°F (23°C). Uponor's NSF-approved quality lab performs daily burst pressure testing on all pipe sizes above and beyond

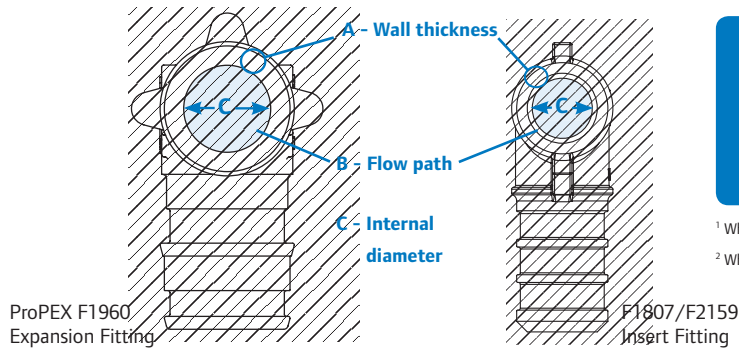


the ASTM F876 standard. All samples are tested at 73.4°F (23°C) and burst at an elevated pressure of 800 psi (+/- 20 psi) — nearly twice the pressure requirement of ASTM F876.

Not All PEX is Created Equal	
Uponor PEX-a	• Highest degree of crosslinking (>80%) • Highest modulus of elasticity • "Hot" crosslinking above the crystal melting temperature • Shape memory ideal for cold-expansion ProPEX fittings • Increased resistance to corrosion • Most flexible; allows kink reparability; easily bendable against the coil; tight bend radius 6x O.D.
PEX-b	• Lowest degree of crosslinking (>65%) • Crosslinking performed in a secondary, post-extrusion process • Stiffer product and no kink reparability
PEX-c	• Lesser degree of crosslinking (>70%) • "Cold" crosslinking below the crystal melting temperature • Less uniform, less consistent • Stiffer, no kink reparability

ProPEX Fittings vs. Standard Insert Fittings

		Uponor ProPEX Cold Expansion Fitting		Standard Insert Fitting	
		ASTM F1960 Brass	ASTM F1960 EP	ASTM F1807 Brass	ASTM F2159 Plastic
A Wall thickness	½"	0.057"	0.057"	0.028"	0.056"
	¾"	0.057"	0.057"	0.037"	0.082"
	1"	0.072"	0.072"	0.041"	0.100"
B Flow path	½"	0.112 sq. inches 2.8 gpm @ 8 ft./sec. 4.2 gpm @ 12 ft./sec.	0.116 sq. inches 2.9 gpm @ 8 ft./sec. 4.4 gpm @ 12 ft./sec.	0.096 sq. inches 2.4 gpm @ 8 ft./sec. 3.6 gpm @ 12 ft./sec.	0.078 sq. inches 1.9 gpm @ 8 ft./sec. 2.9 gpm @ 12 ft./sec.
		0.278 sq. inches 6.9 gpm @ 8 ft./sec. 10.4 gpm @ 12 ft./sec.	0.273 sq. inches 6.8 gpm @ 8 ft./sec. 10.2 gpm @ 12 ft./sec.	0.221 sq. inches 5.5 gpm @ 8 ft./sec. 8.3 gpm @ 12 ft./sec.	0.166 sq. inches 4.1 gpm @ 8 ft./sec. 6.2 gpm @ 12 ft./sec.
		0.496 sq. inches 12.4 gpm @ 8 ft./sec. 18.6 gpm @ 12 ft./sec.	0.488 sq. inches 12.2 gpm @ 8 ft./sec. 18.2 gpm @ 12 ft./sec.	0.396 sq. inches 9.9 gpm @ 8 ft./sec. 14.8 gpm @ 12 ft./sec.	0.292 sq. inches 7.3 gpm @ 8 ft./sec. 10.9 gpm @ 12 ft./sec.
	¾"	0.112 sq. inches 2.8 gpm @ 8 ft./sec. 4.2 gpm @ 12 ft./sec.	0.116 sq. inches 2.9 gpm @ 8 ft./sec. 4.4 gpm @ 12 ft./sec.	0.096 sq. inches 2.4 gpm @ 8 ft./sec. 3.6 gpm @ 12 ft./sec.	0.078 sq. inches 1.9 gpm @ 8 ft./sec. 2.9 gpm @ 12 ft./sec.
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C Internal diameter	½"	0.378"	0.385"	0.350"	0.315"
	¾"	0.595"	0.590"	0.530"	0.460"
	1"	0.795"	0.788"	0.710"	0.610"



Double the wall thickness¹
and **70%** greater flow²

¹ When comparing ½" F1960 with F1807 brass fittings

² When comparing 1" F1960 engineered polymer (EP) with F2159 plastic fittings

Concrete Floor/Ceiling Assembly (ULC ITS Design No. UW/FCA 120-01/02) Steel-stud Wall Assembly (ULC ITS Design No. UW/WA 60-01)

Non-rated wall or non-load bearing wall assembly with Uponor AquaPEX pipe installed per CAN/ULC S101 (refer to ULC Design No. UW/WA 60-01)

For CAN/ULC S101 steel-stud rated walls maximum Uponor AquaPEX pipe of 1.3 lbs./ft. and not to exceed total weight per stud cavity of 8.0 lbs.

Uponor AquaPEX pipe riser

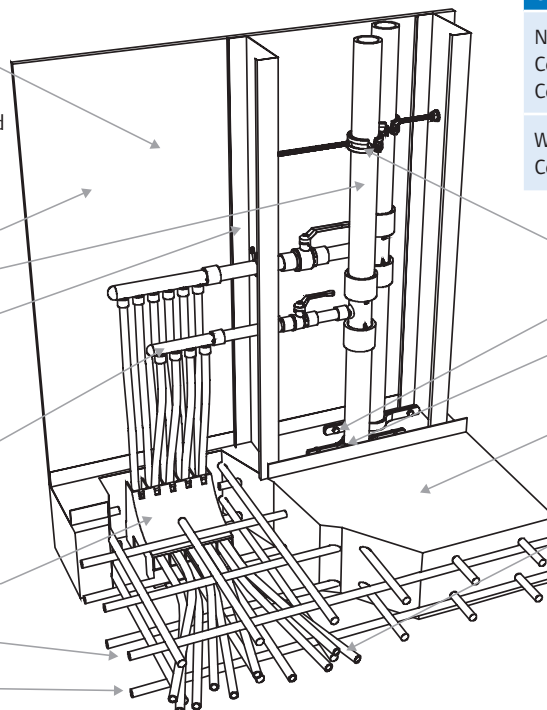
Steel stud

Copper manifold or Uponor EP multi-port tee with a weight not exceeding 1.0 lbs. per cavity (typical)

Uponor PEX one or five-loop stand-up bracket or metal/2x4 wood pre-drilled mounting bracket on top side of slab

6½" minimum restrained or un-restrained

Structural rebar (two layers)



Mid-story guide (if required) (see riser detail on page 5)

Riser clamp (see riser detail on page 5)

Firestop listed to CAN/ULC S101 (must be Uponor AquaPEX pipe compatible)

CAN/ULC S101 slab listed with Uponor AquaPEX pipe only (refer to ULC ITS Design No. UW/FCA 120-01/02)

Maximum tubing density is 13 cubic inches with or without sleeve per one cubic foot of concrete (equivalent of 3" average spacing through slab between ½" Uponor AquaPEX pipe) Polyethylene sleeve ¾" to 1" nominal tubing or PVC conduit 1" to 1¼" nominal and ½" to 2" Uponor AquaPEX pipe

Fire-resistant Construction Ratings

CAN/ULC S101		
Construction Type	Assembly Type	ITS Design No.
Non-combustible Concrete/Steel Construction	Floor/Ceiling	UW/FCA 120-01/02 G524
	Walls	UW/WA 60-01
Wood Frame Construction	Floor/Ceiling	UW/FCA 60-01
	Walls	UW/WA 60-02



Minimum Distance Between ProPEX Fittings

Nominal 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"

Pipe Sizing an Uponor AquaPEX System

Uponor recommends using the uniform friction loss method of pipe sizing. After determining the system's friction loss (psi/100 ft.) by performing a building supply water calculation, develop a water size chart for each system's water temperature. Do this by referencing Uponor AquaPEX flow charts and converting the gallons per minute (gpm) to fixture units for each nominal pipe size.

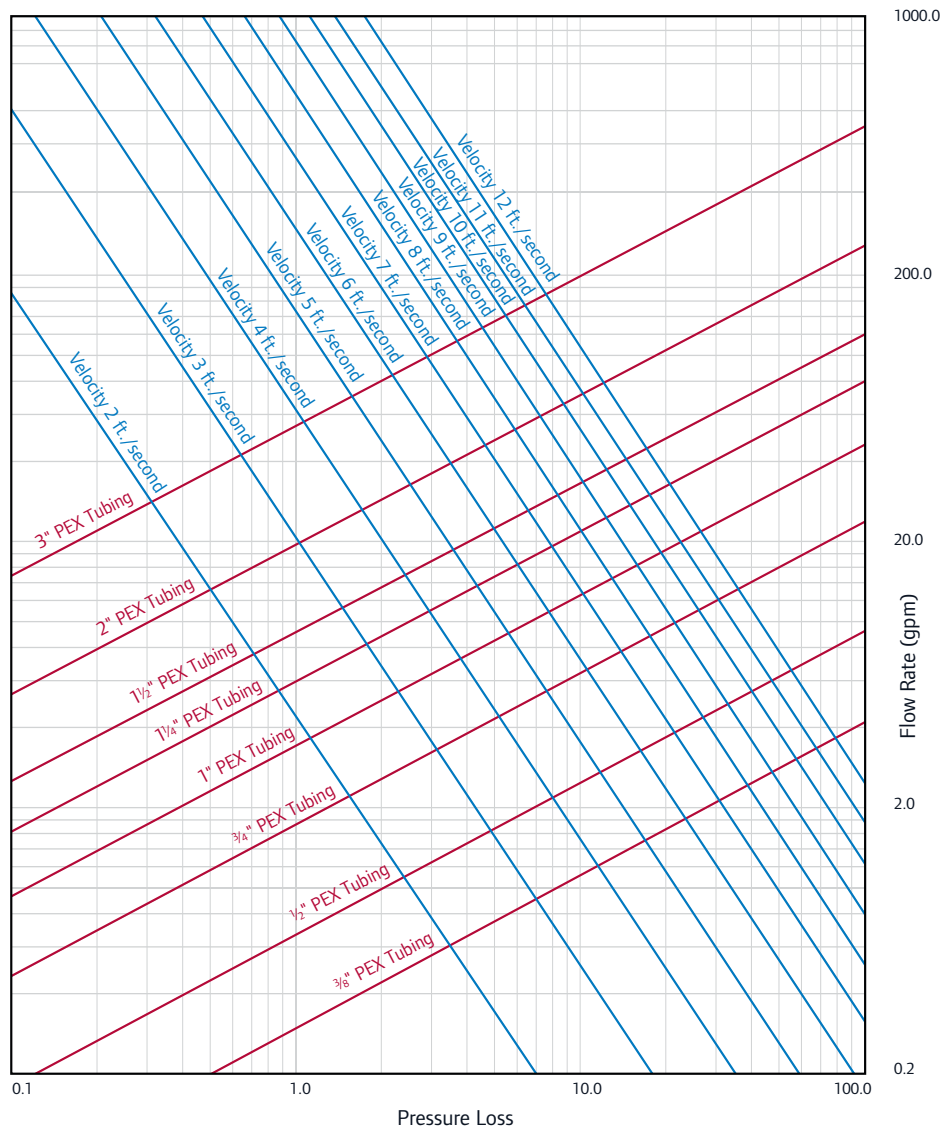
Note: The National Plumbing Code (NPC) Section A.2.6.3.1.(2) states the maximum velocities permitted in accordance with the manufacturers' recommendations for the pipe and fittings chosen for the installation. Uponor recommends 12 ft./sec. maximum velocity for hot and cold domestic water systems using Uponor AquaPEX pipe and ProPEX fittings. Contact Uponor Technical Services at 888.994.7726 or design.ca@uponor.com to determine the maximum velocities based on the use, geographical region and intended operating conditions for your project.

Uponor AquaPEX System Codes and Standards

ASTM, NSF, AWWA, UL, ULC, ICC, IAPMO, NAHB, PHCC, PPI, HUD, NBC, NPC, CSA

- CSA B137.5 for PEX piping systems
- ASTM F876 for PEX pipe
- ASTM F876 for continuous hot water recirculation up to 140°F (60°C)
 - Uponor AquaPEX White listed to 5106 for 100% recirculation at 140°F (60°C) and one (1) month UV resistance
 - Uponor AquaPEX Red and Blue listed to 5206 for 100% recirculation at 140°F (60°C) and three (3) months UV resistance
- ASTM F877 for PEX hot and cold water distribution systems
- ASTM F1960 for cold expansion fittings for use with PEX pipe
- ASTM F2023 for oxidative resistance to hot chlorinated water
- ASTM F2657 for UV resistance of PEX material
- AWWA C904 for water service
- NSF 14 and 61
- CAN/ULC S102.2 for plenum applications up to 3"
- CAN/ULC S115 for through-penetration fire stop up to 2"

Pressure Loss (psi) per 100 Feet of Uponor AquaPEX Pipe at 60°F/15.6°C



Suspended Piping

For suspended runs of piping, Uponor AquaPEX can be supported by the same conventional means as metallic pipe using copper tube size (CTS) pipe hangers or supports.

Uponor recommends using hangers and supports designed for use with plastic pipe. Use PEX-a pipe support channel that continuously supports the pipe to achieve the same support spacing as copper pipe.

Per NPC Table 2.3.4.5., the maximum horizontal support spacing for PEX is 32" (0.8m).

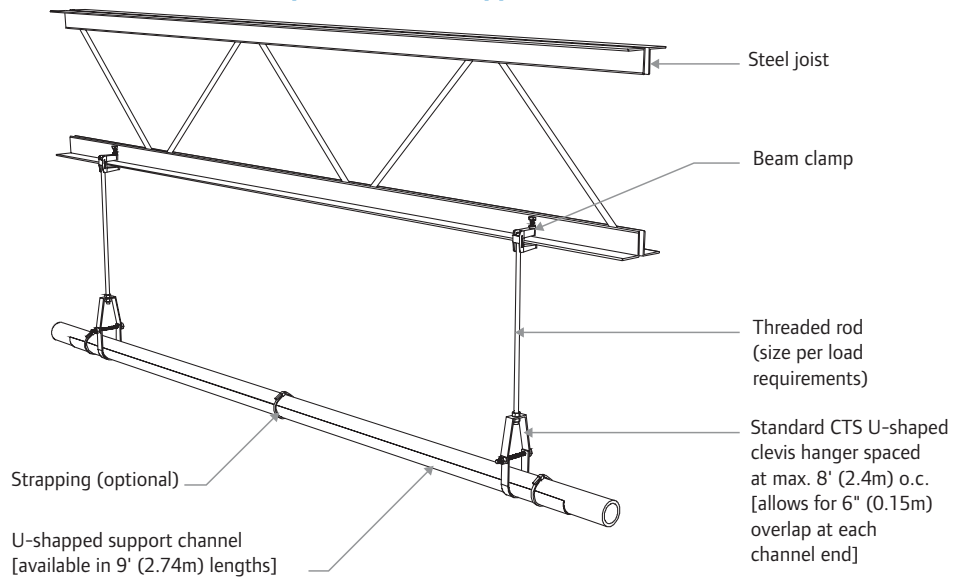
If running pipe in a horizontal assembly requiring fire-resistant construction, pipe must be continuously supported or support spacing must not exceed 16" (0.4m) for 1" and smaller PEX and 24" (0.6m) for 1¼" and larger runs of PEX.

Use of support channel or PEX-a pipe support in conjunction with CTS hangers is an alternative to the 32" (0.8m) on-center support spacing requirements.

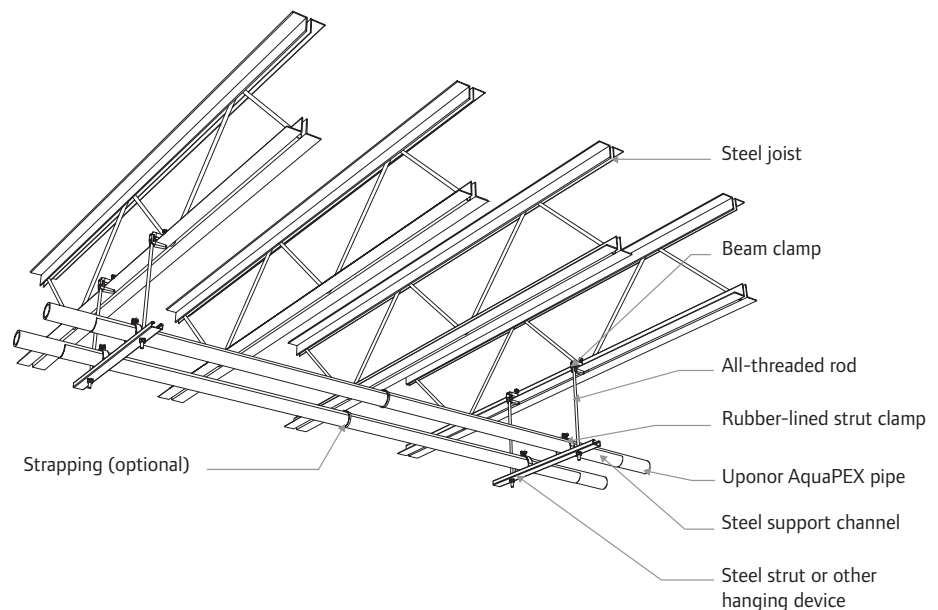
Support channels allow for greater spacing between hangers; 5' to 8' (1.5m to 2.4m) on-center spacing is achievable if the support channel is installed per the manufacturer's instructions.

For more information regarding support solutions, contact Uponor Technical Services at 888.994.7726 or design.ca@uponor.com.

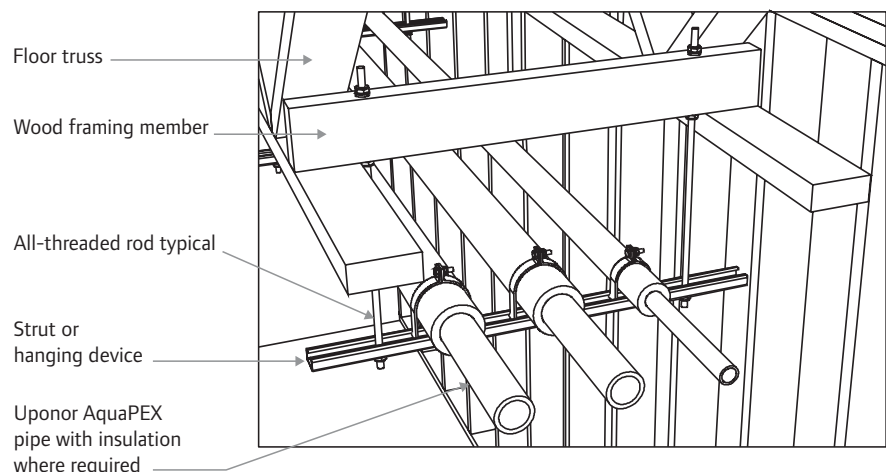
8' (2.4m) On-Center Suspended Clevis Support



8' (2.4m) On-Center Trapeze Support



32" (0.8m) On-Center Trapeze Support



Risers

Risers typically feature Uponor AquaPEX pipe in sizes from 1" to 2" with CTS riser clamps at the base of each floor.

The installation should also include a riser clamp at the top of every-other story to limit the expansion and contraction of the pipe to less than 25' (7.6m). This translates to an expansion of about 1½" in 25' (7.6m) at a 60°F (34°C) Delta T [installed at 60°F (34°C) with an operating temperature of 120°F (48.9°C)].

In this application, the piping will snake slightly in areas where it is not constrained. Use discarded framing as a backer plate for the mid-story guide. Ensure the guide is metal with no sharp edges or fire-rated for risers in walls requiring fire-resistant construction.

Through Penetrant Firestop

The following firestop manufacturers offer PEX solutions as tested in accordance with CAN/ULC S115.

- 3M™
- Hilti®
- HoldRite® HydroFlame™
- Metacaulk®
- NuCo®
- Passive Fire Protection Partners
- ProSet Systems®
- Tremco®

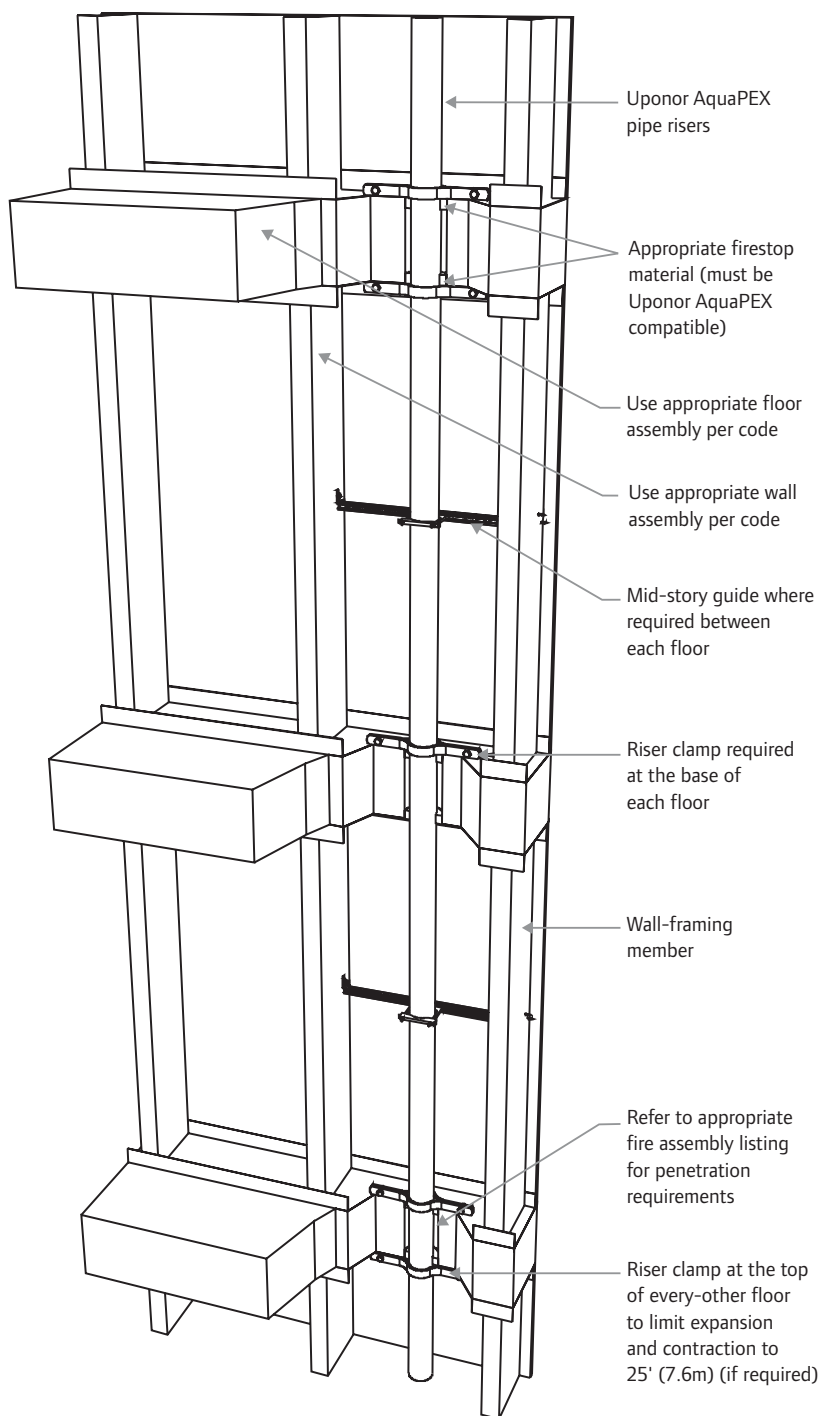
See firestop manufacturer's website for selection of appropriate fire assembly and product.

Plenum Rated

Up to 3" piping in return-air plenums have no spacing limitations if covered with ½" fire-rated fiberglass insulation. Uninsulated ¾" to 1" pipe in a return-air plenum must be separated by 18" (0.46m). Listing for ½" pipe does not specify restrictions on spacing requirements. Pipe larger than 1" may not be installed without ½" minimum fire-rated insulation. Exposed EP fittings are approved.

Pipe in hallway drop-ceiling applications requires special attention due to variances and interpretations of Canada building codes. Always check with local code officials before installing Uponor AquaPEX in hallway drop ceilings.

Detailed Riser Installation



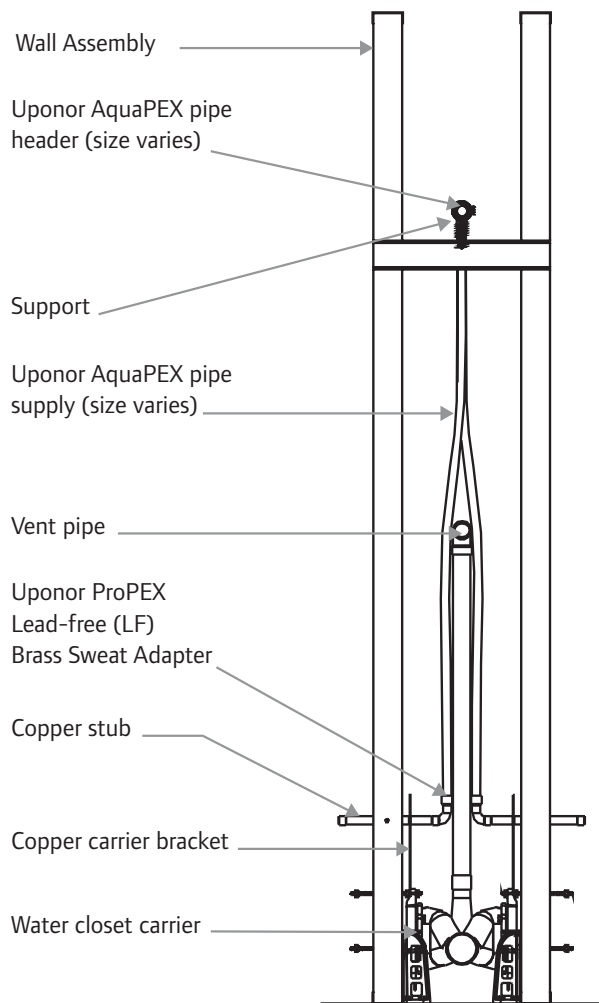
National Building Code (NBC) Requirements for Plenums

Materials exposed in plenums shall have a flame spread (FS) of 25 or less and a smoke developed (SD) of 50 or less when tested in accordance with

CAN/ULC S102.2. A ½" minimum fire-resistant wrap, such as fiberglass insulation, will achieve 25 FS/50 SD classifications for

large-diameter Uponor AquaPEX pipe, thus permitting installations in plenums, ceiling spaces and exposed locations.

Commercial Flush Bank – Section Detail



Surge Pressure and Sound Intensity

The main sources of sound in a water piping system are cavitation, surface roughness and water hammer caused by surge pressure. Cavitation is generally a design issue, so the question is which material will absorb more of the sound if it occurs? Typical polymers will absorb sound in the range of 10 dB/cm, whereas metals are

on the order of 0.1–1.0 dB/cm. For a given change in velocity, the intensity of sound from a copper pipe will be at least 8 times higher than that of PEX-a pipe and peak pressures caused by a quick-acting valve could be reduced by 18–40% by utilizing PEX-a in lieu of copper pipe.

Surge Pressure Generated in Response to a Quick-acting Valve (PPI Report #3285)

Pipe Material	Maximum Measured Pressure, psi				
Flow Rate, gpm	2	2.5	3	4	6
½" Uponor PEX-a	136	150	169	193	244
½" PEX-b	143	168	177	212	274
½" CPVC	155	173	201	222	296
½" Type L Copper	194	239	266	318	422

Pressure response measurements include 60 psi (414 kPa) static pressure. Closing speed of quick-acting valve estimated at 25 milliseconds. Test performed at 54°F (12.2°C) cold water temperature.

PEX-a offers
up to **40%** reduction
in surge pressure

AquaPEX for Water Service Applications

Uponor AquaPEX Pipe is manufactured to meet the requirements of AWWA C904 – Crosslinked Polyethylene (PEX) Pressure Pipe, ½" (12mm) Through 3" (76mm), for Water Service. This standard describes PEX pressure pipe made from materials having a minimum standard PEX material designation code of PEX 1006 in ASTM F876 for use as underground water service lines in sizes ½" through 3" and conforms to a standard dimension ratio of SDR 9.

Install Uponor AquaPEX pipe underground in a manner that ensures external loads will not subsequently cause a decrease in the vertical dimension of the cross section of the pipe that exceeds 5% of the outside diameter. Install Uponor AquaPEX pipe in a snaking pattern with sufficient slack in the line to allow for contraction of the line due to temperature change prior to backfilling.

Use ProPEX or approved AWWA C800 compression fittings to connect pipe to itself or to the corporation and curb stops. Check

with Uponor or the fitting manufacturer for application suitability and proper usage instructions. Uponor EP and LF fittings are rated for direct burial in soil per NSF 14.

Service Fitting Solution Providers

- AY McDonald®
- Cambridge Brass™
- Ford Pack®
- Mueller® 110®
- Philmac® PolyGrip®

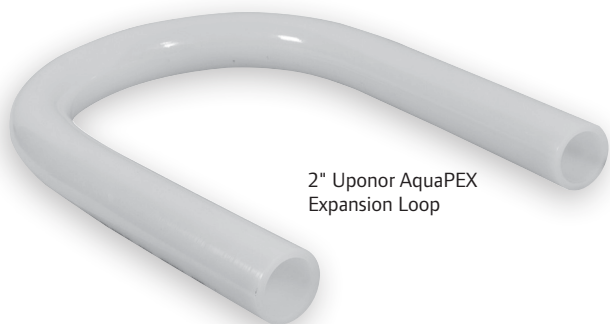
Fluorescent Lighting — UV and Heat Exposure

As a safety precaution against Ultraviolet (UV) exposure from fluorescent lighting, Uponor recommends that all PEX-a pipe be protected from UV by sleeving the pipe with a black material such as closed-cell pipe insulation or HDPE poly sheathing. Protection is recommended when pipe is directly exposed and within 6' (1.8m) of the

fluorescent light source. In such case, pipe should be protected 18" (0.46m) beyond direct exposure on each side of the fluorescent light source.

Furthermore, Uponor requires that all PEX-a pipe be protected from excessive heat by insulating the pipe with closed-cell,

fiberglass or other suitable pipe insulation. Insulation is required when pipe is within 6" (0.15m) of the fluorescent light source. In such case, pipe shall be protected 18" (0.46m) beyond each side of the fluorescent light source and maintain a minimum clearance of 1" (25.4mm).



Expansion and Contraction

Because PEX pipe expands at a rate of 1.1" per 100' per 10°F (27.94mm per 30.48m per 5.56°C) temperature rise, an expansion joint, offset or change in direction is necessary to accommodate the expansion and contraction of the pipe. Compensation for expansion

is typically needed every 65' for domestic hot water and every 150' for domestic cold water in a commercial domestic water plumbing system. Uponor offers a preformed 2" Uponor AquaPEX Expansion Loop (F8152000) to make expansion joint installations more efficient.

Pre-insulated AquaPEX R-value/Heat Loss¹

Pipe Size	R-value	Heat Loss at 70°F ΔT
½"	3.3	8.9 Btu/(hr·ft²·°F)
¾"	3.1	11.1 Btu/(hr·ft²·°F)
1"	3.0	13.1 Btu/(hr·ft²·°F)
1¼"	2.9	15.2 Btu/(hr·ft²·°F)
1½"	2.8	17.1 Btu/(hr·ft²·°F)
2"	2.7	21.0 Btu/(hr·ft²·°F)

¹ Using ½" insulation

Thermal Conductivity

PEX-a pipe has a very low coefficient of thermal conductivity, 0.219 Btu/(hr·ft²·°F), whereas copper has a coefficient of thermal conductivity between 300 and 400 Btu/(hr·ft²·°F) depending on wall thickness (Type K, L or M). Therefore, PEX-a pipe does not sweat like copper does. The thicker walls of PEX-a pipe act as an insulator (approx. R-0.19) whereas

the heat transfer from copper is much greater than with PEX-a. Uponor recommends insulating all PEX-a domestic hot-water supply and return lines to conserve energy and insulating PEX-a domestic cold-water supply lines when installed in an unconditioned space or poorly ventilated areas with excessive moisture content.



Pre-insulated Uponor AquaPEX is available in:

- ½"-2" pipe sizes with ½" PEX-foam insulation
- ¾"-3" pipe sizes with 1" PEX-foam insulation (special order)

PEX-a offers
up to **30% better**
insulation value

PEX-a vs. Copper Heat Loss Comparison — Btu/hr·ft

		Delta T (°F)				20				40				60				80				100			
		FG Insulation Thickness (K=0.28)				0"	½"	1"	1½"	0"	½"	1"	1½"	0"	½"	1"	1½"	0"	½"	1"	1½"				
Nominal Pipe Sizes	½"	Uponor PEX-a	4.00	1.84	1.43	1.24	8.02	3.69	2.86	2.49	12.03	5.53	4.30	3.73	16.04	7.37	5.73	4.97	20.05	9.22	7.16	6.21			
		Type L Copper	4.64	1.94	1.49	1.28	9.28	3.89	2.98	2.57	13.92	5.83	4.46	3.85	18.55	7.77	5.95	5.13	23.19	9.71	7.44	6.42			
	¾"	Uponor PEX-a	5.57	2.39	1.80	1.53	11.15	4.79	3.59	3.05	16.72	7.18	5.39	4.58	22.29	9.58	7.18	6.10	27.87	11.97	8.98	7.63			
		Type L Copper	6.65	2.54	1.87	1.58	13.31	5.08	3.74	3.16	19.96	7.62	5.61	4.73	26.62	10.16	7.48	6.31	33.27	12.70	9.36	7.89			
	1"	Uponor PEX-a	7.06	2.92	2.13	1.78	14.12	5.84	4.27	3.57	21.18	8.75	6.40	5.35	28.24	11.67	8.54	7.14	35.30	14.59	10.67	8.92			
		Type L Copper	8.66	3.11	2.23	1.85	17.31	6.23	4.46	3.70	25.97	9.34	6.69	5.54	34.62	12.46	8.92	7.39	43.28	15.57	11.15	9.24			
	1¼"	Uponor PEX-a	8.50	3.43	2.46	2.03	17.01	6.86	4.92	4.06	25.51	10.29	7.38	6.09	34.01	13.71	9.84	8.13	42.51	17.14	12.30	10.16			
		Type L Copper	10.67	3.68	2.58	2.11	21.34	7.36	5.15	4.21	32.01	11.04	7.73	6.32	42.68	14.72	10.30	8.42	53.35	18.40	12.88	10.53			
	1½"	Uponor PEX-a	9.89	3.93	2.78	2.27	19.77	7.85	5.55	4.54	29.66	11.78	8.33	6.81	39.55	15.71	11.10	9.07	49.43	19.63	13.88	11.34			
		Type L Copper	12.68	4.24	2.91	2.35	25.37	8.47	5.83	4.71	38.05	12.71	8.74	7.06	50.74	16.95	11.65	9.42	63.42	21.18	14.57	11.77			
	2"	Uponor PEX-a	12.57	4.90	3.39	2.73	25.14	9.81	6.78	5.45	37.71	14.71	10.17	8.18	50.21	19.61	13.56	10.91	62.84	24.52	16.95	13.63			
		Type L Copper	16.70	5.34	3.57	2.84	33.40	10.68	7.15	5.67	50.10	16.01	10.72	8.51	66.80	21.35	14.29	11.34	83.49	26.69	17.86	14.18			
	3"	Uponor PEX-a	17.50	6.78	4.57	3.60	35.00	13.57	9.14	7.20	52.51	20.35	13.72	10.80	70.01	27.14	18.29	14.40	87.51	33.92	22.86	18.01			
		Type L Copper	24.74	7.52	4.86	3.76	49.48	15.04	9.72	7.53	74.22	22.56	14.58	11.29	98.96	30.07	19.44	15.06	123.70	37.59	24.30	18.82			

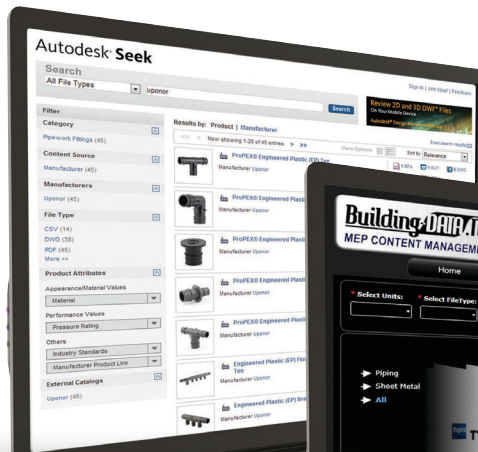
Building Information Modeling (BIM)

Autodesk Seek®

- Uponor parts now available in AutoDesk Seek; search "Uponor" on <http://seek.autodesk.com/>
- For use with Revit, AutoCAD, 3ds Max, Maya and other CAD applications

Building-DATA.net/TSI®

- Uponor parts now included in the Building Data Content Library for use with TSI MEP modeling software www.building-data.net



TECHNICAL SALES INTERNATIONAL
Autodesk
Authorized TSI Partner

For more information, see the **Uponor Plumbing Design Assistance Manual (PDAM)**



Uponorengineering.com

The Engineer's Resource Portal

The Uponor Engineering Resource Center is your single destination for designing and creating a desirable, cost-effective and energy-efficient structure. This portal is custom-made especially for you, the engineer, to help you meet all your goals. Whether it's meeting specific LEED® or other green-building certification

standards or incorporating value engineering into a project, Uponor can provide all the tools and resources, including specifications, submittals, CAD details, instructional manuals, design guidelines and even industry resource links to get you moving and on your way to a successful build.



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