



COMMERCIAL
PIPING SYSTEMS

INSULATING UPONOR
PEX PIPING

INSTRUCTION SHEET

Insulating Uponor PEX Piping

Insulating Hot-water Piping

Best practice is to insulate all domestic and hydronic hot-water piping to conserve energy and maintain desired fluid temperature. Uponor also recommends insulating all piping that is installed in an unconditioned space or poorly ventilated area with excessive moisture content.

For more information, refer to the Uponor Plumbing Design Assistance Manual (PDAM) or the Hydronic Piping Design Assistance Manual (HPDAM).

Insulating Cold-water Piping

Some local codes require cold-water piping be insulated due to condensation that can occur on the outside of the piping. This is typically specific to metallic piping. PEX piping has a very low coefficient of thermal conductivity (0.219), whereas copper has a coefficient of thermal conductivity between 173 and 231.

It's important to note, with both cold-water and chilled-water piping, if the surface temperature of the pipe or insulation is less than the design dew point temperature in the cavity, the pipe or insulation surface will condense. **Table 2** yields the surface temperature of the outermost layer with respect to water temperature, insulation thickness and ambient air temperature. This data can be used to ensure condensation will not occur.

Insulation Thickness (K=0.24)		Delta T (°F)				80				100				
		0"	½"	1"	1½"	0"	½"	1"	1½"	0"	½"	1"	1½"	
Nominal Pipe Size	½"	Uponor PEX-a	21.78	8.87	6.51	5.47	27.22	11.09	8.13	6.84				
		Type L Copper	23.03	8.95	6.53	5.48	28.79	11.18	8.16	6.85				
	¾"	Uponor PEX-a	29.92	10.94	7.78	6.43	37.40	13.67	9.73	8.03				
		Type L Copper	32.25	11.07	7.83	6.45	40.31	13.84	9.78	8.06				
	1"	Uponor PEX-a	37.69	12.93	8.99	7.33	47.11	16.17	11.24	9.16				
		Type L Copper	41.46	13.15	9.06	7.36	51.82	16.44	11.33	9.20				
	1¼"	Uponor PEX-a	45.16	14.88	10.17	8.19	56.45	18.60	12.71	10.24				
		Type L Copper	50.67	15.20	10.27	8.24	63.34	19.00	12.84	10.30				
	1½"	Uponor PEX-a	52.30	16.79	11.31	9.03	65.38	20.99	14.14	11.28				
		Type L Copper	59.89	17.23	11.45	9.10	74.86	21.53	14.32	11.37				
	2"	Uponor PEX-a	65.85	20.54	13.55	10.65	82.31	25.67	16.94	13.32				
		Type L Copper	78.31	21.25	13.78	10.77	97.89	26.57	17.23	13.46				
2½"	Uponor PEX-a	77.20	23.69	15.68	12.01	96.50	29.61	19.60	15.01					
	Type L Copper	96.82	25.26	16.35	12.40	121.02	31.58	20.44	15.50					
3"	Uponor PEX-a	90.14	27.76	17.86	13.77	112.68	34.70	22.33	17.22					
	Type L Copper	115.16	29.24	18.35	14.01	143.95	36.55	22.93	17.51					

Table 1: Uponor PEX vs. Copper Heat Loss Comparison [Btu/(h·ft)]

Water Temp. (°F)	Copper No Insulation	PEX No Insulation	PEX ½" Insulation	PEX 1" Insulation	PEX 1½" Insulation	PEX 2" Insulation
	Surface Temperature (°F)					
30	30.0	32.9	66.9	73.4	75.8	77.0
40	40.0	42.3	69.5	74.7	76.7	77.6
50	50.0	51.8	72.1	76.0	77.5	78.2
60	60.0	61.2	74.8	77.4	78.3	78.8
70	70.0	70.6	77.4	78.7	79.2	79.4
80	80.0	80.0	80.0	80.0	80.0	80.0

Table 2: Uponor PEX vs. Copper Surface Temperature Comparison at 80°F (26.6°C) Ambient Temp.

- Notes:**
1. Assumes SDR9 PEX and Type L copper pipe.
 2. Insulation conductivity of 0.25 (Btu·in)/(hr·ft²·°F).
 3. Assumes natural convection at a rate of 1 Btu/(hr·ft²·°F); 0.88-3.53 are standard values for natural convection.
 4. Calculations based on standard cylindrical thermal resistance calculations.

Example

A nominal 1" (25mm) PEX pipe with ½" thick insulation carrying 40°F (4.4°C) water would have a 69.5°F (20.83°C) insulation surface temperature given an 80°F (26.6°C) ambient temperature. Assuming a relative humidity of 60% at an 80°F (26.6°C) ambient temperature, the dew point temperature would be 65°F (18.3°C). Since the dew point temperature is

lower than the surface temperature, there is no concern for condensation on the piping system. If the surface temperature is lower than or equal to the dew point temperature, a higher level of insulation is necessary. If the surface temperature is 1 to 2 degrees higher than the dew point temperature of the piping system, a higher level of insulation would be recommended.

International Energy Conservation Code (IECC)

All piping serving as part of a heating or cooling system or service water heating system, shall be thermally insulated in accordance with Table C403.2.8 of the 2012 IECC where applicable.

Fluid Operating Temperature Range and Usage (°F)	Insulation Conductivity		Nominal Pipe Size (inches)		
	Conductivity Btu·in./ (h·ft²·°F)	Mean Rating Temperature, °F	< 1	1 to < 1½	1½ to < 4
141-200	0.25-0.29	125	1.5	1.5	2.0
105-140	0.21-0.28	100	1.0	1.0	1.5
40-60	0.21-0.27	75	0.5	0.5	1.0
< 40	0.20-0.26	75	0.5	1.0	1.0

Table 3: Minimum Pipe Insulation Thickness (in inches) from Table C403.2.8 of the 2012 IECC

Insulating Requirements for ASTM E84

Uponor AquaPEX and Wirsbo hePEX pipe are approved for use in applications requiring ASTM E84 and/or CAN/ULC S102.2 certification. For full installation requirements, refer to **Chapter 3: Fire-resistant Construction** in the Uponor PDAM or HPDAM.

Specifications for Approved Pipe Insulations in ASTM E84 and CAN/ULC S102.2 Applications			
Products	ASTM E84 & 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
½" Nomalock	25 or less	50 or less	4.0 pcf

Table 4: Pipe Insulation Requirements

Pre-insulated Uponor PEX Piping

Pre-insulated Uponor PEX pipe is available with ½", 1", 1½" and 2" polyethylene foam insulation. The products are approved for direct burial, however Uponor recommends adding an additional ½" of insulation for direct-burial applications due to soil compression forces.

Pre-insulated Uponor PEX with ½" Insulation			
Pipe Size	Actual Insulation Thickness	R-value	Heat Loss at 70°F ΔT
½"	0.6" (15mm)	3.9	7.4 Btu/(hr·ft)
¾"	0.6" (15mm)	3.6	9.0 Btu/(hr·ft)
1"	0.6" (15mm)	3.4	10.6 Btu/(hr·ft)
1¼"	0.6" (15mm)	3.3	12.1 Btu/(hr·ft)
1½"	0.6" (15mm)	3.2	13.6 Btu/(hr·ft)
2"	0.6" (15mm)	3.1	16.5 Btu/(hr·ft)

Table 5: Pre-insulated Uponor PEX with ½" Insulation

Pre-insulated Uponor PEX with 1" Insulation			
Pipe Size	Actual Insulation Thickness	R-value	Heat Loss at 70°F ΔT
½"	1.0" (25mm)	7.5	6.3 Btu/(hr·ft)
¾"	1.1" (28mm)	7.9	7.1 Btu/(hr·ft)
1"	1.0" (25mm)	6.4	8.8 Btu/(hr·ft)
1¼"	1.0" (25mm)	6.1	10.0 Btu/(hr·ft)
1½"	1.1" (27mm)	6.5	10.6 Btu/(hr·ft)
2"	1.0" (25mm)	5.6	13.4 Btu/(hr·ft)

Table 6: Pre-insulated Uponor PEX with 1" Insulation

Pre-insulated Uponor PEX with 1½" Insulation			
Pipe Size	Actual Insulation Thickness	R-value	Heat Loss at 70°F ΔT
½"	1.6" (40mm)	13.8	4.0 Btu/(hr·ft)
¾"	1.6" (40mm)	12.5	4.9 Btu/(hr·ft)
1"	1.6" (40mm)	11.6	5.7 Btu/(hr·ft)
1¼"	1.6" (40mm)	11	6.4 Btu/(hr·ft)
1½"	1.7" (42mm)	11.2	7.0 Btu/(hr·ft)
2"	1.6" (40mm)	9.9	8.6 Btu/(hr·ft)

Table 7: Pre-insulated Uponor PEX with 1½" Insulation

Pre-insulated Uponor PEX with 2" Insulation			
Pipe Size	Actual Insulation Thickness	R-value	Heat Loss at 70°F ΔT
1½"	2.1" (54mm)	15.4	5.2 Btu/(hr·ft)
2"	2.0" (52mm)	13.7	6.4 Btu/(hr·ft)

Table 8: Pre-insulated Uponor PEX with 2" Insulation

Uponor, Inc.
5925 148th Street West
Apple Valley, MN 55124 USA
Tel: 800.321.4739
Fax: 952.891.2008

Uponor Ltd.
2000 Argentia Rd., Plaza 1, Ste. 200
Mississauga, ON L5N 1W1 CANADA
Tel: 888.994.7726
Fax: 800.638.9517

Uponor

www.uponorpro.com