

SECTION 22 11 16

DOMESTIC WATER PIPING

1. GENERAL
	1. SECTION INCLUDES

**\*\*NOTE TO SPECIFIER\*\* Delete system type that are not required. The information below is intended for inclusion the Domestic Water Piping Specification.**

* + 1. Domestic water piping and fittings for the following applications:
			1. Domestic cold water piping
			2. Domestic hot water piping
			3. Domestic hot water recirculation piping
	1. RELATED SECTIONS

**\*\*NOTE TO SPECIFIER\*\* Delete any sections below not relevant to this project; add others as required**

* + 1. Section 22 11 13 — Facility Water Distribution Piping
		2. Section 22 07 19 — Plumbing Piping Insulation
		3. Section 22 05 29 — Hangers and Supports for Plumbing Piping and Equipment
	1. REFERENCES
		1. ASTM International (ASTM)
			1. ASTM D 2765 Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics.
			2. ASTM D 3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
			3. ASTM D 6394 Specification for Sulfone Plastics (SP).
			4. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
			5. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
			6. ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
			7. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
			8. ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
			9. ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.
			10. ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Crosslinked Polyethylene (PEX) Tubing.
			11. ASTM F2023 Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Pipe, Tubing and Systems to Hot Chlorinated Water
			12. ASTM F2657 Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing
		2. American Water Works Association
			1. AWWA C904 Standard for Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2 in. Through 3 in., for Water Service.
		3. American National Standards Institute (ANSI)/National Sanitation Foundation (NSF)
			1. ANSI/NSF Standard 14 Plastics Piping System Components and Related Materials
			2. ANSI/NSF Standard 61 Drinking Water System Components - Health Effects
			3. ANSI/NSF Standard 359 Valves for Crosslinked Polyethylene (PEX) Water Distribution Tubing Systems
			4. ANSI/NSF Standard 372 Drinking Water System Components – Lead Content
		4. American National Standards Institute (ANSI)/Underwriters Laboratories, Inc. (UL)
			1. ANSI/UL 263 Standard for Safety for Fire Tests of Building Construction and Materials.
			2. ANSI/UL 2846 Standard for Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics.
		5. American Society of Mechanical Engineers (ASME)
			1. ASME B 16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
			2. ASME B16.51 Copper and Copper Alloy Press-Connect Pressure Fittings.
		6. Canadian Standards Association (CSA)
			1. CAN/CSA B137.11 Polypropylene Pipe and Fittings for Pressure Applications
			2. CAN/CSA B137.5 Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
			3. CSA B242-05 Groove-and Shoulder-Type Mechanical Pipe Couplings.
		7. City of Los Angeles, California
			1. Research Report RR-5482
		8. German Welding Society (DVS)
			1. DVS 2207-11:2008 Welding of Thermoplastics — Machines and Devices for Heating Element Welding of Pipes, Pipeline Parts and Sheets.
		9. Department of Housing and Urban Development
			1. Materials Release no. 1269f
		10. International Code Council (ICC)
			1. International Plumbing Code (IPC)
			2. Evaluation Service Report PMG-1006 and PMG-1412
			3. ICC-ES PMG — 1106
			4. International Association of Plumbing Officials (IAPMO)
			5. Uniform Plumbing Code (UPC)
			6. Evaluation Report 253
		11. State of Massachusetts Division of Professional Licensure
		12. National Association of Plumbing, Heating and Cooling Contractors (NAPHCC)
			1. National Standard Plumbing Code (NSPC)
		13. Plastics Pipe Institute (PPI)
			1. PPI Technical Report TR-4
		14. QAI Laboratories
			1. P321-1 Water Pipe Systems - Plumbing Product-Pipe and Accessories
			2. P321-2 Water Pipe Systems - Plumbing Product-Plastic Piping and Accessories
		15. Underwriters Laboratories (UL)
			1. UL 2846 Standard for Fire Tests of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics.
		16. Uponor Inc.
			1. Uponor PEX Piping Systems Installation Guide, current edition.
			2. Uponor PEX Piping Systems Design and Installation Manual, current edition.
	2. SUBMITTALS
		1. Submit under provisions of Section 01 30 00 — Administrative Requirements.
		2. Product data: Provide manufacturer's product submittal data.
		3. Shop drawings: Provide installation drawings indicating piping layout, size dimension by installation segment, vault locations, support fixtures and schedules with all details required for installation of the system.
		4. Samples: Submit selection and verification samples of piping.
		5. Quality assurance/control submittals
			1. Test reports: Upon request, submit test reports from recognized testing laboratories.
			2. Submit the following documentation.
				1. Manufacturer's certificate stating that products comply with specified requirements.
				2. Manufacturer's flow schedule for the distribution system.
				3. Documentation that the installer is trained to install the manufacturer's products
		6. Closeout submittals: Submit the following documents.
			1. Warranty documents specified herein.
			2. Operation and maintenance data.
			3. Manufacturer's field reports specified herein.
			4. Final as-built piping layout drawing.
	3. QUALITY ASSURANCE
		1. Installer qualifications: Installer shall have successfully completed the Uponor Piping Systems Training Course and is able to provide proof/verification. Course shall be conducted by the manufacturer or a manufacturer's representative.
			1. Regulatory requirements and approvals: Ensure the piping distribution system complies with all applicable codes and regulations.
			2. Certifications: Provide letters of certification indicating: Installer uses skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed tradesperson.

**\*\*NOTE TO SPECIFIER\*\* Retain paragraph below if pre-installation meeting is required.**

* + - 1. Pre-installation meetings:
				1. Verify project requirements, excavation conditions, system performance requirements, manufacturer's installation instructions and warranty requirements.
				2. Review project construction timeline to ensure compliance or discuss modifications as required.
				3. Interface with other trade representatives to verify areas of responsibility.
				4. Establish the frequency and construction phase the project engineer intends for site visits and inspections by the tubing manufacturer's representative.
	1. DELIVERY, STORAGE AND HANDLING
		1. General: Comply with Division 1 Product Requirement Section.
		2. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
		3. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
		4. Storage and protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
			1. Store PEX piping in cartons or under cover to avoid dirt or foreign material from entering the piping.
			2. Do not expose white or blue PEX tubing to direct sunlight for more than one month or red PEX tubing to direct sunlight for more than six months. If construction delays are encountered, cover the tubing to prevent exposure to direct sunlight.
			3. Store piping on a flat surface to prevent unwanted deformation.
	2. WARRANTY
		1. Project warranty: Refer to Conditions of the Contract for project warranty provisions.
		2. Manufacturer's warranty: PEX-a manufacturer system warranty shall cover piping and fittings for a duration of 25 years from the date of installation. Piping system warranty shall apply to potable water distribution and water service systems constructed of pipe and fitting products sourced from the same manufacturer.
1. – PRODUCTS
	1. MANUFACTURERS
		1. Acceptable manufacturer: Uponor, located at: 5925 148th St. W.; Apple Valley, MN, 55124; toll-free: 800-321-4739; tel: 952-891-2000;
		email: NAspecifications@uponor.com; web: [uponor.com](http://www.uponor.com).

**\*\*NOTE TO SPECIFIER\*\* Delete one of the following paragraphs; Coordinate with requirements of Division 1 section on product options and substitutions.**

* + 1. Substitutions: Not permitted.
		2. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 — Product Requirements.
	1. DOMESTIC WATER PIPING AND FITTINGS
		1. Performance requirements:
			1. PEX-a piping and fittings shall meet the following pressure and temperature ratings per ASTM F876:
				1. 200 degrees F (93 degrees C) at 80 psi (551 kPa).
				2. 180 degrees F (82 degrees C) at 100 psi (689 kPa).
				3. 73.4 degrees F (23 degrees C) at 160 psi (1,102 kPa).
			2. PEX-a piping and fittings shall be tested for compliance by an independent third-party agency.
			3. Minimum bend radius (cold bending): Six times the outside diameter.
			4. Show compliance with ASTM E119 and ANSI/UL 263 through certification listings through UL.
				1. UL Design No. L557 1 hour wood frame floor/ceiling assemblies.
				2. UL Design No. K913 2 hour concrete floor/ceiling assemblies.
				3. UL Design No. U372 1 hour wood stud/gypsum wallboard wall assemblies.
				4. UL Design No. V444 1 hour steel stud/gypsum wallboard wall assemblies.
			5. PEX-a piping shall be tested to comply with the ASTM F2023 requirement for minimum chlorine resistance at the end use condition of 100% of the time at 140°F (60°C) at 80 psi (0.55 MPa) gauge pressure.
				1. PEX-a piping and tubing material designation codes shall be PEX 5106 or PEX 5306.
		2. Piping:
			1. Uponor AquaPEX®
				1. PEX-a (Engel-method crosslinked polyethylene), ASTM F876 and F877 (CAN/CSA-B137.5), SDR 9, CTS, 1/2 inch (16mm) through 3 inch (75mm) nominal pipe size.
			2. Uponor AquaPEX pre-sleeved piping
				1. High-density polyethylene (HDPE) corrugated sleeved PEX-a (Engel-method crosslinked polyethylene), ASTM F876 and F877 (CAN/CSA-B137.5), SDR 9, CTS, 1/2 inch (16mm) and 3/4 inch (19 mm) nominal pipe size.
			3. Uponor pre-insulated piping
				1. Factory fabricated and assembled Uponor AquaPEX PEX-a piping with a closed-cell polyethylene foam insulation, 1/2 inch (16mm) through 2 inch (51mm) nominal pipe size.

Insulation shall not be exposed to groundwater

* + 1. Fittings:
			1. Uponor ProPEX®
				1. Third-party certified to NSF 14 and ASTM F1960 cold-expansion with PEX reinforcing ring and shall comply with ASTM F876 and ASTM F877, 1/2 inch through 3 inch nominal pipe size fittings manufactured from the following material types: engineered polymer (EP), brass, and lead-free (LF) brass
				2. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked “F1960”.
			2. Uponor multiport tees and elbows: Multiple-outlet fitting complying with ASTM F877 (CAN/CSA B137.5); with ASTM F1960 inlets and outlets.
			3. Uponor manifolds: Multiple-outlet assembly with ASTM F1960 outlets.
				1. Type L copper branch manifold with lead-free brass valve outlets.
				2. Type L copper branch manifold without valves, with lead-free brass outlets.
	1. TRANSITION FITTINGS
		1. PEX-to-metal transition fittings:
			1. Manufacturers: Provide fittings from the same manufacturer of the piping.
			2. Third-party certified to NSF 14 and ASTM F1960 cold expansion with PEX reinforcing ring and shall comply with ASTM F876 and ASTM F877, 1/2 inch through 3 inch nominal pipe size fittings manufactured from the following material types:
			3. PEX-a to thread transition: One-piece Lead free (LF) brass fitting with male or female threaded adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
			4. PEX-a to copper sweat transition: One-piece lead free (LF) brass fitting with sweat adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
			5. PEX-a to copper press transition: One-piece lead free (LF) brass fitting with one ASME B16.51 copper press end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
			6. PEX-a to flange transition: Two-piece fitting with one steel flange conforming to ASME B 16.5 and one lead free (LF) brass adapter conforming to ASTM F1960.
			7. PEX-a to groove transition: One-piece lead free (LF) brass fitting with one CSA B242-05 groove end in either iron pipe size (IPS) or copper tube size (CTS) and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
			8. PEX-a to water meter transition: Two-piece fitting with one NPSM union thread and one ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
		2. PEX-to-thermoplastic transition fittings:
			1. PEX-a to CPVC transition: Thermoplastic fitting with one spigot or socket end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
	2. VALVES
		1. PEX-to-PEX, lead-free (LF) brass ball valves (1/2 inch (13 mm) through 2 inch (50 mm) nominal pipe size)
			1. Manufacturers: Provide ball valve(s) from the same manufacturer as the piping system.
			2. Full-port ball valve: two-piece, ASTM F1960 cold-expansion ends, with PEX-a reinforcing cold-expansion ring.
			3. LF brass valve with a positive stop shoulder.
			4. In compliance with 250 CWP, ANSI/NSF 359, ANSI/NSF 372, ANSI/NSF 14/61, cNSF-us-pw\_G lead free 0.25% lead maximum, ASTM F1960, ASTM F877 (CAN/CSA B137.5).
			5. Provide stem extension kits for insulated piping.
		2. PEX-to-NPSM, lead-free (LF) full-port brass water meter service valve
			1. 3/4 inch PEX x 1 inch NPSM straight and elbow
			2. 1 inch PEX x 1-1/4 inch NPSM straight and elbow
			3. Metal and polypropylene NPSM union nut
			4. In compliance with 250 CWP, ANSI/NSF 359, ANSI/NSF 14/61, cNSF-us-pw\_G lead free 0.25% lead maximum, ASTM F1960, ASTM F877 (CAN/CSA B137.5).
1. – EXECUTION
	1. EXAINATION
		1. Site verification of conditions: Verify that site conditions are acceptable for installation of the domestic water piping. Do not proceed with installation until unacceptable conditions are corrected.
	2. INSTALLATION
		1. Install domestic water piping according to approved shop drawings and coordination drawings.
		2. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including the following.
			1. Install PEX piping system in compliance with the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition, and the Uponor PEX Piping Systems Installation Guide, current edition.
			2. PEX shall not be installed in areas within five feet of a UV light source, such as LED and fluorescent light fixtures or other UV-generating devices.
			3. White or blue PEX shall not be installed outdoors where it is exposed to direct sunlight for more than one month; red PEX shall not be installed outdoors where it is exposed to direct sunlight for more than six months.
			4. PEX piping shall be installed per ASTM E84 requirements for plenum applications.
			5. Install PEX-a Pipe Support and provide all required hangers and supporting strapping as required by manufacturer to provide a code compliant installation.
			6. Install PEX piping in straight runs free of sags and kinks and provide bend supports at all 1/2 inch and 3/4 inch drops.
			7. All PEX piping penetrations through wall plates shall be protected or shielded as required to prevent damage to piping.
			8. PEX tubing passing through metal studs shall use grommets or sleeves at the penetration.
			9. Install PEX piping from the multiport tee or manifold to each fixture as a home run.
			10. Install PEX-a Pipe Support, fixed anchor points, and hangers in compliance with the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition, and the Uponor PEX Piping Systems Installation Guide, current edition, to minimize expansion and contraction.
			11. Install PEX piping at each fixture with out of the wall support bracket to secure piping and prevent excess movement when water stops or shut valves are operated.
			12. Install all PEX manifolds centered in access panels to permit servicing.

**\*\*NOTE TO SPECIFER\*\* Delete the following paragraph if not required.**

* + 1. Below-ground and in-slab installation
			1. Install PEX piping system in compliance with the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition, and the Uponor PEX Piping Systems Installation Guide, current edition.
			2. White and blue PEX shall not be installed outdoors where it is exposed to direct sunlight for more than one month; red PEX shall not be installed outdoors where it is exposed to direct sunlight for more than six months.
			3. Install support strapping as required by manufacturer to provide a code-compliant installation.
			4. Install PEX piping free of kinks.
			5. PEX piping penetrations through slabs shall be protected by PEX stand-up brackets or PVC bend supports to prevent damage to piping.
			6. Install PEX piping from the manifold as a home run. No joints shall be installed in the slab.
			7. Insulation shall not be exposed to groundwater.
			8. The piping system will be installed with the fewest number of underground joints as possible.

**\*\*NOTE TO SPECIFER\*\* Delete the following paragraph if not required.**

* + 1. Backfill
			1. The piping system will be backfilled with clean sand material.
				1. Minimum vertical distance from the bottom of the tubing to the trench floor is 4 inches (100 mm).
				2. Minimum lateral distance from the side of the tubing to the trench wall is 6 inches (150 mm).
				3. Install a minimum of 12 inches (300 mm) of clean fill over the top of the piping.
			2. The balance of the trench can be backfilled with native soil void of stone greater than 2 inches (50m) in diameter.
		2. Comply with manufacturer’s product data, including product technical bulletins, installation instructions, and design drawings, including the following:
			1. Uponor PEX Piping Systems Installation Guide, current edition.
			2. Uponor PEX Piping Systems Design and Installation Manual, current edition.
		3. PEX-a hangers and supports
			1. Horizontal PEX-a piping: Install supports suitable for PEX-a piping in compliance with local codes and the Uponor Piping Systems Installation Guide, current edition.
				1. Note: Per ICC PMG-1006, the above maximum hanger spacing requirements may be extended with the use of a continuous support channel such as Uponor PEX-a Pipe Support.
			2. Horizontal PEX-a piping with PEX-a Pipe Support: Install supports for PEX-a piping with horizontal support channel in accordance with manufacturer's recommendations and the following maximum spacing:
				1. 3 inch nominal and smaller: Maximum span, 8 feet (2.4 m).
				2. Support 1-1/2 inch and smaller fittings within 12 inches (0.3 m).
				3. Install clamps and fixed points per the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition, and the Uponor PEX Piping Systems Installation Guide, current edition.
			3. Vertical PEX-a piping: Install supports suitable for PEX-a piping in compliance with local codes, the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition, and the Uponor PEX Piping Systems Installation Guide, current edition:
				1. Support vertical in-wall piping every 5 feet (1.5 m).
				2. Support riser piping at the base of each floor and every 5 feet (1.5 m) vertically.

Refer to the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition, and the Uponor PEX Piping Systems Installation Guide, current edition, for additional requirements.

* + 1. Piping schedule
			1. Above ground domestic water piping shall be the following:
				1. 3 inch (75mm) and smaller

PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings.

* + - * 1. 2 inch (51mm) and smaller:

Pre-Insulated PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings.

**\*\*NOTE TO SPECIFIER\*\* Delete the following paragraph if not required.**

* + - 1. Domestic water piping installed below ground shall be any of the following:
				1. 3 inch (75mm) and smaller:

PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings. No joints or fittings shall be installed under slab. Protect all slab penetrations.

* + - * 1. 2 inch (51mm) and smaller, not exposed to groundwater:

Pre-Insulated PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings. No joints or fittings shall be installed under slab. Protect all slab penetrations.

**\*\*NOTE TO SPECIFER\*\* Delete the following paragraph if not required.**

* + - 1. Domestic water piping installed within slabs shall be the following:
				1. 3 inch (75mm) and smaller:

PEX-a piping. No joints or fittings shall be installed within slab. Protect all slab penetrations.

* + - * 1. 1/2 inch (13 mm) and 3/4 inch (19 mm):

Pre-sleeved PEX-a piping. No joints or fittings shall be installed within slab. Protect all slab penetrations.

* + - * 1. 2 inch (51mm) and smaller:

Pre-Insulated PEX-a piping. No joints or fittings shall be installed within slab. Protect all slab penetrations.

* + 1. Pipe joint construction
			1. PEX-a connections:
				1. Install per manufacturer's recommendations.
				2. Use manufacturer-recommended cold-expansion ProPEX tool for ASTM F1960 connections.
	1. FIELD QUALITY CONTROL
		1. Pressure testing PEX pipe and fittings: Pressure test PEX-a piping systems in accordance with local code and manufacturer’s requirements.
		2. System flushing, pressure testing and system conditioning procedure:
			1. Hydrostatic pressure testing shall be completed in accordance with local codes and the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition.
			2. Leave joints uninsulated and exposed for the duration of the test.
			3. Flush the domestic water system with ambient temperature, clean, potable water unless there is a risk of damage due to freezing.
			4. After completing each hydrostatic leak testing procedure, drain the system until empty.
			5. If testing with compressed air, do not exceed 120 psi.
	2. CLEANING
		1. Remove temporary coverings and protection of adjacent work areas.
		2. Repair or replace damaged installed products.
		3. Clean the installed products in accordance with manufacturer's instructions prior to Owner's acceptance.
		4. Water system disinfection
			1. Uponor AquaPEX piping should be disinfected in accordance with Uponor Disinfection Guidelines or local codes.
			2. Use non-petroleum-based cleaners
			3. Not exceed a pH of 11
			4. Have water temperatures less than 140°F (60°C)
			5. Use a chlorine solution of 50 parts per million (ppm) for 24 hours or 200 ppm for three hours for disinfection.
			6. To prevent reduced service life of system components, disinfection solutions should not stand in the system longer than 72 hours per Uponor Disinfection Guidelines. Flush the system with potable water after disinfection.
	3. PROTECTION
		1. Protect installed work from damage caused by subsequent construction activity on the site.

END OF SECTION