SECTION 15100

Domestic Water Piping

1. General
   1. Scope:
      * + 1. The Work of this Section shall consist of furnishing all labor, material, and equipment necessary for the installation of domestic water piping as shown on the Drawings and specified herein.
        1. Summary
           1. Domestic water piping system shall be crosslinked polyethylene pipe, and shall include the following:

Crosslinked polyethylene (PEXa) piping

Cold-expansion PEXa compression-sleeve fittings

Pipe fasteners as approved by the manufacturer of the PEXa piping.

Compression-sleeve assembly tools.

Supervision and field engineering required for the complete and proper function of the system.

* + - 1. References
         1. ASTM - American Society for Testing and Materials

ASTM D2765 – Standard Test Method for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics

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 F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing

ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems

ASTM F2023 – Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water

ASTM F2657 – Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing

* + - * 1. AWWA – American Water Works Association

AWWA C904- Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2 In.(12 mm) Through 3 In. (76 mm), for Water Service

* + - * 1. CSA Canadian Standards Associations

CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications

* + - * 1. IAPMO – International Association of Plumbing and Mechanical Officials
        2. ICC – International Code Council
        3. ISO – International Organization for Standardization

ISO 9001 – Quality Management Systems – Requirements

* + - * 1. NSF International

NSF/ANSI 14 – Plastic Piping System Components and Related Materials

NSF/ANSI 61 – Drinking Water System Components – Health Effects

NSF/ANSI 372 – Drinking Water System Components – Lead Content

* + - * 1. Plastic Pipe Institute

PPI TR-3– Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

* + - * 1. Underwriters’ Laboratories

ANSI/UL 263 – Standard Fire Tests of Building Construction and Materials

* + - * 1. Underwriters’ Laboratories of Canada

CAN/ULC S101 – PEX Pipe through Fire Rated Assemblies

CAN/ULC S102.2 – Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials

* + - * 1. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.
      1. Definitions
         1. PEXa pipe – a polyethylene material which has undergone a change in molecular structure using a chemical process whereby the polymer chains are chemically linked, resulting in crosslinked polyethylene pipe. This specification requires PEX to be designated as PEXa and be manufactured by the high-pressure peroxide method.
         2. Cold-expansion PEXa compression-sleeve fittings – includes fittings, compression sleeves, multi-port tees, manifolds, valves and copper ells.
      2. System Description
         1. Design Requirements

Standard grade hydrostatic pressure ratings from Plastics Pipe Institute in accordance with TR-3. The following three standard-grade hydrostatic ratings are required:

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 (1102 kPa)

PEXa piping to be encased with minimum 1/2-inch Armaflex insulation.

Support and hangers for horizontal installation shall provide for continuous, uncompressed insulation.

The Contractor may increase spacing between hangers by using a PEX-a Pipe Support galvanized steel channel.

Anchor points are required every 150 feet for domestic cold-water applications.

* + - * 1. Performance Requirements: To provide a cold domestic water piping system, which is manufactured, fabricated and installed to comply with regulatory agencies and to maintain performance criteria defined by the PEXa pipe manufacturer per their published technical guidelines.
        2. Compliant to the following standards:

NSF/ANSI Standard 14

NSF/ANSI Standard 61

ASTM F877

ASTM E119

ANSI/UL 263 through certification listings with Underwriters Laboratories, Inc. (UL).

UL Design No. L588— 1 hour wood frame floor/ceiling assemblies

UL Design No. K917 — 2 hour concrete floor/ceiling assemblies

UL Design No. U383 — 1 hour wood stud/gypsum wallboard wall assemblies

UL Design No. V461 — 1 hour steel stud/gypsum wallboard wall assemblies

CSA B137.5

* + - 1. Submittals
         1. Comply with Section 01340, Submittals. Approval and/or acceptance of all submittals are required prior to installation.
         2. Product Data: Submit manufacturer's product instructions, product submittal, catalog, specifications, and installation instructions. Submit data required for compliance with the contract documents necessary for the installation of the system.
         3. Submit system design indicating pipe sizing, pipe layout, and fixture connections when required.
         4. Certification:

Submit independent certifications for the piping system components from an accredited third-party testing laboratory.

The design shall be approved by a professional appropriately licensed in the jurisdiction where the installation will take place, as being complete and accurate.

Fittings shall be cold-expansion PEXa compression-sleeve fittings assembled as per Section 3.04.

* + - * 1. Samples: Submit product samples if requested by Engineer.
      1. Quality Assurance
         1. Manufacturer: Must be a company specializing in the Work of this Section with a minimum of 5 years documented experience.
         2. PEXa pipe shall be manufactured in a facility whose quality management system is ISO 9001 certified.
         3. PEXa pipe shall be certified to ASTM F876, F877 and CSA B137.5.
         4. Fittings shall be cold-expansion PEXa compression-sleeve fittings that are certified to ASTM F877 and CSA B137.5.
      2. Delivery, Storage, And Handling
         1. Comply with Section 01 60 00, Product Requirements.
         2. Deliver and store piping and fittings in packaging with labeling in place.

Pipe and fittings shall be kept in original packaging until required for installation.

* + - * 1. Store products in a safe, dry place.

Do not expose pipe and fittings to ultraviolet light beyond exposure limits recommended by manufacturer.

Protect products from exposure of contaminating materials. Install suitable plugs in open pipe ends until installation when necessary.

Piping shall not be dragged across the ground or other surfaces and shall be stored on a flat surface with no sharp edges.

* + - * 1. Protect materials from damage by other trades.
        2. Pipe and fittings shall be protected from oil, grease, paint, direct sunlight, and other elements as recommended by manufacturer.
      1. Warranty
         1. Provide manufacturer's standard written warranty.

The manufacturer shall warrant the PEXa pipe and cold-expansion PEXa compression-sleeve fittings as an approved connection assembly.

The PEXa pipe manufacturer shall warrant the crosslinked polyethylene piping to be free from defects in material and workmanship for a period of twenty-five (25) years.

Cold-expansion PEXa compression-sleeve fittings shall be warranted to be free from defects in material and workmanship for a period of twenty-five (25) years.

All manifolds and distribution headers shall be warranted to be free from defects in material and workmanship for a period of one (1) year starting at completion of successful pressurized water tests immediately following system installation.

* + - * 1. Provide installer’s guarantee as appropriate.

1. Products

2.01 Acceptable Manufacturer

* + - * 1. REHAU, 1501 Edwards Ferry Road, NE; Leesburg, VA 20176; email: [rehau.mailbox@rehau.com](mailto:rehau.mailbox@rehau.com); website: [www.na.rehau.com](http://www.na.rehau.com); upon whose products of which these specifications are based or Owner approved equal.

2.02 Components

* + - * 1. Piping

All pipe shall be high-density crosslinked polyethylene manufactured using the high-pressure peroxide method of crosslinking (PEXa). Pipe shall conform to ASTM F876, ASTM F877 CSA B137.5, NSF/ANSI 14, and NSF/ANSI 61.

Supplier shall provide pipe in sizes 3/8, 1/2, 3/4, 1, 1 1/4, 1 1/2 and 2 in

Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F temperature (690 kPa @ 82°C) and shall have a rating pf 80 psi gauge pressure at 200°F temperature (550 kPa @ 93°C) per the manufacturer’s requirements.

Pipe shall be certified by PPI to standard TR-3, with applicable plumbing and mechanical code certifications.

Pipe to be manufactured using a high-pressure peroxide method with a minimum degree of crosslinking of 70-89% when tested in accordance with ASTM D2765, Method B.

Pipe to be tested for resistance to hot chlorinated water in accordance with ASTM F2023. Pipe to have a minimum extrapolated time-to-failure of 50 years, calculated in accordance with section 13.3 of F2023 and listed as “3306” per the ASTM F876 standard.

Pipe to have a minimum bend radius for cold bending not less than five (5) times the outside diameter. Bends with a radius less than this shall require the use of bending template as supplied by the pipe manufacturer, and/or hot air.

PEXa pipe to have a co-extruded red, white or blue UV Shield made from UV-resistant polyethylene providing a minimum UV resistance of 6 months when tested according to ASTM F2657. In addition, pipe shall have a manufacturer’s recommended UV resistance of 12 months based on additional testing to ASTM F2657.

Pipe to be manufactured in an ISO 9001 certified production facility.

Pipe to have a Flame Spread Index and a Smoke Developed Index listing to ASTM E84 (in U.S.) or CAN/ULC S102.2 (in Canada) with insulation or galvanized support channel as necessary.

* + - * 1. Fittings

All Fittings used with crosslinked polyethylene (PEXa) water distribution pipe intended for plumbing applications shall be cold-expansion PEXa compression-sleeve fittings.

All polymer fittings shall be made from PPSU (black) in accordance with ASTM D6394.

All brass fittings shall be lead free brass made from ECO BRASS UNS C69300 or equivalent.

All compression sleeves shall be made from PEXa crosslinked polyethylene.

All fittings shall be third-party certified to applicable standards ASTM F877, NSF/ANSI 14, NSF/ANSI 61 and CSA B137.5.

Where joints are encased in concrete or buried underground, joints shall be wrapped if required per the manufacturer’s recommendation to protect the material.

* + - * 1. Hose Bibbs

A. Hose Bibbs (HB): 1. Manufacturers: Subject to compliance with requirements, provide the product indicated on the drawings or a comparable product by one of the following:

a. Chicago

b. Arrowhead Brass Products, Inc.

c. Woodford Manufacturing Company

2. Description:

a. Standard: ASME A112.18.1 for sediment faucets.

b. Body Material: Bronze.

c. Seat: Bronze, replaceable.

d. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.

e. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.

E. Insulation

Interior insulation shall be Armacell AP/ArmafFlex tube insulation or Owner approved equal.

Exterior insulation shall be jacketed K-FLEX CLAD AL or Owner approved equal.

* + - * 1. Hangers and Supports

Hangers and supports shall not restrict the free lateral movement caused by thermal expansion and contraction.

Metal hangers and supports shall be free of sharp edges which may abrade the pipe.

Concentrated loads such as metal valves, and other appurtenances shall be directly supported, or the pipe supported immediately adjacent to the load.

When penetrating metal studs, chemically compatible plastic grommets or similar devices shall be used to isolate the pipe from abrasion.

Support spacing shall comply with local code requirements and shall not exceed 32”.

* + - * 1. Assembly Tools

Tools for assembling PEXa pipe and compression-sleeve fittings shall be part of the manufacturer’s cataloged program.

Manufacturer of PEXa pipe and fittings shall provide a warranty for the assembly tools of 2 years.

2.03 Markings

* + - * 1. Pipe shall carry the following markings every three (3) feet (0.9 meters): Manufacturer’s name or trademark, nominal size, PEXa 3306 (material designation) SDR9 (standard dimension ratio), ASTM F876/ F877 / F2080, CSA B137.5, NSF-pw, U.P. Code, 160 psi @ 73.4°F / 100 psi @ 180°F / 80 psi @ 200°F, POTABLE TUBING, manufacturing date and footage mark.
        2. Cold expansion PEXa compression-sleeve fittings shall be marked with manufacturer’s designation, production code, and certification markings.

2.04 Packaging

* + - * 1. Coiled pipe shall be shipped in protective packaging marked with product name and size.
        2. Straight lengths shall be packed in plastic bags.
        3. Fittings shall be shipped in protective packaging marked with product name and size.

1. Execution

3.01 Acceptable Installers

* + - * 1. As a minimum, installation shall be performed by qualified installers with a minimum of three (3) years of PEX systems installation and appropriately licensed for the jurisdiction where the installation will take place.
        2. Installers must comply with all manufacturer’s technical guidelines.

3.02 Examination

* + - * 1. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of work. Do not proceed until unsatisfactory conditions are corrected.
        2. Beginning of installation means acceptance of existing conditions.

3.03 Preparation

* + - * 1. Coordinate with related trades and manufacturer’s recommendations with regard to installation of the domestic water piping system.

3.04 Installation

* + - * 1. The Contractor shall provide forty-eight (48) hours notice to the pump station personnel prior to anticipated water flow interruption and/or physical connection to existing water system.
        2. Install in accordance with manufacturer's most current published technical guidelines and final drawings where required.
        3. Following removal of existing water piping in areas as shown on the drawings, the Contractor shall connect new 1-1/2” PEXa piping to the existing PEX piping at north side of station where piping exits the ground at sheet pile wall. PEXa piping shall be routed south and then above the boat passageway and continue east along north edge of station building. PEXa piping shall enter at the northeast corner of the station building and continue along the east wall where it will exit the station building at Pump Bay No. 5 through the concrete parapet wall. There it will turn down to be connected to the existing water piping servicing Pump Nos. 6 & 7. A hose bibb shall be located at each pump location.
        4. Route piping in an orderly manner, according to layout and spacing shown in final drawings. All installation notes shown on the drawings shall be followed.
        5. All cold-expansion PEXa compression-sleeve fittings shall be assembled using the manufacturer’s approved tools and must consist of the following process:

Make a clean, square cut of the PEXa pipe.

Slide the PEXa compression sleeve over the PEXa pipe.

Expand the PEXa pipe twice with a rotation between expansions.

Insert the cold-expansion compression-sleeve fitting into the expanded PEXa pipe.

Compress the PEXa compression sleeve over the PEXa pipe and fitting using only tools from the manufacturer’s cataloged program.

* + - * 1. At connections and fittings, use a plastic pipe cutter to ensure square (90°) and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants.
        2. Pipe shall be dispensed using a suitable uncoiling device. Remove twists prior to securing pipe. Pipe shall lie flat on an even plane.
        3. Piping that passes through expansion joints or walls shall be covered in protective polyethylene convoluted sleeving (flexible conduit) extending 15 inches (38 cm) on each side of the joint. Sleeving shall be secured on pipe to prevent movement during installation.
        4. Where piping enters or exits a wall a protective conduit shall be placed around the pipe, with the conduit extending a minimum of 6 inches (15 cm) into the floor and exiting by a minimum of 6 inches (15 cm). Seal penetrations with flashing sealant.
        5. Install insulation continuously through hangers and around anchor attachments.
        6. Expansion/contraction of tubing can be accommodated by expansion loops or offsets.

3.05 Field Quality Control

* + - * 1. Tests of domestic plumbing systems shall comply with authorities having jurisdiction, and, where required, shall be witnessed by the building official.
        2. Air Test

Charge the completed, yet unconcealed pipes with air at a minimum of 1.5 times the design pressure.

Do not exceed 150 psig or as required by the local jurisdiction.

* + - * 1. Water Test

Purge air from pipes.

Charge the completed, yet unconcealed pipes with water.

Take necessary precautions to prevent water from freezing.

Check the system for leakage, especially at all pipe joints.

* + - * 1. Perform pressure test per manufacturer’s technical guidelines or condition the PEX to 1.5 times the design pressure, then allow the pressure to drop to 10 psi before repressurizing to 1.5 times the design pressure. Repeat for a duration of 30 minutes. Then, quickly relieve the pressure to actual test levels, close the valve, and start the pressure-test timer after observing a slight rise in pressure.

3.06 Protection

* + - * 1. Protect installation throughout construction process until date of final completion.
        2. Replace components that cannot be repaired.
  + End Section -