



Uponor, Inc.
5925 148th Street West
Apple Valley, MN 55124
Toll Free: (800) 321-4739
Phone: (952) 891-2000
Fax: (952) 891-1409
www.uponor-usa.com

This specification is a manufacturer-specific proprietary product specification using the proprietary method of specifying applicable to project specifications and master guide specifications. Brackets indicate optional text []; delete optional text in final copy of specification. Specifier Notes typically precede specification text; delete notes in final copy of specification. Trade/brand names with appropriate symbols typically are used in Specifier Notes; symbols are not used in specification text. Metric conversion, where used, is soft metric conversion.

This specification is for Pre-insulated Pipe Systems. These products, manufactured by Uponor and marketed under the name Ecoflex[®], are pre-insulated pipes featuring flexible potable HDPE tubing. Revise section number and title below to suit project requirements, specification practices and section content. Refer to CSI MasterFormat[™] 2004 for other section numbers and titles.

**SECTION 23 21 13
HYDRONIC PIPING
(ASTM ECOFLEX[®] POTABLE HDPE DISTRIBUTION SYSTEM)**

PART 1: GENERAL

1.01 SUMMARY

Specifier Note: The work covered by this section includes materials required to supply, install and pressure test potable pre-insulated high-density polyethylene (HDPE) tubing manufactured by Uponor as shown on drawings or as specified. For the purpose of this specification, Uponor is referred to as the piping manufacturer relative to Ecoflex potable pre-insulated HDPE piping.

- A. Section Includes: Flexible potable pre-insulated pipe distribution system that incorporates high-density polyethylene (HDPE) service tubing for potable hot and cold fluid distribution systems.

Specifier Note: When specifying manufacturer's proprietary products and recommended installation, the following References Article (1.02) may be omitted. Retain References Article when specifying products and installation by an industry reference standard. If retained, list standard(s) referenced in this section. Indicate issuing authority name, acronym, standard designation and title. Establish policy for indicating edition date of standard referenced. Conditions of the Contract or Division 1 References Section may establish the edition date of standards. This article does not require compliance with standard. It is a listing of all references used in this section.

1.02 REFERENCES

- A. General Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. ASTM International
1. ASTM F714 - 08 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
 2. ASTM D3350 - 08 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- C. American National Standards Institute (ANSI)/American Water Works Association (AWWA)
1. ANSI/AWWA C901 AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, ½ inch (13 mm) Through 3 inch (76 mm), for Water Service
 2. ANSI/AWWA C906 AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 inch (100 mm) Through 63 inch (1575 mm), for Water Distribution.
- D. American Standards Institute (ANSI)/National Sanitation Foundation (NSF)
1. ANSI/NSF 61 Drinking Water System Components – Health Effects
- E. International Code Council (ICC)
1. International Plumbing Code (IPC)
- F. International Association of Plumbing and Mechanical Officials (IAPMO)
1. Uniform Plumbing Code (UPC)
- G. Plastic Pipe Institute (PPI)
1. PE 3408/PE 3608 IPS Geothermal Pipe Specifications
- H. Uponor, Inc.
1. Uponor Pre-insulated Pipe Systems Design and Installation Manual, current edition

Specifier Note: Article below should be restricted to statements describing design or performance requirements and functional (not dimensional) tolerances of a complete system. Limit descriptions to composite and operational properties required to link components of a system together and to interface with other systems.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements: The potable HDPE service piping is USA manufactured and tested in accordance with ASTM F714, PE 3408, PE 3608 and AWWA C901/C906 standards. This product is listed with NSF/ANSI 61 or NSF-pw. The potable HDPE service piping has hydrostatic ratings in accordance with the temperatures and pressures listed in the ASTM standard. The hydrostatic ratings are:
1. -30 degrees F to 73 degrees F at 160 psig
(-34 degrees C to 23 degrees C at 1103 kPA)
 2. -30 degrees F to 100 degrees F at 125 psig
(-34 degrees C to 38 degrees C at 862 kPA)
 3. -30 degrees F to 120 degrees F at 101 psig
(-34 degrees C to 49 degrees C at 696 kPA)

4. -30 degrees F to 140 degrees F at 80 psig
(-34 degrees C to 60 degrees C at 552 kPA)
- B. Performance Requirements: Provide a potable HDPE distribution system that is USA manufactured, fabricated and installed to comply with regulatory agencies and authorities with jurisdiction, and that maintains performance criteria stated by the tubing manufacturer without defects, damage or failure.
1. Show compliance with ASTM F714 for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 2. Show compliance with ANSI/AWWA C901 for Polyethylene (PE) Pressure Pipe and Fittings (for 3-inch or less piping).
 3. Show compliance with ANSI/AWWA C906 for Polyethylene (PE) Pressure Pipe and Fittings (for 4-inch piping).
 4. Show compliance with NSF/ANSI 61 or NSF-pw regarding Drinking Water System Components.
 5. Show compliance with PE 3408 and PE 3608 for Geothermal Pipe Requirements.

Specifier Note: Article below includes submittal of relevant data to be furnished by Contractor before, during or after construction. Coordinate this article with Architect's and Contractor's duties and responsibilities in Conditions of the Contract and Division 1 Submittal Procedures Section.

1.04 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Submit manufacturer's product submittal data and installation instructions.
- C. 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.
- D. Samples: Submit selection and verification samples of piping.
- E. Quality Assurance/Control Submittals
1. Test Reports: Upon request, submit test reports from recognized testing laboratories.
 2. Submit the following documentation.
 - a. Manufacturer's certificate stating that products comply with specified requirements
 - b. Manufacturer's flow schedule for the distribution system
 - c. Documentation that the installer is trained to install the manufacturer's products
- F. 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

Specifier Note: Article below should include statements of prerequisites, standards, limitations and criteria that establish an overall level of quality for products and workmanship for this section. Coordinate article below with Division 1 Quality Assurance Section.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Use an installer with demonstrated experience on projects of similar size and complexity and possessing documentation proving familiarization training by the tubing manufacturer.

Specifier Note: Paragraph below should list obligations for compliance with specific code requirements particular to this section. Typically, general statements to comply with a particular code are addressed in Conditions of the Contract and Division 1 Regulatory Requirements Section. Avoid repetitive statements.

- B. Regulatory Requirements and Approvals:
 - 1. Ensure the potable pre-insulated HDPE piping distribution system complies with all applicable codes and regulations.
- C. Certifications: Provide letters of certification indicating:
 - 1. Installer uses skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed trades person.

Specifier Note: Retain paragraph below if pre-installation meeting is required.

- D. 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.

Specifier Note: Article below should include specific protection and environmental conditions required during storage. Coordinate article below with Division 1 Product Requirements Section.

1.06 DELIVERY, STORAGE and HANDLING

- A. General: Comply with Division 1 Product Requirement Section.
- B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
 - 1. Store potable pre-insulated piping coils under cover to prevent dirt or foreign material from entering the service tubing.
 - 2. Do not expose the potable HDPE service pipe to direct sunlight for more than 30 days. If construction delays are encountered, cover piping that is exposed to direct sunlight.

Specifier Note: Coordinate article below with Conditions of the Contract and with Division 1 Closeout Submittals (Warranty) Section. Use this article to require special or extended warranty or bond covering the work of this section.

1.07 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for owner's acceptance, USA manufacturer's standard 5-year warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights owner may have under contract documents.
 - 1. Warranty covers the repair or replacement of any piping or fittings proven defective.
 - 2. Warranty may transfer to subsequent owners.
 - 3. The most recent limited warranty published by the manufacturer takes precedence at the time of installation.

Specifier Note: List the requirements applicable to startup of the various systems. Include requirements for instruction of Owner's personnel in the operation of equipment and systems.

1.08 SYSTEM STARTUP

- A. [Specify system startup requirements.]
- B. Instruct Owner's personnel about operation and maintenance of installed system. Provide manufacturer's installation, operation and maintenance instructions for installed components within the system.

PART 2: PRODUCTS

Specifier Note: Retain article below for proprietary method specification. Add product attributes, performance characteristics, material standards and descriptions as applicable. Use of such phrases as "or equal", "or approved equal" or similar phrases may cause ambiguity in specifications. Such phrases require verification (procedural, legal and regulatory) and assignment of responsibility for determining "or equal" products.

2.01 ASTM ECOFLEX POTABLE HDPE PIPE DISTRIBUTION SYSTEM

Specifier Note: Paragraph below is an addition to CSI *SectionFormat*. Retain, edit or delete paragraph below to suit project requirements and practice of Specifier.

- A. Manufacturer: Uponor, Inc.
 - 1. USA Contact: 5925 148th Street West, Apple Valley, MN 55124; Telephone: (800) 321-4739, (952) 891-2000; Fax: (952) 891-2008; Website: www.uponor-usa.com
 - 2. Canada Contact: Uponor Ltd., 2000 Argentia Road, Plaza 1, Suite 200, Mississauga, ON L5N 1W1 Canada; Telephone: (888) 994-7726; Fax: (800) 638-9517; Website: www.uponor.ca

Specifier Note: Edit Article below to suit project requirements. If substitutions are permitted, edit text below. Add text to refer to Division 1 Project Requirements (Product Substitutions Procedures) Section.

2.02 PRODUCT SUBSTITUTIONS

- A. All products, components, etc., specified herein are manufactured by and/or available from the piping manufacturer.
- B. Alternative equipment manufacturers must submit required data for all mechanical and engineering data revisions for an equivalent ASTM piping system for approval 15 days prior to bid.
- C. Alternative equipment manufacturers must submit completed distribution design layout to the project engineer for approval. Plagiarism of another manufacturer's design is unacceptable.

Specifier Note: Specify materials to be furnished. This article may be omitted and the materials can be included with the description of a manufactured unit, equipment, component or accessory.

2.03 ASTM ECOFLEX POTABLE HDPE DISTRIBUTION SYSTEM MATERIALS**A. Service Tubing:**

- 1. Material: High-density polyethylene (HDPE) manufactured to NSF-certified SDR-11.
- 2. Material Standard: Manufactured in accordance with ASTM F714, AWWA C906, PE 3408, PE 3608 (or PE 3454) and NSF 61.
- 3. Pressure Ratings: Hydrostatic design and pressure ratings are in accordance with AMST standards; operating limits stated in System Description Article (1.03).
- 4. Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F714, as indicated. Note: Numbers in brackets are the metric equivalent pipe size.
 - a. ¾ inch [20mm]
 - b. 1 inch [25mm]
 - c. 1¼ inch [32mm]
 - d. 1½ inch [40mm]
 - e. 2 inch [50mm]
 - f. 3 inch [90mm]
 - g. 4 inch [110mm]

B. Outer Jacket

- 1. Material: Corrugated seamless high-density polyethylene (HDPE)
- 2. The HDPE jacket completely encompasses and protects the insulation from moisture and damage.
- 3. Outer jacket shall be extruded directly over the insulation and is flexible.

Specifier Note: Specify materials to be furnished. This article lists product by the inside nominal dimension which is common in ASTM dimensioned tubing.

4. Minimum Bend Radius:

- a. ¾-inch pre-insulated potable HDPE tubing with 2.7-inch [68mm] jacket has a bend radius of 10 inches [254mm].
- b. 1-inch pre-insulated potable HDPE tubing with 2.7-inch [68mm] jacket has a bend radius of 12 inches [304mm].
- c. 1¼-inch pre-insulated potable HDPE tubing with 5.5-inch [140mm] jacket has a bend radius of 14 inches [356mm].
- d. 1½-inch pre-insulated potable HDPE tubing with 5.5-inch [140mm] jacket has a bend radius of 18 inches [457mm].
- e. 2-inch pre-insulated potable HDPE tubing with 5.5-inch [140mm] jacket has a bend radius of 30 inches [762mm].
- f. 3-inch pre-insulated potable HDPE tubing with 6.9-inch [175mm] jacket has a bend radius of 32 inches [812mm].
- g. 4-inch pre-insulated potable HDPE tubing with 7.9-inch [200mm] jacket has a bend radius of 48 inches [1219mm].

5. The outer jacket shall contain 2 percent carbon black, finely divided and thoroughly dispersed to provide protection from UV degradation.

C. Insulation

1. The insulation shall be layered expanded cross-linked water-resistant polyethylene closed-cell foam.
2. All seams of the insulation shall be sealed.
3. Insulation shall not be bonded to the service tubing.

D. End Seals

1. The piping manufacturer will supply all EPDM rubber end caps with water-stop seal.
2. EPDM rubber end caps are to be installed on each end prior to connecting the service pipes and insulating the field joints.
3. The EPDM end caps will seal onto the tubing and outer jacket forming a watertight seal.

Specifier Note: Two fitting programs are available for the potable HDPE Service Tubing. Normally one fitting type is specified on the project. In this case, delete the other fitting reference. It is acceptable to specify both fittings allowing the installing contractor to choose the type of fitting used. For standardization purposes, the installing contractor should then only use one type of fitting for the installation.

E. Fitting Products for 3-inch and Smaller Pipe per AWWA C901

1. Butt Fusion Fittings – Fittings shall be made of 3408 Polyethylene material (PE3408), PE3608 or PE3454. Butt Fittings shall meet the requirements of ASTM D3350, CSA B137.1, NSF 14 and NSF 61. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. All fittings shall meet the requirements of AWWA C901.
2. Electrofusion Fittings – Fittings shall be PE 3408, PE3608 or PE3454 and meet requirements of ASTM D3350, CSA B137.1, NSF 14 and NSF 61. Fittings shall have a pressure rating of equal to the pipe unless otherwise specified in the plans.
3. Flanges and Mechanical Joint Adapters – Flanges and Mechanical Joint Adapters shall be made of PE 3408, PE3608 or PE3454 and meet requirements of ASTM

D3350, CSA B137.1, NSF 14 and NSF 61. Flanges and Mechanical Joint Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

4. Service connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion (branch) saddles, tapping tees or mechanical saddles.
 - a. For electrofusion saddles with threaded outlet, the size of the outlet shall be 1-inch IPS unless a larger size is shown on the plans and shall be made of materials stated above (Article number 2.03.E.2).
 - b. For sidewall fusion saddles, the size of the saddle shall be as indicated on the plans. The saddle can be made according to ASTM D3350, ASTM D3261 or ASTM F2206. After installation, approximately ¼-inch of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide ¼-inch of area beyond the saddle are not acceptable.
 - c. Tapping tees shall be made to ASTM D3261 or D2683.
 - d. Mechanical strap-on saddles can only be used when approved by mechanical saddle manufacturer. The body of the saddle shall be stainless steel or brass. The gasket material and design must be acceptable for PE pipe. The outlet shall be threaded for 1-inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed according to manufacturer's instructions.
5. Heat fusion is the preferred method for joining these pipes. All buried fittings will be installed, insulated and sealed in accordance with the instructions of the manufacturer.

F. Fitting Products for 4-inch and Larger Pipe per AWWA C901

1. Butt Fusion Fittings – Fittings shall be made of HDPE material that has been NSF certified SDR-11 with a minimum material designation code of PE3408. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All fittings shall meet the requirements of AWWA C906.
2. Electrofusion Fittings – Fittings shall be made of HDPE material that has been NSF certified SDR-11 with a minimum material designation code of PE3408. Electrofusion fittings shall have a manufacturing standard of ASTM F1055 and shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and have nominal burst values of four times the Working Pressure Rate (WPR) of the fitting. Markings shall be according to ASTM F1055.
3. Flanges and Mechanical Joint Adapters – Flanges and Mechanical Joint Adapters shall have a material designation code of PE3408 or higher and meet requirements of ASTM D3350, CSA B137.1, NSF 14 and NSF 61. Flanges and Mechanical Joint Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
4. Service connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion (branch) saddles, tapping tees or mechanical saddles.
 - a. For electrofusion saddles with threaded outlet, the size of the outlet shall be 1-inch IPS unless a larger size is shown on the plans and shall be made of materials stated above (2.03/E/2).

- b. For sidewall fusion saddles, the size of the saddle shall be as indicated on the plans. The saddle can be made according to ASTM D3350, ASTM D3261 or ASTM F2206. After installation, approximately ¼-inch of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide ¼-inch of area beyond the saddle are not acceptable.
 - c. Tapping tees shall be made to ASTM D3261 or ASTM D2683.
 - d. Mechanical strap-on saddles can only be used when approved by mechanical saddle manufacturer. The body of the saddle shall be stainless steel or brass. The gasket material and design must be acceptable for HDPE pipe. The outlet shall be threaded for 1-inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed according to manufacturer's instructions.
5. Heat fusion is the preferred method for joining these pipes. All buried fittings will be installed, insulated, and sealed in accordance with the instructions of the manufacturer.

2.04 PIPE AND FITTING IDENTIFICATION

- A. The pipe shall be marked in accordance with the standards to which it is manufactured.
- B. Color identification by the use of stripes on pipe to identify pipe service shall be optional. If used, stripes or colored exterior pipe product shall be blue for potable water, green for wastewater/sewage, or purple for reclaimed water. [Optional]
- C. Tracing wire shall be placed parallel and 18 inches above, but separate from, the pipe and shall be 10 AWG. [Specifier can change this to preferred material or method; all pipes should have a locatable methodology.]
- D. Marking tape shall be approved by the engineer and placed between 12 and 18 inches above the crown of the pipe. [Optional]

2.05 ACCESSORIES

- E. Use accessories associated with the installation of the ASTM Ecoflex Potable HDPE distribution piping system as recommended by or available from the manufacturer.
- F. Insulation Kits
 - 1. Insulation kits will be manufactured of ABS shells or HDPE sleeves, will feature equal thickness of closed-cell PEX insulation as the pipe, and sealed watertight.
- G. Connection Vaults
 - 1. The piping manufacturer will provide the connection vaults when required by the project construction.
 - 2. Connection vaults shall be constructed of rotationally molded composite polyethylene and PE foam, providing a structurally sound and thermally insulated chamber.
 - 3. Heat shrink seals as provided by the tubing manufacturer shall be installed to prevent introduction of water into the vault.
- D. Anchors
 - 1. The project engineer will determine the use of anchors, if required, within the distribution system.

PART 3: EXECUTION

Specifier Note: Article below is an addition to the CSI *SectionFormat*. Revise article below to suit project requirements and specifier's practice.

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including:

1. Uponor Pre-insulated Pipe Systems Design and Installation Manual, current edition

Specifier Note: Specify actions to determine that conditions are acceptable to receive primary products of the section.

3.02 EXAMINATION

- A. Site Verification of Conditions

1. Verify that site conditions are acceptable for installation of the potable pre-insulated HDPE piping distribution system.
2. Do not proceed with installation until unacceptable conditions are corrected.

Specifier Note: Coordinate article below with manufacturer's recommended installation requirements.

3.03 INSTALLATION

- A. Below-grade Installation

1. Potable pre-insulated HDPE piping shall be installed in accordance with manufacturer's recommendations and the details as shown on the contract drawings.
2. The system will be installed with the fewest number of underground joints as possible.
3. The system does not require expansion loops, expansion joints or compensators of any type.
4. An EPDM rubber end cap shall be applied at all terminations of the potable pre-insulated HDPE piping system, including all fitting locations, to form a watertight seal.
5. All buried fittings will be installed, insulated and sealed in accordance with the piping manufacturer's instructions.
6. Connection Vaults or Insulation Kits are required for all below-grade installations.

- B. Backfill

1. The potable pre-insulated HDPE piping system will be backfilled with clean sand material.
 - a. Minimum vertical distance from the bottom of the tubing to the trench floor is 4 inches [100mm].
 - b. Minimum lateral distance from the side of the tubing to the trench wall is 6 inches [150mm].
 - c. Install a minimum of 12 inches [300mm] of clean fill over the top of the potable pre-insulated piping.

2. The balance of the trench can be backfilled with native soil void of stone greater than 2 inches [50mm] in diameter.

Specifier Note: Specify the tests and inspections required for installed or completed work.

3.04 FIELD QUALITY CONTROL

A. Site Tests

1. All piping should be hydrostatically tested after installation. To ensure system integrity, pressure-test the tubing before and during backfilling of the piping.
2. Pneumatic testing is not recommended. The service tubing will be cold-water tested at 1½ times the operating pressure, not to exceed 90 psi, for a minimum of 1 hour prior to system burial.

Specifier Note: Specify the final actions required to prepare installed equipment or other completed work to properly function or perform.

3.05 ADJUSTING

A. [Specify any required adjustments to the system.]

Specifier Note: Specify the final actions required to clean installed equipment or other completed work to properly function or perform. Coordinate article below with Division 1 Execution Requirements (Cleaning) Section.

3.06 CLEANING

- A. Remove temporary coverings and protection of adjacent work areas.
- B. Repair or replace damaged installed products.
- C. Clean the installed products in accordance with manufacturer's instructions prior to Owner's acceptance.
- D. Remove construction debris from project site and legally dispose of debris.

Specifier Note: Specify requirements of the installer or manufacturer to demonstrate or train the Owner's personnel in the operation and maintenance of equipment.

3.07 DEMONSTRATION

- A. Demonstrate operation of the ASTM Ecoflex Potable HDPE piping distribution system to Owner's personnel.

Specifier Note: Specify provisions for protecting work after installation but prior to acceptance by the Owner. Coordinate article below with Division 1 Execution Requirements Section.

3.08 PROTECTION

- A. Protect installed work from damage caused by subsequent construction activity on the site.

END OF SECTION