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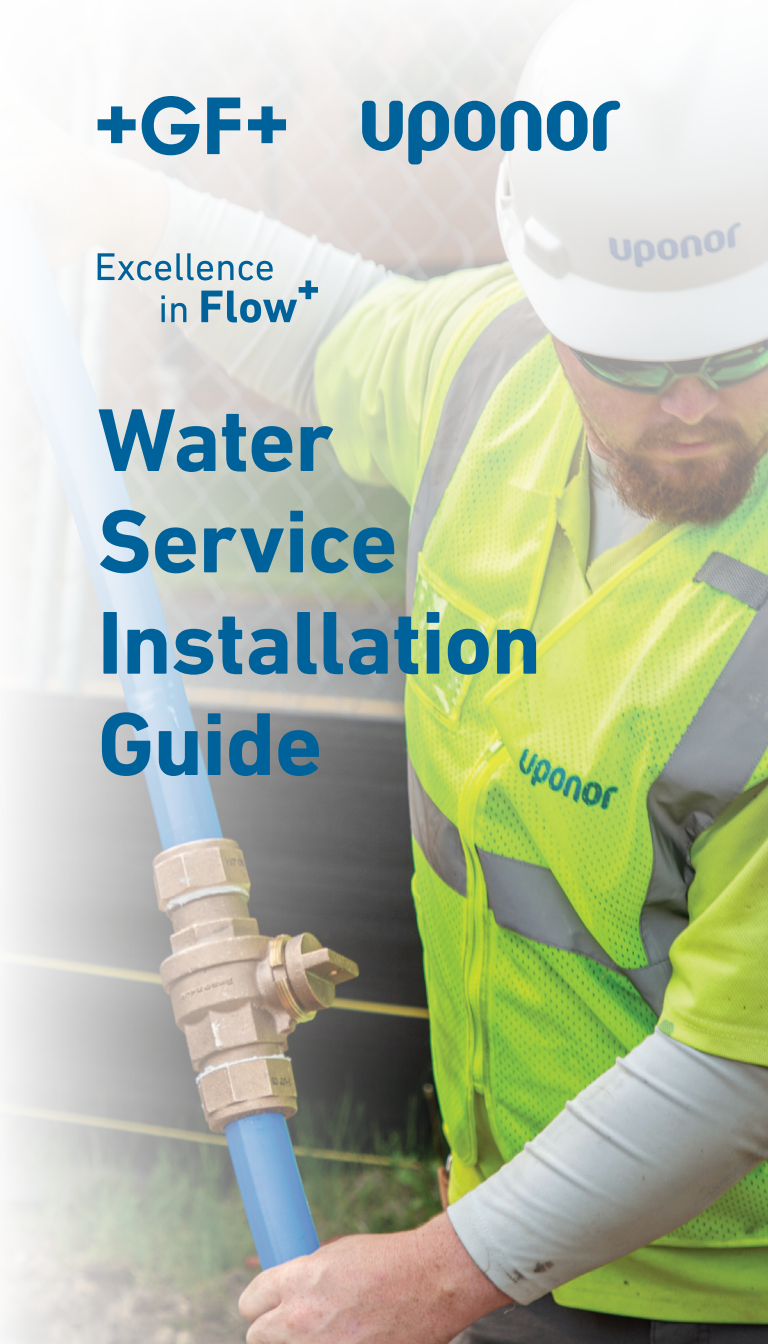
Excellence in Flow+

Water Service Installation Guide



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Foreword

This installation guide is published for water service installers and building officials interested in Uponor ServicePEX™ water service piping systems. It describes general installation recommendations that use Uponor ServicePEX piping products. Refer to local codes for additional requirements.

GF Building Flow Solutions has made reasonable efforts to collect, prepare, and provide quality information and material in this installation guide. However, system enhancements may result in modification of features or specifications without notice.

GF is not liable for installation practices that deviate from this installation guide or are not acceptable practices within the trades, codes, or standards of practice.

Prior to installing Uponor ServicePEX piping systems, GF recommends all installers attend Uponor PEX piping systems installation training performed by a GF trainer or manufacturer's representative. To schedule a training session at your business or job site, contact your local Uponor PEX products representative or call 800 321 4739.

Direct any questions regarding the suitability of an application or a specific design to a local Uponor PEX products representative or by emailing support.UNA@georgfischer.com or calling 888 594 7726 in the United States or 888 994 7726 in Canada.

Throughout this document, there are references to local or national code requirements. GF recognizes the importance of consistent regulations and works closely with industry associations and code development bodies to ensure transparency, consistency, and safety.

It is important to understand the difference between a manufacturer's recommendation and the code requirement as it applies. If there are differences between the manufacturer's recommendations and design parameters and the enforceable code language, it is critically important to follow the more restrictive criteria.

Where GF recommendations are more restrictive than the adopted code, follow the manufacturer's recommendations to promote expected product performance and coverage under the Limited Warranty.

It is important to always confirm the products, design, and intended installation are acceptable to the local Authority Having Jurisdiction (AHJ) and comply with all local codes, ordinances, and regulations prior to installation.

Important Safety Information

To reduce the risk of injury, read and understand this installation guide before beginning work. Read all product safety warnings and operator's manuals for water service connection systems as well as the Milwaukee® Tool M12™, M12 FUEL™, M18™, M18 FUEL™, and FORCE LOGIC™ ProPEX® expansion tools. Also, read all product safety warnings and operator's manuals for PEX pipe cutters and other installation tools to operate those items safely and correctly.

Always wear appropriate personal protective equipment (PPE), including, but not limited to, hardhats, safety vests, gloves, protective boots, safety goggles, or safety glasses with side shields when performing work.

When transitioning from Uponor ServicePEX to other piping materials, follow the appropriate installation instructions for that product.

WARNING: Cancer and Reproductive Harm
P65Warnings.ca.gov

Uponor ServicePEX Pipe Overview

Uponor ServicePEX is the latest innovation from the trusted name in PEX piping for more than 40 years. Designed for both new construction and the replacement of outdated service lines, ServicePEX delivers clean, safe water from the main to the structure, offering a modern, dependable solution that prioritizes health, safety, and top-tier performance in every installation.

Available in sizes from ¾" to 2", Uponor ServicePEX is tested and proven to the highest industry standards to support safe, clean, sustainable water delivery and is fully compliant for water service applications. The highly flexible PEX-a product minimizes connections, reduces kinking, and allows for kink repairability for faster installs, less time in trenches, improved efficiencies, and reduced jobsite waste.

Best of all, the product is confidently backed by a 25-year transferable limited warranty when used with ProPEX F1960 fittings. For complete warranty details, visit uponor.com.

Figure 1: Uponor ServicePEX pipe installation

Uponor PEX Properties

PEX is an acronym for crosslinked polyethylene. The “PE” refers to the raw material used to make polyethylene; the “X” refers to the crosslinking of

the polyethylene across its molecular chains. The molecular chains are linked into a three-dimensional network that makes PEX remarkably durable within a wide range of temperatures and pressures.

GF Building Flow Solutions manufactures Engel-method PEX-a pipe. The PEX industry considers this pipe superior because the crosslinking is done during the manufacturing process when the polyethylene is in its amorphic state (above the crystalline melting point).

Accordingly, the degree of crosslinking reaches more than 80%, resulting in a more uniform product with no weak links in the molecular chain.

Currently, three methods exist for producing PEX:

- Engel or peroxide method (PEX-a)
- Silane method (PEX-b)
- Electron beam (e-beam) or radiation method PEX-c)

All three processes generate pipe that is crosslinked to various degrees according to ASTM F876 and F877 standards.

Figure 2: PEX-a (Engel) 80%+ crosslinked

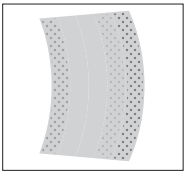

Figure 3: PEX-b (Silane) 65-70% crosslinked

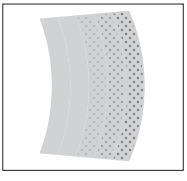

Figure 4: PEX-c (Radiation) 70-75% crosslinked

The properties of PEX-a pipe make it the most flexible PEX on the market. This flexibility allows the tightest bend radius available — six times the outside diameter of the pipe. Its flexibility also greatly reduces instances of kinked pipe. And in the rare instance of a kink, the thermal memory of PEX-a allows kink repair with a simple shot of heat from a heat gun. The pipe's shape memory also offers the unique opportunity for ProPEX fitting connections. Shape memory allows PEX-a to expand and then shrink back to normal size — creating strong, durable and reliable fitting connections.

Finally, PEX-a pipe offers more resistance to crack propagation (how a crack grows) than PEX-b or PEX-c pipe. A crack that occurs in PEX-a pipe is the least likely to grow over time and cause leaks or damage.

Property	English Units	SI Units
Approximate modules of elasticity (Secant at 1% and 73°F/22.8°C)	91,350 psi	630 N/mm^2
Tensile yield strength at 68°F (20°C) per DIN 53455	2.76-3.77 psi	19-26 N/mm^2
Piping density	59 $lbs./ft.^3$	936 Kg/m^3
Impact strength	Will not fail under impact at temperatures of -284°F/-140°C	
Water absorption	Room temperature = 0.01% Boiling for 40 days = 0.07%	
Coefficient of friction (surface-roughness factor)	0.000019 inches	0.0005 mm
Surface tension	0.00014 lbs./inches	25 dyne/cm
Coefficient of linear expansion at 135°F/57°C	Avg. = $9.2*10^{-5}$ in/in•°F	Avg. = $1.7*10^{-4}$ m/m•°C
Softening temperature	264°F to 268°F	129°C to 131°C
Specific heat	0.55 Btu/lb.•°F	2302.3 J/kg•°C
Coefficient of thermal conductivity	0.219 Btu/(hr.•ft.•°F)	0.38 W/(m•°K)
Degree of crosslinking	70 to 89% (per ASTM F876)	
Minimum bend radius	Six times the outside diameter	

Table 1: Material properties of Uponor PEX piping

Standards, Codes, and Listings

Uponor ServicePEX pipe and ProPEX fittings are designed to all applicable industry standards, codes, and listings, including the AWWA C904 Standard for water service as well as ASTM F876, CSA B137.5, NSF 14, and NSF 61.

Refer to the details below for general regulatory information on ServicePEX. However, for the most updated technical information, access the Uponor ServicePEX product submittal on uponor.com.

ASTM International Standards

- ASTM F876 Standard Specification for Cross-linked Polyethylene (PEX) Piping
- ASTM F877 Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
- ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Piping
- ASTM F2023 Standard Test Method Evaluating the Oxidative Resistance of Cross-linked Polyethylene (PEX) Piping and Systems to Hot Chlorinated Water
- ASTM F2657 Standard Test Method for Outdoor Weathering Exposure of Cross-linked Polyethylene (PEX) Piping

NSF International Standards

- ANSI/NSF Standard 14 Plastics Piping System Components and Related Materials
- ANSI/NSF Standard 61 Drinking Water System Components — Health Effects

American Water Works Association (AWWA)

- AWWA C904 Cross-Linked Polyethylene (PEX) Pressure Pipe, ½" (12 mm) through 3" (76 mm) for Water Service

CSA Group (Canadian Standards Association)

- CAN/CSA B137.5 Crosslinked Polyethylene (PEX) Piping Systems for Pressure Applications

Plastics Pipe Institute (PPI)

- PPI Technical Report TR-4

Codes

- UPC
- IMC
- NBC of Canada
- IPC
- IBC
- IRC
- UMC
- NSPC
- UFGS
- NPC of Canada

Listings

- cNSFus-pw
- U.P. Code

Temperature and Pressure Ratings

Uponor ServicePEX has a 5306 PEX material designation. Using the Plastics Pipe Institute (PPI) recommended 0.5 design factor for pipes in this category, ServicePEX achieves temperature and pressure ratings of 160 psi at 73°F (11 bar at 23°C) and 100 psi at 180°F (6.9 bar at 82.2°C).

Additionally, Section F.7 of PPI TR-3 allows polyethylene (PE) materials to qualify for a higher design factor of 0.63. ServicePEX meets these requirements, resulting in a temperature and pressure rating of 200 psi at 73°F (13.8 bar at 23°C).

Per Section F.7 of PPI TR-3, a PE material that meets the following requirements qualifies for a recommended design factor of 0.63.

- Long-term hydrostatic strength substantiation according to PPI TR-3 Part F.5
- Minimum slow-crack growth performance by ASTM F1473 of 500 hours as required by ASTM D3350
- LCL/LTHS ratio of at least 90% as per ASTM D2837

ServicePEX has been tested according to PPI TR-3 policies and procedures. Specimens were submitted for testing to ASTM D2837 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.

The pipe then underwent testing to ASTM F1473 Standard Test Method for Notch Tensile Test to Measure

the Resistance to Slow Crack Growth of Polyethylene Pipes. Results were evaluated and the ServicePEX pipe samples tested met the requirements of Section F.7 of PPI TR-3 for polyethylene (PE) materials to qualify for a higher 0.63 design factor, resulting in a temperature/pressure rating of 200 psi at 73°F (13.8 bar at 23°C).

- ASTM D2837 testing confirms the 73°F (23°C) stress rupture regression is linear to 50 years.
- ASTM F1473 testing confirms a minimum slow crack growth performance of over 500 hours.
- The lower confidence limit/long-term hydrostatic strength (LCL/LTHS) ratio is above 90%, as required by ASTM D2837 (i.e., there is good consistency in the test data).

For questions regarding the suitability of an application or a specific design, email Uponor Technical Services at support.UNA@georgfischer.com or call 888 594 7726 in the United States or 888 994 7726 in Canada.

Figure 5: Uponor ServicePEX temperature and pressure rating on pipe

UV Resistance Rating

The test method for evaluating UV resistance as required by ASTM F876 is ASTM F2657 Test Method for Outdoor Weathering Exposure of Cross-linked Polyethylene (PEX). According to ASTM F876, PEX piping must bear a four-digit code to signify the requirements it meets. The second digit in the code references the minimum ultraviolet (UV) resistance of the piping.

Uponor ServicePEX has a 5306 PEX material designation. The second digit of "3" indicates the pipe has been tested and meets the ASTM F876 requirement for minimum ultraviolet (UV) resistance of 6 months. However, the pipe has been tested and proven to resist the damaging effects of UV for up to 12 months.

Specimens were exposed to natural UV for 12 months according to ASTM F2657 Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing. The pipe then underwent chlorine-resistance testing according to ASTM F2023 Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Pipe, Tubing, and Systems to Hot Chlorinated Water. Results were evaluated according to ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing, and the PEX pipe samples tested met the requirements of the 12-month UV exposure.

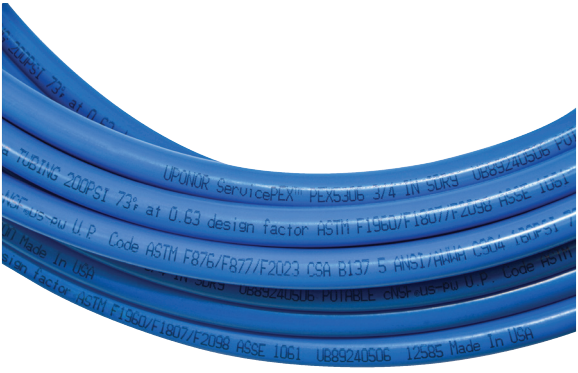

Figure 6: Uponor ServicePEX 5306 PEX material designation on pipe

Chlorine Resistance

The test method for evaluating oxidative resistance as required by ASTM F876 is ASTM F2023 Test Method for Evaluating the Oxidative Resistance of Cross-linked Polyethylene (PEX) Piping and Systems to Hot Chlorinated Water.

According to ASTM F876, PEX piping must bear a four-digit code to signify the requirements it meets. The first digit in the code references the minimum chlorine resistance at end-use conditions. Uponor ServicePEX was evaluated according to the ASTM F2023 test method for evaluating oxidative resistance to hot, chlorinated water, which is the most stringent test method in the industry.

Uponor ServicePEX **exceeds** the minimum life expectancy requirement of 50 years when operating with end-use conditions 100% of the time (including

recirculation) at 140°F (60°C) at up to 80 psi for potable water.

Holding the highest chlorine resistance rating of '5' per ASTM F2023, Uponor ServicePEX is approved for use in continuous-recirculation systems where the pipe is exposed to hot, chlorinated water 100% of the time.

IMPORTANT! Do not install Uponor ServicePEX in systems where **chlorine dioxide** is or may be used for secondary disinfection or where injection systems using chlorine dioxide are present. This is based on the limited industry data available for the long-term effects of chlorine dioxide on PEX piping systems at allowable controlled levels.

Termiticides and Pesticides

Uponor ServicePEX piping is approved for below-grade installation in soil or in-slab installation in concrete where water-based termiticide/pesticide treatment is required. Note that Uponor ServicePEX is only approved for use with water-based treatment products. Do not use organic solvent-based (petroleum solvent-based) products with Uponor ServicePEX.

Chemical Resistance

Before applying any type of adhesive, sealant, cleaning product, primer, paint, cement, or compound to Uponor ServicePEX, contact the manufacturer of that product to ensure it does not interfere with Uponor PEX piping systems. Contacting the manufacturer for compatibility with Uponor products is the best assurance that their product will not impact the performance of Uponor products.

For water system disinfection chemicals, refer to the **System Disinfection** section in this installation guide. If incorporating treatments or chemicals that are not included in this document, contact Uponor Technical Services and consult the Plastics Pipe Institute (PPI) Technical Report TR-19: Chemical Resistance of Plastic Piping Materials for compatibility prior to system exposure. If necessary, have the chemical manufacturer approve the suitability of the chemical for all components of the piping system.

Note: These guidelines are subject to change. Please email Uponor Technical Services at support.UNA@georgfischer.com or call 888 594 7726 in the US or 888 994 7726 in Canada for the latest information.

Corrosion Resistance

Uponor ServicePEX is a highly durable product that resists corrosion, rust, and scale buildup. While these challenges often plague metallic piping systems, ServicePEX has a natural immunity based on its polymer design.

Engineered polymer (EP) fittings are also naturally resistant to corrosion, rust, and scale buildup, but metal fittings are prone to these issues depending on the surrounding soil and water conditions. Hence, it is important to select the appropriate fitting material based on environmental conditions and the application. It is also advisable to wrap lead-free (LF) brass fittings with a minimum 6-mil poly wrap to protect the product in direct-burial applications.

Figure 7: Corroded metallic pipes

Figure 8: Clean PEX pipe

Freeze Resilience

PEX pipe can withstand extreme freeze-thaw cycles better than other piping materials. The crosslinking of the piping allows it to expand and absorb much of the expansion energy from the freezing process. In fact, the Plastics Pipe Institute (PPI) Technical Report (TR-52) (plasticpipe.org/common/Uploaded%20files/Technical/PPI-TR-52.pdf) proves the exceptional resiliency of PEX pipe in freeze/thaw cycles.

However, no pipe is completely freeze proof, so it is good practice to install all water service pipes below the frost line to help prevent damage from frozen water. If the water in the pipe does happen to freeze, refer to the following instructions for safe thawing.

Safe Thawing Instructions

For buried pipe, use hot-water injection equipment to melt the ice inside the pipe.

IMPORTANT! Do not allow the water to exceed the pipe's maximum temperature rating of 200°F (93.3°C).

If the pipe is still exposed, slowly heat the affected area with a heat gun or hair dryer. Rub a hand over the area while heating to ensure the piping does not get too hot and exceed the maximum temperature rating.

Also try pouring hot water over or wrapping hot towels around the affected portion of the piping. Another option is placing a small portable heating unit in the area to heat the space.

Storing and Handling Guidelines

Although not comprehensive, the following highlights the most common guidelines when storing and handling Uponor ServicePEX.

- Do not store outdoors.
- Keep in the original packaging until the time of installation.
- Do not use where temperatures and pressures exceed ratings.
- Do not use or store where the product will be exposed to direct sunlight beyond the UV ratings. (Refer to the **UV Resistance Rating** section for complete details.)
- Do not install in soil environments contaminated with solvents, fuels, organic compounds, pesticides, or other detrimental materials that may cause permeation, corrosion, degradation, or structural failure of the piping. In areas where such conditions are suspected, perform a chemical analysis of the soil or groundwater to ascertain the acceptability

of Uponor PEX piping for the specific installation. Check local codes for additional requirements.

- Do not weld, glue, or apply open flame to the pipe.
- Minimum clearance from Insulation Contact (I.C.)-rated fixtures is 2". Minimum clearance from non-I.C. rated fixtures is 12". For distances closer than the above minimums, protect the pipe with an approved insulation.
- Do not install within 5 ft. of direct view from fluorescent and LED lighting without protecting the pipe with a UV-blocking material.
- Do not use Uponor ServicePEX to convey natural gas.
- Do not solder, braze, weld, or fusion-weld within 18" of Uponor ServicePEX piping in the same water line. Make any heat-related connections prior to connecting the pipe.
- Do not use piping for an electrical ground.
- Do not spray on or allow organic chemicals, strong acids, or strong bases to come into contact with the pipe.
- Do not use petroleum or solvent-based paints, greases, or sealants on the pipe. It is acceptable to use latex and acrylic-based paint, such as 100-percent acrylic exterior latex house paint, which will not harm the molecular structure or integrity of Uponor ServicePEX pipe or Uponor ProPEX fittings (both EP and brass).
- Use only approved and appropriate firestop materials with Uponor ServicePEX.

- Do not allow rodents, insects, or other pests to come into contact with Uponor ServicePEX.
- Do not subject Uponor ServicePEX to blunt impact.
- Do not press standard ProPEX LF brass fittings or standard brass (i.e., copper press). Only press Uponor ProPEX copper press adapters.
- Do not install Uponor ServicePEX in steel-stud applications without the use of grommets to protect the pipe from abrasion.
- Do not install Uponor ServicePEX within 6" (15.2 cm) of a vent pipe for direct or gravity-vented appliances, and maintain a minimum 1" (25 mm) distance from double-wall B vents or zero-clearance plastic vents.
- When transitioning from Uponor ServicePEX to other piping materials, follow the appropriate installation instructions for that product.

Trench Preparation

To achieve a satisfactory installation, it is essential that the soil provides stable and continuous support for the piping.

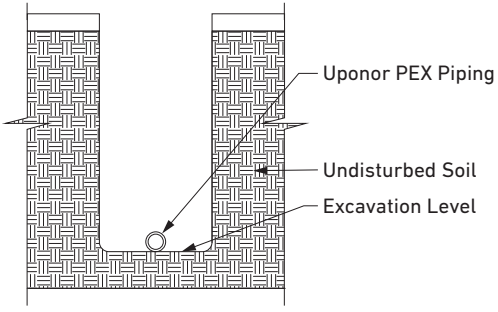

Figure 9: Good soil conditions – If the trench is dug smoothly, install the piping directly on the prepared bottom. The bottom must be flat with no hollows, lumps or rocks.

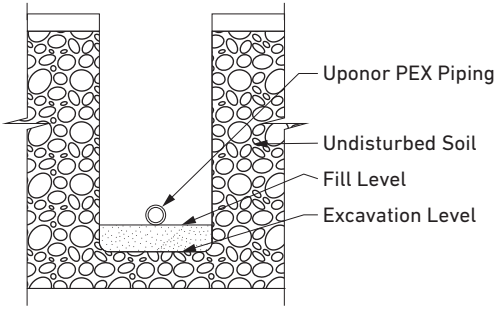

Figure 10: Poor soil conditions – With rocky, clay, muddy, or other poor soil conditions, it may be necessary to prepare the trench bottom using granular material of such size and grading to provide a stable base. See local code for additional requirements.

Piping Embedment

Proper soil selection, placement and compaction are essential in the area around the piping. Backfill around the piping with sand or gravel that has a maximum particle size of ¾".

Compact the initial backfill around the piping to provide adequate piping support and prevent settling. It is particularly important to adequately compact the soil around the tap connection. Uponor recommends pressurizing the piping prior to backfilling to reveal any damage. In heavy vehicular traffic areas, compact backfill to 90 percent of maximum soil density.

Do not use highly plastic clays, silts, organic materials, or sharp or large rocks as backfill in the immediate vicinity of the piping. Compact the backfill from the subgrade to a level per local code that will cover the piping 4" to 6" to provide protection around the piping and to prevent settling that puts stress on the fittings and the piping.

Installation

Figure 11: Install Uponor ServicePEX in a snaking pattern with sufficient slack in the line to allow for contraction due to temperature change prior to backfilling.

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

piping is approximately 1.1" per 10°F temperature change per 100 ft. of piping (27.94 mm per 5.56°C temperature change per 30.48 m of piping).

Note: Do not use blocking to support the piping or change the piping grade. Do not install potable-water service piping in, under or above cesspools, septic tanks, septic-tank drainage fields, or pits.

CAUTION: Do not install Uponor PEX piping in soil environments contaminated with solvents, fuels, organic compounds, pesticides, or other detrimental materials that may cause permeation, corrosion, degradation, or structural failure of the piping. In areas where such conditions are suspected, perform a chemical analysis of the soil or groundwater to ascertain the acceptability of Uponor PEX piping for the specific installation. Check local codes for additional requirements.

Handling and Repairs

Although Uponor PEX piping is highly resistant to kinking and abrasion, take care while handling and installing the piping to prevent damage and possible failure of the piping. If damage occurs during installation, cut out the damaged area and repair before backfilling.

To reform kinked piping, see **Reforming Kinked Piping** on **page 44**. If the piping is damaged beyond its thermal-memory capacity, use a ProPEX coupling. Do not reuse or reclaim EP fittings.

External Loads

H-20 loads

When installing Uponor PEX under a roadway, follow the same procedures as previously indicated with the following exception: Ensure the top of the piping is 16" below the bottom of the roadbed material as specified. You can also use a suitable steel or structural conduit to sleeve the Uponor PEX pipe.

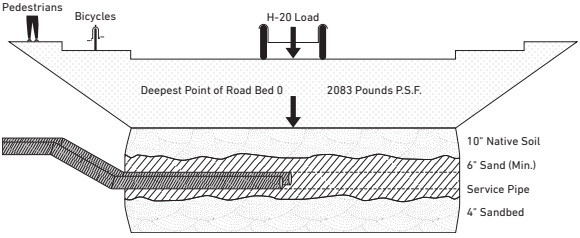

Figure 12: Traffic loads

Building Penetrations

Because Uponor ServicePEX piping is available in long, continuous lengths, it is an ideal material for running below grade. Always follow local code when burying the pipe as some jurisdictions require additional sleeving and protection.

Protect Uponor ServicePEX piping where it enters and exits a building with 0.025" (0.064 mm) thick protective material, such as HDPE wrapping, closed-cell pipe insulation, PVC elbows and sleeves, or equivalent that allow expansion and contraction of the piping. These products are described as slab-penetration protection devices.

When using a protection sleeve, an annular gap between these protection devices and the Uponor ServicePEX piping will exist. In such installations, fill the annular gap between the protection device and pipe at the exposed ends to help prevent pathways for pests and the mistaken application of harmful chemicals into the space between the pipe and the protection device. Use only sealants that are compatible with Uponor ServicePEX piping.

Note: The following products are appropriate for use when sealing Uponor ServicePEX piping and slab-penetration protection devices:

- Latex caulk
- Latex foam
- Silicone sealant
- Polyurethane expanding foam

Note: Misapplication of these products could result in pooling or puddling of the products around the PEX piping, which is prohibited.

Important Guidelines

- If applying termiticides/pesticides while the installed Uponor ServicePEX piping still has exposed open ends, be sure to cap, plug, or close the ends of the piping to prevent these chemicals from entering the piping.
- Do not allow organic (petroleum-based) chemicals, petroleum distillates, termiticides, or pesticides to come into direct contact with the piping.

- Fill the annular gap between Uponor ServicePEX and protection devices (sleeving or PVC bend guides) at the ends of the piping to help prevent pathways for pests and the mistaken application of harmful chemicals into the space between the PEX piping and the protection device.
- Use only sealants that are compatible with PEX piping.
- With continuously sleeved Uponor ServicePEX piping, do not fill the space between the pipe and the sleeving with any liquid chemical, including pesticides or termiticides. Prevent pooling or puddling of these liquids around PEX piping.
- When it is necessary to retreat soil near Uponor ServicePEX piping, prevent puddling or pooling of the termiticide/pesticide.

Cutting Large-Diameter PEX Pipe

CAUTION: Read and thoroughly understand all safety instructions in the pipe cutter operator's manuals before performing work.

CAUTION: Be sure to wear safety gloves and proper eye protection prior to cutting pipe. Failure to do so could result in personal injury.

Use a swing or ratchet-type cutter to create smooth, clean cuts.

Figure 13: Swing-style pipe cutter

Figure 14: Ratchet-style pipe cutter

Making Compression Fitting Connections

Use only SDR9 compression fittings listed in compliance with AWWA C800 as referenced in AWWA C904 for water service applications when transitioning from curb stops or corporation stops to Uponor ServicePEX piping.

Be sure to use insert stiffeners when assembling a compression fitting with PEX. Commonly available SDR9 compression fitting manufacturers include:

- Ford Meter Box Company, Inc.®
- Mueller Company®
- A.Y. McDonald Mfg. Co.®
- Philmac®

Note that Uponor ServicePEX pipe is also approved for use with ASTM F1960 expansion fittings. Be sure to check local codes for approval and follow all fitting manufacturers' instructions.

IMPORTANT! Ensure all fittings and valves meet NSF 61 for drinking water safety.

Making the Connection

Important! Before making any connections, inspect the pipe and remove all dirt and foreign material from the interior and ends of the pipe. Ensure the pipe is lined up straight to connect directly into the joint; there should be no angle or misalignment, which will add stress on the connection. Additionally, ensure pipe bends are no less than 10 pipe diameters from any fitting or valve.

1. Use a PEX pipe cutter to make a square cut on the end of the pipe. DO NOT use a hacksaw or knife as these tools may cause a rough or jagged cut that will result in an improper connection, causing potential leaks, property damage, or loss of water pressure.
2. Choose the appropriate-size stainless-steel or plastic insert.
3. Place the insert inside the pipe.
4. Use a standard pipe wrench on AWWA C800 compression joint connections and follow all manufacturer instructions when making the connection.

Figure 15: Square cut pipe with PEX cutter

Figure 16: Select appropriate insert

Figure 17: Place insert in pipe

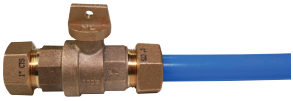

Figure 18: Make connection

Note: At the water main connection, ensure Uponor ServicePEX leaves the main at a 20-degree angle with at least 4 ft. (1.2 m) of extra pipe to prevent stress on the connection. (PEX does not require the wider, 45-degree angle necessary with copper pipe.)

Making ProPEX Expansion Fitting Connections

For inline connections, use Uponor ProPEX EP or LF brass fittings, which are approved for direct burial with 4 to 6 mil poly wrap.

For $^{5}/_{8}$" to 1" water meter connections, use **Uponor ProPEX EP Water Meter Fittings** (straight or elbow)

as well as

Uponor ProPEX LF Brass Water Meter Valves (straight or elbow).

Refer to the Uponor Product Catalog on uponor.com for the complete offering of water meter connections and accessories.

Figure 19: Uponor ProPEX LF Brass Elbow Water Meter Valve

Making ProPEX Connections

Uponor ProPEX ASTM F1960 (CAN/CSA B137.5) cold-expansion fittings make solid, permanent, manufactured connections without the need for torches, glues, solder, flux, or gauges. The unique shape memory of Uponor PEX piping forms a tight seal around the fitting, creating a strong, reliable connection. This section shows how to make proper ProPEX connections using one of the following tools.

- Milwaukee M12, M12 FUEL, M18, or M18 FUEL 2" ProPEX expansion tools
- Milwaukee M18 FORCE LOGIC ProPEX Expansion Tool
- ProPEX 201 Corded Expander Tool
- ProPEX Hand Expander Tool

Distance Between Fittings

Uponor requires a minimum distance between ProPEX fittings to avoid damaging the fittings during installation and to protect against elevated stress on the pipe and fittings. Refer to **Table 2** for the minimum distance between fittings, which is expressed as cut length of pipe.

Nominal Fitting Size	Cut Length of Pipe
½"	2"
¾"	3"
1"	3½"
1¼"	4½"
1½"	4½"
2"	6" or 6¾"*
2½"	7½"
3"	9"

Table 2: Minimum distance between ProPEX fittings

*6¾" for Milwaukee M18 FUEL 2" ProPEX Expansion Tool.

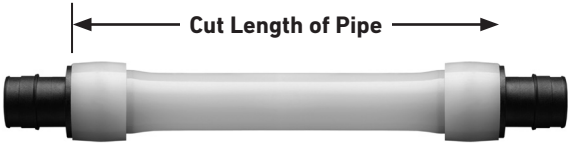

Figure 20: Distance between fittings

General ProPEX Connection Tips

- If the fitting does not slide into the piping all the way to the stop, immediately remove it from the piping and expand the piping one final time.
  Note: To avoid over-expanding the piping, do not hold the piping in the expanded position.
- **Table 3** shows the recommended number of expansions. Experience, technique, and weather conditions influence the actual number of expansions. Fewer expansions may be necessary under certain conditions. The correct number of expansions is the amount necessary for the piping and the shoulder of the fitting to fit snugly together.
- Ensure the ProPEX ring rests snugly against the fitting shoulder. If there is more than 1/16" (1 mm) between the ring and the shoulder of the fitting, the connection must be replaced. Square cut the piping 2" away from the fitting for 3/8" to 1" pipe, 3" away for 1¼" to 2" pipe, and 5" away for 2½" and 3" pipe prior to making the new connection.
- Brass ProPEX fittings can be disconnected and reused. EP fittings must be discarded. Be sure to follow the recommended minimum distance between ProPEX fittings shown in **Table 2**.

Pipe Size	Milwaukee ProPEX Expansion Tools					Uponor ProPEX Expander Tools		
	M12 with Standard Heads (2432)	M12 FUEL with RAPID SEAL™ Heads (2532)	M18 (2632)	M18 FUEL 2" (2932)	M18 FORCE LOGIC (2633)	Manual	100/150	201
⅜"	6-7	6-10	5	5-7	—	5	7	—
½"	7-8	5-8	9	7-9	—	4	4	—
⅝"	9-10	6-10	9	8-9	—	9	9H	—
¾"	11-12	7-12	10	9-11	—	14	7H	—
1"	17-18	12-18	19	12-13 (or 7-8H)	—	—	7H	—
1¼"	—	—	9	9-10H	—	—	8H	—
1½"	—	—	10	8-9H	—	—	—	—
2"	—	—	—	9-10	4	—	—	5H
2½"	—	—	—	—	5	—	—	—
3"	—	—	—	—	7	—	—	—

Table 3: Recommended number of expansions for ⅜" to 3" piping at 73.4°F (23°C)

Note: "H" in the table refers to Uponor H-series expander heads.

Making ProPEX Connections with Milwaukee M12, M12 FUEL, M18, or M18 FUEL 2" ProPEX Expansion Tools

Note: All standard Uponor expander heads are compatible with the M12 and M18 tools. Uponor expander heads will not auto-rotate on the Milwaukee tools (only Milwaukee expansion heads will auto-rotate on the M12 and M18). H-heads are not compatible with Milwaukee tools and Milwaukee heads are not compatible with Uponor tools. Milwaukee heads are easily distinguished by color coding and the Milwaukee logo.

Figure 21: 3/8" and ½" Milwaukee expansion heads

Figure 22: ¾" to 3" Milwaukee expansion heads

IMPORTANT! Making expansions are slightly different when using a tool that features auto rotation. When making a ProPEX connection, be sure to follow the guidelines for the tool you are using in your application.

1. Square cut the PEX piping perpendicular to the length of the piping. Remove all excess material or burrs that might affect the fitting connection.
2. Slide the ProPEX ring over the end of the piping until it reaches the stop edge. If using a ProPEX ring without a stop edge, extend the ring over the end of the piping no more than 1/16" (1mm).

With Auto Rotation (Standard Milwaukee Heads)

3. Milwaukee ProPEX expansion tools come with built-in auto rotation. If using a Milwaukee expansion head, simply hold the piping and tool in place while holding the trigger to expand the piping. The head will automatically rotate to ensure the piping is evenly expanded. Continue expanding and rotating until the piping and ring are snug against the shoulder on the expander head. See **Table 3** for the recommended number of expansions for each piping size.

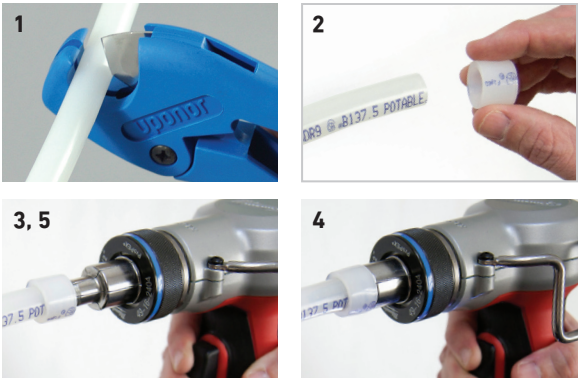

Figure 23: Expansion with Milwaukee M12, M12 FUEL, M18, and M18 FUEL 2" ProPEX expansion tools

Note: Do not force the pipe onto the expander head. Ensure the expander head is rotating during each expansion.

Without Auto Rotation (Standard Uponor Heads)

4. Press the trigger to expand the piping.
5. Release the trigger, remove the head from the piping, rotate it ⅛ turn, and slide the head back into the piping. Continue expanding and rotating until the piping and ring are snug against the shoulder on the expander head. See **Table 3** for the recommended number of expansions.

IMPORTANT! Rotating the tool between expansions will provide smooth, even expansion of the piping. Failure to rotate the tool will cause deep grooves in the piping which can result in potential leak paths.

Figure 24:
ProPEX coupling

Figure 25: ProPEX tee

Figure 26: Inserting ProPEX fitting into ½" Uponor PEX piping

Figure 27: Inserting ProPEX fitting into 1" Uponor PEX piping

6. After the final expansion, immediately remove the tool and insert the fitting. Ensure the piping and ring seat against the shoulder of the fitting.

IMPORTANT! Only perform the necessary number of expansions. DO NOT over expand the pipe. You should feel some resistance as the fitting goes into the piping. If you do not feel any resistance, the piping may be over expanded and will require additional time to shrink over the fitting.

Figure 28: Expansion with Milwaukee M18 ProPEX Expansion Tool

Troubleshooting ProPEX Connections

Trouble-free ProPEX installations begin with a tool that is maintained in proper working condition. If the tool or segment fingers are damaged, it is very difficult to make a proper connection. Refer to the following guidelines to assist with challenges in the field.

Fittings Won't Seal

- Make sure the expander head is securely tightened onto the tool.
- Ensure the segment fingers are not bent. If the head does not completely close when the drive unit is fully retracted or the handles of the manual tool are open, replace the head.
- Examine the tool for excess grease on the segment fingers. Remove excess grease prior to making connections.
- Check the fitting for damage. Nicks and gouges will cause the fitting to leak.
- Make sure the internal driver cone is not damaged or bent.
- Make sure the last expansion is not held in the expanded position before the fitting is inserted. You should feel some resistance as the fitting goes into the piping. If you do not feel any resistance, the piping may be over expanded and will require additional time to shrink over the fitting.
- Be sure to rotate the tool ⅛ turn after each expansion to avoid deep grooves in the piping which can result in potential leak paths.

Expansion is Difficult

- Make sure the internal cone is properly greased.

Expansion Head Slips Out of Piping When Making Expansions

- Ensure the piping and ProPEX ring are dry.
- Make sure that grease is not getting into the piping.
- Examine the segment fingers to ensure they are not damaged or bent.

ProPEX Ring Slides Down Piping During Expansion

- Ensure your hands are clean while handling the piping. Any sweat or oils on your hands can act as a lubricant. Due to the smoothness of PEX, any form of lubricant can cause the ProPEX ring to slide down the piping during expansion.
- If you anticipate the ProPEX ring may possibly slide down, position the ring slightly farther over the end of the piping and make the first couple of expansions slowly. Once the ring and the piping begin to expand together, continue with the normal number and type of expansions.
- Place your thumb against the ProPEX ring to help support it and feel for any movement. If caught early, you can slide the ring up the piping and expand as described in the previous bullet point.

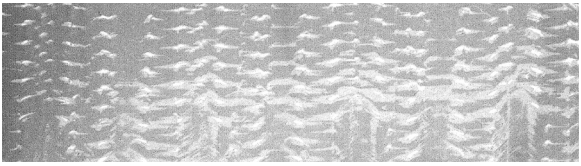

Figure 29: Expansion with proper rotation

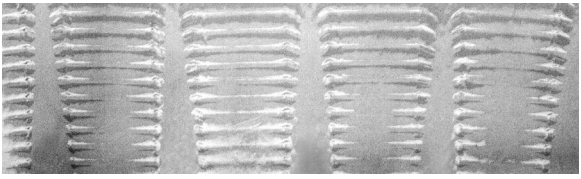

Figure 30: Expansion without proper rotation

More Than the Recommended Number of Expansions Are Needed to Make a Connection

- Ensure the head is hand-tightened to the expander tool.
- Examine the segment fingers for damage.
- Be sure to completely cycle the tool on each expansion (i.e., close the manual tool handle or release the trigger).

Cold-Weather Expansions

- Uponor recommends the use of the Milwaukee M12 FUEL ProPEX expansion tool with RAPID SEAL™ heads for cold-weather installation of ⅜" to 1" Uponor piping systems.

- Temperatures affect the time required for the piping and ring to shrink onto the fitting. The colder the temperature, the slower the contraction time.
- Warming ProPEX fittings and ProPEX rings reduces contraction time. Put fittings and rings in your pockets prior to installation to keep them warm.
- Fewer expansions are necessary in temperatures below 40°F (4.4°C).

Figure 31: Milwaukee RAPID SEAL 1" head

Note: Do not use a heat gun on EP fittings to speed up the contraction time as this could result in damage to the fitting.

Reforming Kinked Piping

IMPORTANT! Wait until pipe cools completely before proceeding with the installation.

If the piping is kinked and hinders flow, easily make repairs following the steps below.

1. Make sure the system is not pressurized.
2. Straighten the kinked portion of the piping.
3. Heat the kinked area to approximately 265°F/129.4°C with an electric heat gun (approximately 450 watts of power). Apply the heat evenly until the piping returns to its original size and shape. **Do not use an open flame** (see **Figure 32**).

Figure 32: Reforming kinked piping

4. Allow the repaired piping to cool undisturbed to room temperature. When the piping returns to its opaque appearance, the repair is complete.

CAUTION: The piping surface temperature must not exceed 338°F/170°C. Do not apply direct flame to Uponor PEX piping. Uponor PEX piping repaired according to these recommendations will return to its original shape and strength. If the piping is sliced, punctured, or otherwise damaged beyond the capacity of the crosslinked memory, install a ProPEX coupling. Uponor PEX piping cannot be welded or repaired with adhesives.

Backfilling

Uponor ServicePEX is designed to resist damage from impact and abrasion during backfilling and trench compaction. However, to protect the pipe from shifting, UV exposure, or damage by other construction trades, it is important to backfill the trench and cover the pipe as soon as possible.

Per ASTM D2774, Standard Practice for Underground Installation of Thermoplastic Pressure Piping, it is appropriate to use the excavated native material for backfilling the remainder of the trench. Unless otherwise specified, backfill and compact trenches under pavements, sidewalks, or roads to at least 90% Standard Proctor Density.

In traffic areas, install the pipe per local code requirements and follow best practices for underground piping applications as defined by the American Water Works Association (AWWA), the American Association of State Highway and Transportation Officials (AASHTO), and the Plastics Pipe Institute (PPI).

Horizontal Directional Drilling (HDD)

Horizontal directional drilling is used when trenching or excavation is not practical. A surface-launched drilling rig provides a steerable, trenchless method of installing underground pipes along a shallow arc bore path, resulting in minimal impact to surrounding areas. It is suitable for a variety of soil conditions.

HDD is further categorized into the following types:

- Mini-HDD
  - Distances less than 600 ft.
  - Depths up to 15 ft.
  - Pipe diameters up to 12"
- Equipment pullback capability of up to 20,000 lbs. and torque less than 950 ft-lbs.
- Maxi-HDD
  - Distances greater than 600 ft.
  - Depths up to 200 ft.
  - Pipe diameters up to 48"
  - Equipment pullback capability of up to 100,000 lbs. and torque up to 80,000 ft.-lbs.

Criteria for Uponor PEX Piping in HDD Applications

- Use Uponor PEX only as the follow pipe.
- Take precautionary steps to ensure piping does not come in contact with sharp objects.
- Do not exceed minimum bend radius of 6 times the O.D. of the piping.
- Pressure test installed piping after installation to ensure the integrity of the piping has not been compromised.

For HDD applications using Uponor PEX piping, reference PPI TR-46 Guidelines for Use of **Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe**.

SDR9 Uponor PEX 12-Hour Pull		
Nominal Pipe Size	Tensile Yield Design (Safety) Factor	Allowable Tensile Load at 73°F/22.8°C - Lbs. (N)
½"	0.4	128 (569)
¾"	0.4	248 (1,103)
1"	0.4	411 (1,828)
1¼"	0.4	615 (2,735)
1½"	0.4	859 (3,821)
2"	0.4	1,465 (6,516)
2½"	0.4	2,239 (9,960)
3"	0.4	3,169 (14,096)

Table 4: Safe pull force

Note: The method set forth in ASTM F1804 determines the allowable tensile load.

Trace Wire

GF recommends the use of trace wire to facilitate the detection of underground pipe systems. Trace wire should be 14-gauge minimum solid copper with thermoplastic insulation suitable for direct burial. Refer to local code for further requirements.

Water System Disinfection

When system disinfection is required, treatment can be accomplished through chemical disinfection.

Chemical Disinfection – When adding chemicals to a plumbing system, disinfection chemicals are strong oxidizing agents and have the potential to reduce system life of the piping system. See **Table 5** for recommended maximum concentration of common chemicals used for disinfection, and corresponding duration and temperature.

Note: Flush the system with clean, potable water after disinfection.

Chemical disinfection treatment should not exceed 80 psi system pressure or the maximum guidelines stated in **Table 5**.

Chlorine Dioxide

Uponor **does not** recommend use of its PEX pipe and ProPEX fittings as part of any potable-water distribution system in buildings where chlorine dioxide is used for secondary disinfection or where injection systems using chlorine dioxide are present. This is based on the limited industry data available for the long-term effects of chlorine dioxide on PEX piping systems at allowable controlled levels.

IMPORTANT! System Disinfection Notes

- Uponor does NOT recommend long-term or continuous-dosing chemical treatments.
- Do not use chemical disinfection/shock treatment on a monthly basis. Limit chemical disinfection to four cycles over the life of the piping system.
- Do not use especially high oxidizing agents, such as ozone, chlorine dioxide, etc.
- These guidelines are for disinfection treatment and do not supersede normal operating parameters.

These guidelines are set forth for informational purposes only, and it remains the responsibility of the facility manager, water management contractor, and end-user to maintain system health and to ensure compatibility and effectiveness of the disinfection treatment with the entirety of the plumbing system.

If other treatments or chemicals not included in this document are intended for use, contact Uponor Technical Services for compatibility prior to system exposure. If necessary, have the chemical manufacturer approve the suitability of the disinfectant for all components of the plumbing system and installation.

Note that these guidelines are subject to change. Please contact Uponor Technical Services at 888 594 7726 to confirm the latest guidelines.

Chemical	Symbol	Concentration of Free Chlorine	Maximum	
			Duration	Temperature
Sodium hypochlorite	NaOCl	200 mg/L (ppm)	3 hours	77°F (25°C)
		50 mg/L (ppm)	24 hours	
Chlorine (liquid or gas)	Cl2	200 mg/L (ppm)	3 hours	
		50 mg/L (ppm)	24 hours	
		4 mg/L (ppm)	72 hours	140°F (60°C)
Hydrogen peroxide	H2O2	200 mg/L (ppm)	3 hours	77°F (25°C)
		50 mg/L (ppm)	24 hours	
Chloramines	NH2Cl	200 mg/L (ppm)	3 hours	
		50 mg/L (ppm)	24 hours	
		4 mg/L (ppm)	72 hours	140°F (60°C)

Table 5: Uponor disinfection guidelines

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