



**Viega PEX Commercial**  
System Design Manual



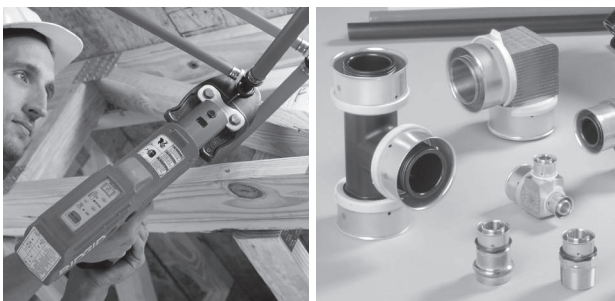
The global leader  
in plumbing, heating  
and pipe joining systems

**viega**



## Viega, heritage of quality, vision for the future

Viega's heritage of superiority demands nothing but the best for our customers. Engineered to be efficient, Viega products perform at the highest possible level of quality, providing confidence and peace of mind. Viega is the only manufacturer to offer press systems in multiple pipe joining materials, including polymer. More than one million Viega press fittings are installed every day around the world and, with a Supply Chain that can process orders in less than 24 hours, Viega is positioned to provide customers the best, most versatile support in the industry.



## Manual content and use

**It is the responsibility of the specifying engineer, contractor and installer to ensure the PEX system is properly designed and installed, adhering to the most current installation instructions, utilizing the appropriate components intended for the application.**

### Important notice

This installation manual is intended for commercial installations of traditional (branch and tee) plumbing systems, combination plumbing systems using termination manifolds and ManaBloc and MiniBloc parallel / manifold plumbing systems.

**NOTE:** References to ViegaPEX tubing made throughout this publication include the entire line of Viega cross-linked polyethylene products.

**NOTE:** Zero Lead identifies Viega® products meeting the lead free requirements of NSF 61-G through testing under the NSF/ANSI 372 (0.25% or less maximum weighted average lead content).

**In the event of conflict or inconsistency between these installation guidelines and local building or plumbing codes, local codes should take precedence.**

**NOTE:** Failure to follow the installation instructions will void the Viega PEX Warranty. Nothing in this publication is intended to create any warranty beyond Viega's applicable warranty. For additional information, contact Viega at 800-976-9819.

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## 1.1 Viega PEX Solutions

Viega PEX Commercial Systems provide the most complete potable water solution available. With tubing, fittings and distribution manifolds, Viega provides everything you need for a total plumbing system that is not only easy to install but also helps reduce energy cost and water waste. Viega provides the highest-quality PEX tubing with the highest-rated UV and chlorine ratings in the industry. Viega PEX Press fittings allow installers to make secure connections in less than seven seconds. With Viega press technology, pressure testing can be completed immediately after connections are made without waiting for glues or solvents to dry or for expansion rings to contract. Viega PEX Press fittings are approved for potable water and hydronic heating applications and are available in sizes ranging from 3/8" to 2" in both Zero Lead bronze and high-grade polymer materials. With a 10-year transferable warranty and unmatched quality in the industry, Viega offers a complete system solution for all your plumbing needs.

## Do more with Viega

Viega was the first PEX manufacturer to introduce press technology in the North American market with its Bronze PEX Press fitting system. Viega press technology is consistent and reliable, providing the same quality pipe connections every time. Viega PEX Press polymer fittings incorporate the Viega Smart Connect feature, which helps installers identify unpressed connections easily. Viega PEX Press polymer fittings are manufactured in the United States and provide secure, reliable connections for residential, light commercial and commercial projects, ranging from potable water to snow melting applications.

A true innovator since 1899, Viega is at the forefront of pipe joining technology with personalized support, efficient delivery processes and trustworthy quality. No other manufacturer can provide the same level of service. The global leader in plumbing, heating and pipe joining systems, Viega is the name you can trust.



Viega PEX cross-linked polyethylene tubing is the ideal tubing choice for potable water systems. The smooth wall of Viega PEX tubing is resistant to corrosion and scaling. Viega is the only PEX manufacturer that is vertically integrated, meaning we manufacture our own raw PEX resin controlling the entire manufacturing process from start to finish to ensure the highest quality.

### 2.1 What is PEX

PEX is a material made up of molecules of high density (HDPE) that are permanently linked to each other by a process called crosslinking. This process allows PEX to withstand higher temperatures and pressures compared to standard HDPE tubing, making it ideal for hot and cold potable water applications as well as hydronic radiant heating and cooling systems. There are three common methods of crosslinking polyethylene, two of which are a chemical method and one that is physical.

- Peroxide - Pressure/heat/chemical
- Silane - Moisture cure
- Radiation - Electron beam

Each method induces links between single strands of PE to form a more dense network. The number of links between these strands determines the crosslink density and is an important factor in determining the physical properties of the material. The minimum percent crosslinking for each method is specified in the ASTM F876 standard. These methods are also known as PEX-a, PEX-b and PEX-c, respectively, but are not related to any type of a quality rating system.

The ASTM F876 manufacturing standard incorporates a material designation number that is a rating scale for chlorine resistance, UV resistance and material strength. This designation consists of the tubing material type “PEX” followed by a 4-digit number. These 4 digits break down as follows:

**What does the material designation code mean?**

Chlorine resistance  
 UV resistance  
 HDS @ 73°F 630 psi

PEX tubing with a printed rating of 5306 indicates that it will be suitable for installation areas of constant hot water circulation and has a maximum UV exposure of 6 months.

The UV protection rating is important because certain construction practices and storage conditions subject PEX tubing to sunlight exposure for an extended period of time. UV testing confirms the longevity of the PEX tubing under various lengths of UV exposure.

Property	0	1	2	3	4	5	6
Chlorine Resistance	Not tested	75% at 73° and 25% at 140°F	Reserved	50% at 73° and 50% at 140°F	Reserved	100% at 140°F	
Minimum UV Resistance	Not tested	1 mo.	3 mo.	6 mo.			
HDS for water at 73°F							630

**Viega’s silane crosslinked PEX (PEX-b) has the highest chlorine and UV resistance per this rating (PEX 5306). Another benefit is it has higher burst pressures than peroxide crosslinked PEX (PEX-a). This is due to the 3-dimensional molecular bonding that occurs during the crosslinking process.**

## 2.2 Properties and performance

ViegaPEX Ultra cross-linked polyethylene is the ideal tubing choice for potable water systems. In addition, the smooth walls of ViegaPEX Ultra tubing are resistant to corrosion and scaling.

### 2.2.1 ViegaPEX Ultra properties and performance

Linear Expansion Coefficient:

- 1.1 inch per 100 feet per 10°F

Temperature and Pressure Ratings:

- 100 psi at 180°F
- 160 psi at 73.4°F

UV Resistance:

- Maximum exposure 6 months

Chlorine Resistance:

- PEX 5306 - end use condition of 100% at 140°F (approved for continuous domestic hot water circulation systems)

**⚠ Do not use PEX for circulation lines exceeding 140°F.**

Bend Radius:

- ViegaPEX Ultra can be easily bent by hand, or with the use of Viega-approved bend supports to a radius as small as five times tubing outside diameter.

#### SDR-9 PEX Tubing ASTM F876/F877/CTS-OD SDR-9

Tubing Size	O.D.	Wall Thickness	Nom. I.D.	Weight Per Ft	Vol. (gal.) Per 100 Ft
3/8"	0.500±.003	0.070+.010	0.350	.0413	0.50
1/2"	0.625±.004	0.070+.010	0.475	.0535	0.92
3/4"	0.875±.004	0.097+.010	0.671	.1023	1.82
1"	1.125±.005	0.125+.013	0.862	.1689	3.04
1 1/4"	1.375±.005	0.153+.015	1.054	.2523	4.52
1 1/2"	1.625±.006	0.181+.019	1.244	.3536	6.30
2"	2.125±.006	0.236+.024	1.629	.6026	10.83

**NOTE:** Dimensions are in English units. Tolerances shown are ASTM requirements. ViegaPEX Ultra is manufactured within these specifications.

Table 2.1 SDR-9 PEX Tubing

### 2.2.2 Tubing markings

ViegaPEX tubing is marked every five feet with the following representative information. See Table 2.2.

Print Line Markings	
Length Marker	000 feet
Company	Viega
Product Name	ViegaPEX™ Ultra
Nominal Tubing Size	1/2"
Standard Dimension Ratio Tube Size	SDR 9 CTS (copper tube size)
Material Designation Code	PEX 5306
Temperature & Pressure Rating	100 psi @ 180F 160 psi @ 73F
NSF Listing (Potable)	cNSF®us-pw
ASTM Tubing Standards Certification	F876/F877
Canadian Standard Assoc	CSA B137.5
Fittings System Compatibility	PureFlow - ASTM F877/ F1807/F2159
IAPMO listing	UPC®
UL Listing Rating*	cULus 3SAV UL1821 130 psi @ 120F
Plenum Rating**	FS/SD 25/50 ASTM E84 CAN/ULC S102.2
Fire Resistance Ratings	CAN/ULC S101 ANSI/UL 263
ICC Listing	ES-PMG™ - 1038
AWWA Listing	C904
HUD Listing	MR 1276
Manufacturer's Date Code	1/1/2010
Material Code	X14.2
Country of Manufacture	Made in the USA

\* 3/4" through 2" Black ViegaPEX Ultra in residential NFPA 13D systems only  
\*\* 2" and smaller tube sizes when wrapped with 1/2" - 1" thick E84 rated insulation, 1/2" and smaller with no insulation per ULC S102.2 listing. Tubing may include fitting connections when wrapped.

Table 2.2 ViegaPEX Ultra Tubing Markings

#### Minimum Burst Pressure (PSI) Per ASTM F876/F877

SIZE	73°F (23°C)	180°F (82°C)
3/8"	620	275
1/2"	480	215
3/4"	475	210
1"	475	210
1 1/4"	475	210
1 1/2"	475	210
2"	475	210

Table 2.3

FostaPEX tubing is the perfect companion for the Viega PEX plumbing system. This tubing can be easily bent by hand like the ViegaPEX tubing but holds its shape after bending (combining the benefits of both rigid and flexible tubing). The result is fewer fittings and bend supports and less labor. A unique feature of FostaPEX is that the inner layer is fully dimensioned Black ViegaPEX Ultra tubing. The aluminum and outer PE layers surround the inner PEX tubing. This construction allows the inner layer alone to meet all temperature and pressure requirements of the system. Using the prep tool to remove the outer layers allows the use of the standard Viega PEX Press bronze and polymer fitting systems, which reduces tooling costs for the contractor and simplifies connections.

### 3.1 FostaPEX properties and performance

Linear Expansion Coefficient:

- 0.16 inch per 100 feet per 10°F

Temperature and Pressure Ratings:

- 80 psi at 200°F\*
- 100 psi at 180°F
- 160 psi at 73.4°F

\*For non-potable hydronic heating systems only

UV Resistance:

- Maximum exposure 6 months based on FostaPEX's fully dimensioned black PEX core. Extended exposure due to the outer aluminum layer (do not install where permanently exposed to sunlight)

Chlorine Resistance:

- PEX 5306 — end use condition of 100% at 140°F (approved for continuous domestic hot water circulation systems)

**⚠ Do not use PEX for circulation lines exceeding 140°F.**

Bend Radius:

- FostaPEX tubing can be bent to a radius of 3.5 times tubing outer diameter with the use of a Viega tubing bender.

**⚠ Only for use with Viega PEX Press fittings.**

#### Minimum Burst Pressure (PSI) Per ASTM F876/F877

SIZE	73°F (23°C)	180°F (82°C)
1/2"	480	215
5/8"	475	200
3/4"	475	210
1"	475	210

Table 3.1

### 3.2 Tubing markings

FostaPEX tubing is marked every five feet with the following representative information. See Table 3.2.

Print Line Markings	
Length Marker	000 feet
Company	Viega
Product Name	FostaPEX®
Nominal Tubing Size	1/2"
Standard Dimension Ratio Tube Size	SDR 9 CTS (copper tube size)
Material Designation Code	PEX 5306
Temperature & Pressure Rating	100 psi @ 180F 160 psi @ 73F
NSF Listing (Potable/Heating)	cNSF <sup>®</sup> us-pw-rfh
ASTM Tubing Standards Certification	F876/F877
Canadian Standard Assoc	CSA B137.5
Fittings System Compatibility	PureFlow ASTM F877
IAPMO Listing	UPC <sup>®</sup>
Plenum Rating*	FS/SD 25/50 ASTM E84 CAN /ULC S102.2
Fire Resistance Ratings	CAN/ULC S101 ANSI/UL 263
ICC Listing	ES-PMG™ - 1015,1038
AWWA Listing	C904
HUD Listing	MR 1276
Manufacturer's Date Code	1/1/2010
Material Code	X18.1
Country of Manufacture	Made in the USA

\* 1" and smaller tube sizes when wrapped in 1/2" - 1" thick E84 rated insulation, 1/2" and smaller with no insulation per ULC S102.2 listing. Tubing may include fitting connections when wrapped.

Table 3.2 FostaPEX Tubing Markings

#### SDR-9 PEX Tubing ASTM F876/F877/CTS-OD SDR-9

Tubing Size	Wall O.D.	Nom. Thickness	I.D.	Weight Per Ft	Volume(Gal.) Per 100 Ft
1/2"	0.625±.004	0.070+.010	0.475	.0600	0.92
5/8"	0.750±.004	0.083+.010	0.574	.0900	1.34
3/4"	0.875±.004	0.097+.010	0.671	.1200	1.82
1"	1.125±.005	0.125+.013	0.863	.2000	3.04

NOTE: Dimensions are in English units. Tolerances shown are ASTM requirements. Viega FostaPEX is manufactured within these specifications. (These dimensions do not reflect the outer aluminum and PE layers.)

Table 3.3 SDR-9 PEX Tubing



### 4.1 Codes

The Viega PEX system is accepted by the following model codes for use in potable hot and cold water distribution systems.

ICC – International Code Council  
 IPC – International Plumbing Code  
 IMC – International Mechanical Code  
 IRC – International Residential Code  
 UPC – Uniform Plumbing Code  
 UMC – Uniform Mechanical Code  
 NSPC – National Standard Plumbing Code  
 HUD – Housing for Urban Development  
 NPCC – National Plumbing Code of Canada  
 NBCC – National Building Code of Canada

Check with your local Viega representative for code compliance in your area.

### 4.2 Standards

#### ASTM – American Society for Testing and Materials

**ASTM F876/F2023: Standard Specification for Cross-linked Polyethylene (PEX) Tubing** – This standard contains finite dimensional requirements for SDR9 PEX tubing in addition to burst, sustained pressure, chlorine resistance and other relevant performance tests at different water temperatures.

**ASTM F877: Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems** – This standard contains performance requirements for SDR9 PEX tubing and fitting systems. The standard contains finite dimensional requirements for tubing, in addition to burst, sustained pressure and other relevant performance tests at different water temperatures.

**ASTM E84** – Standard Test Method for Surface Burning Characteristics of Building Materials

**ASTM E119** – Standard Test Method for Fire Testing of Building Construction and Materials

**ASTM E814** – Standard Test Method for Fire Test of Through-Penetration Firestop Systems

#### NSF International

**ANSI/NSF 14: Plastics Piping System Components and Related Materials** – This standard establishes minimum physical and performance requirements for plastic piping components and related materials. These criteria were established for the protection of public health and the environment.

**ANSI/NSF 61: Drinking Water System Components – Health Effects** – This standard establishes minimum health effects requirements for the chemical contaminants and impurities that are indirectly imparted to drinking water from products, components and materials used in drinking water systems. This standard does not establish performance or taste and odor requirements for drinking water system products, components or materials.

**American Water Works Association (AWWA) AWWA C904** – Cross-linked Polyethylene (PEX) Pressure Pipe, ½" through 2" for Water Service

#### ISO – International Standards Organization

**ISO 9001** – This standard is intended to establish, document and maintain a system for ensuring production output quality. ISO 9001 certification is a tangible expression of a firm's commitment to quality that is internationally understood and accepted. All PureFlow PEX Press fittings are manufactured in ISO 9001 certified facilities.

### 4.3 Certifications

#### PPI – Plastic Pipe Institute

##### TR 4 Listed Materials

Listing of Hydrostatic Design Bases (HDB), Strength Design Bases (SDB), Pressure Design Bases (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.

Pressure/Temperature Ratings:

- 160 psi at 73.4°F
- 100 psi at 180°F
- 80 psi at 200°F

#### NSF International

**NSF-pw certification mark** – Product meets all applicable performance standards for pressure-rated potable water applications required in ANSI/NSF Standard 14 and complies with ANSI/NSF Standard 61 for health effects.



**cNSF®us pw-G** — Product meets Zero Lead listing meeting California AB 1953 and Vermont Act 193

**CSA B137.5** — This standard specifies requirements for thermoplastic pressure piping. It includes reference publications, definitions, abbreviations, general requirements for materials and manufactured pipe and fittings, relevant test methods, and marking requirements.

**NSF U.P. Code** — Product meets requirements of the Uniform Plumbing Code™.

**PEX 5306** — Tested and certified to the NSF-pw 5306 chlorine resistance rating for an end use condition of 100% @ 140°F per ASTM F876, which is the highest chlorine resistance rating available through ASTM. When the product is marked with the PEX 5306 designation it affirms the product is approved for use in continuous domestic hot-water circulation systems with up to 140°F water temperatures and has a maximum UV rating of 6 months.

**Underwriters Laboratories Inc. (UL)**

**UL1821** — Standard for Safety for Thermoplastic Sprinkler Pipe and Fittings for Fire Protection Service (NFPA 13D systems only)

**ANSI/UL 263** — Standard for Safety for Fire Tests for Building Construction and Materials

**Underwriters Laboratories of Canada Inc. (cUL)**

**CAN/ULC — S101** — Standard Methods of Fire Endurance Tests of Building Construction and Materials

**CAN/ULC — S102.2** — Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

**CAN/ULC — S115** — Standard Method of Fire Tests of Firestop Systems

**CAN/ULC/ORD/-C199P** — Combustible Piping for Sprinkler Systems

**IAPMO R&T — International Association of Plumbing and Mechanical Officials Research and Testing**

**Certificate of Listing** — Product meets the requirements of the Uniform Plumbing Code™

**ICC — ES — International Code Council — Evaluation Services**

**ICC ES-PMG™** — Product complies with International Plumbing Code

**Note:** Certifications available at:

- www.nsf.org
- www.spec-direct.com (Intertek)
- www.ul.com
- www.canada.ul.com

**4.4 Specifying Viega PEX Systems**

Viega offers many tools to assist the specifying engineer, engineer, contractor and installer to ensure Viega PEX systems are properly designed and installed. This can be done by referring to one of the resources listed below:

- Engineering Specifications are available at [www.viega.us](http://www.viega.us)
- Viega guide specifications in Master Spec format are available upon request at 1(800) 976-9819.
- Contact your local Viega field sales representative.

Check with your local Viega representative for further information or copies of above-mentioned listings and certifications.

## 5 Viega Manifolds

Viega offers several different manifolds to meet a variety of applications, whether it is a parallel water distribution system or combination installation.

### 5.1 Viega manifold markings

Each Viega manifold is marked where space permits with the following information:

Manufacturer	VIEGA
ASTM standard	ASTM F877 / F1807 / F2159
Temperature Rating	180°F
Certifications	UPC <sup>®</sup> , cNSF <sup>®</sup> us pw-G, CSA B137.5, ICC-ES PMG™ 1038

**NOTE:** All manifolds may not be listed with each organization shown.



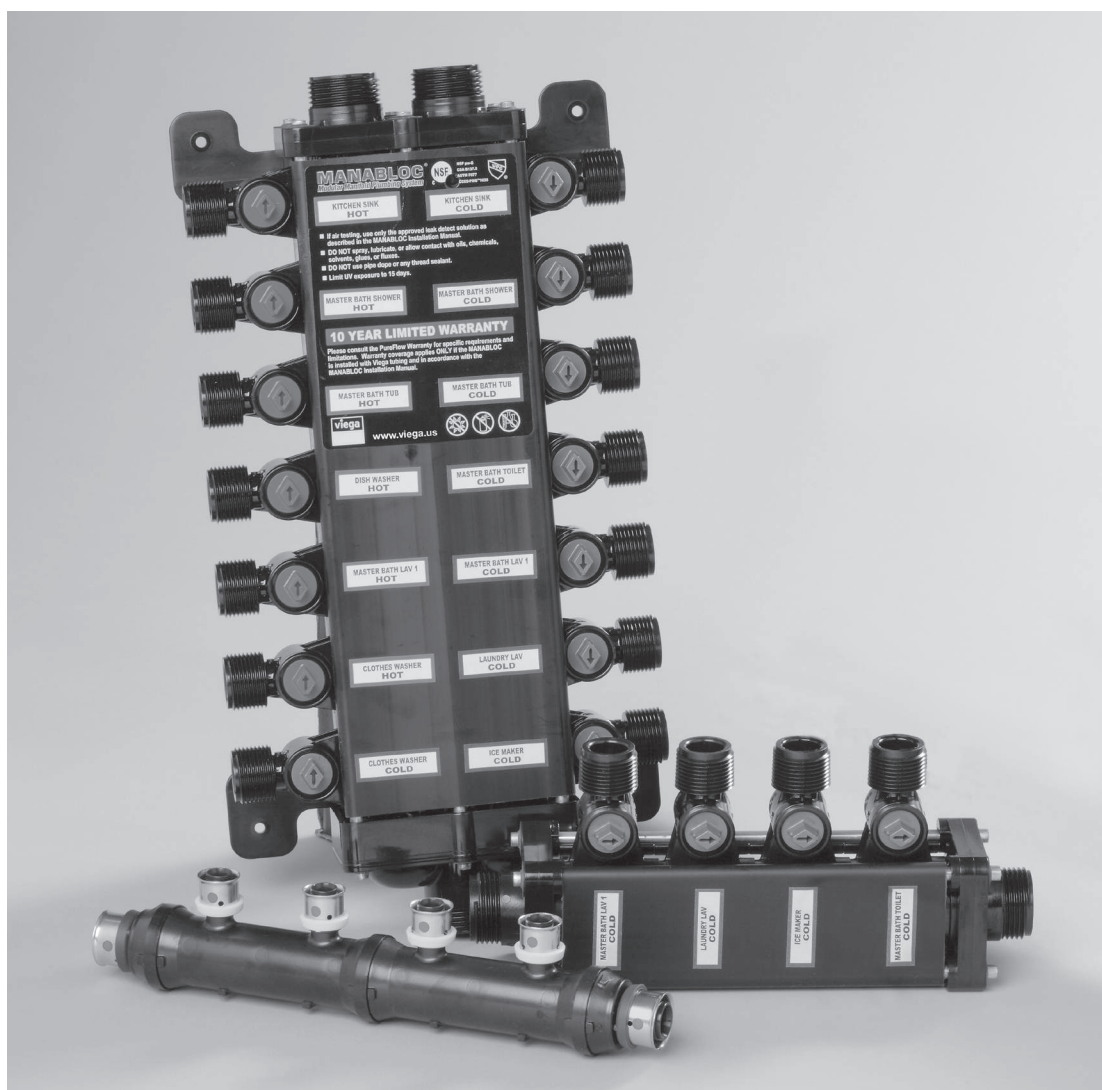
To maintain your warranty and be code compliant, use only Viega-approved fittings to connect ViegaPEX Ultra tubing to the ManaBloc.



Viega polymer manifolds must be protected from UV exposure, which can damage them. In the event of incidental UV exposure during storage, installation and handling, combined exposure of Viega polymer manifolds shall not exceed 15 days.



Do not expose Viega products to any foreign substance that includes but is not limited to VOC (volatile organic chemical) compounds, paints, solvents, glues, cleaners and disinfectants. Viega products that are exposed to these types of substances are at risk of having failures (leaks).



Viega PEX Press fittings are available in Zero Lead bronze and polymer and include a factory-assembled stainless steel sleeve with three viewing holes and a color-coded tool locator ring to ensure a proper press connection. The following design criteria make Viega PEX Press fittings ideal for use in commercial potable water applications.

- High corrosion resistance
- Excellent strength properties
- Resistant to stress corrosion
- Superior wear properties

All Viega PEX tubing, fittings and manifolds are NSF certified for use in potable water systems.

### 6.1 Viega PEX Press Polymer

Viega PEX Press Polymer fittings are manufactured from Radel® R and incorporate the Viega Smart Connect feature.

#### 6.1.1 Viega Smart Connect feature

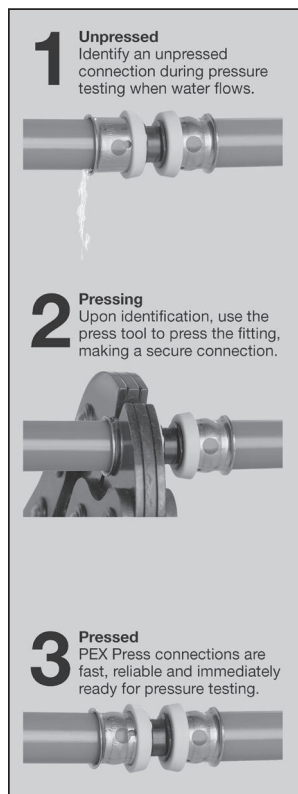



Figure 6.1 Smart Connect Feature

The Viega PEX Press Polymer fitting system incorporates the Viega Smart Connect feature, which is designed to identify unpressed connections by intentionally leaking under test pressures of .5 psi to 100 psi. This can be visually identified by water leaking from the unpressed fitting joint. If testing with compressed air, it is necessary to use an approved leak-detect solution (see “9.7.3 Leak detection” on page 47), applied to each connection, to identify a suspected leak. Press any connections that may have been missed and/or replace connections found to be in question. Repeat the system pressure test.

### 6.2 Viega PEX Press Bronze


Viega PEX bronze fittings are manufactured from a high-quality Zero Lead material specifically designed for press technology meeting or exceeding all manufacturing requirements.


 Use only Teflon tape on all threaded connections

### 6.3 Viega PEX Press fitting markings

Each Viega PEX Press fitting is marked where space permits with the following information:

 Use only Viega stainless steel attached PEX Press sleeves and press tools with Viega PEX Press fittings.

 Viega PEX Press polymer fittings must be protected from UV exposure, which can damage them. In the event of incidental UV exposure during storage, installation and handling, combined exposure of PEX Press fittings shall not exceed 15 days.

 Do not expose Viega products to any foreign substance that includes but is not limited to VOC (volatile organic chemical) compounds, paints, solvents, glues, cleaners and disinfectants. Viega products that are exposed to these types of substances are at risk of having failures (leaks).



## 6.4 PEX Press Tools

### 6.4.1 PEX Press power tools

The Viega PEX Press fitting connection shall be installed with use of a Viega PEX Press tool. The Ridgid power tool is designed to make consistent presses and has interchangeable jaws that can be easily changed out as needed. The compression of the tool also allows press connections to be made in temperatures as low as 23°F.



Figure 6.2 Compact Power Tool



Figure 6.3 Standard Power Tool

### 6.4.2 PEX Press hand tools

The Viega PEX Press fitting connection may also be installed with a Viega PEX Press hand tool. The hand tool incorporates a forced compression mechanism to complete a secure connection each time. A ratchet inside the tool prevents the tool from being opened until the proper force has been applied to the press sleeve. A safety release screw allows the tool to be opened at any time, but any connection made without full tool compression must be repressed. The tool handles are color coded to match the PEX Press tool locator rings.

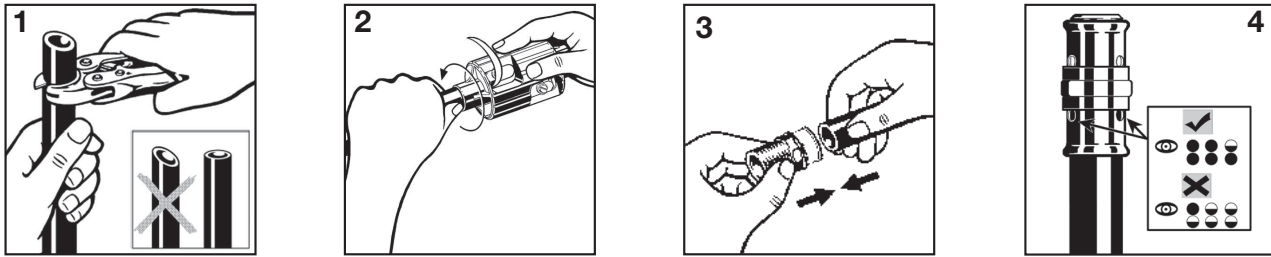
The reduced grip feature permits one-handed operation, making the Viega PEX Press system perfect for tight spaces and awkward locations. The compression of the tool also allows press connections to be made in temperatures as low as -4°F.



Figure 6.4 PEX Press Hand Tools

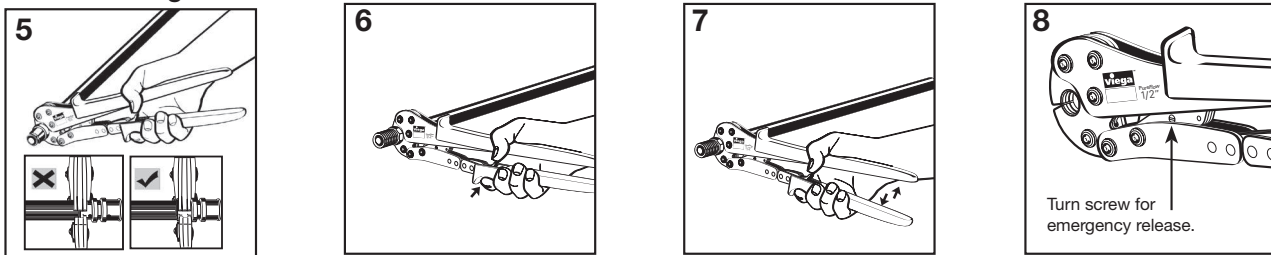
## 6.5 Making a Viega PEX Press connection with hand tool

### 6.5.1 Trimming and inserting the tubing



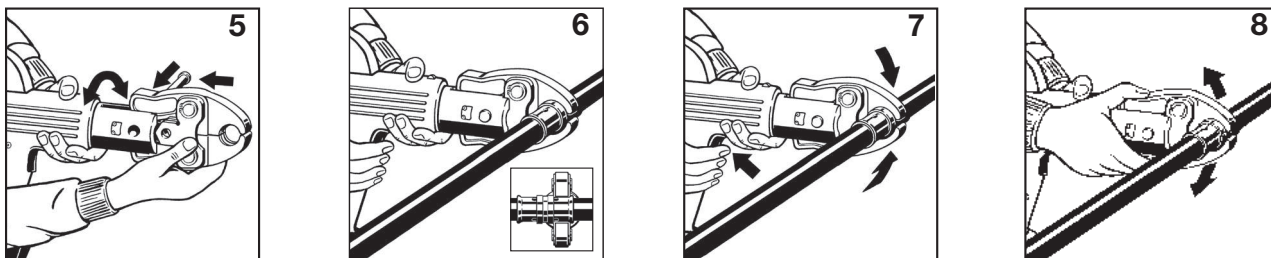
1. Square off tubing to proper length. Uneven, jagged or irregular cuts will produce unsatisfactory connections.
2. If using FostaPEX tubing, insert into prep tool, push and turn until no resistance is felt. If using ViegaPEX, continue to Step 3.
3. Insert PEX Press fitting with attached sleeve into tubing and engage fully.
4. Ensure full tubing insertion at view holes in attached press sleeve. Full insertion means tubing must be completely visible in at least two view holes and partially visible in the one.

### 6.5.2 Pressing with a hand tool



5. Position press tool perpendicular over press sleeve, resting it against the tool locator ring.  
Note: The tool locator ring must be in the factory-installed position while making a press to provide a consistent leakproof connection. It may be necessary to rotate the tool locator ring to avoid interference between the ring and tool.
6. Close handles, using trigger to reduce grip span if desired.
7. Extend handle and continue ratcheting until automatic tool release occurs at proper compression force.
8. **Warning:** The connection is not leakproof when the tool has been opened by emergency release. The tool locator ring must be present to ensure a proper PEX Press connection.

### 6.5.3 Pressing with a power tool



5. Insert the appropriate Viega PEX Press jaw into the press tool and push in the holding pin until it locks.
6. Open jaw and position perpendicular over press sleeve, resting it against the tool locator ring.  
Note: The tool locator ring must be in the factory-installed position while making a press to provide a consistent leakproof connection. It may be necessary to rotate the tool locator ring to avoid interference between the ring and tool.
7. Start pressing process; hold the trigger until the jaw has automatically released.
8. When press connection is complete, open and remove jaw.
9. **Warning:** The tool locator ring must be present to ensure a proper PEX Press connection.

## 7.1 Code references



### 7.1.1 U.S. code approvals

Viega PEX and its related plumbing components are recognized by the International Plumbing Code (IPC), Uniform Plumbing Code (UPC) and the National Plumbing Code (NPC).

Viega has attained the below evaluation reports attesting its compliance with their respective model plumbing codes. Refer to these reports and their respective codes when sizing PEX systems for residential and light commercial buildings.

- ICC-ES PMG 1038
- IAPMO 4030
- IAPMO 3700



### 7.1.2 Canadian code approvals

Viega PEX and its related plumbing components are recognized by the National Plumbing Code of Canada (NPCC). Refer to the respective sizing tables and/or any provincial code requirements for sizing Viega PEX systems for residential and light commercial buildings.

## 7.2 Sizing a PEX system

### 7.2.1 General


Viega PEX plumbing systems are sized using the same methods as other traditional piping materials outlined in each respective model plumbing code. While all PEX tubing has a slightly smaller I.D. than equivalent metal piping systems, its flexibility (requiring fewer fittings) and smooth inner walls make up for this slight dimensional difference. For pipe sizing methods that require the friction loss and velocity characteristics of PEX tubing, this information is available in Section “7.3 Viega PEX tubing” on page 15.

### 7.2.2 Sizing methods

There are several methods for determining potable water distribution pipe sizing within each model plumbing code. While each method may differ they all rely on similar basic information to be attained in order to accurately size a system. Below are the most common factors required for sizing a system.

- Available water supply pressure
  - This includes pressure losses through inline devices like meters & water softeners
- Total fixture demand for all fixtures being supplied within the building expressed as:
  - W.S.F.U. (water supply fixture units) or
  - GPM (gallon per minute)
- Vertical elevation changes from water supply to highest fixture
  - Account for pressure loss or gain of 0.433 psi per foot of elevation change due to gravity
- Total pipe length from water supply to most remote highest-demand fixture
  - Total tube length includes equivalent length of fittings and/or valves inline (depends on sizing method)

Once this information is compiled it can be applied to the sizing method being used. The minimum meter size is also determined within these methods. In some cases you must account for all fittings and/or valves as part of calculating the total pipe length (also known as the developed tube length). The fitting pressure loss is traditionally expressed as an equivalent length of PEX tubing and is added to the total pipe length to determine the developed tube length. The fitting equivalent lengths of PEX tubing are available from the fitting manufacturer; see Section “7.5 Viega PEX Press fittings” on page 17.

 **Note:** Always refer to the relevant code sizing tables being used to size your system.



## 7.3 Viega PEX tubing

### 7.3.1 Flow velocity table

Flow Rate GPM	Flow Velocity ft/Sec							
	3/8	1/2	3/4	1	1 1/4	1 1/2	2	
0.5	1.7	0.9			Velocity < 0.5 ft/Sec			
0.75	2.5	1.4	0.7					
1.0	3.3	1.8	0.9	0.5				
1.5	5.0	2.7	1.4	0.8	0.6			
2.0	6.7	3.6	1.8	1.1	0.7	0.5		
2.5	8.3	4.5	2.3	1.4	0.9	0.7		
3.0	10.0	5.4	2.7	1.6	1.1	0.8		
3.5		6.3	3.2	1.9	1.3	0.9	0.5	
4.0		7.2	3.6	2.2	1.5	1.1	0.6	
4.5		8.1	4.1	2.5	1.7	1.2	0.7	
5.0		9.1	4.5	2.7	1.8	1.3	0.8	
6.0		10.9	5.4	3.3	2.2	1.6	0.9	
7.0			6.4	3.8	2.6	1.8	1.1	
8.0			7.3	4.4	2.9	2.1	1.2	
9.0			8.2	4.9	3.3	2.4	1.4	
10.0			9.1	5.5	3.7	2.6	1.5	
11.0			10.0	6.0	4.0	2.9	1.7	
12.0			10.9	6.6	4.4	3.2	1.8	
13.0			11.8	7.1	4.8	3.4	2.0	
14.0				7.7	5.1	3.7	2.2	
15.0				8.2	5.5	4.0	2.3	
16.0				8.8	5.9	4.2	2.5	
17.0				9.3	6.3	4.5	2.6	
18.0				9.9	6.6	4.8	2.8	
19.0				10.4	7.0	5.0	2.9	
20.0				11.0	7.4	5.3	3.1	
25.0					9.2	6.6	3.8	
30.0		Velocity > 12 ft/Sec			11.0	7.9	4.6	
35.0						9.2	5.4	
40.0							10.6	6.2
45.0							11.9	6.9
50.0						7.7		
55.0						8.5		
60.0						9.2		
65.0						10.0		
70.0						10.8		
75.0						11.5		

Table 7.1

### 7.3.2 Pressure loss table

Flow Rate GPM	60°F (16°C) Water						
	Pressure Loss PSI/ 100 ft of Pipe						
	3/8	1/2	3/4	1	1 1/4	1 1/2	2
0.5	2.0						
0.75	4.1						
1.0	7.0	1.6		Pressure Loss <1 PSI			
1.5	14.9	3.4					
2.0	25.4	5.8	1.1				
2.5	38.5	8.7	1.6				
3.0	53.9	12.2	2.3				
3.5		16.2	3.0				
4.0		20.8	3.9	1.1			
4.5		25.8	4.8	1.4			
5.0		31.4	5.9	1.7			
6.0		44.0	8.2	2.4			
7.0			10.9	3.2	1.2		
8.0			14.0	4.1	1.6		
9.0			17.4	5.1	1.9		
10.0			21.1	6.2	2.3	1.0	
11.0			25.2	7.4	2.8	1.2	
12.0			29.6	8.8	3.3	1.5	
13.0			34.3	10.1	3.8	1.7	
14.0				11.6	4.4	2.0	
15.0				13.2	5.0	2.2	
16.0				14.9	5.6	2.5	
17.0				16.7	6.3	2.8	
18.0				18.5	7.0	3.1	
19.0				20.5	7.7	3.4	
20.0				22.5	8.5	3.8	1.0
25.0					12.8	5.7	1.5
30.0		Pressure Loss Excessive as Flow velocity is > 12 ft/Sec			18.0	8.0	2.2
35.0						10.7	2.9
40.0						13.7	3.7
45.0						17.0	4.6
50.0							5.6
55.0							6.6
60.0							7.8
65.0							9.0
70.0							10.4
75.0							11.8

**NOTE:** Pressure Loss based on Hazen-Williams Formula (C = 150)  
 Pressure Loss for Actual Length can be calculated by following formula:  
 Actual Length / 100 ft X Value from chart above

Table 7.2

### 7.3.3 Velocity limits

Viega recommends the following design velocities for hot and cold PEX water distribution systems:

- Domestic cold water — 10 fps
- Domestic hot water — 8 fps

The flow velocity through Viega’s PEX Press fittings does not fall under these limitations. The equivalent length of PEX tube for Viega PEX Press fittings is available from Viega to assist in system sizing where applicable (refer to Section “7.3.1 Flow Velocity Table” on page 15).

### 7.4 Viega ManaBloc/MiniBloc

#### 7.4.1 Pressure loss

ManaBloc / MiniBloc Pressure Loss			
Size	Rate Flow	Pressure Loss*	K - Factor
3/8" Port	2.5 GPM	2 PSI	0.35
1/2" Port	4.4 GPM	4.1 PSI	0.21
1 1/4" Manifold**	31 GPM	11.5 PSI	0.012

\*Pressure Loss =  $K \times \text{gpm}^2$

\*\*36 port manifold

Table 7.3

### 7.5 Viega PEX Press fittings

#### 7.5.1 Equivalent feet of PEX tubing factor

Pressure loss through PEX insert fittings can be expressed by referencing the Equation of Continuity, which states inflow equals outflow.

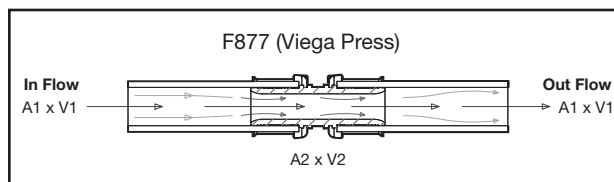


Figure 7.1 Effects of fitting I.D.

$$A1 \times V1 = A2 \times V2$$

Where: A = cross sectional area  
V = velocity of liquid

The water velocity increases as it passes through the fitting, creating a slight pressure loss. This pressure loss can be calculated by using the equivalent feet of PEX tubing factor (see Table 7.4).

#### 7.5.2 Viega PEX Press friction loss – equivalent feet of SDR9 PEX tubing

PEX Press Bronze Fittings				
Size	Coupling	Elbow	Tee Run	Tee Branch
3/8"	2.9	9.2	2.9	9.4
1/2"	2.0	9.4	2.2	10.4
3/4"	1.0	8.0	1.0	9.0
1"	1.0	10.0	2.0	10.0
1 1/4"	2.0	11.0	2.0	11.0
1 1/2"	2.0	13.0	2.0	12.0
2"	1.0	19.0	2.0	18.0

PEX Press Polymer Fittings				
Size	Coupling	Elbow	Tee Run	Tee Branch
3/8"	4.5	14.3	6.5	14.7
1/2"	2.6	12.6	3.9	14.0
3/4"	2.5	18.9	3.6	19.1
1"	3.1	17.7	3.8	18.4
1 1/4"	4.0	18.6	6.4	18.7
1 1/2"	5.2	29.4	7.9	28.3
2"	8.9	36.4	10.2	37.5

Table 7.4



### 7.5.2.1 Calculating pressure drop through fittings

To account for pressure drop through a PEX fitting, simply take the equivalent feet factor noted in Table 7.4 for the size and type of fitting and multiply it by the PEX tubing pressure loss per foot factor (see “Table 7.2” on page 16) for that same PEX tube size per the flow rate being applied.

Example:

- 1/2" PEX Polymer Elbow has an equivalent PEX tubing factor of 12.6 ft.
- 1/2" PEX tubing has a 20.8 psi drop per 100 feet at 4 gpm.
- $20.8/100 \text{ ft.} = 0.208 \text{ psi per foot}$
- $12.6 \times 0.208 = 2.6 \text{ psi drop}$

### 7.5.2.2 Reducing fittings

When a reducing fitting is used, a tee for example, simply use the coinciding value for the branch leg size. If the run legs are different sizes, use half (0.5)\* of each of their respective equivalent value for each size. Once these values are determined, apply them to their respective tubing pressure drop factors per the flow rate being applied.

Example:

3/4" x 1/2" x 3/4" PEX Press polymer tee at 4 GPM through the 1/2" connection would have the following pressure drop:

#### *Calculating 3/4" run leg*

- 3/4" run leg of tee = 3.6 equiv ft of PEX
  - $3.6 \times 0.5 = 1.8 \text{ equiv ft of PEX}$
- 3/4" PEX at 4 GPM = 3.9 PSI / 100ft loss
  - $3.9 \text{ PSI} / 100\text{ft} = 0.039 \text{ PSI} / \text{ft. loss}$
  - $0.039 \text{ PSI} \times 1.8 \text{ equiv ft} = 0.07 \text{ PSI loss}$

#### *Calculating 1/2" run leg*

- 1/2" run leg of tee = 3.9 equiv ft of PEX
  - $3.9 \times 0.5 = 1.95 \text{ equiv. ft of PEX}$
- 1/2" PEX at 4 GPM = 20.8 PSI / 100ft loss
  - $20.8 / 100\text{ft} = 0.208 \text{ PSI} / \text{ft. loss}$
  - $0.208 \times 1.95 = 0.41 \text{ PSI loss}$

#### *Combined run leg*

- $0.07 \text{ PSI} + 0.41 \text{ PSI} = 0.48 \text{ PSI loss through run leg of reducing tee}$

\* Multiply by 0.5 to get half of the full run length value for the reducing tee.

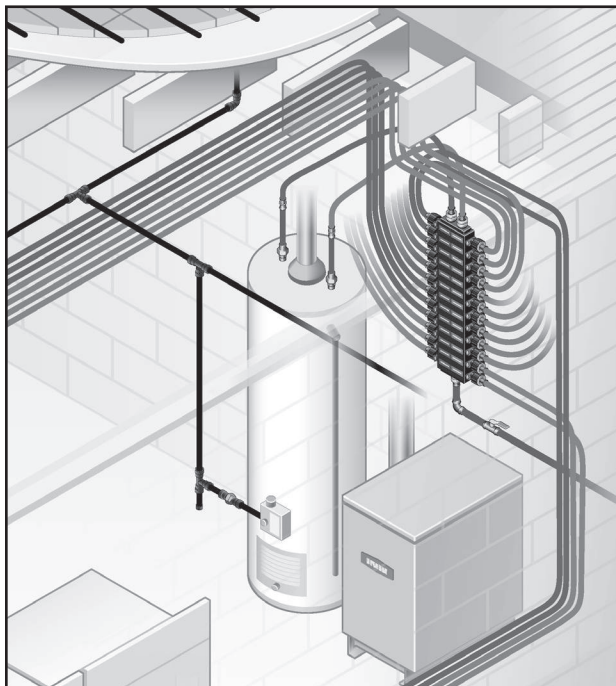
## 8.1 General

While a branch and tee system design is still the most common method used for potable water distribution installations, Viega recommends using more efficient system design methods when possible. These methods consist of combination manifold and/or home run systems that promote water and energy savings as well as reducing the number of fittings in the system. The following sections will provide an overview of each system type to assist with selecting a system that best fits your needs.

### 8.1.1 Manifold installations

#### 8.1.1.1 Homerun

A homerun system, also known as parallel system, is a unique method of plumbing that provides water and energy savings and can reduce water waste up to 40% compared to traditional distribution plumbing systems. This system consists of a centralized manifold with individual distribution lines that run to each fixture (hot and cold). These lines are sized to the specific fixture demand using  $\frac{3}{8}$ " for low-demand fixtures (2.5 gpm or less) and  $\frac{1}{2}$ " for higher-demand fixtures (up to 4 gpm).

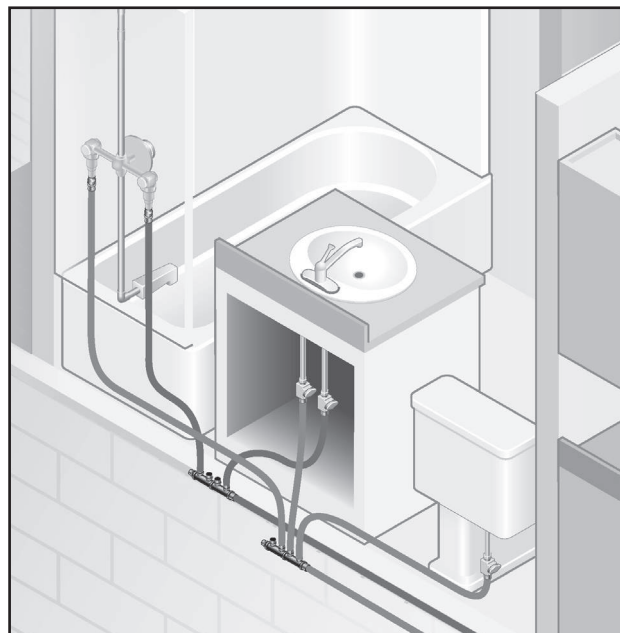


Home Run Installation	Low	Med	High
Connections	Black	White	White
Installation Time	Black	Black	White
System Efficiency	Black	White	White

Figure 8.1 Home Run Installation

#### 8.1.1.2 Zone / combination

Zone or combination manifold plumbing systems use multiple manifolds combined with a branch and tee system. These systems use various sizes of manifolds located throughout a structure placed near each main fixture group supplied by the main hot and cold supply lines, similar to a branch and tee system. Multiple branch lines are connected to a manifold in a common location in lieu of multiple tees spread throughout the system. This takes advantage of benefits from both types of systems and helps keep hidden fittings to a minimum.



Combination Installation	Low	Med	High
Connections	Black	Black	White
Installation Time	Black	White	White
System Efficiency	Black	Black	White

Figure 8.2 Combination Installation

#### 8.1.2 Grounding / bonding

Viega PEX tubing shall not be used as an electrical ground. Consult with the NEC (National Electrical Code) for recommended ground method when plastic pipe is used.

**Do not ground plastic piping!**

### 8.1.3 Hybrid

Viega PEX tubing installed in a potable water distribution system with metallic tubing is considered a hybrid system. Hybrid systems can give the installer and/or designer more versatility in their designs while staying price competitive. An example of this type of installation method would be using a copper riser as the main supply with PEX tubing on each level as distribution tubing.



### 8.1.4 Connecting PEX to metal tubing

PEX can be connected directly to metal tubing with the use of ProPress by PEX Press adapters, threaded adapters, flare adapters, female union adapters or the use of solder adapters. Viega is the only manufacturer that offers a solution for connecting PEX tubing directly to copper tubing using press technology.

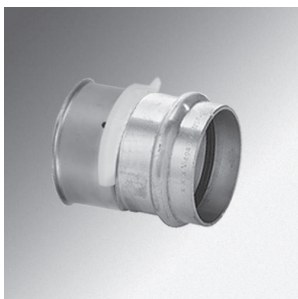


Figure 8.3 Model 2813PZL  
PEX Press x ProPress



Figure 8.4 Model 2811ZL  
PEX Press x M NPT



Figure 8.5 Model 2813.5ZL  
PEX Press x Female  
Copper Tube Size



Figure 8.6 Model 2892ZL  
PEX Press x Flare

## 8.2 Hot Water System Design

There are several types of hot water circulation systems to choose from as well as considerations for designing each of them. These can range from building size and/or layout to the required water delivery temperature for a specific application. It is the responsibility of the designer / specifier to select the appropriate system based on the application while ensuring the system temperatures and pressures don't exceed the ratings for the plastic tubing being used.

Viega's PEX tubing is tested and listed to the requirements of ASTM F876 with a material designation code of PEX 5306. The first digit of this code (5) is the PEX tubing chlorine resistance ratings which means the PEX product is approved for 100% end use condition at 140°F. This is the highest chlorine rating available per the ASTM F876 standard. Products marked with the (5) designation are approved for continuous domestic hot water circulation systems not to exceed 140° F.

**⚠ Do not use PEX for circulation lines exceeding 140°F.**

### 8.2.1 Re-circulation systems

There are three main types of hot water circulation systems.

- Continuous
- Timer
- On demand

These systems have their own strengths and weaknesses so it is important to understand their differences in order to specify the right one. Below is an overview of what these systems entail.

**Continuous** – The system operates 24 hours a day, 7 days a week. This being said there is a noticeable cost of operation. This system should only be used where hot water is necessary all the time throughout the system. These can have high operating costs and premature component wear.

**Timer** – The system can be programmed to activate during peak hours of usage, limiting how often the pump runs throughout the day. Some of these systems incorporate an aquastat to limit pump use even more. This reduces the operating cost and wear and tear on those components.

**On demand** – The system is activated manually when hot water is needed. These systems are probably the most efficient but require the end user to be accustomed to operating them effectively. There is a priming period once the system is activated, causing a slight delay prior to hot water being present.

Proper stub out supports for PEX tubing in this application are crucial. Do not rely on nearby piping to support the stub out piping. Use engineered solutions designed for the application. Use appropriate support techniques as identified by the manufacturer of the carrier system.

### 8.2.2 Balancing / velocity

Industry agencies like American Society of Plumbing Engineers (ASPE) provide design criteria for hot water systems that include balancing and velocity guidelines. Proper balancing eliminates uneven water temperatures and delivery times caused by the water naturally taking the path of least resistance known to happen on shorter loops. Also, as a general design practice for hot water circulation systems, you shall not exceed velocities of 2 fps including circulation lines. Viega provides the necessary product specifications to design efficient hot water systems.

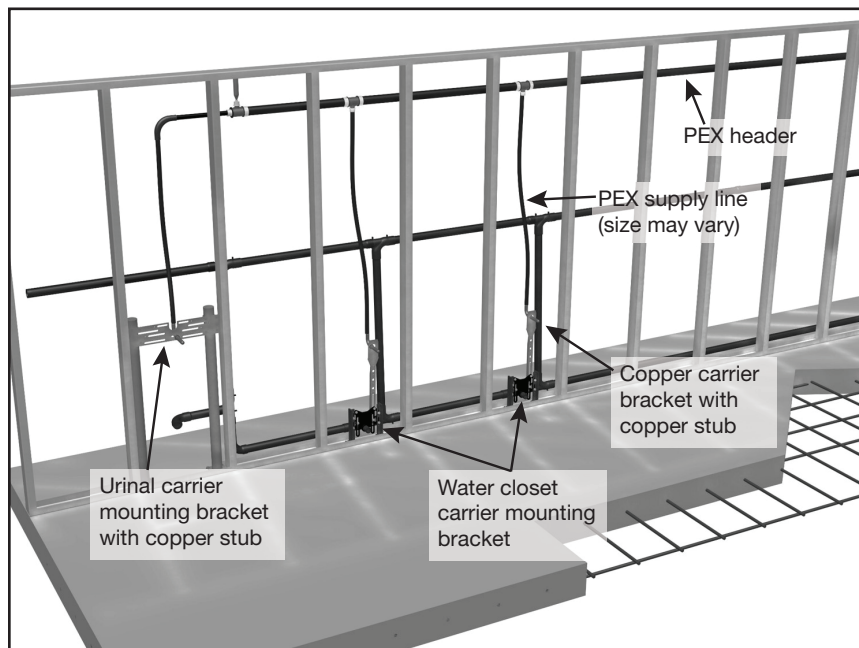


Figure 8.7 PEX Piping to Flush Valves - Front View

### 8.2.3 Insulation

While plastic tubing has some insulation properties (R-value) it generally is not enough to meet most thermal performance requirements as outlined in hot water plumbing or energy codes. As a general practice, anywhere metal piping requires insulation, plastic piping will too. Always check code for necessary insulation requirements.

## 8.3 Fixture connections

### 8.3.1 Carrier systems

Carrier systems that utilize flush valves are commonly used in commercial applications. The detail to the right shows a typical bank installation of multiple flush valves and PEX supply piping.

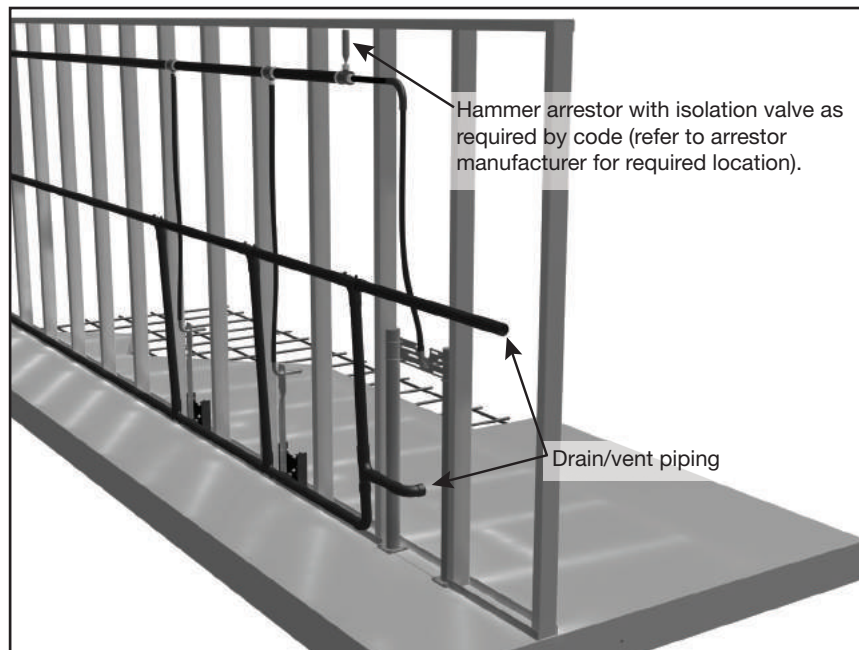


Figure 8.8 PEX Piping to Flush Valves - Rear View



## 8.4 Water quality

In recent years, the focus in the U.S. has split between drinking water treatment and pollution prevention prior to treatment. While both improve drinking water, by focusing on the cleanliness of the source water the EPA is able to ensure cleaner water for the environment as well as people. Below are some of the restrictions placed on both our raw water and our finished water.

Water quality, according to the U.S. EPA, is the chemical, physical and biological characteristics of water. The quality of both source and treated water must adhere to the standards and mandates of the Clean Water Act (CWA). The CWA includes requirements related to effluent discharge limits, guidelines, testing and pretreatment guidelines. The primary purpose of the CWA is to minimize the pollutants discharged to public waters. The purpose of this limit is twofold. Limiting industrial discharge to bodies of water protects the plants and animals that live in and depend on that body of water. Also, many surface waters are processed for human consumption or other use; minimizing the pollution that goes into the water makes it easier and less expensive to further process the water. Overall, the CWA is in place to maintain the health of ecosystems and safety of all waters for human use and consumption.

Stagnation in water distribution systems is a problem in most modern buildings, but it is a larger problem in hospitals where immunocompromised patients can be found coexisting with piping dead ends and inconsistent occupancies that lead to periods of stagnation. Stagnation can lead to a buildup of biofilms and pathogens that can ultimately damage the system, causing health problems for those exposed. Other areas where stagnation and the consequences associated with it may cause health concerns are hotels and schools, where water use follows the inconsistent use of the building.

### 8.4.1 Piping details

There are a few methods for piping hot water supply lines to help eliminate dead legs and keep water moving. Below are a few piping diagrams showing series and loop methods.

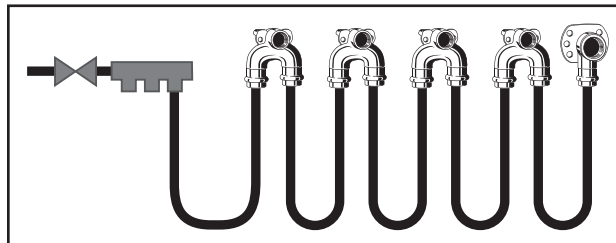


Figure 8.9 Series Diagram

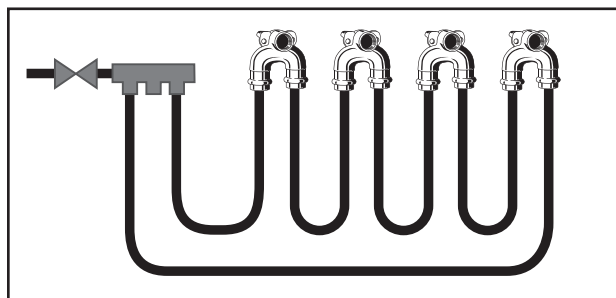


Figure 8.10 Loop Diagram

The following design methods have been proven in Europe and will soon be available in North America thanks to Viega's line of flow-through fittings. Stagnation can now be minimized to extents not previously possible by designing and installing plumbing in a completely new way. Just as the Viega ManaBloc provided an innovative alternative to branch and tee systems, Viega's flow-through fittings make "series" and "loop" installation a possibility.

A series installation utilizes a strategy that generates flow through the supply piping of all fixtures connected in series prior to the one in use. Figure 8.9 shows a series installation where each circle represents a fixture connection. A loop installation, like the one in Figure 8.10, incorporates supply piping that allows flow in either direction. This lets water be supplied to a single fixture from both the left and right sides. The use of any fixture in a loop will induce flow up to the point of connection, significantly reducing or eliminating dead legs.

For more detailed design information contact your local Viega sales representative.

### 8.4.2 Fittings

Viega offers a special Zero Lead double elbow fitting that simplifies piping these circuits. It allows you to flow the supply water through the fitting and on to the next fixture. The fixture supply connects to a standard 1/2" F NPT to transition out from the wall.

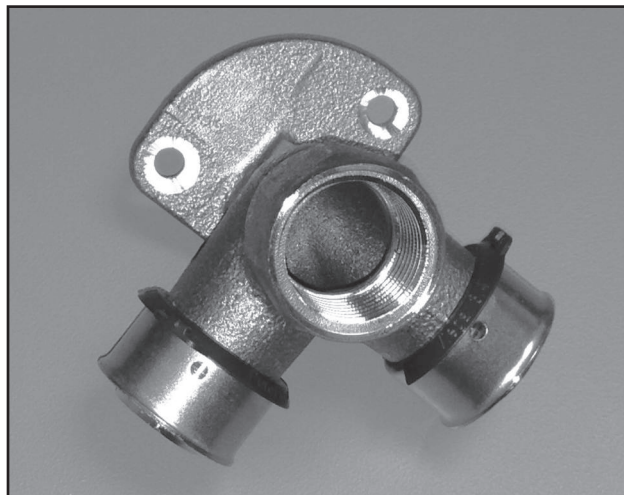


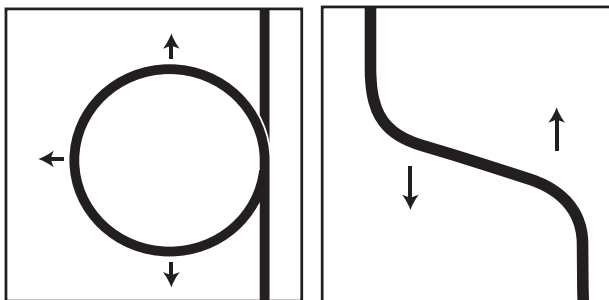
Figure 8.11 Double Elbow

### 8.5 Thermal expansion compensation

ViegaPEX Ultra tubing, as with any PEX tubing, expands and contracts with temperature changes in the environment or the fluid inside the tubing. The longer the tubing run and the higher the temperature change, the more linear expansion the system will experience. This expansion and contraction can affect the appearance as well as integrity of the system by putting stress on the tubing, fittings, valves and fasteners. The system should be designed to accommodate tubing expansion.

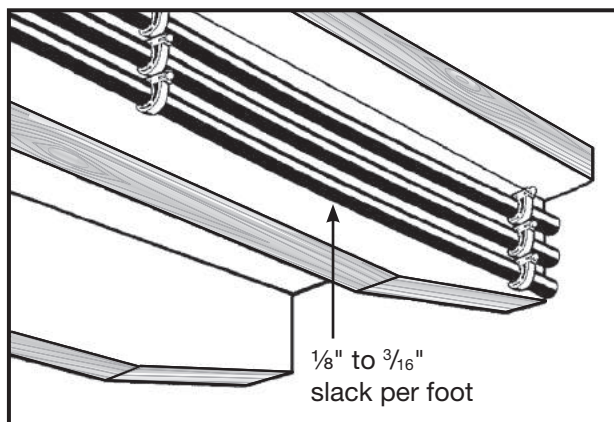
Tubing fasteners perform two functions: providing support for the tubing and guiding the tubing during expansion and contraction. It is important to keep this in mind when installing fasteners. An expansion compensator will not be effective if the fasteners prevent linear movement of the piping system. Tubing sizes smaller than 3/4" generally do not require expansion compensators with fittings and can easily be bent into loops and offsets to absorb linear expansion. For tube sizes 1" and larger, refer to "Calculating expansion loops and offsets" on page 24 for compensation options.

For unconstrained tubing runs (not within the floor) Viega recommends the use of expansion offsets. This can be accomplished at a corner or by using offsets or loops on straight tubing runs. Expansion compensators should be installed at the midway point of tubing runs and should be spaced no more than 50 feet apart.



Using a loop to accommodate tubing expansion

Offsets also provide room for tubing expansion



Allow some slack in all runs to prevent damage from tubing contraction.

Figure 8.12 Tubing Expansion

Below is an example of required offsets for a 100-foot tubing run. Note that the expansion compensators are no more than 50 feet apart.

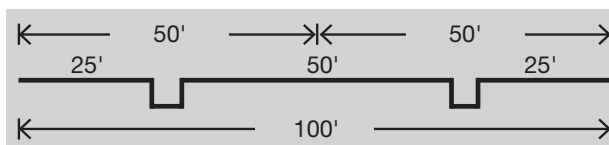


Figure 8.13 Example of Required Offsets

### 8.5.1 Calculating expansion loops and offsets

There are three types of expansion offsets recommended for use with large-diameter tubing: the corner expansion offset, the Z-type expansion offset and the U-type expansion loop. A description, illustration and dimensions chart for each type of offset is on the next few pages. See “FostaPEX” on page 28 for FostaPEX recommendations.

#### Linear expansion:

To calculate linear expansion for PEX tubing, use the following formula:

$$\Delta L = \frac{\text{PEX expansion rate}}{100' \times 10^{\circ}\text{F}} \times \Delta T \times \text{tubing length ft}$$

Where:

ViegaPEX and ViegaPEX Ultra expansion rate = 1.1" per 100' per 10°F

$\Delta T$  = Change in temperature (in °F)

For example:

40' of 1" ViegaPEX tubing going from 70°F to 130°F

$$\Delta L = \frac{1.1''}{1000} \times 60^{\circ} \times 40' = 2.64''$$

$$\Delta L = 2.64''$$

**Compensation distance:**

To calculate the dimensions of the expansion compensation offset needed, use the following formula:

$$L = C\sqrt{OD \times \Delta L}$$

Where:

- L = length of compensation distance
- C = 12 (PEX material specific constant)
- OD = outer tubing diameter (1/8" + nominal tube size)
- ΔL = change in length from temperature change

**Corner expansion offset:**

Where piping takes a corner after a long straight run, a simple 90° elbow in the piping will allow for the absorption of expansion.

Calculate the necessary "L" dimension between elbow and nearest fastener or use the chart below, which was figured using the maximum run for a single expansion compensator (50 feet).

Following the previous example:

$$L = C\sqrt{OD \times \Delta L}$$

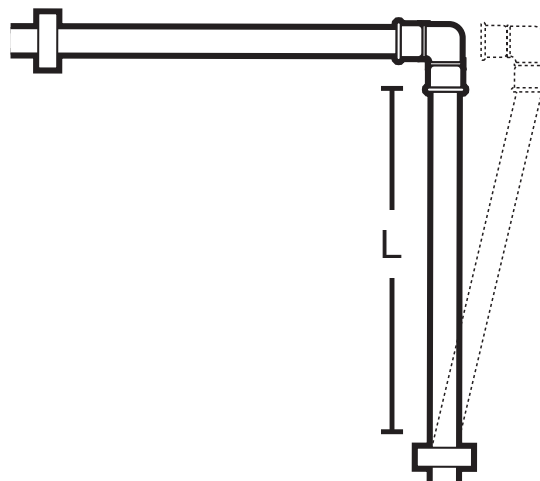
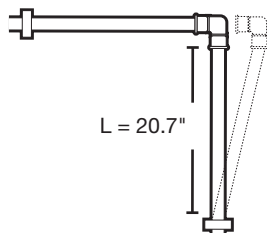
Where:

- C = 12
- OD = 1.125 (1" PEX)
- ΔL = 2.64"

$$L = 12\sqrt{1.125" \times 2.64"} = 20.7"$$

$$L = 20.7"$$

*Illustration of Example*



*Figure 8.14 Corner Expansion*

		Corner Expansion Offset (L, in) per 50 linear feet of run							
Tubing	ΔT(°F) Tube nom.	60	80	100	120	140	160	180	200
ViegaPEX & ViegaPEX Ultra	3/4"	20.4	23.6	26.4	28.9	31.2	33.4	35.4	37.3
	1"	23.2	26.7	29.9	32.8	35.4	37.8	40.1	42.3
	1 1/4"	25.6	29.6	33.1	36.2	39.1	41.8	44.4	46.8
	1 1/2"	27.8	32.1	35.9	39.4	42.5	45.5	48.2	50.8
	2"	31.8	36.8	41.1	45.0	48.6	52.0	55.1	58.1

*Table 8.1 Corner Expansion*



**Z-type expansion offset:**

The Z-type expansion offset integrates two 90° elbows that form a “Z” pattern.

With this type of configuration ½ of the “L” dimension is applied to the center area of the “Z” (represented as L1 in the table and illustration) while ¼ of the “L” dimension would be applied to each of the top and bottom areas (represented as L2).

Calculate the necessary L1 and L2 dimensions or use the chart below, which was figured using the maximum run for a single expansion compensator (50 feet).

$$L = 20.7''$$

$$L1 = \frac{1}{2} (L)$$

$$L1 = 20.7''/2 = 10.35''$$

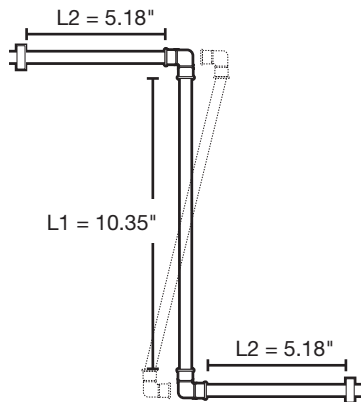
$$L1 = 10.35''$$

$$L2 = \frac{1}{4} (L)$$

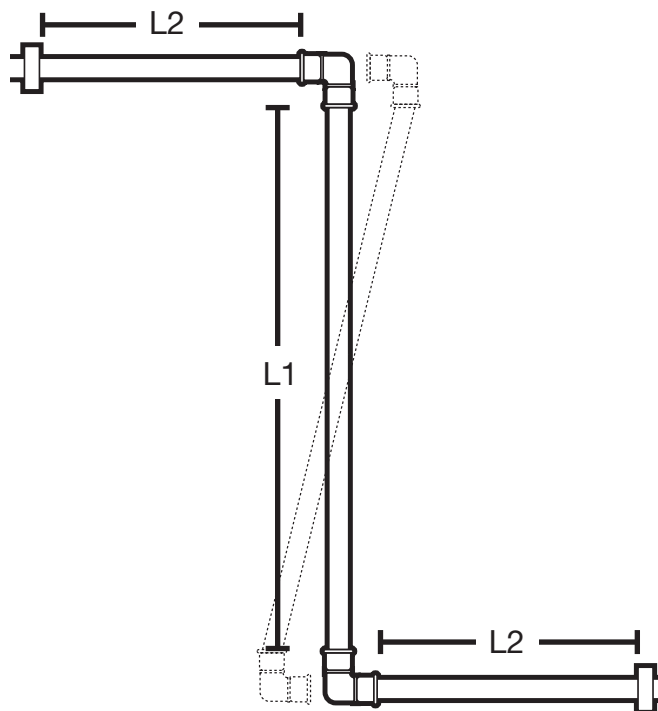
$$L2 = 20.7''/4 = 5.18''$$

$$L2 = 5.18''$$

*Illustration of Example*



*Figure 8.15 Z-Type Expansion*



		Z- Type Expansion Offset (in) per 50 linear feet of run															
Tubing	ΔT(°F) Tube nom.	60		80		100		120		140		160		180		200	
		L1	L2	L1	L2	L1	L2	L1	L2	L1	L2	L1	L2	L1	L2	L1	L2
ViegaPEX & ViegaPEX Ultra	¾"	10.2	5.1	11.8	5.9	13.2	6.6	14.4	7.2	15.6	7.8	16.7	8.3	17.7	8.8	18.6	9.3
	1"	11.6	5.8	13.4	6.7	15.0	7.5	16.4	8.2	17.7	8.8	18.9	9.5	20.1	10.0	21.1	10.6
	1¼"	12.8	6.4	14.8	7.4	16.5	8.3	18.1	9.1	19.6	9.8	20.9	10.5	22.2	11.1	23.4	11.7
	1½"	13.9	7.0	16.1	8.0	18.0	9.0	19.7	9.8	21.3	10.6	22.7	11.4	24.1	12.1	25.4	12.7
	2"	15.9	8.0	18.4	9.2	20.5	10.3	22.5	11.3	24.3	12.2	26.0	13.0	27.6	13.8	29.1	14.5

*Table 8.2 Z-Type Expansion*

### U-type expansion offset:

The U-type expansion loop integrates four 90° elbows that form a “U” pattern.

With this arrangement 1/5 of the “L” dimension is applied as the width (represented as L3) while 2/5 of “L” is applied as each leg in the other dimension (represented as L4).

Calculate the necessary L3 and L4 dimensions or use the chart below, which was figured using the maximum run for a single expansion compensator (50 feet).

$$L = 20.7''$$

$$L3 = \frac{1}{5} (L)$$

$$L3 = \frac{20.7''}{5} = 4.14''$$

$$L3 = 4.14''$$

$$L4 = \frac{2}{5} (L)$$

$$L4 = \frac{2(20.7'')}{5} = 8.28''$$

$$L4 = 8.28''$$

#### Illustration of Example

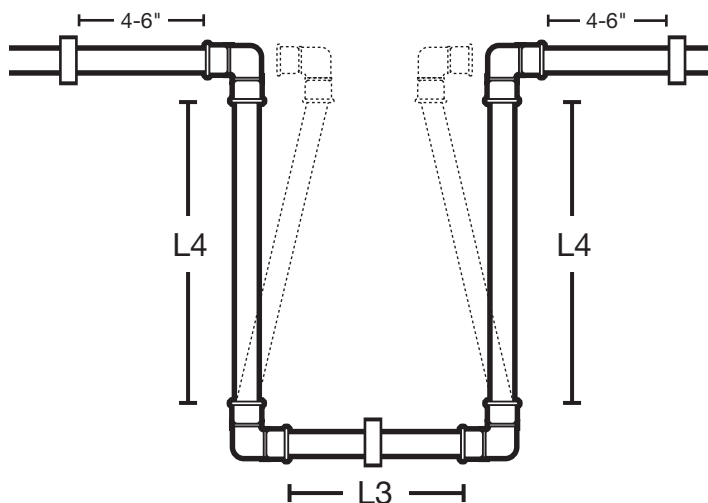
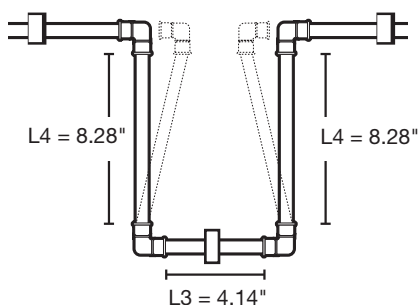


Figure 8.16 U-Type Expansion

The fastener shown on the L3 leg may be required to provide additional support depending on how the expansion loop is installed (horizontal/vertical).

		U-Type Expansion Offset (in) per 50 linear feet of run															
Tubing	ΔT(°F) Tube nom.	60		80		100		120		140		160		180		200	
		L3	L4	L3	L4	L3	L4	L3	L4	L3	L4	L3	L4	L3	L4	L3	L4
ViegaPEX & ViegaPEX Ultra	3/4"	4.1	8.2	4.7	9.4	5.3	10.5	5.8	11.6	6.2	12.5	6.7	13.3	7.0	14.2	7.5	14.9
	1"	4.6	9.3	5.3	10.7	6.0	12.0	6.6	13.1	7.1	14.2	7.6	15.1	8.0	16.0	8.5	16.9
	1 1/4"	5.1	10.2	5.9	11.8	6.6	13.2	7.2	14.5	7.8	15.6	8.4	16.7	8.9	17.7	9.4	18.7
	1 1/2"	5.6	11.1	6.4	12.9	7.2	14.4	7.9	15.7	8.5	17.0	9.1	18.2	9.6	19.3	10.2	20.3
	2"	6.4	12.7	7.4	14.7	8.2	16.4	9.0	18.0	9.7	19.5	10.4	20.8	11.0	22.1	11.6	23.2

Table 8.3 U-Type Expansion

**FostaPEX:**

FostaPEX tubing has a fully dimensional PEX wall with an additional outer layer of aluminum and polyethylene. As a result of these extra layers, FostaPEX expands considerably less than that of standard PEX tubing and slightly more than copper tubing (0.16" per 100' per 10°F).

An approved method for expansion absorption when using FostaPEX is through the use of a coiled loop expansion compensator (at least every 50 feet). Do not use fitting offsets with FostaPEX as the stiffness of FostaPEX may lead to high stress at connections.

**Coiled loop:**

The coiled loop configuration calls for loops within the piping system. The diameter of the loop (D) is shown in the table and will increase or decrease as the tubing in the system expands and contracts.

Note: Tubing fasteners should be secured as to not prevent linear movement of tubing.

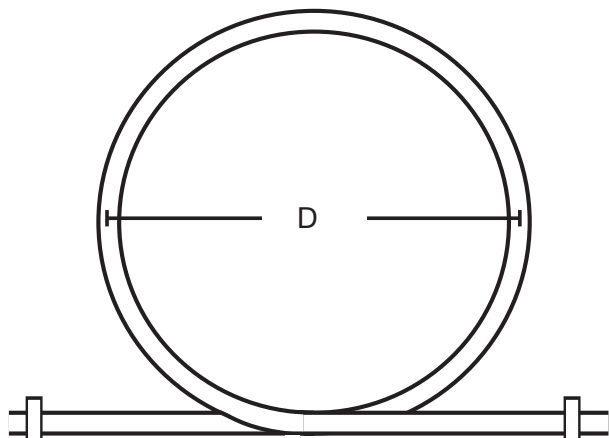


Figure 8.17 Coiled Loop Expansion

Tube nom.	D (in)
1/2" FostaPEX	12"
5/8" FostaPEX	14"
3/4" FostaPEX	16"
1" FostaPEX	20"

Table 8.4 Coiled Loop Expansion

**8.6 Structural considerations**

Support of piping materials varies geographically. Refer to local code for support specifications per your location. Any bracing or clamping should be done with supports that are designed for use with plastic tubing that do not crush or damage the pipe surface. The best practice is to use clamps with integral insulators or line the clamp or hanger with thin foam.

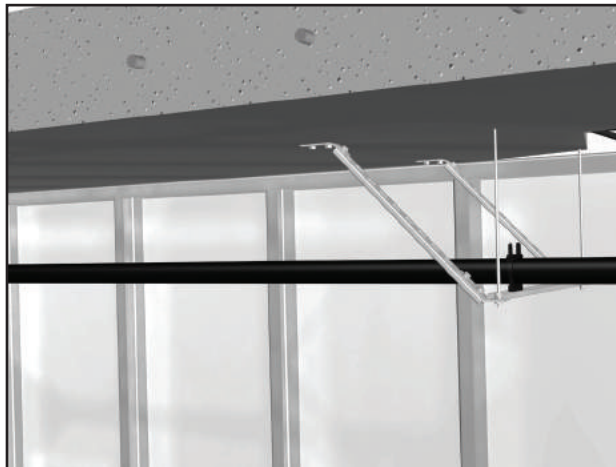


Figure 8.18 Pipe Braced with Brackets

## 9.1 General handling

### 9.1.1 Handling ViegaPEX tubing

The properties of ViegaPEX tubing make it easy to work with and install in most types of construction. Some care must be taken to prevent damage to the tubing before and during installation:

- Use care to protect both ViegaPEX and FostaPEX tubing from physical damage during storage and installation. Keep the tubing away from sharp objects, open flames, etc., and do not place heavy objects on the tubing.
- Damaged sections of tubing should be cut out and discarded.
- Do not expose ViegaPEX tubing to sunlight or any UV source for extended periods of time exceeding six months for ViegaPEX Ultra.
- FostaPEX, with its aluminum layer, is resistant to UV light, but long-term exposure should still be avoided.
- Do not store ViegaPEX or FostaPEX tubing outdoors where it may be exposed to UV light.



### 9.1.2 Bending ViegaPEX tubing

ViegaPEX tubing can be free bent (unsupported bend) to a minimum radius of eight times the tubing O.D. and five times the tubing O.D. with the use of a Viega-approved bend support. FostaPEX tubing can be free bent to a minimum radius of eight times the tubing O.D. and 3.5 times the tubing O.D. with the use of a Viega tubing bender. For situations requiring tighter bends, use elbow fittings. If bending against a PEX coil bend direction, the bending radius is 24 times the tubing O.D. Viega does not allow the practice of “hot bending” ViegaPEX tubing to make a tighter bend radius.

ViegaPEX Nominal Size*	Minimum Radius	
	Free Bend (8 x O.D.)	Supported (5 x O.D.)
3/8"	4"	2.5"
1/2"	5"	3.1"
3/4"	7"	4.4"
1"	9"	5.6"
1 1/4"	11"	6.75"
1 1/2"	13"	8.1"
2"	17"	10.6"

\*ViegaPEX bend radius values were calculated using standard CTS O.D. dimensions, which are 1/8" larger than the nominal tube size listed.

Table 9.1 ViegaPEX Bend Radius

FostaPEX Nominal Size**	Minimum Radius	
	Free Bend (8 x O.D.)	Supported (3.5 x O.D.)
1/2"	5.6"	2.4"
3/4"	7.5"	3.3"
1"	9.6"	4.2"

\*\* FostaPEX bend radius values were calculated using the actual O.D. dimensions, which include the additional aluminum and PE layers.

Table 9.2 FostaPEX Bend Radius

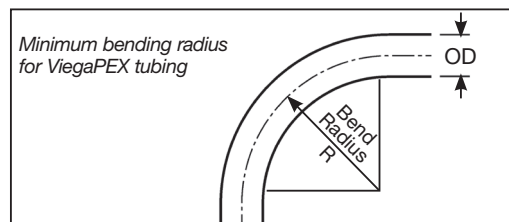


Figure 9.1 Bend Radius

To reduce damaging stress on Viega PEX fittings, bend supports or tubing fasteners must be used to anchor all bends made close to fittings. Support must be provided for tubing bends located closer to fittings than distance “L” in table below. (See the diagrams below for typical installation examples.) Since FostaPEX will maintain its shape once bent, supports may not be necessary. However, support must be used at the “L” distance while making the bend.

Tubing size	Maximum distance from fitting to bend
3/8" PEX	L = 6 inches
1/2" PEX	L = 8 inches
3/4" PEX	L = 10 inches
1" PEX	L = 12 inches
1 1/4" PEX	L = 14 inches
1 1/2" PEX	L = 16 inches
2" PEX	L = 18 inches

Table 9.3 Tubing Support Distances

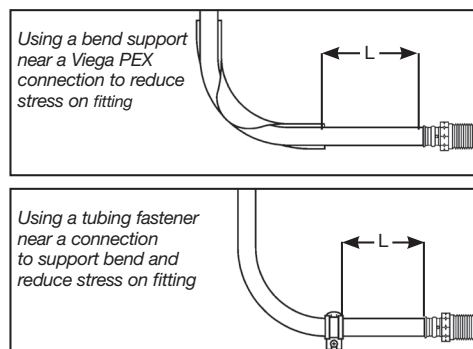


Figure 9.2 Installation Examples



### 9.1.3 Support ViegaPEX tubing

Use only plastic or plastic coated tubing supports. Metal supports are not recommended. They may damage the tubing.

When installing ViegaPEX tubing, leave a small amount of slack between fasteners to account for tubing contraction.

Note that ViegaPEX tubing will expand or contract 1.1" per 100' for every 10°F of temperature change. In long straight runs, allow adequate clearance for this. (See "Thermal expansion compensation" on page 23.) The aluminum layer in FostaPEX reduces expansion and contraction so that it expands only 0.16" per 100' for every 10°F of temperature change. This makes it ideal for locations where expansion must be minimized.

Tubing should be allowed freedom to move slightly as it expands. Do not clip it tightly into place or locate it where it will be tightly constrained. Use suspension clips or an approved plastic insulator where tubing passes through studs or joists where abrasion and noise is a concern. (See illustrations to right.)

ViegaPEX tubing shall be fastened at a minimum interval noted in the below table for horizontal and vertical support.

	PEX Size	Horizontal	Vertical
<b>ViegaPEX Ultra</b>	½" - 1"	32" O.C.	Base of each floor with mid-level guide
	1¼" - 2"	48" O.C.	
<b>FostaPEX</b>	½" - 1"	32" O.C.	mid-level guide

Table 9.4 PEX Support

- Suspension clips are required for metal studs and optional for wood studs
- Use nailing plates to protect tubing from nails and screws where it passes through wood studs.
- Some model codes may reference different support spacing intervals for plastic tubing. Always refer to local code for approved spacing requirements that exceed the ones referenced in this manual.

In risers or vertical runs, ViegaPEX and FostaPEX tubing should be attached with suspension clips or an approved plastic insulator at each floor or ceiling penetration, and every four feet in between (see below).

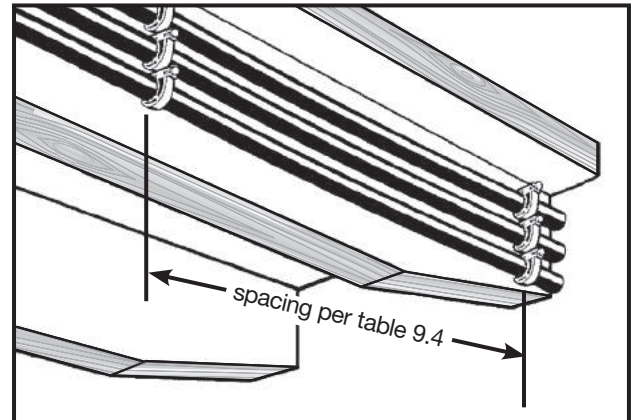


Figure 9.3 Tubing supported with U-clip or lock clip fasteners on horizontal runs

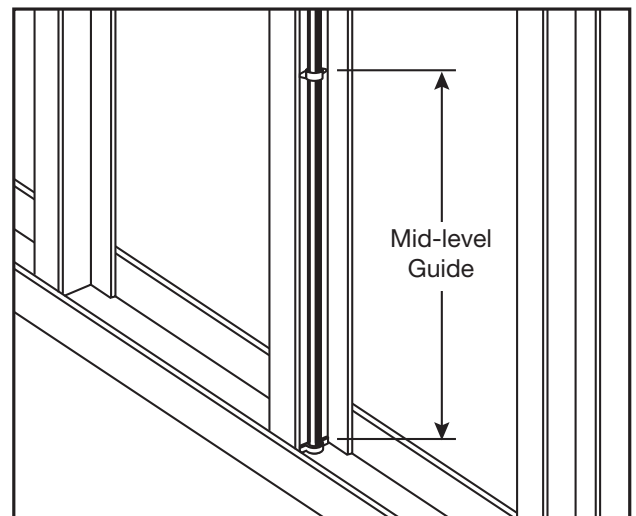


Figure 9.4 J-clamp or lock clip fasteners used to support tubing in vertical runs between floors

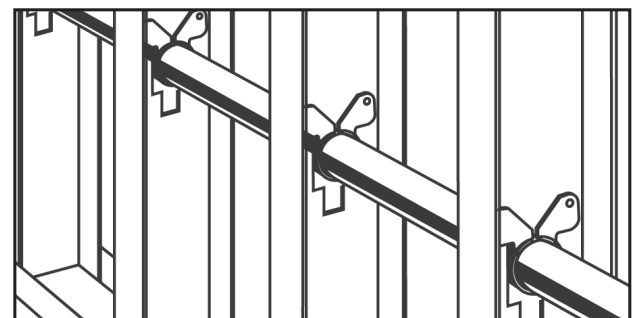


Figure 9.5 Suspension clip fasteners used to protect tubing from abrasion when passing through steel studs

## 9.1.4 PEX hangers

There are a several methods for hanging pipe from a ceiling surface that varies based on the construction type being used. Below are some examples of typical methods used with PEX tubing.

### 9.1.4.1 Trapeze hangers

Trapeze hangers are typically used for multiple runs of tubing going to a similar location. These are attached to the ceiling by threaded rods using female threaded anchors (in wood or cement) or beam clamps for I-Beam type construction. There is a variety of clamps designed for use with PEX tubing that are compatible with Uni-strut supports.

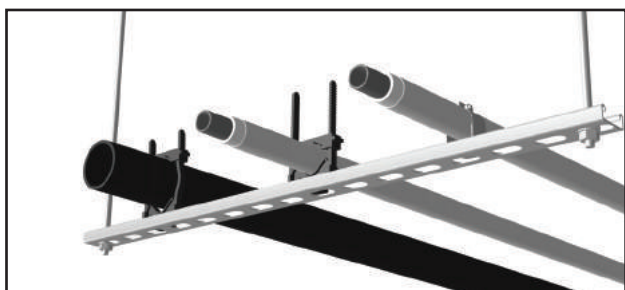


Figure 9.6 Typical PEX tubing support for trapeze hanger

### 9.1.4.2 Clevis / tear drop hangers

Clevis and/or tear drop hangers are commonly used to support individual runs of piping. These are attached to the ceiling or support beam by a threaded rod with female anchor or beam clamp, respectively. Hangers shall have a rubber or foam lining when used with PEX tubing. No lining is necessary with PEX protected with jacketed insulation.

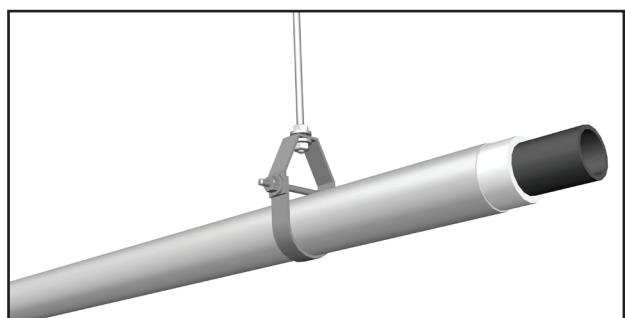


Figure 9.7 Typical PEX tubing support for clevis hanger

### 9.1.4.3 PEX support trays

PEX support trays or channels can be used with clevis hangers and/or insulated ring clamps to help reduce the number of support hangers that are required for hanging PEX tubing. Refer to the tray or channel support supplier for recommended hanger spacing.

### 9.1.4.4 Pipe labels

When pipe labels are required, it is acceptable to place flexible, pressure-sensitive stickers directly on Viega PEX tubing and/or on jacketed insulation that is installed over the tubing. If label adhesion is an issue, zip ties can be used to assure long-term placement. Refer to local code for required pipe labeling and placement.

### 9.1.5 Noise and water hammer in PEX systems

As with all plumbing materials under some operating conditions, water hammer can occur in PEX plumbing systems. The inherent flexibility of ViegaPEX Ultra drastically reduces the magnitude of pressure surges compared with metallic plumbing materials. Damage to plumbing components in a PEX system due to these pressure surges is highly unlikely, although noise can sometimes result. Fortunately, there are solutions to minimize or eliminate water hammer noise.

- Install fixtures that are not water hammer prone. As a general rule, two-handle fixtures are less likely to cause hammer than single-handle fixtures. Single-handle shower valves, which rotate to close and therefore are difficult to close quickly, might be good choices.
- Clamping or strapping more frequently may help prevent tubing noise. It is important that the tubing not be in contact with wallboard, forced air ducts or other high-resonance articles. Insufficiently or improperly clamped or strapped tubing may move during fixture operation and hit against these surfaces.
- Install a water hammer arrestor at fixtures where noise is a problem. A water hammer arrestor (AA sized) installed as close as possible to the fixture on the cold-water side only will eliminate the source of the noise (the pressure wave). It should be noted that even with an arrestor, tubing that is clamped or strapped insufficiently may still hit against something as it moves slightly when the water flow is stopped.

- Avoid operating fixtures in such a way that causes near instantaneous shutoff. Simply closing fixtures in a less abrupt manner can eliminate hammer noise.

### 9.1.6 Chemical compatibility

#### 9.1.6.1 Spray foams

When penetrations must be sealed for air infiltration purposes, there are several options available. Use a good grade of silicone, acrylic or siliconized acrylic caulking. **DO NOT use oil-based caulks.** Most expanding foams and open- or closed-cell pipe insulation are good sealing materials and may be used in direct contact with PEX tubing. Other materials may be used provided they do not cause short- or long-term damage to the PEX tubing.

#### 9.1.6.2 Termiticides / pesticides

Applications of different termiticides, pesticides and insecticides that may come in contact with the outer surface of our PEX products, based on our present knowledge, should not adversely affect the performance of ViegaPEX tubing and/or fitting products for use in potable water distribution systems.

Because of the wide array of insect and pest eradication products available to consumers today, it is impossible to make a general assessment of all available products' impact on plastic plumbing components. However, if utilized in accordance with the pesticide/termiticide/insecticide manufacturers' application guidelines, it is unlikely the products will negatively impact Viega's PEX tubing.



When using expanding spray foam to insulate walls in a structure, there are several options available. Viega suggests using water-based or urethane-based open-cell insulation only. **DO NOT use closed-cell spray foams.** Closed-cell spray foams have the potential to generate high temperatures during their expansion process, especially when not applied properly, which can damage PEX tubing. Always follow the spray foam manufacturer's installation instructions and warnings.



**Do not expose Viega products to any foreign substance that includes but is not limited to Volatile Organic Chemical (VOC) compounds, paints, solvents, glues, cleaners and disinfectants. Viega products that are exposed to these types of substances are at risk of having failures (leaks).**



As with any product, misapplication of any chemical could result in unwanted results or damage to other household components, including the plumbing system, per the typical warnings accompanying the products.

### 9.1.7 Freeze protection

#### 9.1.7.1 Insulation

While plastic tubing has some insulation properties (R-value) it generally is not enough to meet most thermal performance requirements as outlined in code. As a general practice, anywhere metal piping requires insulation, plastic piping will too. Always check code for necessary insulation requirements.

#### 9.1.7.2 Heat tape

It is an acceptable practice to use heat tape on PEX tubing as long as it is a self-limiting type not controlled by an external thermostat. Below is a list of manufacturers that offer heat tapes meeting these requirements:

- EasyHeat® /10800 series
- Heaterzone.com
- WRAP-ON / PIPE-GUARD™
- BriskHeat®

### 9.1.8 Freeze repair

The flexibility of ViegaPEX tubing makes it resistant to damage from freezing. PEX tubing systems should not be intentionally subjected to freezing. However, if freezing occurs there are several methods to thaw PEX tubing.

- Hot water
- Wet, hot towels
- Hand-held hair dryer
- Low-wattage electric heating tape (self limiting)
- A commercial system that pumps heated water through a tube to the ice blockage and returns the cooled water for reheating.



Heat must be applied directly to the frozen tubing section. Temperatures on tubing shall not exceed 180°F.



Do not use open torch or excessive heat to thaw PEX tubing. Tubing failure or damage can result.

### 9.1.9 Condensation control

As a general practice, anywhere metal piping requires insulation for condensation control, plastic piping will too. Always check code for necessary insulation requirements.

## 9.2 Building water service installation

Viega PEX and its related fittings are listed to the requirements of AWWA C904 and approved for use in water service applications. Viega offers a variety of threaded, solder and ProPress adapters to transition PEX to several types of piping materials

### 9.2.1 Installing PEX below grade as service line

ViegaPEX and FostaPEX tubing may both be used underground and for water service piping. When running lines underground, it is important to provide a stable, continuous trench base to support the tubing.

Always allow sufficient slack when tubing is laid in trenches. Snake the tubing slightly side-to-side to provide for contraction due to temperature change.

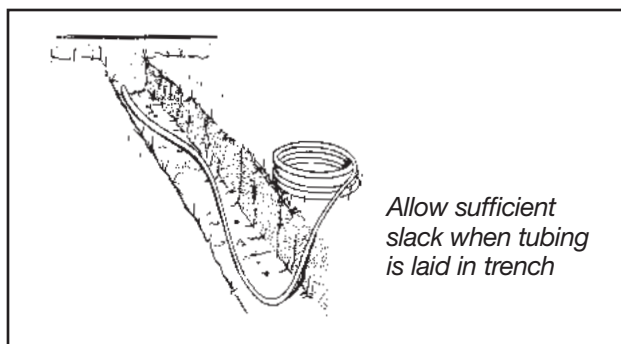


Figure 9.8

Do not use blocking to support tubing. PEX tubing can be damaged by contact with sharp objects. Ensure that trench bottom and fill do not contain sharp rocks or other items. In good soil conditions tubing may be placed directly on trench bottom. In poor soil conditions (rocky, loose, etc.) the trench should be excavated at least six inches below the tubing level and backfilled with appropriate material to provide a stable base (coarse sand, pea gravel or similar).

Backfill material must be free of large rocks, glass or other sharp objects. Provide sufficient coverage over tubing so that expected traffic loads will not deform tubing (consult local codes). Compact this material to at least 6" above the tube.

Do not install ViegaPEX tubing where soil is or may become contaminated with solvents, fuels or similar chemicals. Do not install tubing above or below septic tanks, leach fields, pits or cesspools.

Always follow local codes when installing ViegaPEX tubing. Consult standards such as ASTM D2774: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping for further information.

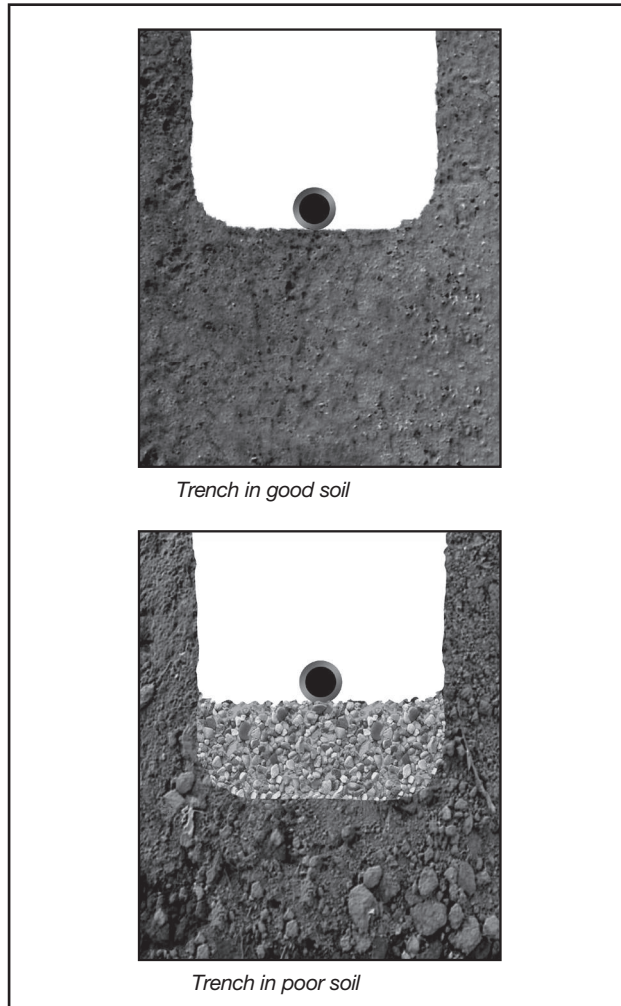


Figure 9.9 Installing PEX below grade

#### 9.2.1.1 Trace wire

It is an acceptable practice to use trace wire to assist with the detection of Viega underground piping systems. Refer to local code for minimum wire gauge and material requirements.



### 9.2.2 Installing PEX under the slab

When installing ViegaPEX or FostaPEX tubing in the ground under the slab, the tubing should be snaked from side to side in the prepared trench. The trench bottom should be smooth and free of rocks and debris. Lay the tubing directly on the trench bottom. Tubing must be continuously supported by the trench bottom. Use only continuous lengths of tubing in or under slab. Any connections shall be outside the slab or in an access box.

### 9.2.3 Installing PEX under a roadway

ViegaPEX tubing can be installed under a roadway as long as it is buried to the minimum frost level depth required by local code and following proper direct burial practices for plastic pipe.

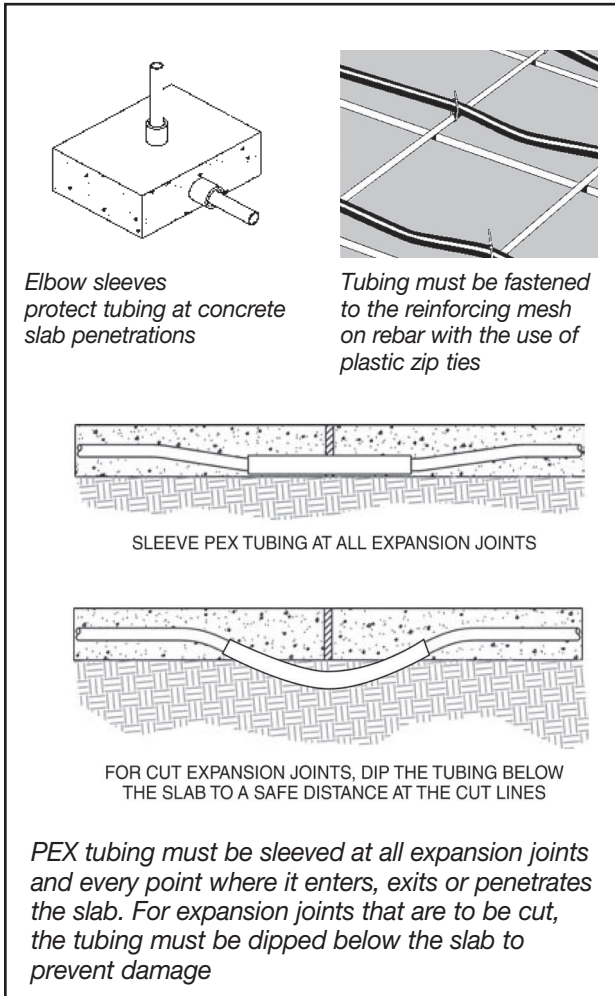


Figure 9.10 Installing PEX under the slab

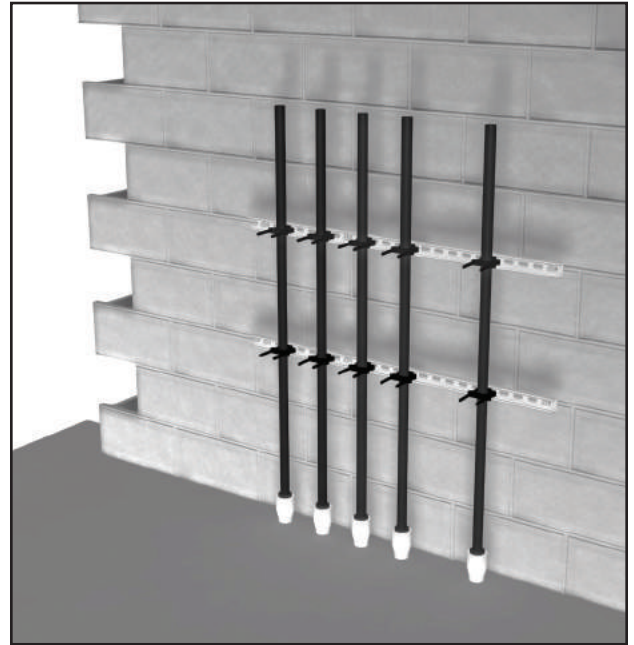


Figure 9.11 Water Service Tubing through slab

### 9.3 PEX installed in slab

ViegaPEX tubing can be installed within concrete slabs. Every effort should be made to use only continuous lengths of tubing within the slab.

#### 9.3.1 Sleeving requirements

All penetration points of ViegaPEX tubing run within concrete slabs or walls shall be sleeved to protect the tubing from expansion and contraction. Sleeving may consist of a larger piece of plastic tubing or open or closed cell insulation with a wall thickness no less than 0.022" thick.

#### 9.3.2 Sealants

Use of a silicone, acrylic or siliconized acrylic caulk may be necessary to seal any voids between PEX tubing and the sleeving material. Most canned expanding foams and open- or closed-cell pipe insulation are also good sealing materials and may be used in direct contact with PEX tubing. **DO NOT use oil-based caulks or closed-cell spray foams!**



### 9.4 PEX risers

Viega PEX tubing can be used as a riser to supply multiple floors with hot and cold water. To help control thermal expansion between multiple floors you should use a mid-level guide at every floor and riser clamps at the following intervals:

#### Hot lines

Use clamps above and below floor every other floor with a single clamp above the floor in between.

#### Cold lines

Use clamps above and below floor every 4th floor with a single clamp above floor each floor between.

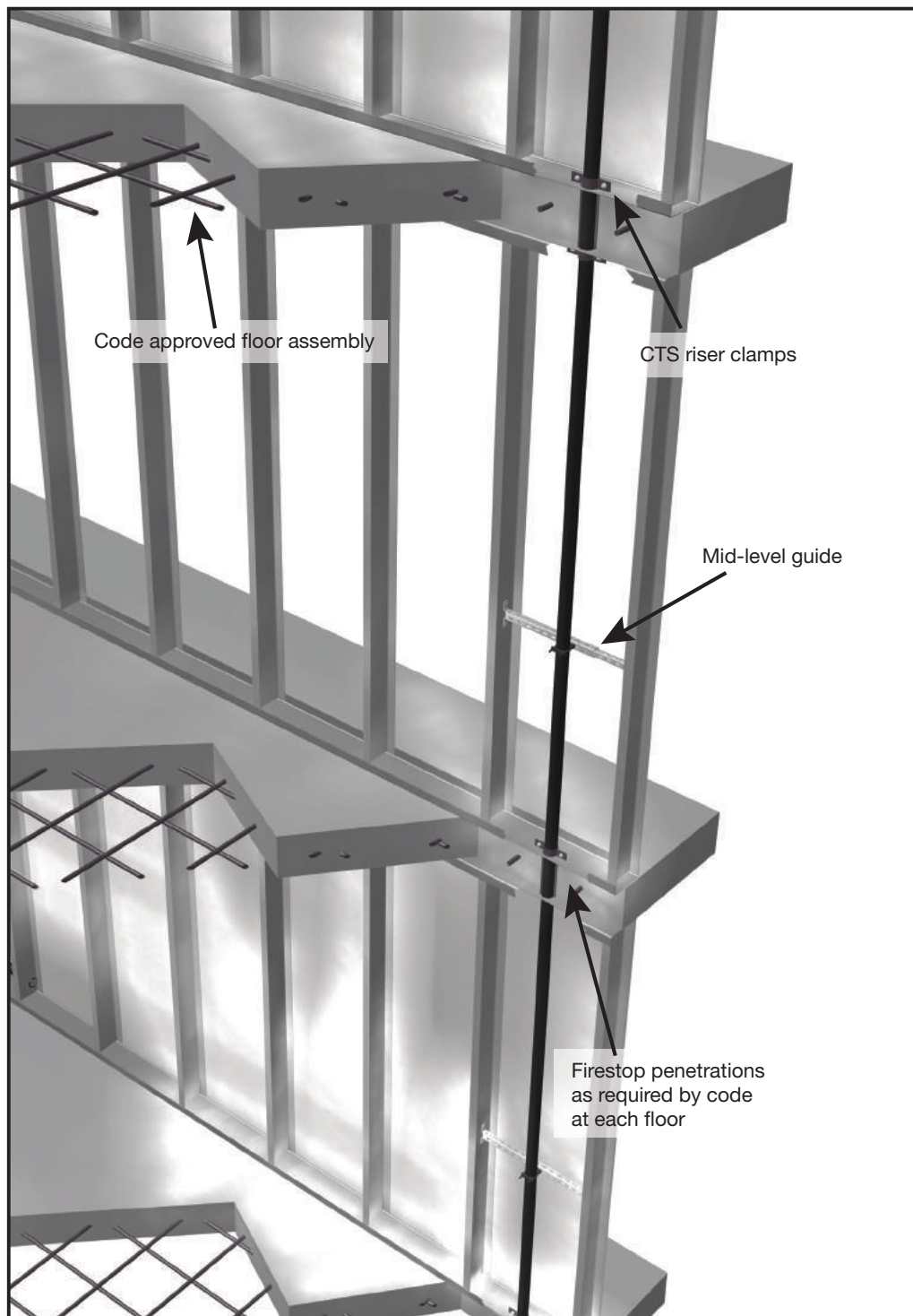


Figure 9.12

### 9.4.1 Support

There are a variety of clamps and hangers to support PEX tubing risers to support members or wall surfaces. Always use products designed for use with plastic tubing that have no sharp edges or can potentially flatten or crush PEX tubing.

#### 9.4.1.1 Clamps

Viega offers two types of multi clips that will fit up to 2" PEX tubing. One is designed to mount to a wall surface and comes with a mounting screw. The other type is designed to insert into a Uni-strut support bar. Lock clips, tubing insulators and suspension clips are also available for use with PEX tubing. Ring clamps, clevis or tear drop hangers shall have a rubber or protective lining when used with PEX tubing.

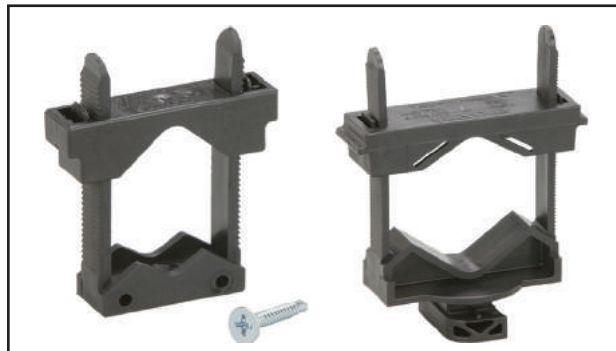


Figure 9.13

## 9.5 Fire resistant construction



### 9.5.1 U.S. listings

#### 9.5.1.1 Plenum rating

ViegaPEX tubing has been tested and listed to the ASTM E84 with the following ratings:

ASTM E84 Plenum Ratings / Listing				
Manufacturer	Products Listed	Flame Spread	Smoke Development	Limitations
Viega	3/8" to 2" PEX	25 or less	50 or less	1/2" minimum insulation thickness, no spacing limitations

**Note:** Listings include fitting connections in line when covered by insulation.

Table 9.5 U.S. Plenum Rating

#### 9.5.1.2 Fire resistant construction

ViegaPEX has the following listings for each respective construction type:

ANSI/UL 263 and ASTM E119		
Construction Type	Assembly Type	Design No.
Wood Frame Construction	Floor / Ceiling	M517
	Walls	VL/FWDP 60-01
Non-combustible Concrete / Steel Construction	Floor / Ceiling	VL/FWDP 120-01
		VL/FWDP 120-02
	Walls	VL/FWDP 60-02

Table 9.6 U.S. Fire Resistant Construction

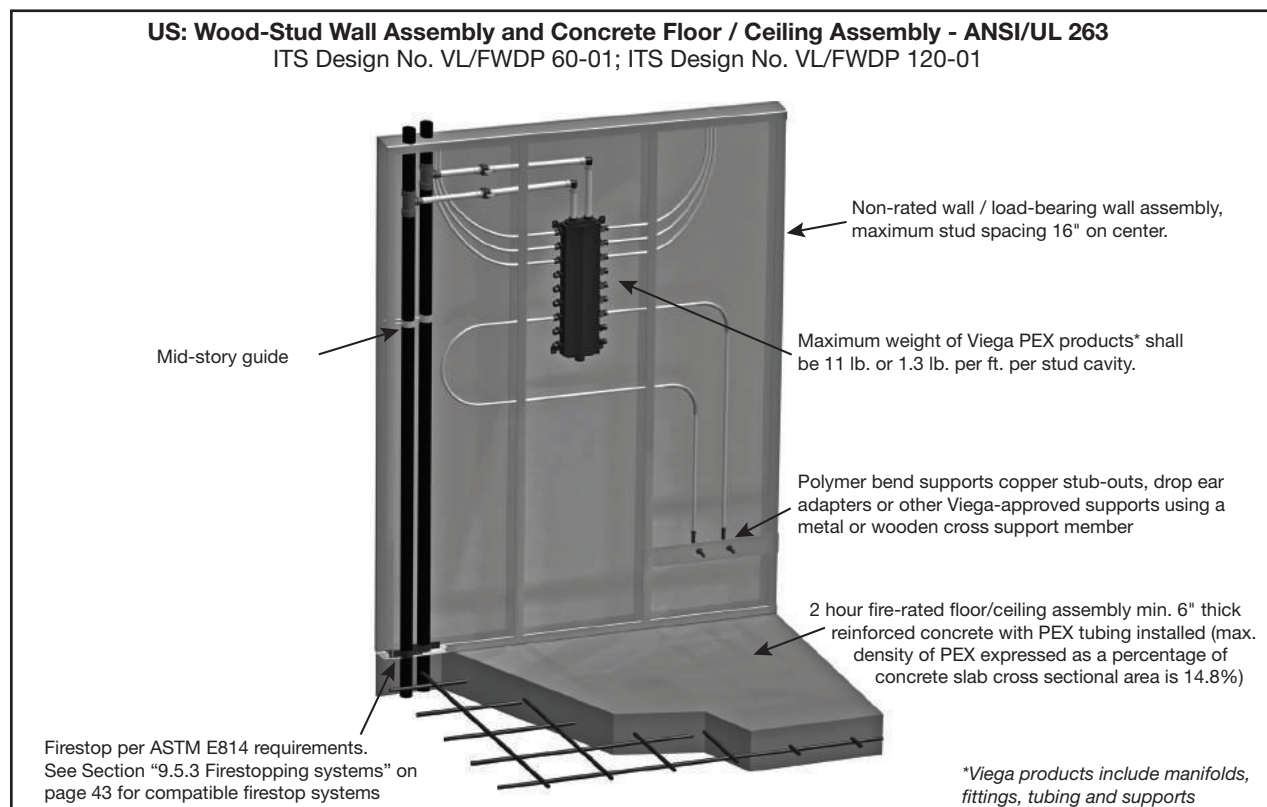


Figure 9.14

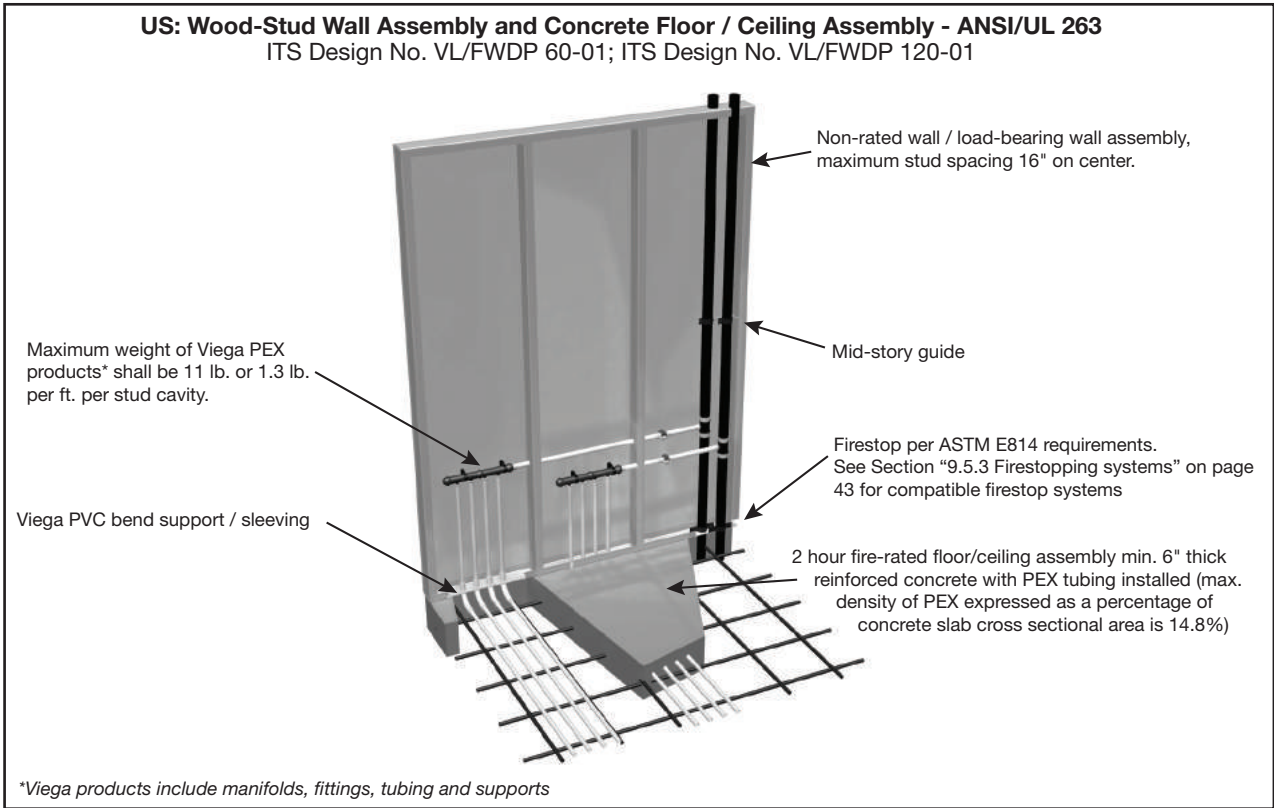


Figure 9.15

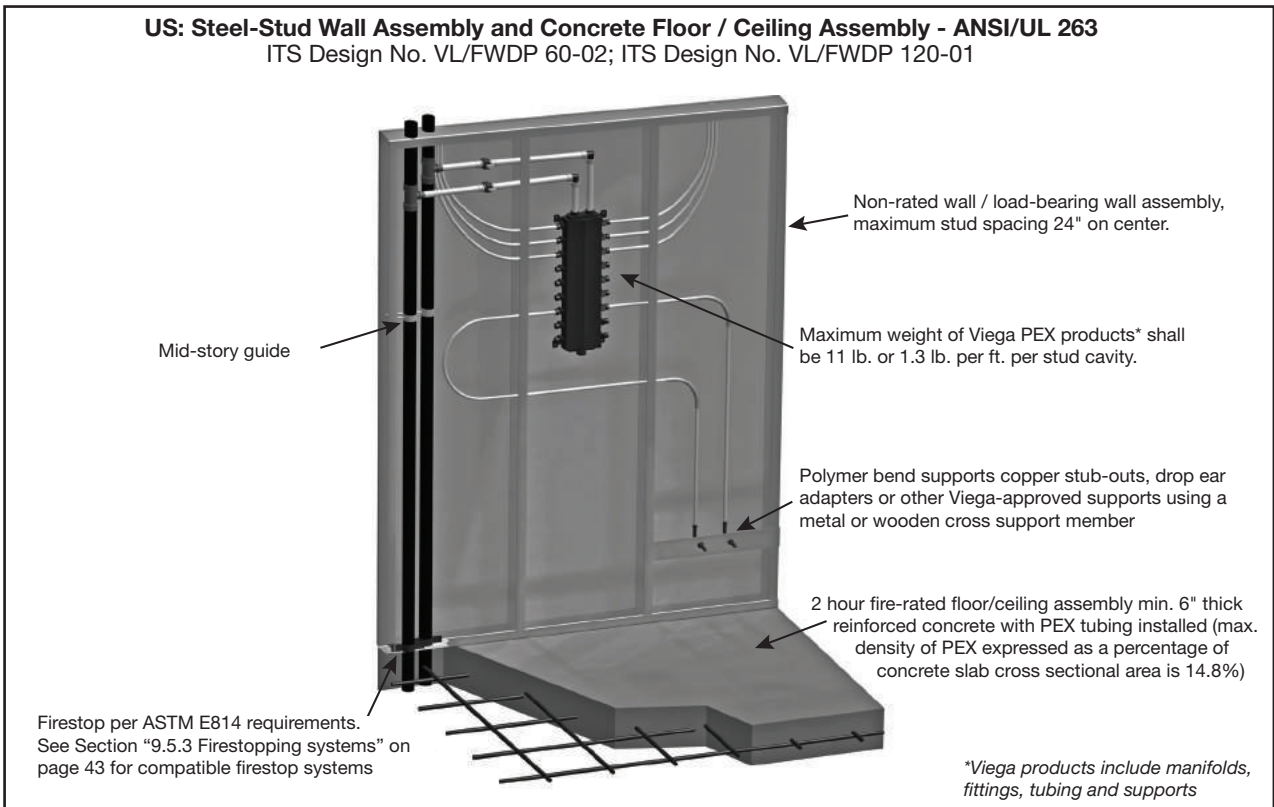


Figure 9.16

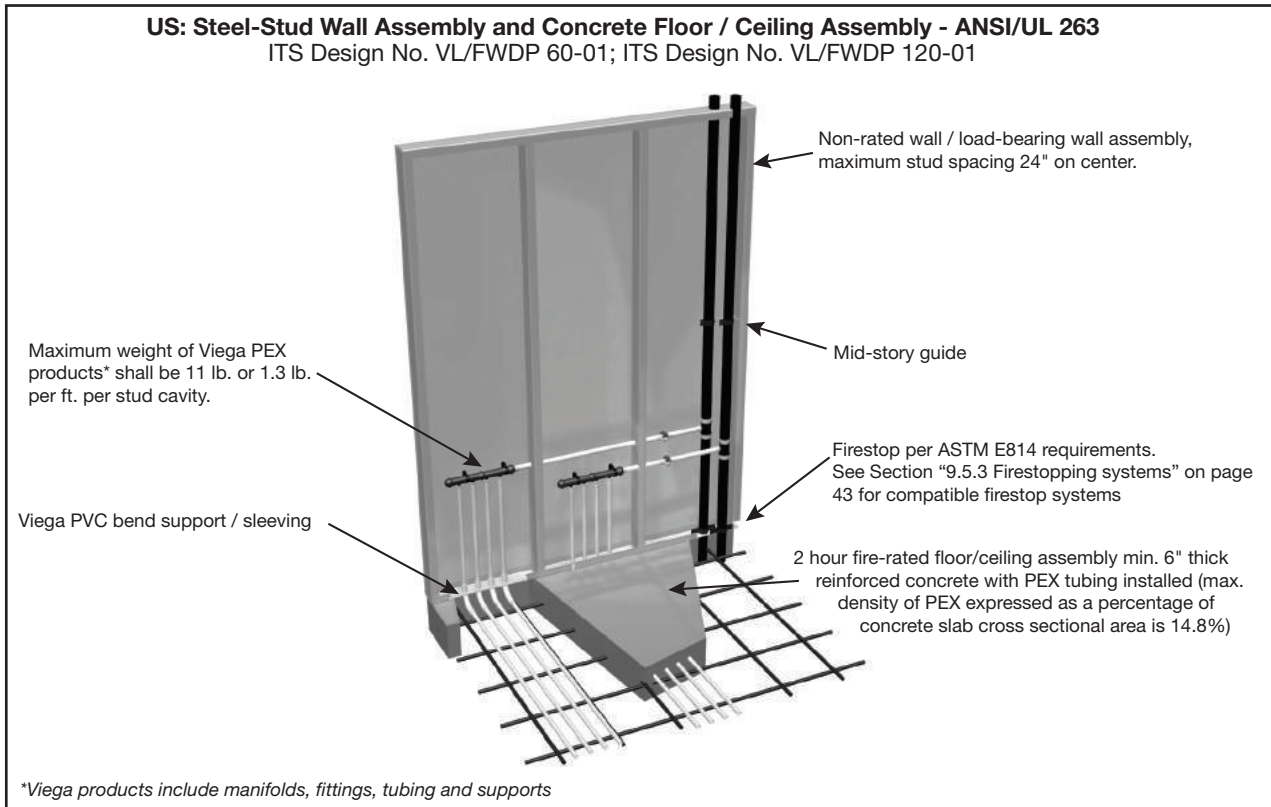


Figure 9.17

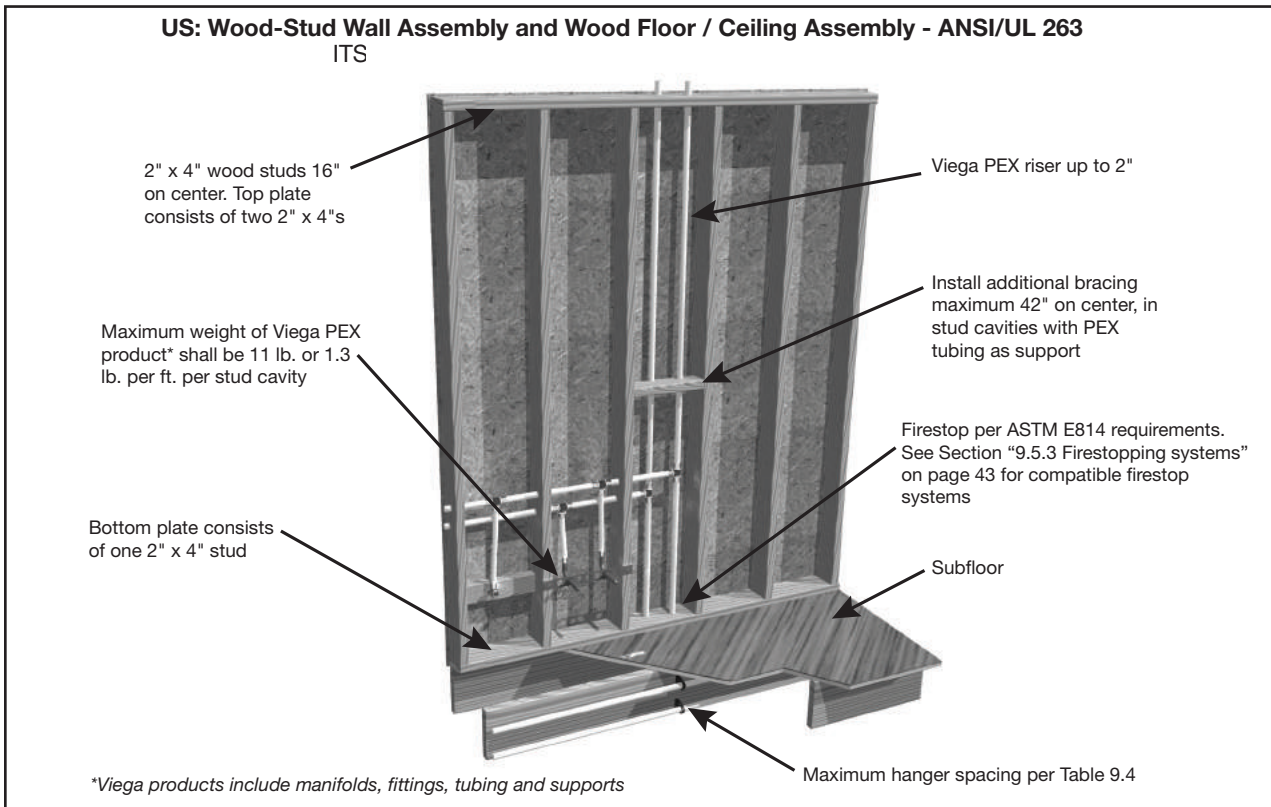


Figure 9.18





## 9.5.2 Canadian listings

### 9.5.2.1 Plenum rating

ViegaPEX tubing has been testing and listed to the CAN/ULC S102.2 with the following ratings:

CAN/ULC S102.2 Plenum Ratings / Listings				
Manufacturer	Products Listed	Flame Spread	Smoke Development	Limitations
Viega	3/8" to 2" PEX	25 or less	50 or less	1/2" minimum insulation thickness, no spacing limitations
Viega	3/8" to 1/2" PEX	25 or less	50 or less	No spacing limitations

**Note:** Listings include fitting connections in line when covered by insulation.

Table 9.7 Canadian Plenum Ratings

### 9.5.2.2 Fire resistant construction

ViegaPEX has the following listings for each respective construction type:

CAN/ULC - S101		
Construction Type	Assembly Type	Design No.
Wood Frame Construction	Floor / Ceiling	M522
	Walls	VL/FWDP 60-01
Non-combustible Concrete / Steel Construction	Floor / Ceiling	VL/FWDP 120-01
		VL/FWDP 120-02
	Walls	VL/FWDP 60-02

Table 9.8 Canadian Fire Resistant Construction

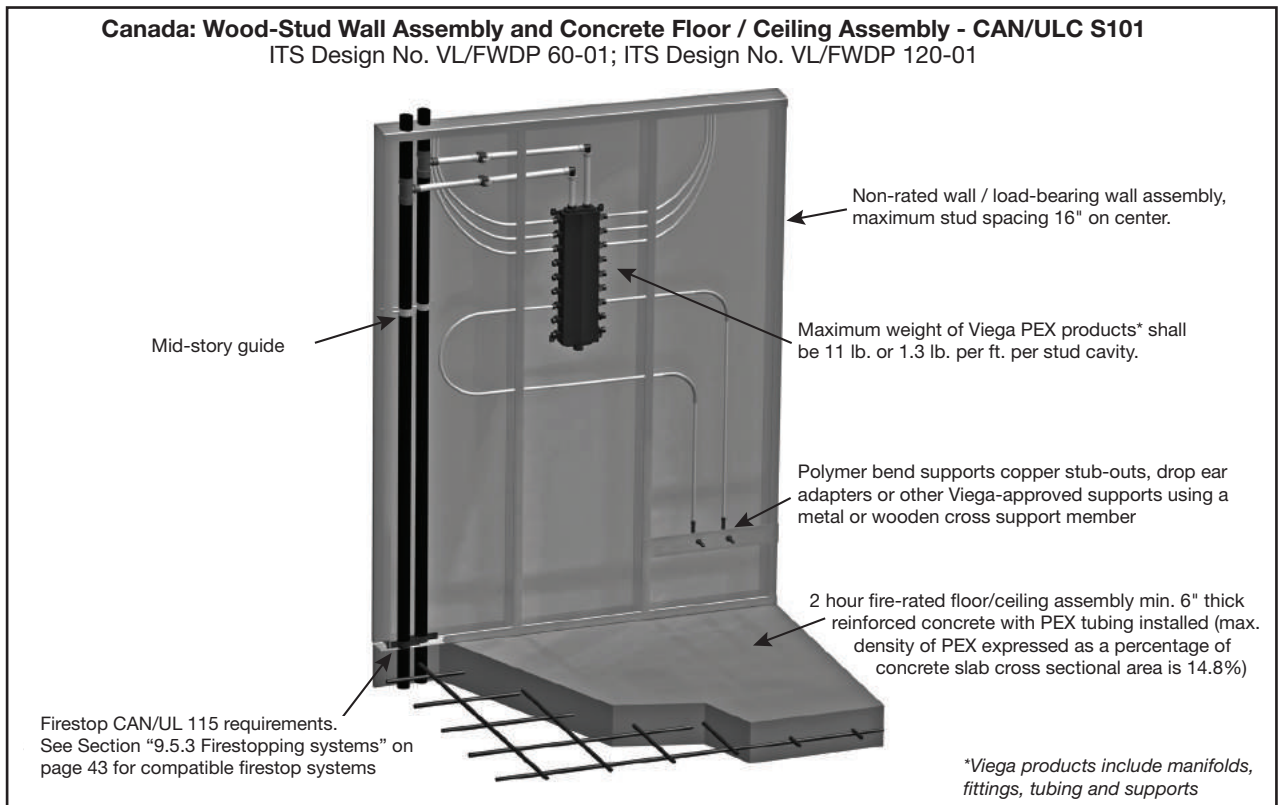


Figure 9.19

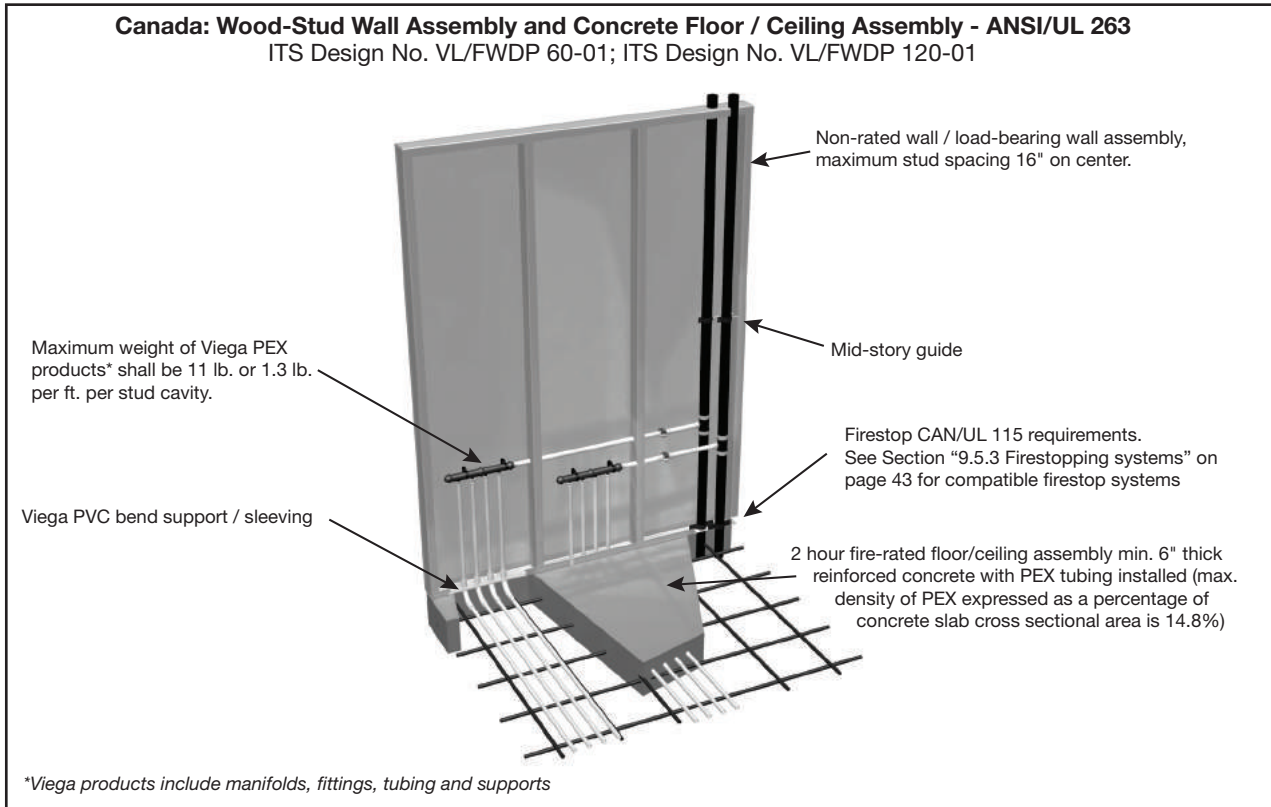


Figure 9.20

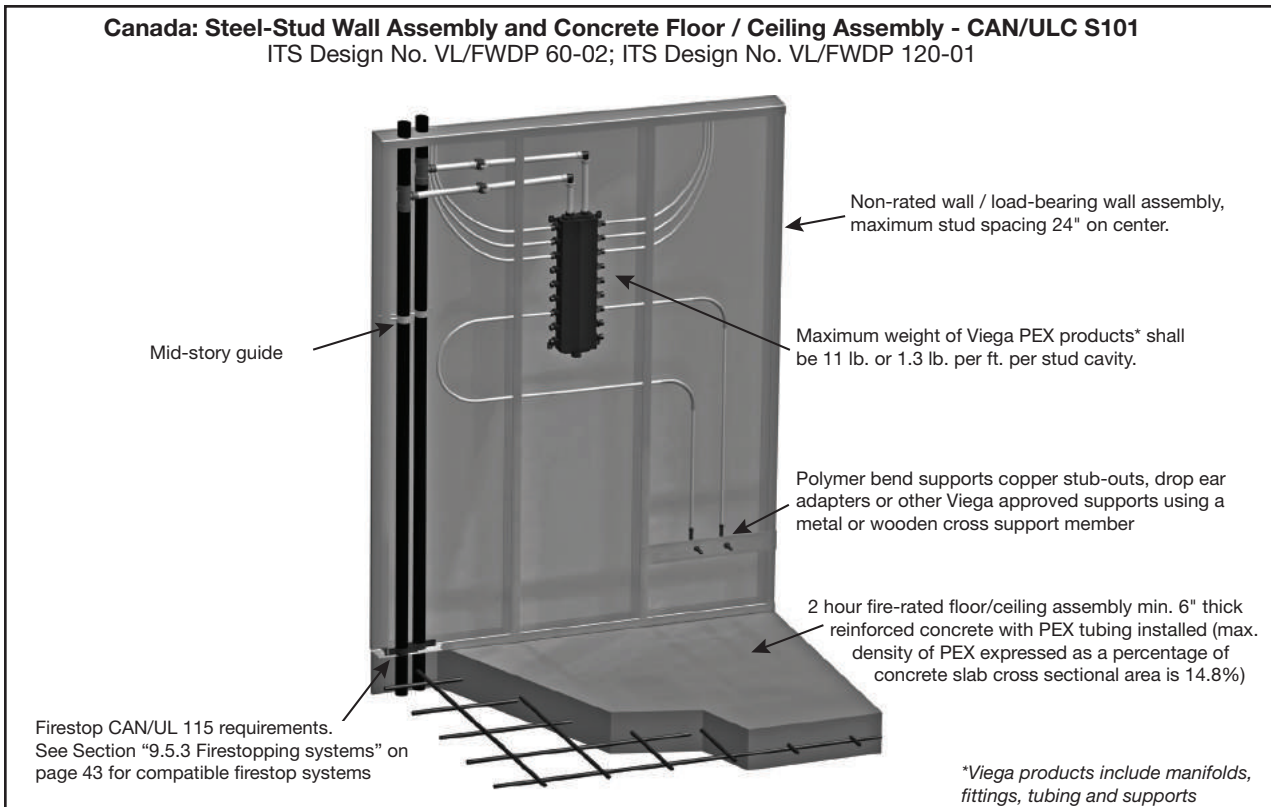


Figure 9.21

**Canada: Steel-Stud Wall Assembly and Concrete Floor / Ceiling Assembly - ANSI/UL 263**  
 ITS Design No. VL/FWDP 60-02; ITS Design No. VL/FWDP 120-01

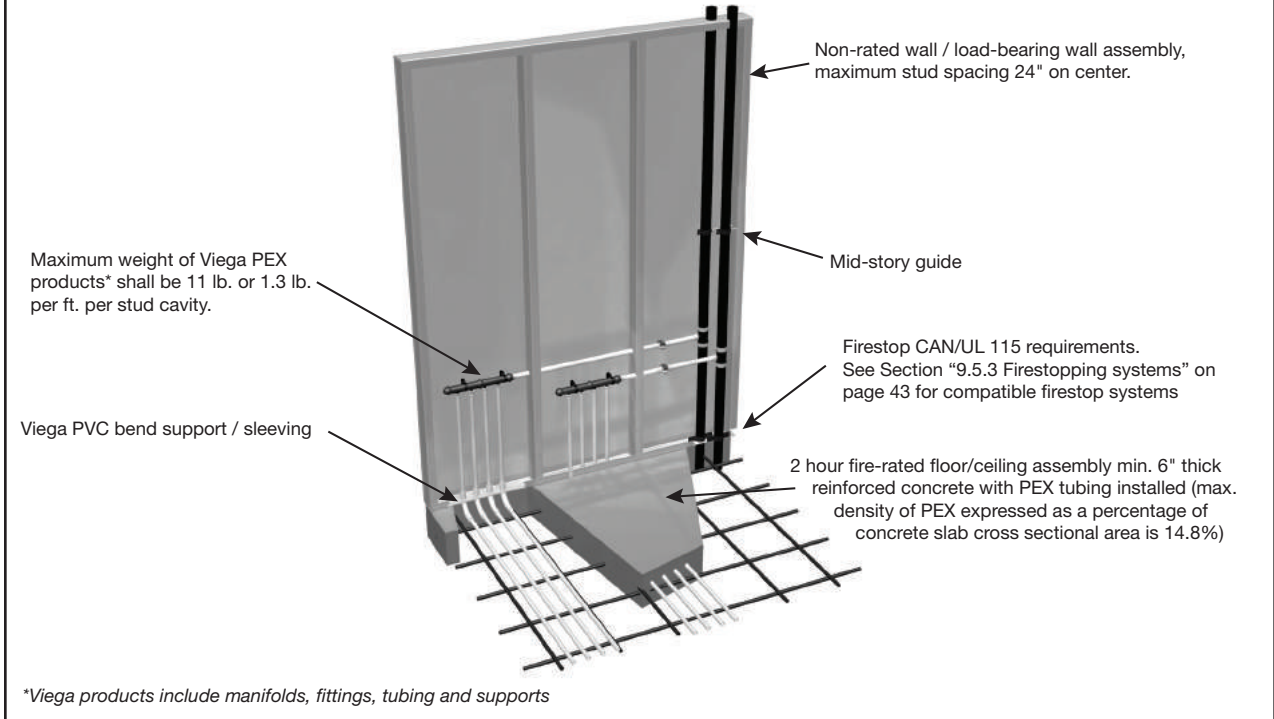


Figure 9.22

**Canada: Wood-Stud Wall Assembly and Wood Floor / Ceiling Assembly - CAN/ULC S101**  
 ITS Design No. VL/FWDP 60-01; ITS Design No. VL/FWDP 120-01

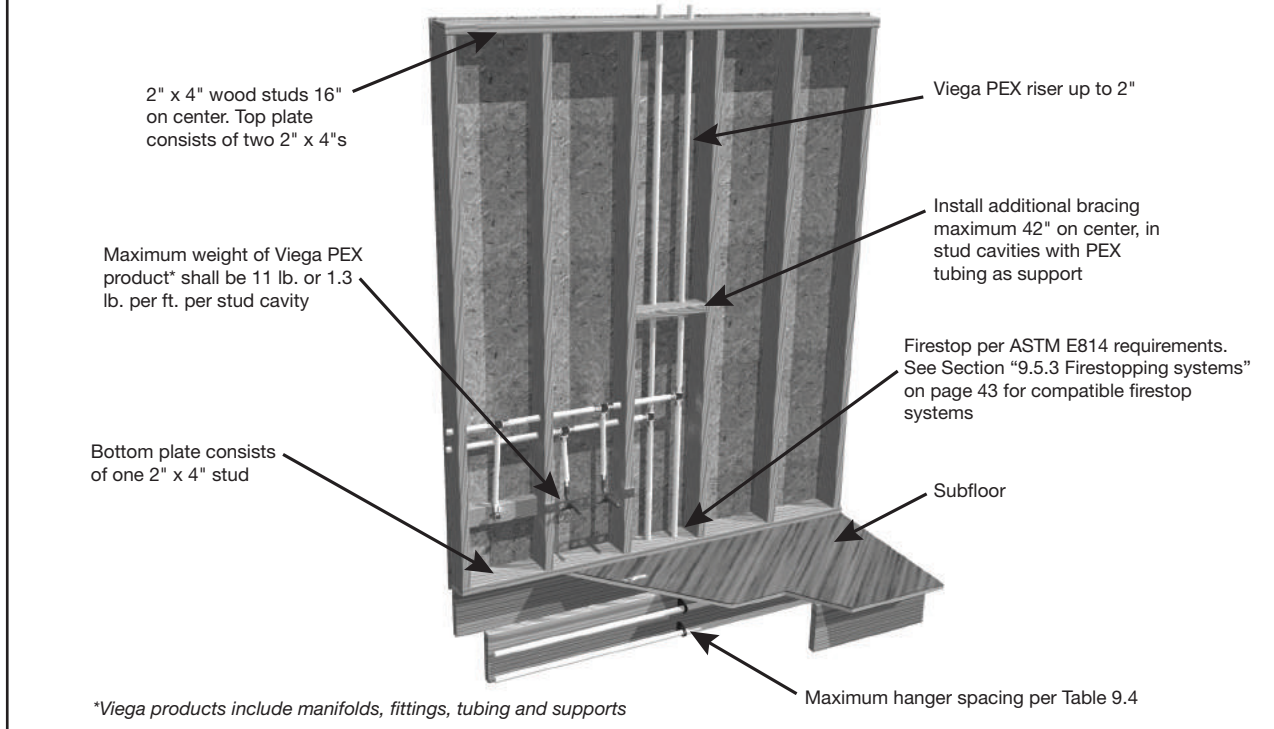


Figure 9.23

### 9.5.3 Firestopping systems

#### 9.5.3.1 Caulking

Most building codes require the use of a firestopping compound when tubing penetrates a fire-rated wall. There are a number of firestopping compounds identified as water based, acrylic or latex that have been listed for use with PEX tubing. The information provided on firestopping is to assist users in selecting a firestop compound for use with ViegaPEX tubing and is not intended as a warranty of these compounds or an endorsement of their use. The firestop materials listed below are known to have been third-party tested with PEX tubing. It is the responsibility of the user to determine the suitability of these or any products for the intended application and to install the compounds in accordance with the product's installation instructions.

Assembly Types		RectorSeal®					
		Wall	Caulk	Tube size	Floor / ceiling	Caulk	Tube size
Wood-stud / steel-stud Assemblies	1-hour	W-L-2121	MC Wrap	1"	F-C-2192	MC 1000	1"
		W-L-2209	MC 1000	1"	F-C-2212	MC 150+	1"
		W-L-2262	MC 150+	1"	F-C-2329	MC 150+	1"
		W-L-2342	MC 1000	2"	F-C-2298	MC 1000	1"
		W-L-2373	MC 150+	1"	F-C-8015	MC pipe collar	1"
		W-L-2402	MC 1000	1"	F-C-8039	MC 350i	1"
		W-L-2430	MC 1000	2"			
		W-L-2457	MC 350i	2"			
	2-hour	W-L-2121	MC Wrap	1"			
		W-L-2209	MC 1000	1"			
		W-L-2262	MC 150+	1"			
		W-L-2342	MC 1000	2"			
		W-L-2373	MC 150+	1"			
		W-L-2402	MC 1000	1"			
W-L-2430		MC 1000	2"				
	W-L-2457	MC 350i	2"				
Concrete Assemblies	2-hour	W-J-2025	MC 1000	1"	F-A-2171	MC 1000	1½"
		W-J-2122	MC 1000	1"			
		W-J-2142	MC 150+	1"			
		W-J-2162	MC 1000	1½"			
		W-J-2180	MC 1000	2"			
		W-J-2197	MC 350i	1"			
		C-AJ-2176	MC pipe collar	1"	C-AJ-2176	MC pipe collar	1"
	C-AJ-2628	Sleeve	2"	C-AJ-2628	Sleeve	2"	
3-hour	C-AJ-2119	MC 1000	1"	C-AJ-2119	MC 1000	1"	

Table 9.9 RectorSeal Caulking

Assembly Types		3M™					
		Wall	Caulk	Tube size	Floor / ceiling	Caulk	Tube size
Wood-stud / steel-stud Assemblies	1-hour	PHV-120-04	CP 25WB+	1" (x3)	F-C-2039	CP 25WB+	1"
		PHV-120-11	CP 25WB+	1"	F-C-2240	CP 25WB+	1"
		W-L-2091	CP 25WB+	1"	F-C-2343	CP 25WB+	1/2"
		W-L-2146	CP 25WB+	1" multiple	F-C-2344	CP 25WB+	1/2" (x2)
		W-L-2173	FB1000NS	3/4"	F-C-2391	CP 25WB+	2"
		W-L-2448	CP 25WB+	2"	F-E-2002	CP 25WB+	1"
		W-L-2483	CP 25WB+	1"	F-E-2012	CP 25WB+	1"
		W-L-2543	FB-3000 WT	2"	F-E-2040	CP 25WB+	2"
		W-L-2547	CP 25WB+	2"	PHV-120-04	CP 25WB+	1" (x3)
	2-hour	PHV-120-04	CP 25WB+	3"	PHV-120-04	CP 25WB+	3"
		PHV-120-11		1"			
		W-L-2090	FB-3000 WT	1"			
		W-L-2091	CP 25WB+	1"			
		W-L-2146	CP 25WB+	1" multiple			
		W-L-2448	CP 25WB+	2"			
		W-L-2483	CP 25WB+	1"			
W-L-2543		FB-3000 WT	2"				
W-L-2547		CP 25WB+	2"				
Concrete Assemblies	2-hour	C-AJ-2510	FB-3000 WT	2"	C-AJ-2510	FB-3000 WT	2"
		C-AJ-2536	CP 25WB+	2"	C-AJ-2536	CP 25WB+	2"
		PHV-120-04	CP 25WB+	1" (x3)	F-A-2115	FB-3000 WT	1" (x3)
		PHV-120-11	CP 25WB+	1"	PH-120-10	CP 25WB+	1"
		C-AJ-2213	CP 25WB+	1"	PHV-120-04	CP 25WB+	1" (x3)
		C-AJ-2378	CP 25WB+	1"	PHV-120-11	CP 25WB+	1"
		W-J-2110	CP 25WB+	1"			
		W-J-2232	CP 25WB+	2"			

Table 9.11 3M Caulking



Assembly Types		Hilti®					
		Wall	Caulk	Tube size	Floor / ceiling	Caulk	Tube size
Wood-stud / steel-stud Assemblies	1-hour	W-L-2186	FS-ONE	1"	F-C-2081	FS-ONE	1"
		W-L-2235	CP 648 wrap	1"	F-C-2230	FS-ONE/CP 648-E	1"
		W-L-2466	FS-ONE	1"	F-C-2310	FS-ONE	1"
		W-L-2467	FS-ONE	1"	F-C-2334	FS-ONE	1"
		W-L-2474	CP 648 wrap	2"	F-C-8038	FS-ONE/CP 606	multiple
					F-C-8044	CP CFS-S SIL SL	multiple
	2-hour	W-L-2186	FS-ONE	1"	F-C-2081	FS-ONE	1"
		W-L-2235	CP 648 wrap	1"	F-C-2310	FS-ONE	1"
		W-L-2466	FS-ONE	1"			
		W-L-2467	FS-ONE	1"			
W-L-2474		CP 648 wrap	2"				
Concrete Assemblies	2-hour	C-AJ-2170	FS-ONE	1"	C-AJ-2170	FS-ONE	1"
		C-AJ-2407	FS-ONE	1"	C-AJ-2407	FS-ONE	1"
		C-AJ-2647	FS-ONE	1"	C-AJ-2647	FS-ONE	1"
		W-J-2071	FS-ONE	1"	F-B-2040	CP 680-P / CP	2"
					F-B-2041	CP 680-P / CP	2"
					F-A-2142	CP 680-P / CP	½" multiple
	3-hour	C-BJ-2028	FS-ONE	1"			
		C-BJ-2040	FS-ONE	2"			
		C-BJ-2041	FS-ONE	1"			

Table 9.10 Hilti Caulking

### 9.5.3.2 Support collar systems

There are a variety of cast-in place sleeves available when penetrating PEX tubing through floor / ceiling concrete slabs. It is best to contact the manufacturer of these support collar systems for detailed installation information.

For additional installation support and/or assistance with selecting the appropriate firestop system for your application, contact one of the firestop manufacturers listed below.

- Rector Seal®  
800-231-3345  
<http://www.metacaulk.com/>
- Hilti  
800-879-8000  
<https://www.us.hilti.com/firestop>
- 3M Fire Protection Products  
800-328-1687  
[http://solutions.3m.com/wps/portal/3M/en\\_US/fire-protection-systems-NA/firestop/](http://solutions.3m.com/wps/portal/3M/en_US/fire-protection-systems-NA/firestop/)

## 9.6 System Testing and Flushing

### 9.6.1 General

Upon the completion of installing a Viega PEX plumbing system, a hydrostatic (potable water) pressure test shall be conducted. If potable water is not available, or the potential for a freezing condition exists, compressed air\* (air or nitrogen) testing and/or the use of an RV antifreeze\*\* solution are also acceptable methods for pressure testing.

\* Use air testing only if approved by local code or the Authority Having Jurisdiction (AHJ)!

\*\* RV antifreeze shall be drained and flushed from all portions of the plumbing system prior to consumer use.

Always refer to local plumbing code for pressure testing requirements and approved methods specific to plastic plumbing systems. If none are specified, refer to Table 9.12 for acceptable methods, test pressures and durations.



**NOTICE - ManaBloc VALVE INFORMATION!**

Opening a port valve to an empty or unpressurized distribution line may cause valve damage.

To prevent potential valve damage or failure, open the port valves before filling and pressurizing the lines. The force of water rushing to fill an empty line can cause the valve's seal to "clip off," resulting in incomplete sealing or complete valve failure.

CARE must be exercised when opening a port valve to an empty or unpressurized line. The fixture to which the line is connected should be in the OFF position and the valve must be opened slowly until water starts to flow into the line.

DO NOT CONTINUE to open the valve until the line is full and pressurized. Open the valve fully only after the line is up to system pressure. The fixture can then be opened to purge the line of air.

Valve stems are replaceable. Order Part Number 51602.



WATER TESTING SHALL BE AVOIDED DURING FREEZING CONDITIONS. UNDER NO CIRCUMSTANCES SHALL THE SYSTEM BE TESTED AT TEMPERATURES LOWER THAN 10°F (-12°C).



FOLLOW ANTIFREEZE MANUFACTURER'S INSTRUCTIONS FOR CONCENTRATIONS. Use only non-toxic antifreeze approved for drinking water systems.

**NOTE:** If such a solution is used, the antifreeze solution must be sufficiently concentrated to withstand the lowest temperature encountered while the testing fluid is in the system. Antifreeze solutions should be purged and the system flushed with potable water prior to consumer use.



WARNING! PRESSURES USED IN TESTING CAN BLOW UNMADE OR INCOMPLETE CONNECTIONS APART WITH TREMENDOUS FORCE!

This force is many times greater when air is used as a test medium. To reduce the risk of personal injury, ensure that all connections are completed before testing. Use only the pressure and time required to determine that the system is leak free.

Testing Viega PEX Water Systems				
Test Method	Min/Max Duration (Min)	Max Pressure (psi)	Min Pressure (psi)	Allowable Variance (psi)
Water	15 min/1 hr	100	40	N/A
Air	15 min/1 hr	100	40	8*

\* If the pressure in the system declines more than 8 psi during the 15-minute to one-hour period, repressurize the system to the original test pressure and retest. If the system pressure declines more than 8 psi again during the test period, test the distribution line test caps or any other fittings in the system with the approved leak-detect solution.

**NOTE:** Some plumbing fixtures may not withstand test pressures greater than 80 psi. Consult fixture manufacturer's instructions for pressure limitations or plug all distribution lines at the fixture end. The system shall, at a minimum, withstand the test pressure, without leaking, for a period of 15 minutes.

Table 9.12

### 9.6.2 Air testing

Air testing of a Viega PEX plumbing system shall use the checklist provided to ensure safety.



**It is the responsibility of the installer to read and understand the below pressure testing criteria and all safety precautions. Compressed air can store extremely high energy as compared to compressed water systems. Failure to follow these steps could result in personal injury, death and/or property damage.**

#### **Preparing for air pressure test:**

- ✓ Notify other trades that air pressure test will be conducted on the plumbing system. Only qualified personnel should be present during the system testing.
- ✓ Use only compressed air or nitrogen that is free of any kind of lubricating oils.
- ✓ Do not conduct pressure testing overnight or if a large temperature change is anticipated.
- ✓ Before pressurizing the system, conduct a visual inspection to ensure proper connections have been made throughout the plumbing system.
- ✓ All personnel involved in the pressure testing shall wear, at a minimum, eye and hearing protection. It is recommended the person applying the pressure to the system wear a full face shield.
- ✓ Only Viega PEX plumbing system components (tubing/fittings/manifolds) shall be pressure tested. All other system components (water heaters and fixtures) shall be isolated from the pressure test.
- ✓ Contact the inspector and schedule the pressure test.

#### **Pressurizing the system:**

- ✓ Verify no other trades are present prior to starting the pressure test. Only qualified testing personnel should be present during pressure test.
- ✓ Introduce pressure into the system as outlined in the stages below.

**Stage 1:** Gradually increase system pressure to 10 psi (approx. 30-sec. duration).

- Wait for 10 minutes before inspecting pressure gauge.
- If pressure holds steady, continue to Stage 2.
- If pressure falls over the test period, look for potential leaks with an approved leak-detect solution. Once system pressure is completely relieved and the leak is fixed, restart test procedure.

**Stage 2:** Gradually increase system pressure to 50 psi (approx. 1-min. duration).

- Wait for 10 minutes before inspecting pressure gauge.

- If pressure holds stable, continue to Stage 3.
- If pressure falls over the test period, look for potential leaks with an approved leak-detect solution. Once system pressure is completely relieved and the leak is fixed, restart testing procedure from beginning.

**Stage 3:** Gradually increase system pressure to 100 psi (approx. 1-min. duration).

- Inspect gauge pressure over next 10-minute period to verify pressure has not decreased more than the allowable variance noted in Table 9.12.
- If pressure variance allowed is not exceeded, the system test has passed.
- If pressure decreases more than the allowable variance, the test has failed. Apply approved leak-detect solution (see “9.7.3 Leak detection” below) on fitting and/or manifold connections to isolate the location of the leak. Once system pressure is completely relieved and the leak is fixed, start testing procedure from beginning.

#### **Completing the air test:**

- ✓ Depressurize system.
  - Use of the same safety equipment applies to these steps.
  - Slowly bleed off any remaining air pressure from system (approx. 1-min. duration).
  - Notify other trades the test is complete and work area is safe to occupy.
  - Document the time and date test was completed and the pressure and duration of the test.

### 9.6.3 Leak detection

Viega has identified the leak detect solutions listed below as being compatible for use with Viega PEX Press system components. Consult leak detect manufacturer for proper application and product instructions. To determine the compatibility of other leak detect solutions not listed below, contact Viega Technical Services prior to their use.

- megabubble® Leak Detector
- Oatey® All Purpose Leak Detector
- Snoop Liquid Leak Detector

As an alternative leak detect a mixture of Original Palmolive Green™ dishwashing soap (#46100-46200) or Palmolive Ultra™ (#356140 or 46128) mixed with potable water at a ratio of two ounces of soap to one gallon of water (mix Ultra at a ratio of 1.5 ounces per gallon) may be used.

**NOTE:** If the solution does not show a leak on any of the caps or fittings, isolate the ManaBloc by turning the valves to the “OFF” position, repressurize if needed and apply the same solution to the ManaBloc manifold components.

### 9.6.4 Disinfection

Public potable water distribution systems today generally require some form of residual disinfection to greatly eliminate or render harmless waterborne pathogens such as E-coli and Legionella. Some commonly used disinfection methods include the use of chlorine, chloramines and chlorine dioxide at levels not to exceed EPA established levels. These can be used at the water supply / municipality as a primary treatment and within a building as a secondary treatment.

Viega LLC does not recommend use of ViegaPEX tubing as part of any potable water distribution system in buildings where chlorine dioxide is used as a 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 tubing at allowable controlled levels. This does not include the disinfection / commissioning of a new or repaired system.

Local codes may require system disinfection. When no other method is available, follow the time limitations and exposure levels shown below.

1. Use a chlorine solution and one of the exposure durations listed below:

Concentration	Period	Authority
200 PPM	3 hours	IPC/UPC®
50 PPM	24 hours	IPC/UPC®

Table 9.13

2. Mix the disinfection solution thoroughly before adding it to the system.
3. The chlorine solution must reach all parts of the system. Open all fixtures (both sides) and flow water until a chlorine smell is present. As an alternative, chlorine test tablets can be used to detect chlorine at each fixture.
4. The chlorine source for the solution can be, but is not limited to, the following:

Chlorine Source	% Active Chlorine	Form	Amount Per 100 Gallon Water for a 200 PPM solution
Laundry bleach	5.25	Liquid	3 pints (48 oz.)

Table 9.14

5. After the solution has been in the system for the time required by the Authority Having Jurisdiction (AHJ) or the exposure durations listed in Step 1, the system shall be flushed completely with potable water until present at each fixture.
6. The system must be purged or drained of all water or protected from freezing.



#### FAILURE TO FLUSH THE SYSTEM NOTICE!

To prevent reduced service life of system components, disinfection solutions shall not be allowed to stand in the system longer than 24 hours. Thoroughly flush the system with potable water after disinfection.

#### 9.6.4.1 California flushing requirements

The State of California requires all installations of PEX piping where it is the initial plumbing system installed in new construction shall be flushed twice over a period of at least one week. The piping system shall be first flushed for at least 10 minutes and then filled and allowed to stand for no less than one week, after which all the branches of the piping system must be flushed long enough to fully empty the contained volume. This shall not apply to installations of PEX pipe where it replaces an existing tubing system of any material. At the time of fill, each fixture shall have a removable tag, shown on the right.

This new plumbing system was first filled and flushed on \_\_\_\_\_ (date)  
by \_\_\_\_\_ (name)

The State of California requires that the system be flushed after standing at least one week after the fill date specified above. If this system is used earlier than one week after the fill date, the water must be allowed to run for at least two minutes prior to use for human consumption.

This tag may not be removed prior to the completion of the required second flushing, except by the building owner or occupant.

Figure 9.23

### 10.1 Installers checklist for Viega PEX systems

In the event there is a conflict between the contents of this list or any applicable code, the code or the instructions, whichever is more restrictive, shall govern.

#### System components

##### Tubing markings

- ASTM F876 Cross-linked polyethylene (PEX) tubing.
- ASTM F877 Cross-linked polyethylene distribution systems (connection listed with manufacturer-supplied fitting and PEX tubing).

##### Fitting markings

- ASTM F877 Cross-linked polyethylene distribution systems (connection listed with manufacturer-supplied fitting and PEX tubing).

##### Joints and connections

- Tube end cuts shall be cut square and free of burrs.
- Connection shall be assembled per manufacturer's product instructions.
- Incorrectly assembled fittings shall be cut out and replaced.

##### General installation recommendations

- Contraction: Allow 1/8-inch slack per foot of PEX tubing.
- PEX may be loosely bundled (NOT TAPED).
- Do not bend PEX tubing tighter than the manufacturer's recommended minimum bending radius.

- Install minimum 18 inches of metallic or other approved material piping between gas water heater and PEX tubing connections.
- PEX must be free of gouges, cuts, deep scratches, tar, kinks, grease, flux and fading or discoloration.
- Protective sleeves or bushings shall be used with metal studs.
- Use clamps or straps at the required minimum "L" spacing between a tubing bend and PEX connections.
- Minimum horizontal support shall be per Table 9.4.
- Vertical tubing shall be supported at every floor and at the midpoint between floors.
- Supports/clamps shall not restrict the movement of PEX tubing.
- Supports/clamps shall not pinch, cut, kink or damage tubing.
- Use only hangers and straps recommended for plastic tubing.
- Tubing passing through slabs or foundations shall have a protective sleeve.
- Tubing shall be protected from nail damage.
- Transition connections shall be made with fittings approved for that purpose.
- PEX shall be located at least 6 inches horizontally and 12 inches vertically from sources of high heat.

##### Testing

- Test pressure shall be at least equal to normal system working pressure, but not less than 40 psi and not greater than 100 psi.
- Test duration shall not be less than 15 minutes.
- A slight drop in pressure after 2 hours is normal.



**VIEGA® LLC PEX WATER SYSTEMS LIMITED WARRANTY**

Subject to the conditions and limitations in this Limited Warranty, VIEGA LLC (Viega) warrants to owners of real property in the United States and Canada that the components in its PEX Plumbing Systems (as described below) when properly installed by licensed plumbers in potable water systems, under normal conditions of use, shall be free from failure or leak caused by manufacturing defects for a period of ten (10) years from date of installation.

Viega PEX Plumbing Systems and components covered by this ten-year warranty are:

ViegaPEX™ and ViegaPEX ULTRA cross-linked polyethylene (PEX) tubing, FostaPEX®, ManaBloc®, MiniBloc™ or polymer or copper manifolds sold by Viega and approved connections sold by Viega installed as a manifold plumbing system.

ViegaPEX and ViegaPEX ULTRA cross-linked polyethylene (PEX) tubing or FostaPEX installed with PEX metal or polymer press fittings and PEX Press sleeves sold by Viega installed as a system.

ViegaPEX and ViegaPEX ULTRA cross-linked polyethylene (PEX) tubing and ASTM F1807 metal crimp insert fittings sold by Viega and ASTM F2159 PolyAlloy™ crimp fittings sold by Viega installed with copper crimp rings as a system.

Viega does not extend any warranty on its components used in systems with tubing, fittings, manifolds, or press sleeves not sold by Viega or installed by other than a licensed plumber. In addition, the warranty does not apply if distribution lines and their connections to manifold plumbing systems sold by Viega are not ViegaPEX or FostaPEX tubing or approved connections sold by Viega.

Power tools and jaws used with PEX Press fittings are warranted by the manufacturer and Viega extends no separate warranty on those tools or jaws. Viega warrants that PEX Press hand tools sold by Viega, under normal conditions of use, shall be free from failure caused by manufacturing defects for a period of two (2) years from date of sale. Viega warrants that PEX Crimp hand tools and tubing cutters sold by Viega, under normal conditions of use, shall be free from failure caused by manufacturing defects for a period of twelve (12) months from date of sale.

Viega warrants that properly installed PEX valves, PEX lav and closet risers and riser accessories manufactured and/or sold by Viega shall be free from failure caused by manufacturing defects for a period of two (2) years from date of installation.

Under this limited warranty, you only have a right to reimbursement if the failure or leak or resulting damage resulted from a manufacturing defect in the products covered by this warranty and the failure or leak or resulting damage occurred during the warranty period. You do not have a remedy or right of reimbursement under this warranty and the warranty does not apply if the failure or leak or resulting damage is caused by (1) components in the plumbing system other than those manufactured or sold by Viega; (2) not designing, installing, inspecting, testing, or operating the system in accordance with Viega's installation instructions at the time of the installation, applicable code requirements and good plumbing practices; (3) improper handling and protection of the product prior to and during installation, inadequate freeze protection, exposure to water pressures or temperatures in excess of the limitations on the tubing or application of unauthorized or harmful solvents or chemicals; (4) acts of nature such as earthquakes, fire, flood or lightning.

In the event of a failure or leak in the system, it is the responsibility of the property owner to obtain and pay for repairs. Only if the warranty applies will Viega be responsible for reimbursement under this warranty. The part or parts which you claim failed should be kept and Viega contacted at the address below\* or by telephoning 800-976-9819 within thirty (30) days after the failure or leak and identifying yourself as having a warranty claim. You should be prepared to ship, at your expense, the product which you claim failed due to a manufacturing defect, document the date of installation, and the amount of any claimed bills for which you claim reimbursement. Within a reasonable time after receiving the product, Viega will investigate the reasons for the failure, which includes the right to inspect the product at Viega and reasonable access to the site of damage in order to determine whether the warranty applies. Viega will notify you of the results of this review.

In the event that Viega determines that the failure or leak and any resulting damages were the result of a manufacturing defect in the products and occurred during the time periods covered by this warranty, Viega will reimburse the property owner for reasonable repair or replacement charges to include drywall, flooring and painting costs as well as damages to personal property resulting from the failure or leak. VIEGA SHALL NOT BE LIABLE FOR CONSEQUENTIAL ECONOMIC LOSS DAMAGES UNDER ANY LEGAL THEORY AND WHETHER ASSERTED BY DIRECT ACTION, FOR CONTRIBUTION OR INDEMNITY OR OTHERWISE.

THE ABOVE LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IF FOUND APPLICABLE, ANY IMPLIED WARRANTIES ARE LIMITED TO THE DURATION OF THE TIME LIMITS SET OUT IN THIS WRITTEN WARRANTY. Other than this limited warranty, Viega does not authorize any person or firm to create for it any other obligation or liability in connection with its products. This written warranty applies for the full term of the applicable warranty regardless of any change of ownership in the property.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on the duration of implied warranties in certain types of transactions, so the above exclusion or limitations may not apply to you. This limited warranty gives you specific legal rights and you also may have other rights which vary from state to state. This warranty shall be interpreted and applied under the law of the state in which the product is installed.

\* 100 N. Broadway, 6th Floor, Wichita, KS 67202



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