

Installation Manual

Viega® Climate Mat



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1 About this Document

1.1 Disclaimer



This document is subject to updates. For the most current Viega technical literature please visit www.viega.us.



Viega products are designed to be installed by licensed and trained plumbing and mechanical professionals who are familiar with Viega products and their installation. **Installation by non-professionals may void Viega LLC's warranty.**

1.2 Symbols Used

The following symbols may be used within this document:



DANGER!

This symbol warns of possible life-threatening injury.



WARNING!

This symbol warns of possible serious injury.



CAUTION!

This symbol warns of possible injury.



NOTICE!

This symbol warns of possible damage to property.



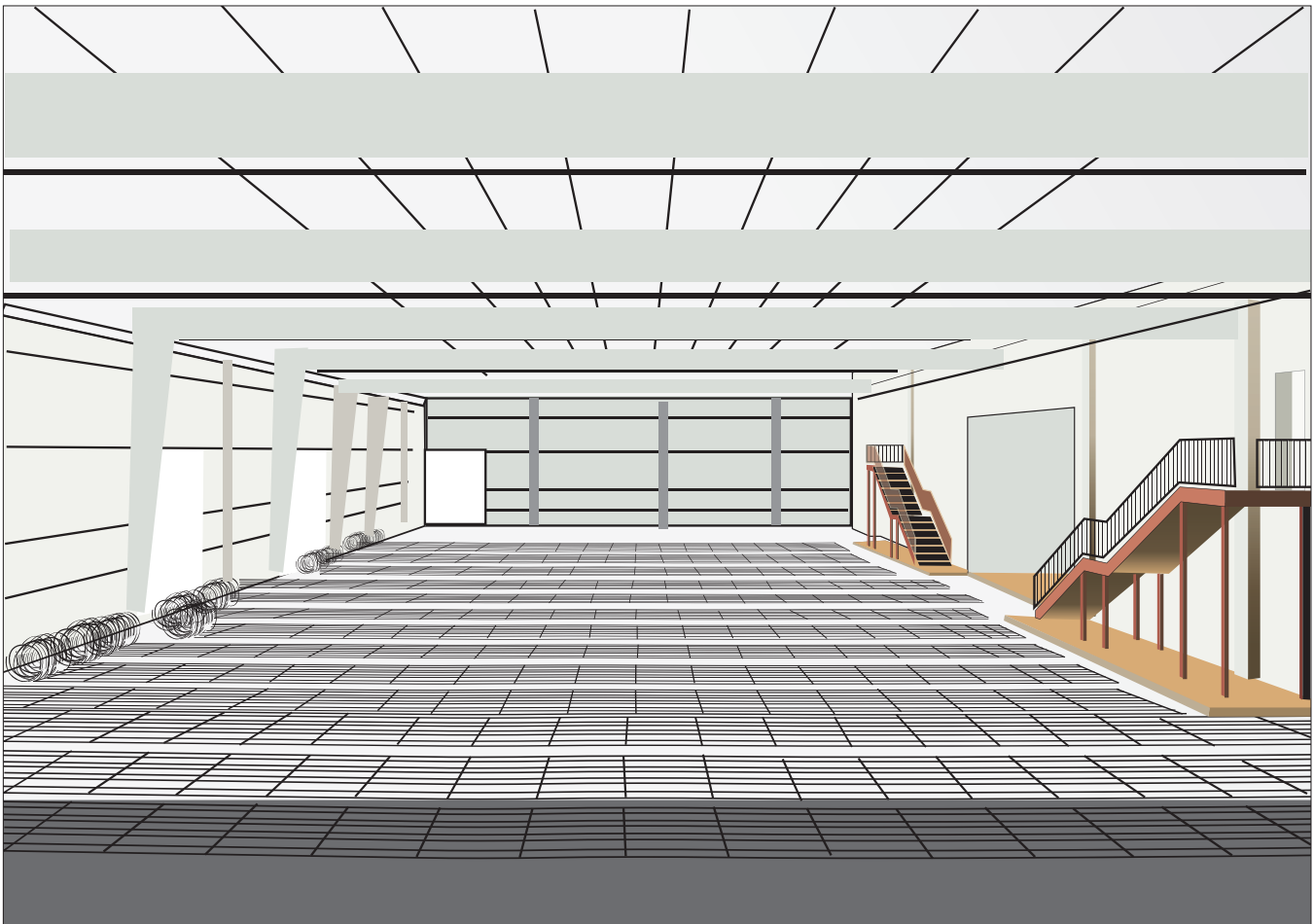
Notes give additional helpful tips.

2 Product Information

2.1 Climate Mat

Climate Mat was developed by Viega to deliver the well documented advantages of radiant heating and/or cooling within a package that increases affordability and labor-efficiency for mid- and large scale jobs. Unlike typical radiant tubing installations, which require that individual lengths of tubing be extended and attached to a sub-base, Climate Mat is a tubing module which permits the installer to simply roll out as many as six equivalent lengths of tubing simultaneously. Advantages over typical installations include:

- Reduced installation time
- Tubing securement method guarantees desired tubing spacing
- Pre-pressurized tubing eliminates downtime
- Pre-engineered design taking the guesswork out of installation
- No balancing needed due to same circuit lengths



Typical Climate Mat Layout

2.2 Safety

Please read and understand the instructions before beginning installation to eliminate safety concerns and reduce risks associated with use and handling of Viega products.

2.3 Areas of Use

Climate Mat comes in modules that are 5 or 6 feet wide, with lengths that are customized to the specific job. The rectangular modules are best suited to applications that have large, open spaces ($\geq 10,000 \text{ ft}^2$) and rectangular geometries, though more complicated geometries can be accommodated. Examples of typical applications include space heating and/or cooling for:

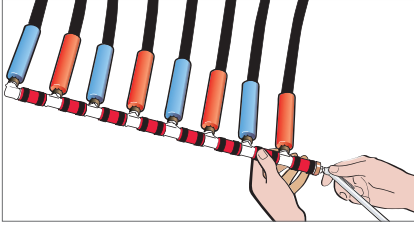
- Agricultural buildings
- Airports and hangars
- “Big box” retail
- Car dealerships
- Convention centers
- Garages
- Lobbies
- Museums
- Places of worship
- Snow melt
- Turf conditioning (e.g. dairy farms, athletic fields)
- Warehouses
- Offices & Corporate Headquarters
- Strip malls

While Climate Mat is made to cover large areas, you can still achieve a high degree of climate control in your spaces, since each module can be individually zoned. Individual zoning of mats is not necessary in most applications, but may be desirable along perimeters in very cold climates or where there is a large amount of glazing. For example, heating capacity of the Climate Mat is typically limited to $\sim 35 \text{ Btu/hr}\cdot\text{ft}^2$ in areas intended for human occupancy, but this may be increased to over $50 \text{ Btu/hr}\cdot\text{ft}^2$ along the perimeter of a building.

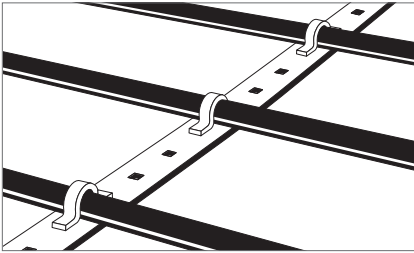


The use of the system for applications other than those listed or outside of these parameters must be approved by the Viega Technical Services Department.

2.4 Components



Climate Mat Header



Spacer Strips

Each Climate Mat is composed of PureFlow Barrier PEX tubing arranged in a serpentine pattern. Climate Mats have up to six circuits, each with a supply and return that are connected to a temporary/test header. “Spacer strips”, plastic cross-braces installed at the factory, are connected to the tubing at 4 foot intervals with clips to maintain consistent tubing spacing. Spacer strips have pre-formed holes that facilitate attachment to the sub-base with nails, staples, or zip ties. Leaders are the lengths of tubing that connect temporary headers to the first spacer strip in a mat. Integral sheaths provide permanent protection for the leaders where they penetrate the slab. Temporary headers are shipped with a Schrader valve to maintain pressurization during the concrete pour.



Climate Mat Layout

3 System Design

3.1 Viega’s Design Services

For the design of a commercial radiant heating/cooling project, Viega provides the following services:

- Climate Mat design and layout: CAD drawings of layouts, tubing dimensions, tubing spacing, Climate Mat configurations
- Manifold design and layout: CAD drawings of layouts, number of mats per manifold, manifold flow rates, and supply temperatures to achieve design loads
- Calculation of head loss and flow rates per manifold
- Material list
- Technical support

Responsibilities of the designer include:

- Calculation of heating/cooling design loads
- Specification of heat sources/sinks and related components
- Structural design of slabs to accommodate loads
- Providing adequate insulation for the radiant installation
- Specification of system controls

Consult Viega’s Design Services for more information on radiant system design: Design@viega.us

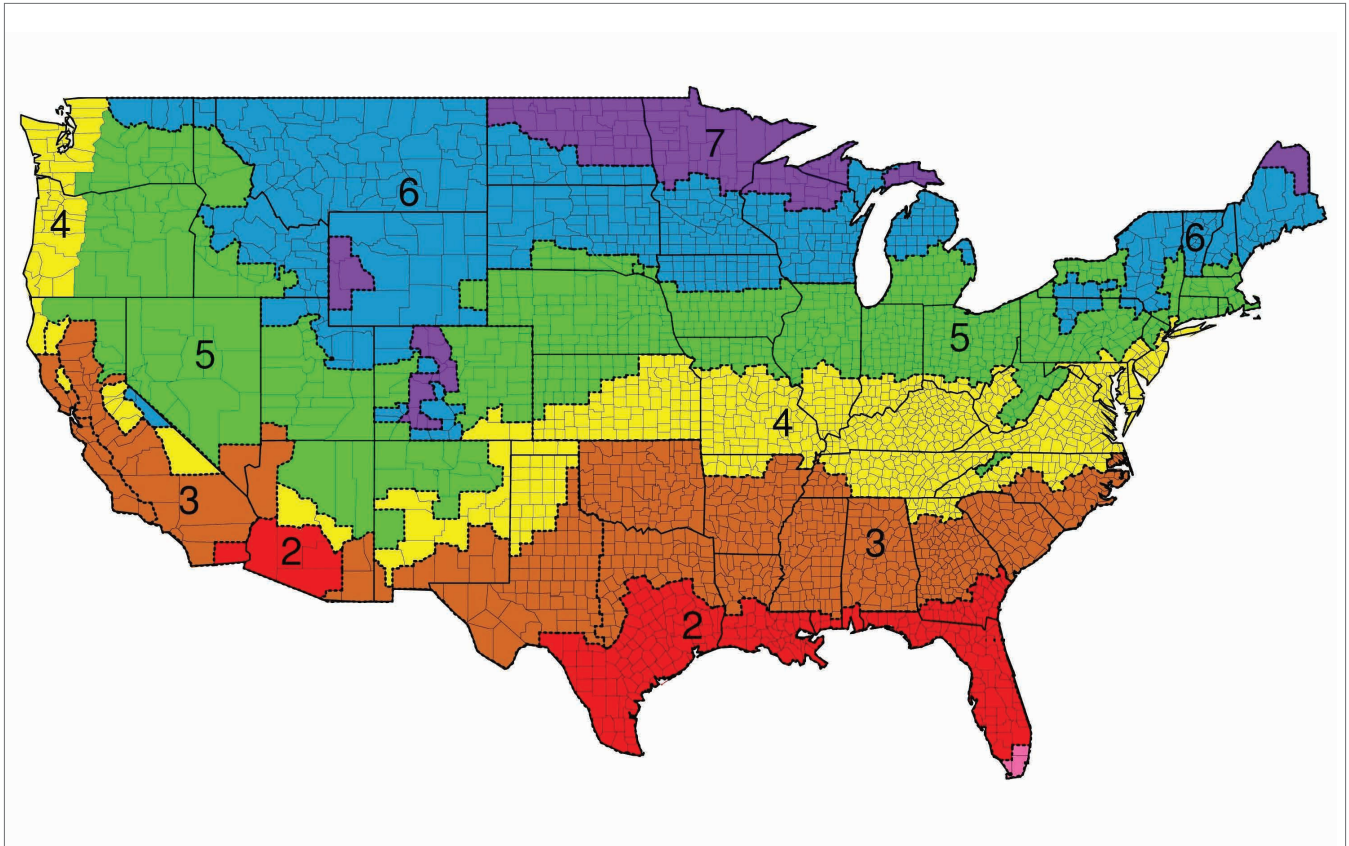
3.2 Insulation

In some cases, local building codes will specify the insulation requirements for heated or cooled slabs, but in other cases, insulation requirements are left to the discretion of the designer. Recommended minimum levels of slab insulation are given in the following table. If radiant floor delivery temperatures are limited by the equipment type, higher levels of insulation can be specified to increase the heat transfer between the conditioned space and the slab. In all cases, a vapor barrier should be provided under slabs with ground contact for all indoor installations.

Application	Slab with Ground Contact Perimeter Insulation by Climate Zone	Suspended Slab (e.g., between floors) Horizontal Insulation
Heating Only	CZ 1-2: R-7.5, 12 inch depth CZ 3: R-10, 24 inch depth CZ 4-5: R-15, 24 inch depth CZ 6-8: R-20, 48 inch depth	R value that is 5 times the value of the floor covering’s R-value.
Cooling Only	R-5 at perimeter where chilled slab abuts unconditioned space	Same as heating
Heating and Cooling	Same as heating	Same as heating

Table 1: Minimum recommended R-values for slab insulation of conditioned slabs

Perimeter insulation may be applied on the interior or exterior of the foundation. Perimeter insulation should be applied vertically or a combination of vertically and horizontally, when it extends to at least the depth of the slab. Listed depths are measured from the top of the slab.

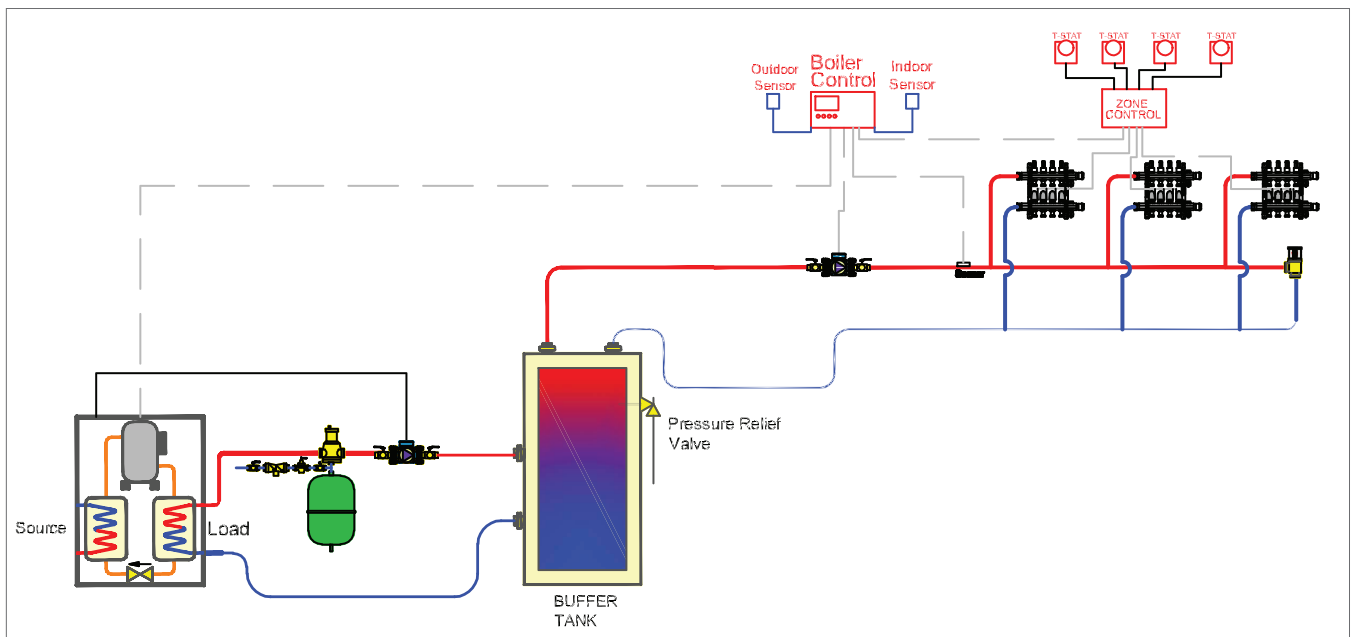
*Climate Zones*

3.3 Floor Covering

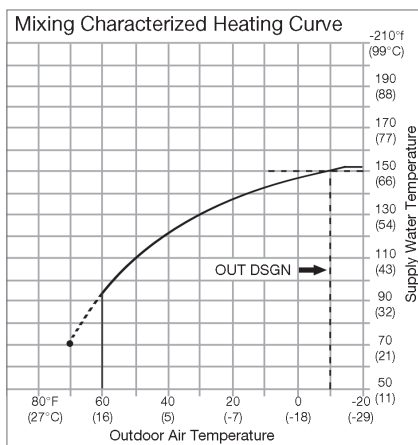
To optimize heat transfer between the conditioned space and the conditioned slab, consider an unfinished or stained slab in lieu of floor coverings that would dampen the thermal efficiency of the radiant system. If installing a floor covering for a heating only system, floor coverings with a thermal resistance greater than R-2.5 are not recommended. For a cooling or heating/cooling system, Viega recommends hard-surface installations. A table of R-values of typical floor coverings is provided in Appendix A.

3.4 Controls and Equipment

Optimization of a radiant heating and/or cooling system can be accomplished by selection of efficient equipment and complementary controls. A thoughtful control strategy can reduce peak loads and save energy and operational costs while maintaining occupant comfort. This can be very worthwhile, especially in the case of radiant slab cooling, where simulations have shown that up to 30% energy savings can be realized by optimizing controls.



3.4.1 Heating Considerations



Low temperature heating requirements of Climate Mat heating systems open up many options for specifying high efficiency or renewable energy central heating plants. Options include ground source heat pumps; solar water heating; waste heat capture; and using one or more high efficiency, modulating boilers. Pairing one or more of these systems with a constant or variable speed pump and modulating supply water temperature via an outdoor reset control will lead to a very efficient design that also reduces the likelihood of overshooting thermostat set point. Most control strategies rely on an outdoor reset curve like the one shown in the figure to the left. This allows the system heat delivery to match building heat loss and maintain a nearly constant indoor temperature with varying outdoor temperatures.

3.4.2 Cooling Considerations

Properly designed Climate Mat cooling systems operate by reducing the surface and air temperature within a space, which is referred to as “sensible cooling”. “Latent cooling” occurs when the heat content of air is reduced through condensation of the air’s vapor on a cool surface. To avoid condensation on radiant cooled slabs, latent cooling should be provided by a supplemental forced-air cooling system. The use of radiant slabs for sensible cooling combined with dedicated outdoor air systems for latent cooling and ventilation has shown great promise for energy savings.

Condensation control for a radiant cooled slab is accomplished by ensuring that the slab surface temperature does not fall below the space dew point. To do this, exhaust high humidity loads at their source, provide for dehumidification of air (latent cooling) through supplementary cooling equipment, and install controls to keep the supply water temperature above the space dew point temperature by mixing or by bypassing the chiller when necessary.

Climate Mat cooling lends itself to the use of relatively high system water temperatures, which increases options for specifying high efficiency or renewable energy equipment such as ground and air source heat pumps, indirect evaporative cooling, and solar absorption cooling systems. Further, air source heat pumps, indirect evaporative coolers, and conventional chillers all operate more efficiently when outdoor temperatures are low, so off-peak cooling could be pursued as a strategy to reduce energy use, utility costs, and peak load. Other cooling control scenarios, including their advantages and disadvantages, are listed in Table 2.

Control Scenario	Advantages	Disadvantages
Constant speed pump, constant water temp	Simple, reliable	Does not maximize energy efficiency
Variable speed pump, constant water temperature	Reduces pumping energy requirements by matching loads across multiple zones that may be on or off	Does not maximize central plant efficiency
Constant speed pumps with variable water temperature	Improves efficiency of central plant by letting it operate over a broader range of temperatures	Does not maximize pumping efficiency
Variable speed pumps with variable water temperature	Can minimize pumping energy requirements and maximize central plant efficiency	

Table 2: Cooling control scenarios and attributes

When optimizing control strategies, consider a building energy simulation to identify the best control strategy for a particular site.

3.4.3 Combination Heating and Cooling Considerations

For systems that will provide both heating and cooling, installation of variable speed pumps is recommended to facilitate matching design flow rates and loads. Sizing of equipment and components should accommodate the largest design load, whether heating or cooling.

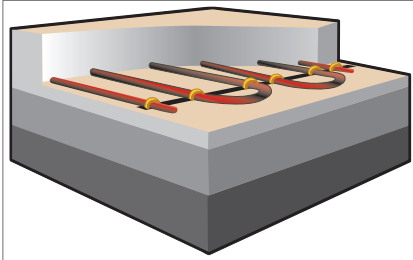
4 Planning the Installation

4.1 Planning

Before starting the installation, ensure that the following tools and materials are on site to help the process go smoothly:

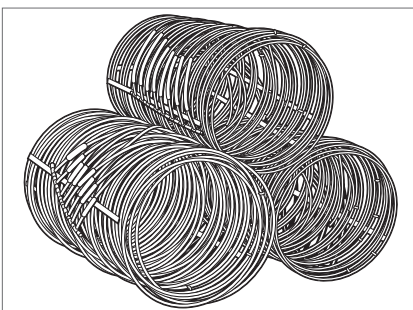
- Tubing cutters and ViegaPEX Press Tool
- ViegaPEX Press couplings
- Extra mounting strips and clips
- Repair tape to wrap repair PEX Press couplings in-slab
- Fasteners for securing clip strips and leaders to sub-base, wire mesh, or re-bar
- Fasteners for securing Climate Mat leaders near manifolds
- Tools for installing fasteners
- Air compressor for adding extra pressure to Climate Mats if necessary
- Bend support to support slab penetration sleeve

4.2 Preparing the Site

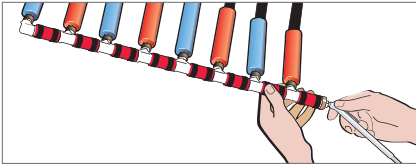


1. Compact the sub-base where necessary.
2. Install vapor barrier if specified. Viega recommends installing a vapor barrier on all heating and cooling installations.
3. Install insulation if specified.
4. Install wire mesh if specified. Though wire mesh is not required for Climate Mat installations, it can be helpful for securing Climate Mat leaders near manifolds.
5. Where specified, re-bar or other slab enforcement may be installed prior to or after the installation of Climate Mat, depending on the slab design and construction schedule, though it is generally easier to sequence the installation of slab reinforcement after the Climate Mat is installed.
6. Remove any unintentional obstructions and construction waste.

4.3 Off-Loading and Storing the Mats

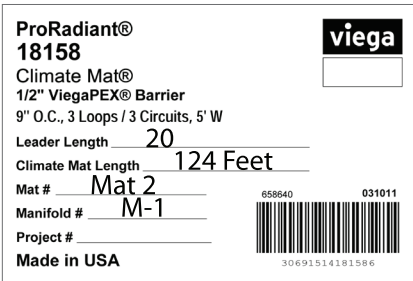


Climate Mats are typically delivered to the site stacked vertically on a pallet, and wrapped in cardboard and plastic shrink wrap for protection during shipping. Unload the mats with care, and ensure that all tubing and fittings are stored in a flat, dry, well ventilated location that is protected from UV exposure. UV exposure must never exceed six months.

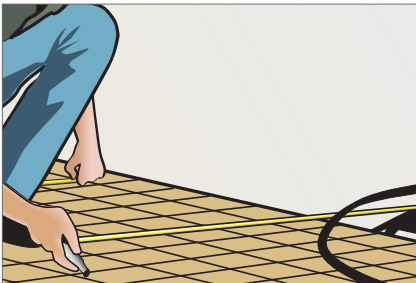


All Climate Mat assemblies are pressure tested prior to shipment and remain under a static internal pressure of ~20 psig during shipping (actual gauge pressure will vary with site elevation). Upon receipt of the Climate Mat, inspect each assembly for damage, and verify pressure retention. Examine each Climate Mat for damage. Do not install any defective or damaged products.

4.4 Layout and Staging

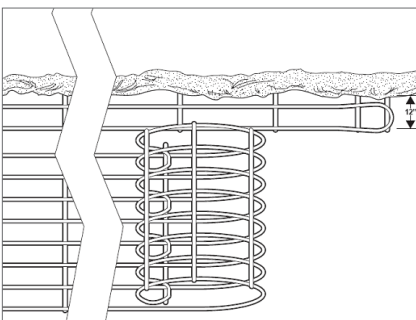


Each Climate Mat delivery is provided with a design layout that details the location of each manifold and its corresponding Climate Mats. If you did not receive a Climate Mat design layout, contact Viega design services. Each Climate Mat is shipped with a label that provides the specifications for that mat. See figure to the left.

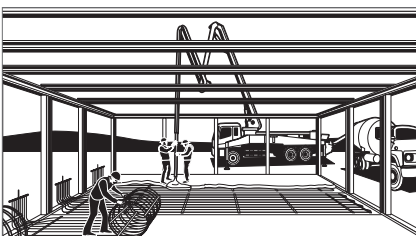


Prior to placing the Climate Mats, it is advisable to measure and mark the location on the sub-base of the first spacer strip for each Climate Mat. This location can be determined from the design layout provided by Viega. Also, to keep the Climate Mats straight and square during installation, the installer may find it useful to mark the sub-base to indicate the position for the outer tube of each Climate Mat. See figure to the left.

Using the layout provided by Viega, identify the designated manifold locations and the Climate Mats that correspond with these manifolds. To move the Climate Mat off the pallet, two installers can carry and place the rolled mat into position. During placement, avoid dragging or rolling the Climate Mat across long distances. When it's time for installation, Climate Mats will be unrolled away from the manifolds, with the Climate Mat's temporary headers placed near the manifold location.



Heavy equipment must not be operated on top of the tubing, so consider this when determining how many Climate Mats to roll out at any one time. For example, if the concrete installation will require heavy equipment to be driven on the sub-base, the Climate Mats will need to be rolled out in stages. In this case, the number of Climate Mats which can be installed at any one time will depend on the length of the chute on the concrete trucks, which is generally less than 20 feet. Leave at least one foot of clearance between the concrete pour and the edge of the Climate Mat to ensure that you can easily roll out subsequent sections without interference from concrete over-pour. See figure to the left.



Once the heavy concrete pour and screed equipment has moved a sufficient distance, subsequent Climate Mats may be unrolled and secured.

If a concrete pump, boom, and hose is used to install the concrete, you can generally avoid heavy equipment on the substrate. In this case, it may be possible to roll and anchor all of the Climate Mats prior to the pour.

5 Installing the Climate Mat

5.1 Precautions During Installation

While it's okay to walk on the Climate Mat, do not operate heavy equipment (including lifts, vehicles, concrete buggies, wheelbarrows, etc.) on the tubing prior to installing concrete over the tubing. Avoid exposure of the tubing to harmful substances and conditions such as excessive heat, sharp objects, and excessive UV light (i.e., exposure over six months). When bending sections of tubing, do not bend beyond the maximum bend radius (see Appendix B for bend radius of tubing). Tubing must be sleeved at all concrete penetrations. Climate Mat is shipped with slab penetration sleeves installed on all leaders for this purpose. When securing tubing, use plastic zip ties, plastic clips, or clamps approved by Viega. Never use metallic clips or straps to secure tubing.

5.2 Repairing Tubing

If tubing is kinked or punctured, it can be easily and effectively repaired on-site. Tubing punctures must be repaired using Viega PEX Press couplings. To comply with the Viega Climate Mat warranty, in-slab couplings must be wrapped to protect the fittings from exposure to concrete. A small tubing puncture may be repaired with only one coupling, if there is sufficient slack in the undamaged tubing that can be pulled from the nearest U-bend. Otherwise, the repair will require two couplings and a length of PureFlow Barrier PEX tubing of the same outer diameter as the Climate Mat.

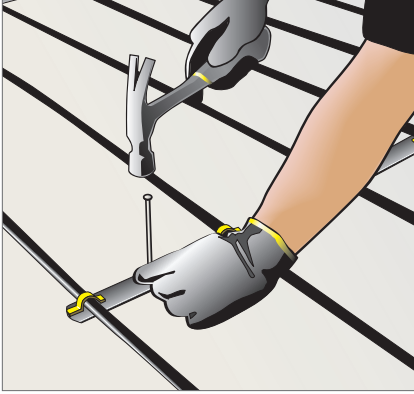
5.3 Fastening the Climate Mat

Determine the distance from the control line indicated on the design layout to the first spacer strip location. Secure the first spacer strip to the sub-base or wire mesh near the manifold location. Fully unroll the Climate Mat and pull it hand-tight to ensure that it is straight and square. Attach the last spacer strip to the sub-base or wire mesh, and then go back and anchor each spacer strip with at least two fasteners. Fastening methods will vary depending on the sub-base.

Fasten leaders at two foot intervals between the first spacer strip and the manifold. If attaching leaders to wire mesh or re-bar, use zip ties. For other applications, use foam staples or other appropriate fasteners. When anchoring leaders back to the manifold location, maintain uniform spacing of the tubing as much as possible.

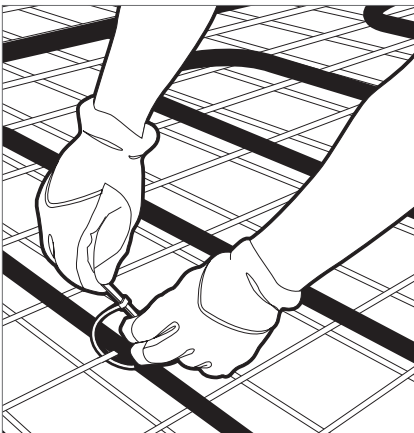
Tie off the temporary header so that it's not in the way when the slab is poured.

5.3.1 Fastening to a Compacted Sub-Base



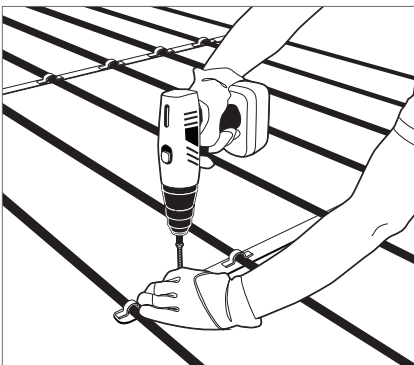
Use at least two 6" landscaping nails to anchor each spacer strip.

5.3.2 Fastening to Rebar or Wire Mesh



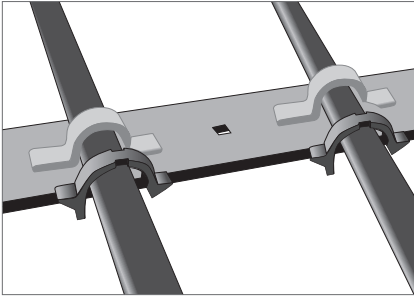
Climate Mat can also be secured to wire mesh or rebar with zip ties.

5.3.3 Fastening to an Existing Slab



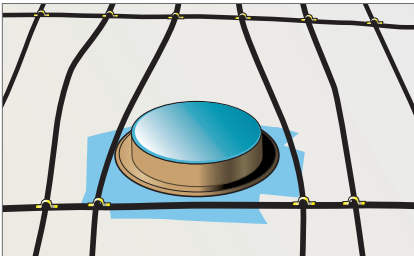
Climate Mat may be nailed or screwed to a sub-slab for an overpour application.

5.3.4 Fastening to Foam Insulation



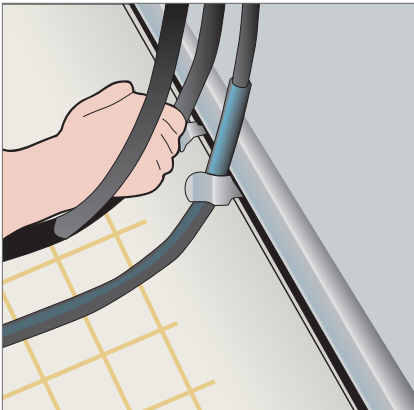
Use at least two foam staples to anchor each spacer strip. Staple tubing close to each spacer strip.

5.4 Getting Around Obstacles



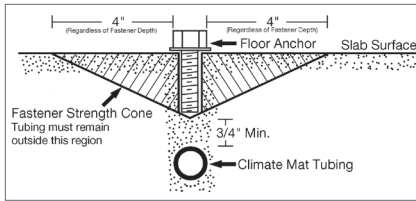
The Climate Mat layout supplied by Viega will seek to avoid large obstacles as much as possible. However, slab penetrations due to structural, electric, or plumbing components are almost inevitable. Where necessary, remove the tubing from the spacer strip to spread the tubing around obstacles. If this does not lend sufficient clearance, spacer strip(s) may be cut or removed to give you more flexibility.

5.5 Sleeving Control Joints and Slab Penetrations



Tubing must be sleeved at all concrete control joints and slab penetrations. For the penetration of leaders at manifold locations, slide each leader's factory-installed sleeve until it is in position. For control joints and slab penetrations, see the figure to the left.

5.6 Pouring the Concrete



Prior to the concrete pour, pressurize each Climate Mat to 100 psi of air through the Schrader valve on the temporary header. Keep the Climate Mats under pressure for the duration of the concrete pour. Check with local code to determine if there are pressurization requirements that exceed this recommendation, and if so, ensure that local code is followed. In absence of local code pressurize the system for minimum of 1 hour. Frequently confirm throughout the pour that tubing integrity is maintained.

At least $\frac{3}{4}$ " of concrete should be maintained between the top of the Climate Mat and the top of the slab. If shelving or other slab anchors will be installed after the concrete slab is poured, ensure that the slab and anchors will be designed to leave at least $\frac{3}{4}$ " clearance between the top of the Climate Mat and the bottom of any anchor pilot holes.

5.7 Connecting to Permanent Manifolds

Permanent manifolds can be installed when the Climate Mats are installed or later in the construction process after the slab has cured. Manifold locations are designated on the Viega design layout for each project. Ensure that manifolds are in locations that will remain easily accessible (e.g. Manifold cabinet). Manifolds must be protected from freezing temperatures, so sufficient insulation must be provided.

Release air pressure from the mats. With a tubing cutter, trim the Climate Mat leaders squarely to the proper length at the manifold location, and discard the temporary header. To maintain the product warranty, use only Viega manifolds and fittings to connect the Climate Mat leaders to the manifolds. Viega recommends a shutoff valve at each circuit for isolation. In addition, each manifold should have an isolation ball valve on the supply and return headers. Climate Mat leaders are color coded to help you distinguish between supply and return. Ensure that all of the manifolds are connected with the same color scheme for supply and return throughout the installation.

5.8 Manifold Dimensions

Stock Code	Dimensions	Manifold Length	Length with End Cap and Ball Valve
17100	2" CM x $\frac{3}{4}$ " CM - 18	57"	69.25"
17120	1 $\frac{1}{2}$ " CM x $\frac{3}{4}$ " CM - 18	57"	68.0"
17143	1" CM x CM, $\frac{1}{2}$ " CM - 12	26"	35.25"
17140	1" CF x CM, x $\frac{1}{2}$ " CM - 2	6.75"	16.0"
17141	1" CM x CM, x $\frac{1}{2}$ " CM - 3	8.75"	18.0"
17142	1" CF x CM, $\frac{1}{2}$ " CM - 4	10.75"	20.0"

Table 3: Copper manifold dimensions

	2 outlet	3 outlet	4 outlet	5 outlet	6 outlet	7 outlet	8 outlet	9 outlet	10 outlet	11 outlet	12 outlet
width no accessories	10.2"	10.2"	12.2"	14.1"	16.1"	18.1"	20.0"	22.0"	24.0"	25.9"	27.9"
width with ballvalve and adapter fitting	14.95"	14.95"	16.95"	18.85"	20.85"	22.85"	24.75"	26.75"	28.75"	30.65"	32.65"
width with ballvalve and adapter fitting for flow through	16.95"	16.95"	18.95"	20.85"	22.85"	24.85"	26.75"	28.75"	30.75"	32.65"	34.65"
Depth	3.6"	3.6"	3.6"	3.6"	3.6"	3.6"	3.6"	3.6"	3.6"	3.6"	3.6"
Depth with ball valve handle	4.85"	4.85"	4.85"	4.85"	4.85"	4.85"	4.85"	4.85"	4.85"	4.85"	4.85"

Table 4: Stainless manifold dimensions

Stock Code	Interior Box Dimension	Exterior Box Dimension	1¼" Stainless Steel Manifold with No Accessories	1¼" Stainless Steel Manifold with Ball Valve Set	1¼" Stainless Steel Manifold with Ball Valve Set and Adapters for Flow Through	1¼" Stainless Steel Manifold with No Accessories and Zone Control	1¼" Stainless Steel Manifold with Ball Valve Set and Zone Control
15800	21"	22 5/8"	2-6 outlet manifold	2-5 outlet manifold	2-4 outlet manifold	2 outlet manifold	N/A
15801	27"	28 3/8"	2-9 outlet manifold	2-8 outlet manifold	2-7 outlet manifold	2-4 outlet manifold	2-3 outlet manifold
15802	45"	46"	2-12 outlet manifold	2-12 outlet manifold	2-12 outlet manifold	2-12 outlet manifold	2-12 outlet manifold

Table 5: 1¼" Stainless steel manifold dimensional information for manifold cabinet

If use of a zone control is necessary, hold the manifold to the right and install the zone control on the left side of the manifold cabinet. Use of a zone control in the manifold cabinet is not compatible with flow through applications.

Stock Code	Interior Box Dimension	Exterior Box Dimension	1" Copper Manifold with No Accessories	1" Copper Manifold with ProPress Ball Valve and End Cap
15800	21"	22 5/8"	2,3,4 outlet manifold	N/A
15801	27"	28 3/8"	2,3,4 outlet manifold	2,3,4 outlet manifold
15802	45"	46"	2,3,4 and 12 outlet manifold	2,3,4 and 12 outlet manifold

Table 6: 1" Copper manifold dimensional information for manifold cabinet

Copper manifolds are available in 2, 3, 4, and 12 outlet configurations. Manifold brackets are sold separately for copper manifolds.

6 System Startup

6.1 Purging Procedure

The purging procedure varies based on availability of water.

Assuming water for filling and purging is provided by the primary loop makeup water system:

1. With manifold connected, close all manifold circuit valves.
2. Close isolation ball valve on the return header.
3. Attach a drain hose to the return header drain valve.
4. Open circuit shutoff valves on supply and return headers for first circuit to purge and fill this circuit.
5. Once purge and fill for first circuit is complete, close circuit shutoff valves on supply and return headers.
6. Repeat steps 4 and 5 for each additional circuit, one at a time.
7. Once last circuit is purged and filled, close last circuit shutoff valve.
8. Open all circuit shutoff valves on supply and return headers.
9. Close drain valve.

Where water for filling and purging is not provided from primary piping:

1. Close isolation ball valves on supply and return headers.
2. Connect fill hose/purge water source to drain valve on supply header.
3. Attach a drain hose to the return header drain valve.
4. Open drain valve on supply header to start water flow into supply header.
5. Steps 5-9 above are the same as if water fill is from primary system.
6. Close drain valve on supply header.

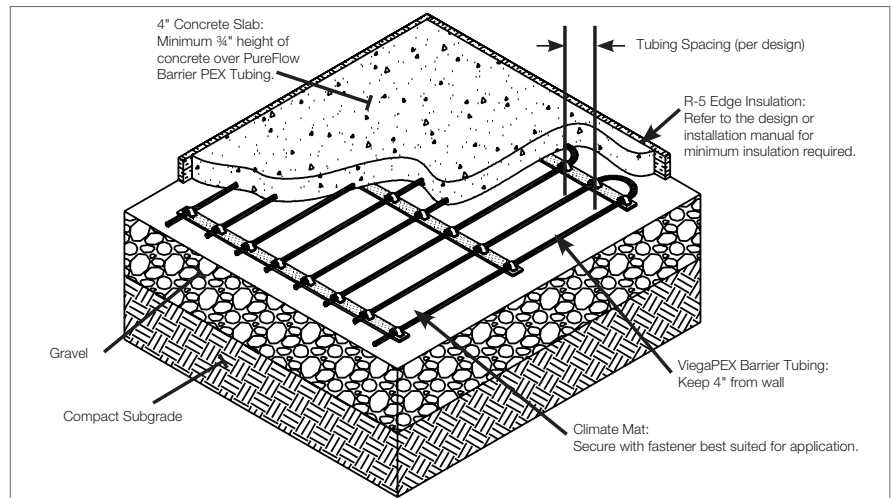
Precautions should be taken to keep the system from freezing. Ensure the proper amount of glycol is on site for mixing. Mix ratio should not exceed 50%. Premix glycol ahead of time before adding to the system.

Note: Steps above would be the same for the addition of glycol.

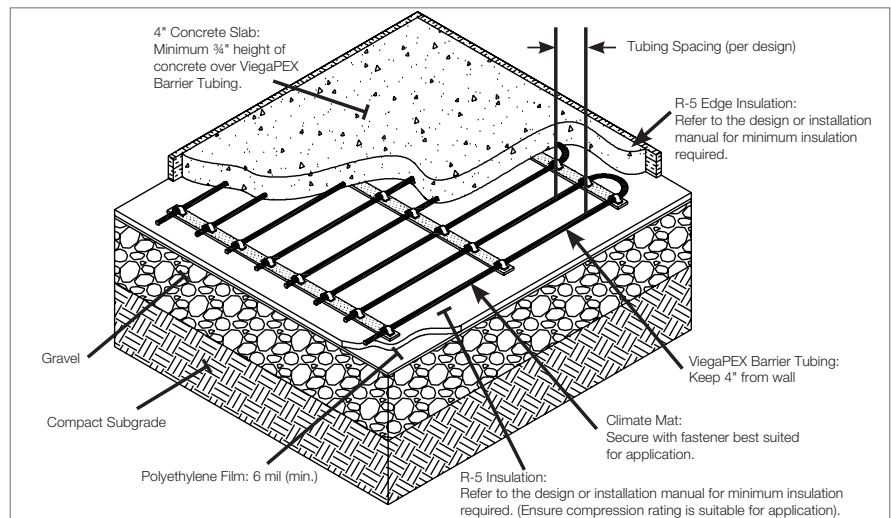
When starting up the system in heating mode, it is best to warm the thermal mass up slowly to help prevent possible shock to the slab. In accordance with DIN 4725 section 4, Viega recommends:

- Start warm up after concrete has reached its final set (curing complete).
- Set supply water temperature to 77°F for the first three days.
- Increase supply water temperature to the set point in gradual increments for the next four days (maximum of a 50°F increase in a period of 24 hours).
- Slab warm up should follow the concrete manufacturer's recommendations.

Appendix A - Climate Mat Details



Section Through Climate Mat on Existing Slab Without Insulation



Section Through Climate Mat on Existing Slab With Insulation

Appendix B - PureFlow Barrier PEX Tubing

This specification designates the requirements for Viega Barrier cross-linked polyethylene (PEX) tubing for use in hydronic radiant heating systems. Viega Barrier PEX includes an oxygen barrier layer that helps restrict the passage of oxygen through the wall of the tubing. All Viega PEX is manufactured and tested to the requirements of ASTM F876, F877, and CSA B137.5, and is CTS-OD (copper tube size outer dimension controlled) with an SDR - (standard dimension ratio) 9 wall thickness. Viega Barrier PEX is compatible with both PureFlow PEX Press fittings and F1807 PureFlow PEX Crimp fittings. Viega has no control over the quality of other manufacturers, therefore, we do not extend any warranty to those components that are not supplied by Viega.

B.1 Materials

Viega Barrier PEX tubing is produced from cross-linkable, high density polyethylene resin. This cross-linkable resin is produced by grafting organo-silane molecules onto a base polyethylene chain. A catalyst that initiates the cross-linking process is blended with the resin before extrusion. Cross-linking is conducted after extrusion by exposing the tubing to heat and moisture (steam). Viega Barrier PEX includes four (4) layers. The first layer is cross-linked, high density polyethylene. The second layer is an adhesive for the third layer, the ethylene vinyl alcohol layer (EVOH oxygen barrier). The fourth layer is another thin layer of polyethylene, applied on the outside to protect the EVOH layer from damage. EVOH is highly resistant to the passage of oxygen.

B.2 Marking and Certification

Tubing is marked with manufacturer, Viega Barrier PEX, nominal size, rating, codes and standards, approvals, date, material code, and location of production (i.e., 0000FT Viega Barrier PEX 5/16" SDR-9 100 PSI @ 180°F [NSF-pw U.P. Code ASTM F876/F877 CSA B137.5] ICBO ES ER-5287 PEX 5306 Date Code Material Code Made in the USA 0002FT). Tubing is third party tested to the requirements of the stated ASTM and CSA standards. Tubing includes incremental footage markings to assist with loop layout. PureFlow PEX is certified to NSF 61 and 14 for use as part of, or connected to a potable water system.

B.3 Handling and Installation

Viega Barrier PEX tubing is recommended for hydronic radiant heating, cooling, and snow melting systems using water or a water/glycol mix as the heat transfer media. Tubing may be installed in concrete, gypsum based lightweight concrete, sand, asphalt (in accordance with special guidelines) in or under wood flooring or behind wallboard or plaster. Viega Barrier PEX may also be used as transfer lines for baseboard heating systems with a maximum operating temperature of 200°F @ 80 psi.

B.4 Recommended Uses

Install Viega Barrier PEX in accordance with installation manuals provided by manufacturer and applicable code requirements. Water or air can be used to pressure test the system. Please follow manufacturer's requirements on pressure and length of time. Viega Barrier PEX comes with a six month UV protection. For information on the suitability for other applications, contact your Viega representative.

B.5 Quality Assurance

Viega Barrier PEX tubing is manufactured and tested to the requirements of ASTM F876, F877 and CSA B137.5. The degree of cross-linking of finished tubing is determined by method ASTM D2765.

B.5.1 Quality Assurance

Quality Assurance

NSF-pw - tested for health effects to ANSI/NSF 61 and performance to ANSI/NSF standard 14.

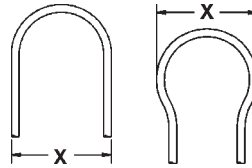
B.5.2 Tube Spacing

When the tube spacing is less than the minimum recommended bending dimension, the loops ends should be swept out to at least the dimensions shown. Otherwise, if tube spacing is equal or greater than "X", a standard loop may be used.

B.5.3 Viega Barrier PEX Oxygen Permeation

All sizes have less than 0.1 gram/m³/day

Note: ViegaPEX Barrier tubing meets DIN 4726 requirements for oxygen tight pipes.



Tube Size	Tube Size with Coil
5/16"	7"
3/8"	8"
1/2"	10"
5/8"	12"
3/4"	14"
1"	18"
1 1/4"	22"
1 1/2"	26"
2"	34"

Table 7: Dimension X

Tube Size	O.D.	Wall Thickness	Nom. I. D.	Weight Per Ft	Volume (gallon) Per 100 Ft
5/16"	.430±.003	.064+.010	0.292	.0340	0.34
3/8"	.500±.003	.070+.010	0.350	.0413	0.50
1/2"	.625±.004	.070+.010	0.475	.0535	0.92
5/8"	.750±.004	.083+.010	0.574	.0752	1.34
3/4"	.875±.004	.097+.010	0.671	.1023	1.82
1"	1.125±.005	.125+.010	0.862	.1689	3.04
1 1/4"	1.375±.005	.153+.015	1.053	.2523	4.52
1 1/2"	1.625±.006	.181+.019	1.243	.3536	6.30
2"	2.125±.006	.236+.024	1.629	.6026	10.83

Table 8: SDR-9 PEX Tubing ASTM F876/F877/CTS-OD SDR-9

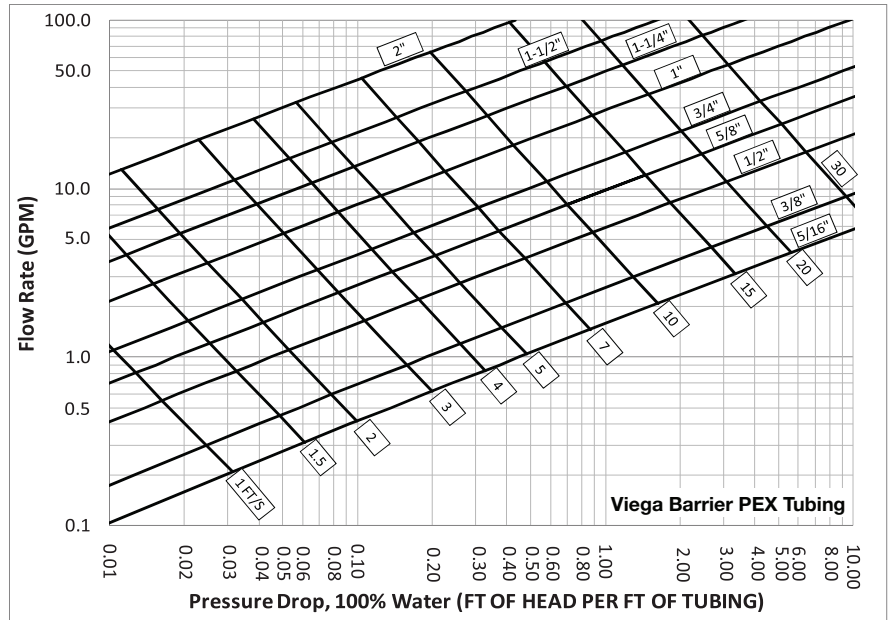
Dimensions are in English units. Tolerances shown are ASTM requirements. Viega Barrier PEX tubing is manufactured within these specifications.

Viega Barrier PEX tubing is available in both straight lengths and coils.

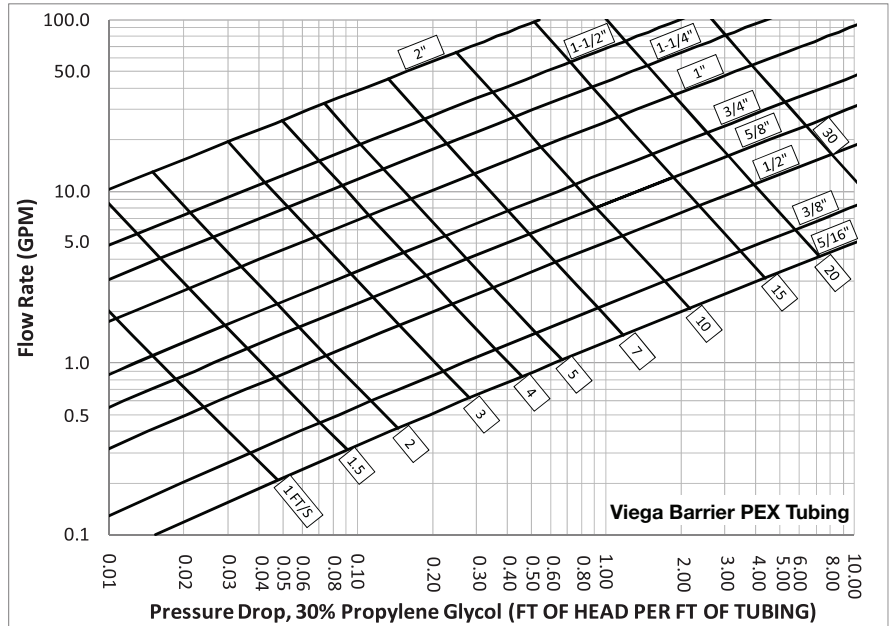
GPM	Size								
	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	2"
.1	.002	.001							
.2	.009	.004	.001						
.3	.018	.008	.002	.001					
.4	.031	.013	.003	.001					
.5	.047	.020	.004	.002					
.6	.066	.027	.006	.003	.001				
.7	.088	.036	.008	.003	.002				
.8		.047	.011	.004	.002				
.9		.058	.013	.005	.002				
1		.070	.016	.007	.003	.001			
1.5			.034	.014	.006	.002			
2			.058	.024	.011	.003			
3				.050	.023	.007			
4				.085	.039	.011			
6				.181	.082	.024			
8					.140	.041			
10					.211	.062	.023		
12					.296	.087	.032		
14							.042		
16							.053	.022	
18							.065	.027	
20							.078	.033	
22							.093	.039	
24							.108	.045	
26								.052	
28								.060	
30								.067	
32								.075	.021
34									.023
36									.026
38									.028
40									.031
45									.038
50									.046
55									.055
60									.064
65									.075
70									.085
75									.097

Table 9: Pressure drop table expressed as psi/ft.

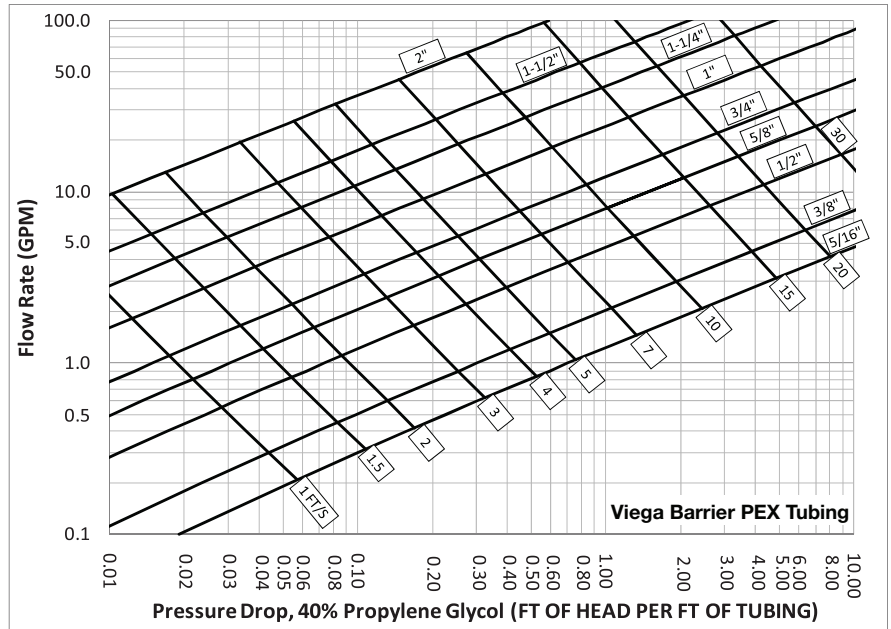
Appendix C - Pressure Drop Charts



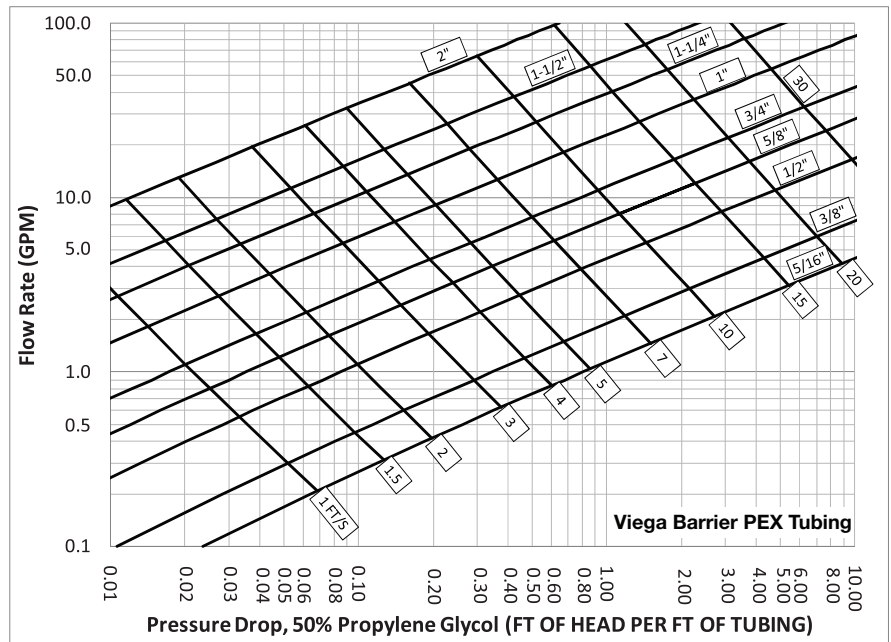
Pressure drop of Viega Barrier PEX tubing based on flow rate and diameter.



Thirty percent propylene glycol pressure drop table for Viega Barrier PEX tubing.



Forty percent propylene glycol pressure drop table for Viega Barrier PEX tubing.



Fifty percent propylene glycol pressure drop table for Viega Barrier PEX tubing.

Appendix D - Mixing Device Flow Rate

Type of Valve	Size	Connection Type	Stock Code	Cv Rating	Flow (GPM)	Heat Capacity (BTU/HR)	Pressure Drop (psi)	Pressure Drop (FT. Of Head)
Diverting	¾"	Solder	20001	5.3	5	50,000	0.9	2.04
					6	60,000	1.3	3.0
Diverting	1"	Solder	20002	7.6	7	70,000	0.8	2.0
					9	90,000	1.4	3.3
Diverting	1¼"	Solder	20003	11.1	10	100,000	0.8	1.9
					12	120,000	1.4	2.7
Diverting	1½"	Solder	20041	11.1	13	130,000	1.4	3.2
					14	140,000	1.6	3.7
3-Way Mixing	¾"	FNPT	20080	7.3	5	50,000	0.7	1.6
					7	70,000	1.0	2.2
3-Way Mixing	1"	FNPT	20081	11.7	12	120,000	1.0	2.4
					17	170,000	2.1	4.8
3-Way Mixing	1¼"	FNPT	20082	18.7	19	190,000	1.0	2.3
					24	240,000	1.6	3.7
3-Way Mixing	1½"	FNPT	20083	29.3	29	290,000	1.0	2.2
					34	340,000	1.2	2.7
					38	380,000	1.7	3.8
3-Way Mixing	2"	FNPT	20084	46.8	47	470,000	1.0	2.3
					53	530,000	1.2	2.9
					59	590,000	1.3	3.0
					65	650,000	1.9	4.4

Table 10: Mixing device flow rate

Appendix E - Floor Covering R-Values

	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	3/8"	1"
Building Board								
Gypsum or Plaster Board	0.11	0.23	0.32	0.45	0.56	0.68	0.79	0.90
Plywood	0.16	0.31	0.47	0.62	0.77	0.93	1.09	1.24
Particleboard, low density	0.18	0.35	0.53	0.71	0.88	1.06	1.23	1.41
Particleboard, medium density	0.13	0.27	0.40	0.53	0.66	0.80	0.93	1.06
Particleboard, high density	0.11	0.21	0.32	0.43	0.53	0.64	0.74	0.85
Waferboard	0.20	0.40	0.60	0.80	0.99	1.19	1.39	1.59
Wood subfloor	0.16	0.31	0.47	0.62	0.78	0.93	1.09	1.24
Cement board	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24
Tile								
Ceramic Tile	0.02	0.03	0.05	0.07	0.08	0.10	0.12	0.13
Marble	0.01	0.01	0.02	0.03	0.03	0.04	0.04	0.05
Granite	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08
Slate	0.01	0.03	0.04	0.05	0.06	0.08	0.09	0.10
Linoleum or Vinyl	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40
Rubber, hard	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96
Cork Tile	0.28	0.56	0.84	1.12	1.40	1.68	1.96	2.24
Carpet Pad								
Waffled Sponge Rubber	0.20	0.41	0.61	0.81	1.01	1.22	1.42	1.62
Synthetic Jute	0.43	0.86	1.28	1.71	2.14	2.57	2.99	3.42
Bonded Urethane, 4 lb Density	0.52	1.05	1.57	2.09	2.61	3.14	3.66	4.18
Bonded Urethane, 8 lb Density	0.55	1.10	1.65	2.20	2.75	3.30	3.85	4.40
Prime Urethane, 2.2 lb Density	0.54	1.08	1.61	2.15	2.69	3.23	3.76	4.30
Carpet								
Acrylic Level Loop	0.52	1.04	1.56	2.08	2.60	3.12	3.64	4.16
Acrylic Level Loop w/Foam Back	0.51	1.02	1.53	2.04	2.55	3.06	3.57	4.08
Acrylic Plush	0.43	0.86	1.29	1.72	2.15	2.58	3.01	3.44
Polyester Plush	0.48	0.96	1.44	1.92	2.40	2.88	3.36	3.84
Nylon Level Loop	0.68	1.36	2.04	2.72	3.40	4.08	4.76	5.44
Nylon Plush	0.26	0.52	0.78	1.04	1.30	1.56	1.82	2.08
Nylon Shag	0.27	0.54	0.81	1.08	1.35	1.62	1.89	2.16
Nylon Saxony	0.44	0.88	1.32	1.76	2.20	2.64	3.08	3.52
Wool Plush	0.55	1.10	1.65	2.20	2.75	3.30	3.85	4.40
Hardwood								
Ash	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Beech	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96
Cherry	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Elm	0.14	0.28	0.42	0.56	0.70	0.84	0.98	1.12
Maple	0.13	0.26	0.39	0.52	0.65	0.78	0.91	1.04
Oak	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Cedar	0.23	0.46	0.69	0.92	1.15	1.38	1.61	1.84
Fir	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Hemlock	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44
Pine	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60
Redwood	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60
Spruce	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60
Engineered Flooring								
Laminated Parquet Flooring	0.11	0.23	0.34	0.45	0.57	0.68	0.79	0.91

Table 11: Floor covering R-values

7 Limited Warranty

7.1 Limited Warranty for Viega Heating and Cooling Solutions

Subject to the conditions and limitations in this Limited Warranty, Viega LLC (Viega) warrants to property owners in the United States with hydronic radiant heating/cooling and/or snow melt systems (the systems) properly installed by Viega trained contractors that its Viega Barrier PEX tubing, under normal conditions of use and properly maintained, will be free from failure caused by manufacturing defect for a period of thirty (30) years from date of installation.

In addition, Viega warrants that Viega PEX press metal and polymer fittings properly installed in the systems with the above listed tubing, to include protected PEX press metal and polymer fittings used in slab, will be free from failure caused by manufacturing defect for a period of thirty (30) years from date of initial installation; warrants that any accessible metal compression or metal/polyalloy crimp fittings, manifolds and panels sold by Viega and used in the systems will be free from failure caused by manufacturing defect for a period of five (5) years, and warrants that any controls, mixing stations, or electrical components sold by Viega and used in the systems will be free from failure caused by manufacturing defect for a period of two (2) years from date of initial installation.

Power tools and jaws used with press fittings are warranted by the manufacturer and Viega extends no separate warranty on those tools or jaws. Viega warrants that PEX press hand and pneumatic PEX hammer 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.

Under this limited warranty, you only have a right to reimbursement if the failure or leak resulted from a manufacturing defect in the products covered by this warranty and the failure or leak 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 any resulting damage is caused by (1) components in the systems other than those manufactured or sold by Viega or components not recommended for use in the systems (2) not installing, inspecting, or testing the products covered by this warranty in accordance with Viega's installation instructions at the time of the installation, applicable code requirements and accepted industry practices (for example, guidelines of the Radiant Professionals Alliance); (3) improper design, including determining proper heat-load of the system, or improper maintenance of the system; (4) exposure to unauthorized solvents or chemicals, antifreeze, rust inhibitor or other treatment fluids; freezing; or by failure to appropriately limit recommended water temperature levels or other misuse or abuse of the tubing in the handling of the tubing prior to or during installation or by other construction activity on the property; (5) acts of nature such as earthquakes, fire, flood, wind, or lightning.

In the event of a leak or other failure in the system, it is the responsibility of the property owner to obtain and pay for the 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 by writing to the address below or telephoning 1-800-976-9819 within thirty (30) days after the leak or other failure 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 notification, 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 the damage in order to determine whether the warranty applies. Viega will notify you in writing of the results of its 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 covered by this warranty and occurred during the first ten years of the time period covered by this warranty, Viega will reimburse the property owner for reasonable repair or replacement charges resulting from the failure or leak and, additionally will reimburse damages to personal property resulting from the failure or leak. After the first ten years of the time period covered by this warranty, the EXCLUSIVE and ONLY remedy will be reimbursement for repair and replacement of the product covered by this warranty. 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 ANY 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 of the property.

In the event that the tubing or fittings covered by this warranty are used in potable water plumbing systems, the Viega Limited Warranty for Viega PEX Water Systems will apply.

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.

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IM-HC 0621 Climate Mat (EN)

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