Viega Concrete System

Installation Manual

The global leader in plumbing, heating and pipe joining systems

viega

Welcome

By choosing to install a Viega Concrete System, you have joined the ranks of heating system installers around the world who believe there is no substitute for quality.

Viega has a history of bringing high quality and innovative technology to the hydronic marketplace.

It is the business of our engineers to research and develop complete systems that provide you the most effective and easy-to-use products available.

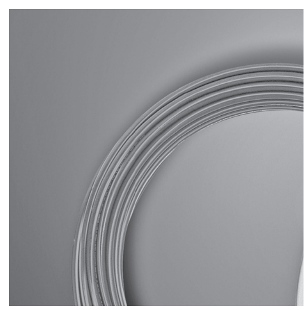
In the following pages, you will be guided through the system design, layout, installation and start-up of our ProRadiant System.

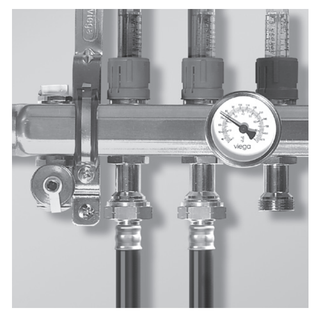
Call 877-843-4262 for your local district manager and wholesale location.

Working with Viega is the perfect solution.

Viega researches, develops and produces complete system solutions for you, our customers. The components are produced at our plants or are supplied exclusively by the finest quality manufacturers. Each of our systems is developed in-house and tested under stringent quality control conditions to guarantee safe and efficient operation.

Disclaimer: Systems should be protected from freezing at all times. Proper insulation or glycol mixture may be needed in system if not used for an extended period of the heating season.





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.***

Contents

1.1 Why Is Radiant So Comfortable

Even Heat Distribution

Ideal Heating Curve

For maximum comfort, the warmest temperature is at floor level and cooler temperatures are at head and ceiling levels. By comparing the four main heat distribution systems (see below) one can easily see that in forced air, radiators, and convective baseboard heating patterns, heat becomes trapped at the ceiling level, causing an inversion of the ideal heating pattern.

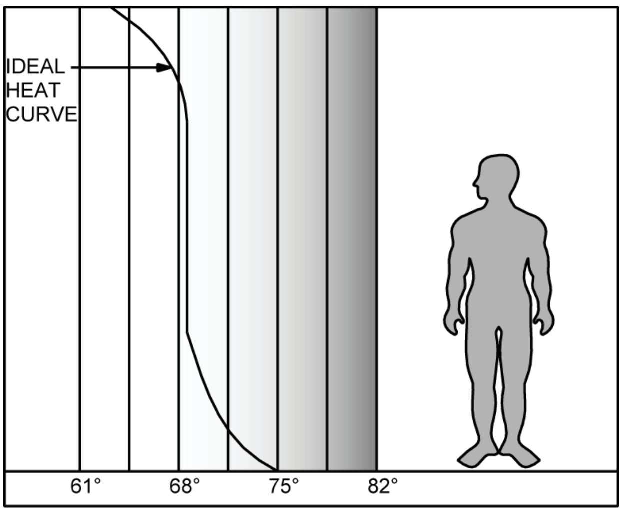


Figure 1.1a

Q: Is there energy being wasted from certain heating systems?

A: Yes, the area between the ideal heating curve and each specific heating system curve represents wasted energy, which causes higher monthly fuel bills.

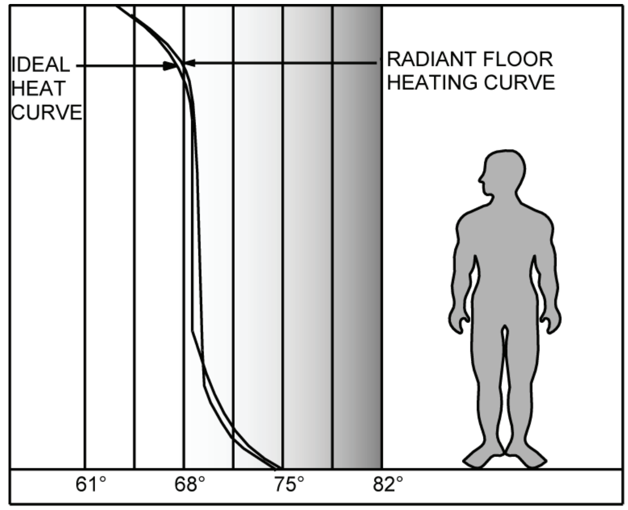


Figure 1.1b

Radiant Floor

- Entire floor surface area is in effect a low temperature radiator
- Warms other surfaces in that room and they, in turn, become heat emitters
- Has superior energy efficiency

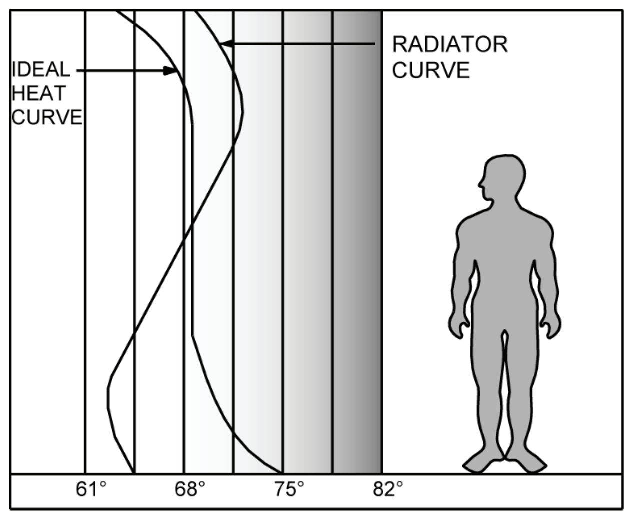


Figure 1.1c

Radiators

- Most of the heat is delivered by convection
- Operates at high water temperatures
- Creates convective warm air currents

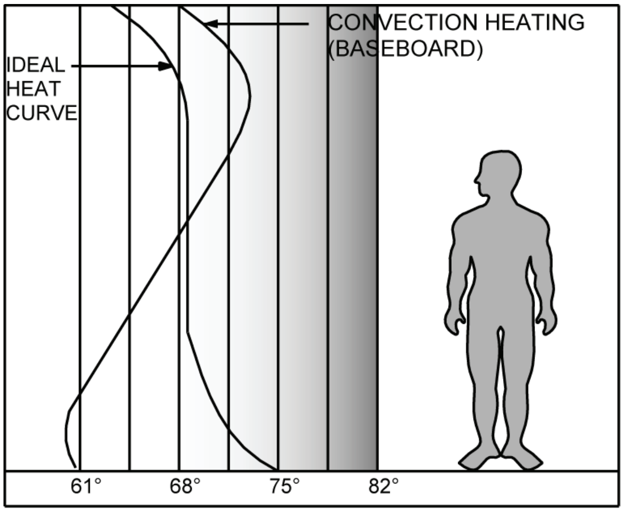


Figure 1.1d

Baseboard (natural convection)

- Has minimal surface area
- Operates at high water temperatures
- Tends to create uneven pools of warmth

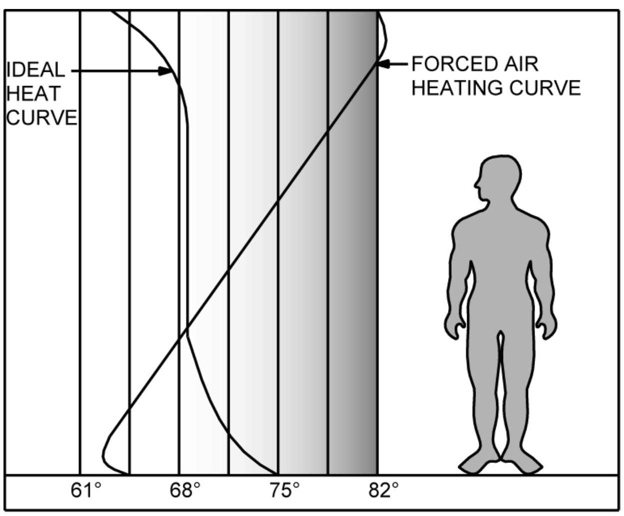


Figure 1.1e

Forced Air

- Drafts may occur
- High temperature air may be blown at occupants
- Exact opposite of the ideal heat curve, i.e. cold feet and hot head

1.2 Application Benefits

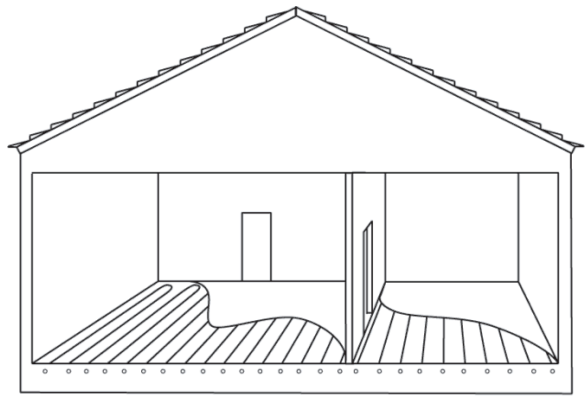


Figure 1.2a

Slab on Grade

Used in new single story slab houses

- Typical tubing spacing 9" on center.

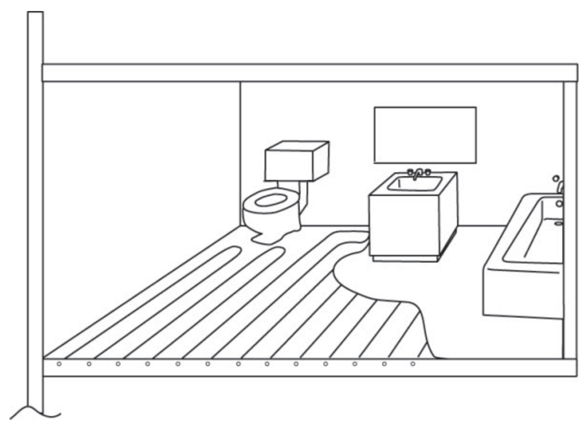


Figure 1.2b

Bathrooms/Foyers

A thin-slab (lightweight pour) is a good medium in some marble or ceramic tile finish floor applications. Thin-slabs may also be used over thick mud jobs.

- Typical tubing spacing 6" on center.

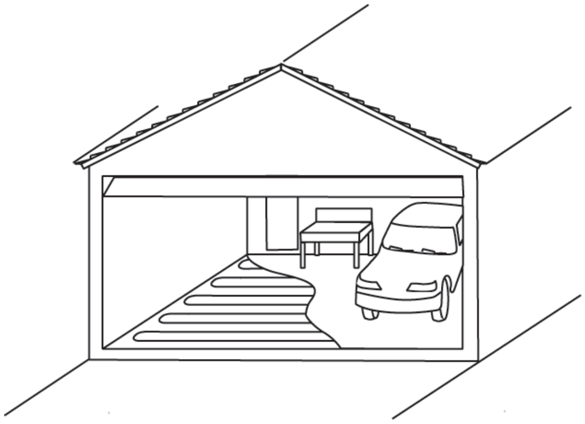


Figure 1.2c

Garages/Workshops

Ideal for heating garages. Makes working in the shop comfortable. Dries floors and cars in the wet winter weather. Helps prevent tracking unwanted snow and dirt inside in the winter.

- Typical tubing spacing 12" on center.

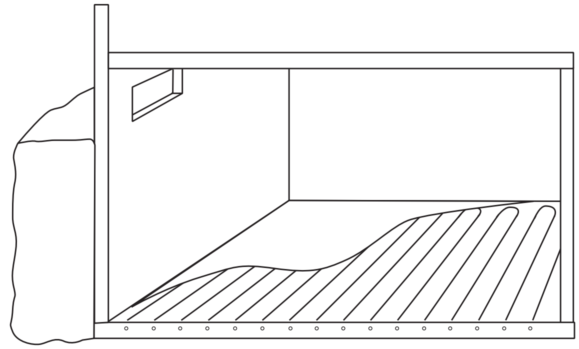


Figure 1.2d

New Basements

Radiant heating in the slab makes a more comfortable basement. It also decreases the downward heat loss through the first floor.

- Typical tubing spacing 12" on center.

2.1 Creating a Concrete System Material List

- Calculate the net heated area.
- Use table 2.1a and 2.1b to make an initial material list for the net area to be heated.

Note: This estimation does not include controls.

ViegaPEX Barrier/ FostaPEX Tubing*	Net Heated Area	Multiplier	Estimated Amount
6" Spacing		2.2	
9" Spacing		1.6	
12" Spacing		1.1	

Table 2.1a *Sizes ½", ⅝", ¾"

Fasteners*	Net Heated Area	Multiplier	Estimated Amount
6" Spacing		1.1	
9" Spacing		.75	
12" Spacing		.55	

Table 2.1b * Various fasteners available

Solutions

Remember this chart is only for estimating. The number of circuits in the area will be covered in section 3.1 Layout Planning. Installer's preference determines choice of fasteners.

Note: Changing tubing size does not necessarily give you a higher heat output (remember the floor is the main heat emitter). The larger tubing allows for longer circuit lengths (Refer to section 3.1 for maximum circuit lengths).

ViegaPEX Barrier*	Net Heated Area	Multiplier	Estimated Amount
6" Spacing	510 ft^2	2.2	1,122 ft
9" Spacing	510 ft^2	1.6	816 ft
12" Spacing	510 ft^2	1.1	561 ft

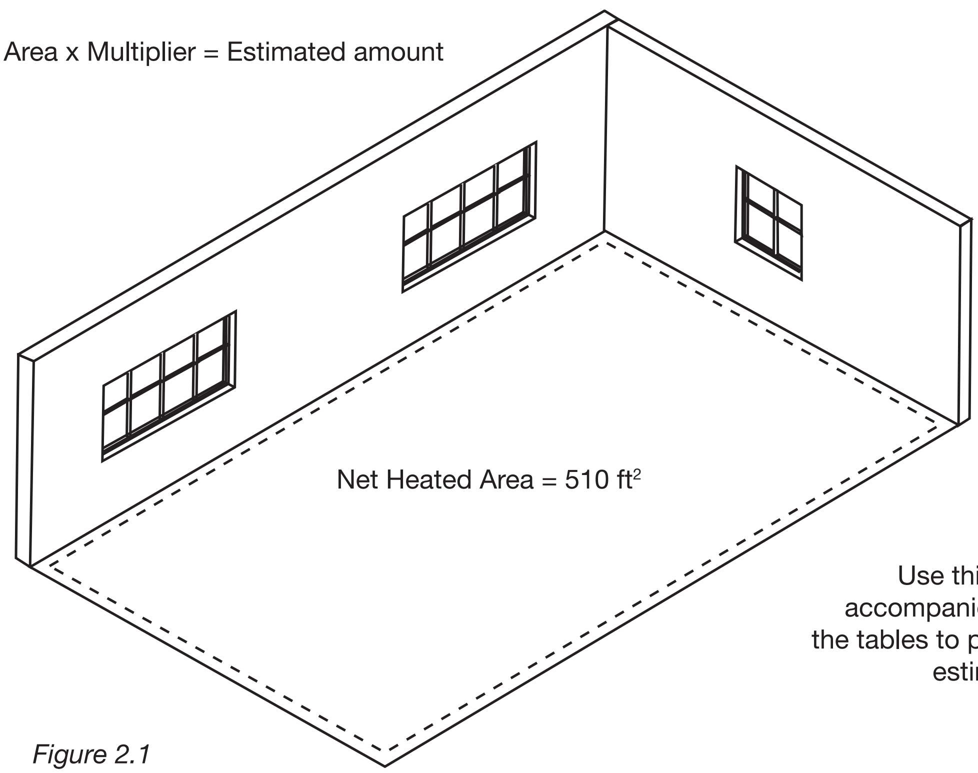
Table 2.1c *Sizes ½", ⅝", ¾"

Fasteners*	Net Heated Area	Multiplier	Estimated Amount
6" Spacing	510 ft^2	1.1	561 pc
9" Spacing	510 ft^2	.75	383 pc
12" Spacing	510 ft^2	.55	281 pc

Table 2.1d * Various fasteners available

Tubing is sold in coils and fasteners in packages

Equation:
Net Heated Area x Multiplier = Estimated amount



Use this room accompanied with the tables to practice estimating.

Figure 2.1

2.2 Heat loss calculations for floor heating systems using LoopCAD®

Viega's easy to use LoopCAD program will calculate the heat loss for any residential building. LoopCAD is based on ASHRAE fundamentals and is capable of providing a full design, while calculating a material list and quote. A free 30 day trial version is available for download at the Viega website: www.viega.us

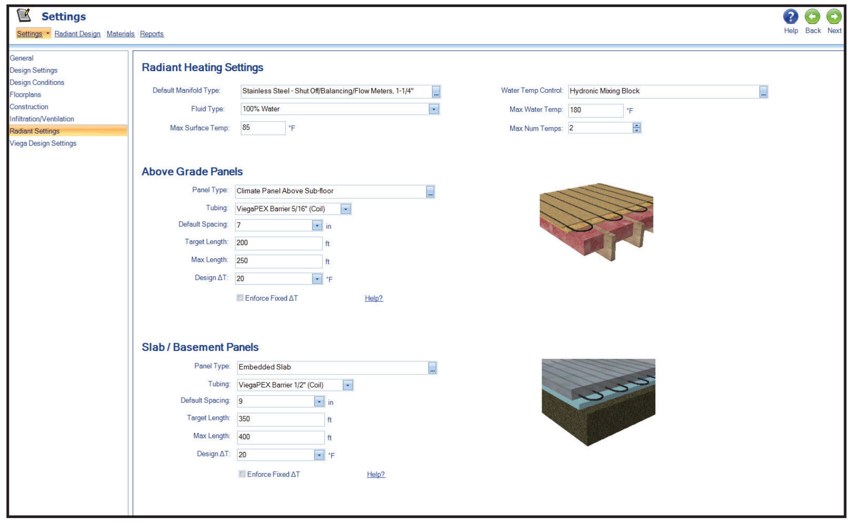


Figure 2.2

2.3 Calculating the Supply Water Temperature

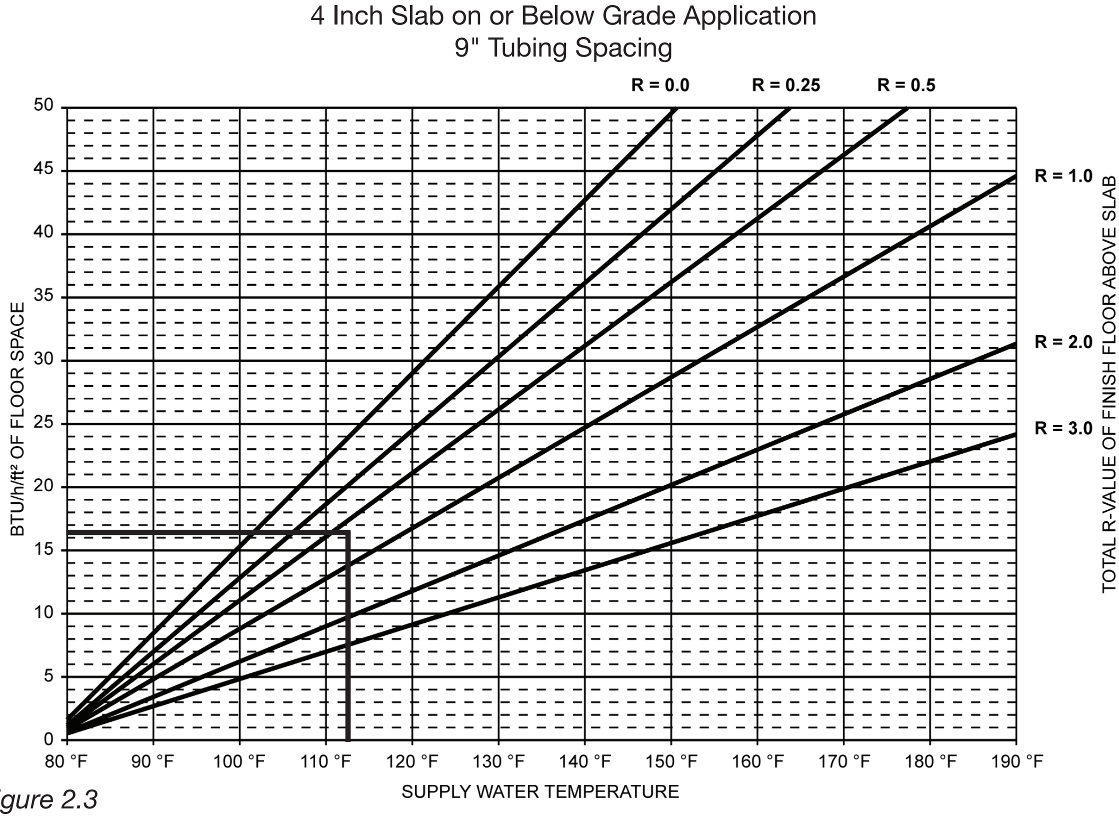


Figure 2.3

Based on 68°F room temperature with ½" ViegaPEX Barrier tubing and R-5 insulation below the slab.

Procedure:

1. Locate desired BTU output on left vertical axis.
2. Follow to the right until you reach the selected total R-value curve.
3. Then move down to the horizontal axis and read the supply water temperature.

Example:

Output needed: 20 BTU/h/ft2
Finish floor R-value: 0.25
Supply water temperature: 112°F

2.4 Calculating the Floor Surface Temperature

This chart shows the relationship between room temperature and floor surface temperature for floor heating systems.

Procedure

1. Locate required output (from Radiant Wizard or other source) on left vertical axis.
2. Follow to the right until you reach the curve.
3. Then move down to the horizontal axis and read the ΔT between the room temperature and the floor surface temperature.
4. Add the room temperature and the ΔT to get the floor surface temperature.

Example

Output needed: 25 BTU/h/ft^2
Room temperature: 68°F
ΔT (from chart): ~ 12°F
Floor surface temperature: 68°F + 12°F = 80°F

The floor surface temperature will be 80°F with 25 BTU/h/ft^2 output and 68°F room temperature.

Floor Surface Temperature Chart

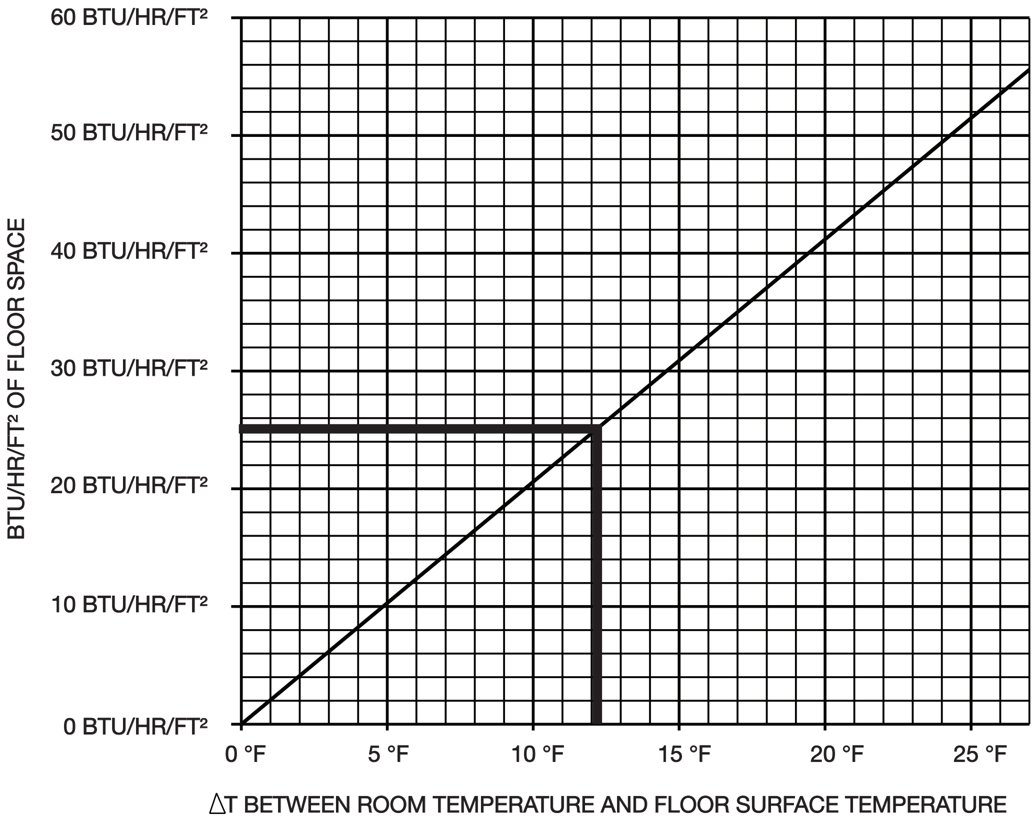


Figure 2.4

2.5 Calculating the Pressure Drop

In order to select the correct pump size for the system, the pressure drop must be calculated. Use the chart below to calculate the pressure drop.

Procedure

1. Locate desired flow rate for one circuit on the left vertical axis (from design).
2. Follow to the right until you reach the selected tubing size.
3. Then move down to the horizontal axis and read the pressure drop in feet of head per floor of tubing.
4. Multiply pressure drop per foot by length of longest circuit.

ViegaPex Barrier Tubing Data Table			
Nominal Size (in.)	**Outside Diameter (in.)**	**Inside Diameter (in.)**	**Water Content (in.)**
***5⁄16**	**0.430**	**0.292**	**0.004**
⅜	0.500	0.350	0.005
½	0.625	0.475	0.009
⅝	0.750	0.574	0.014
¾	0.875	0.671	0.018
1	1.125	0.862	0.030
1¼	1.375	1.053	0.045
1½	1.625	1.243	0.063
2	2.125	1.629	.1083

*5⁄16" used in Climate Panel installation.

Table 2.5

Example

GPM through ½" ViegaPEX Barrier tubing: 0.7 GPM
Pressure drop per foot: 0.022 ft. of head / ft.
Total pressure drop: 0.022 x 350 total ft = 7.7 ft. of head

Pressure Drop Chart

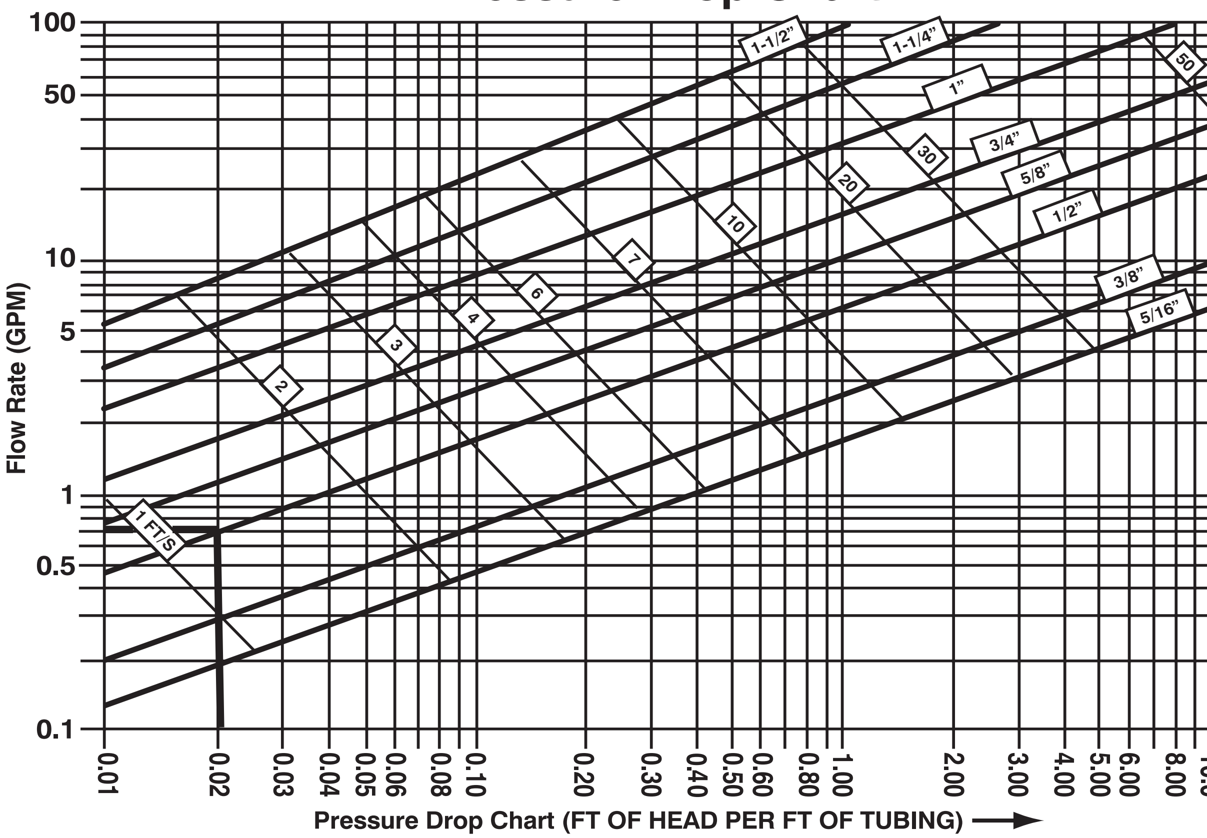


Figure 2.5

2.6 Selecting the Circulator Pump

The pump must have a capacity equal to the system flow rate and a head equal to the system pressure loss. These two system characteristics are the primary ones in selecting a pump. Flow rates come from the LoopCAD program. Pressure drop comes from section 2.5 (Calculating the Pressure Drop) or from the LoopCAD program. Remember that for pressure drop, use the highest pressure drop of all the circuits fed by their circulator. If the circulator can overcome that pressure drop, then it can overcome all the others.

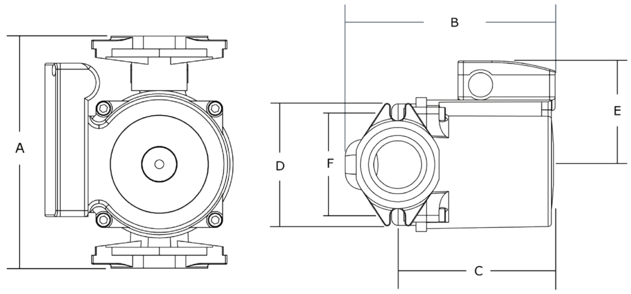


Figure 2.6a

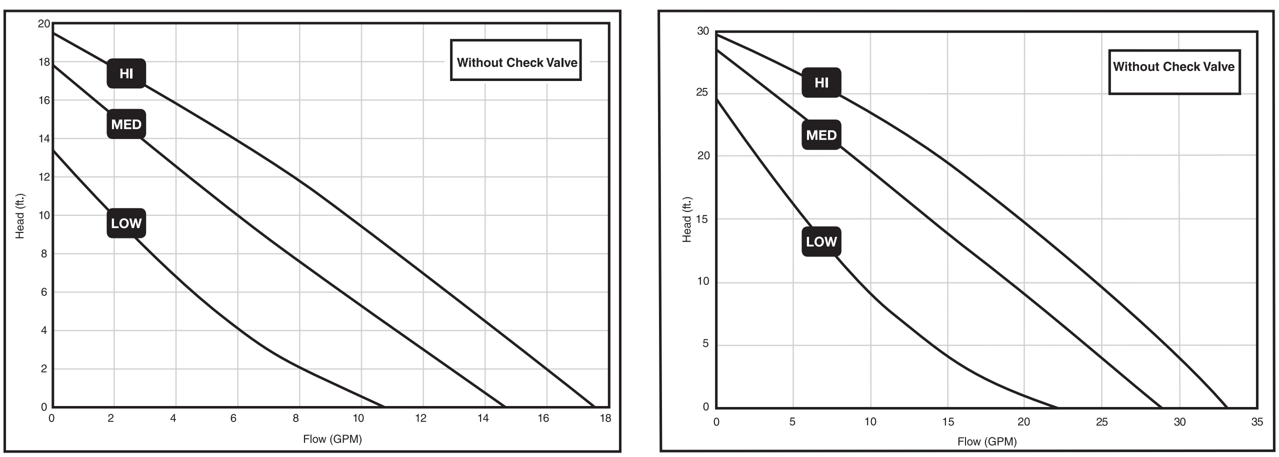
Part No.	A	B	C	D	E	F
12126	6½"	5¼"	4"	4³⁄₁₆"	3"	3⁵⁄₃₂"
12127	6½"	6"	4⅞"	3½"	3⁷⁄₁₆"	3⁵⁄₃₂"

Procedure

1. Locate the pressure drop on the left vertical axis.
2. Locate the total system flow rate on the bottom horizontal axis.
3. Follow to the intersection of both variables.
4. Select the pump with a curve higher than this point.

Example (see below)

Total GPM through ½" ViegaPEX: 5 GPM
Longest circuit pressure drop: 10 ft of head
Pump selected: Low Head Pump



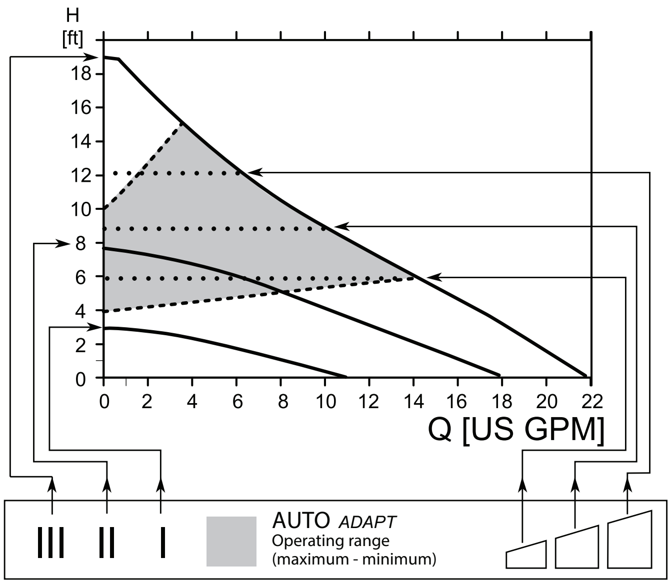
Part Number	Speed	Amps	Watts	HP
12126	HI	0.75	87	¹⁄₂₅
	MED	0.66	80	¹⁄₂₅
	LOW	0.55	60	¹⁄₂₅

Part Number	Speed	Amps	Watts	HP
12127	HI	1.8	197	⅙
	MED	1.5	179	⅙
	LOW	1.3	150	⅙

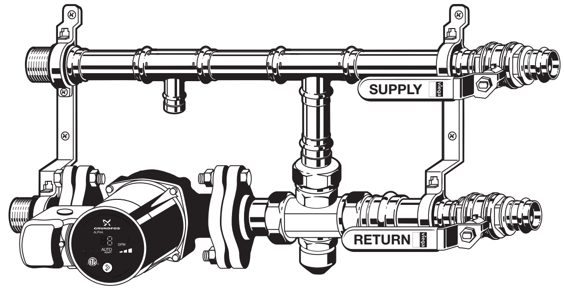
Figure 2.6b

2.7 Enhanced mixing station pump performance

Performance* and operation mode selection



*Hydraulic performance without check valve
Figure 2.7



Approximate power usage:

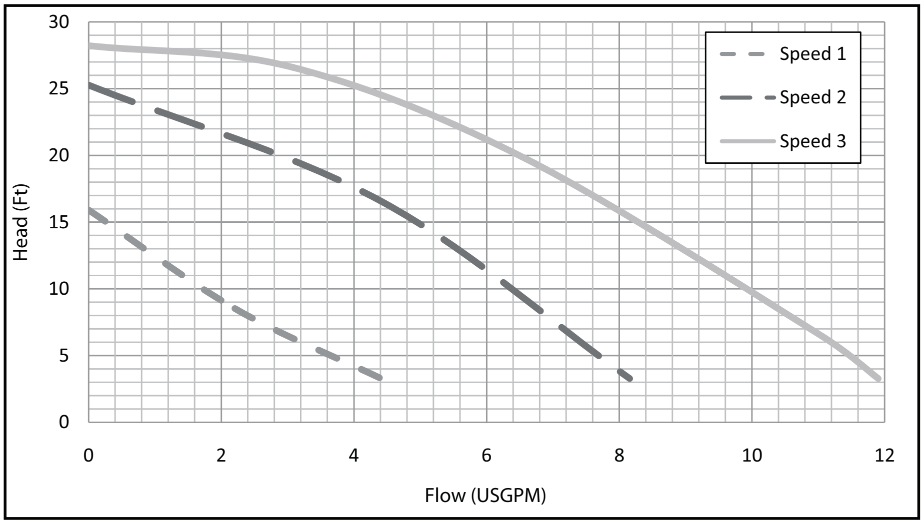
Speed setting		Min.	Max.
High fixed speed	III	39W	45W
Medium fixed speed	II	15W	30W
Low fixed speed	I	5W	8W
Constant pressure		8W	45W
Constant pressure		14W	45W
Constant pressure		22W	45W
Auto*ADAPT*	AUTO ADAPT	5W	45W

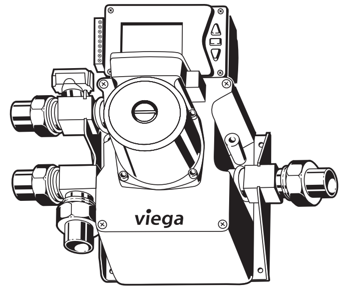
Table 2.7a

Pos.	Description
	• *Push-button for selection of pump setting* • *Every time the push-button is pressed, the circulator setting is changed*
III	**High Fixed Speed** • *Runs at a constant speed and consequently on a constant curve. In Speed III, the pump is set on the maximum curve under all operating conditions. Quick Vent of the pump can be obtained by setting the pump to Speed III for a short period.*
II	**Medium Fixed Speed** • *Runs at a constant speed and consequently on a constant curve. In Speed II, the pump is set on the medium curve under all operating conditions.*
I	**Low Fixed Speed** • *Runs at a constant speed and consequently on a constant curve. In Speed I, the pump is set on the minimum curve under all operating conditions.*
	Constant Pressure I • *The duty point of the pump will move left and right along the lowest constant-pressure curve depending on water demand in the system. The pump head (pressure) is kept constant, irrespective of the water demand.*
	Constant Pressure II • *The duty point of the pump will move left and right along the middle constant-pressure curve depending on water demand in the system. The pump head (pressure) is kept constant, irrespective of the water demand.*
	Constant Pressure III • *The duty point of the pump will move left and right along the highest constant-pressure curve depending on water demand in the system. The pump head (pressure) is kept constant, irrespective of the water demand.*
AUTO ADAPT	**AutoADAPT (Factory Setting)** • *This function controls the pump performance automatically within the defined performance range (shaded area). AutoADAPT will adjust the pump performance to system demands over time.*

Table 2.7b

2.8 Pump curve for hydronic mixing block



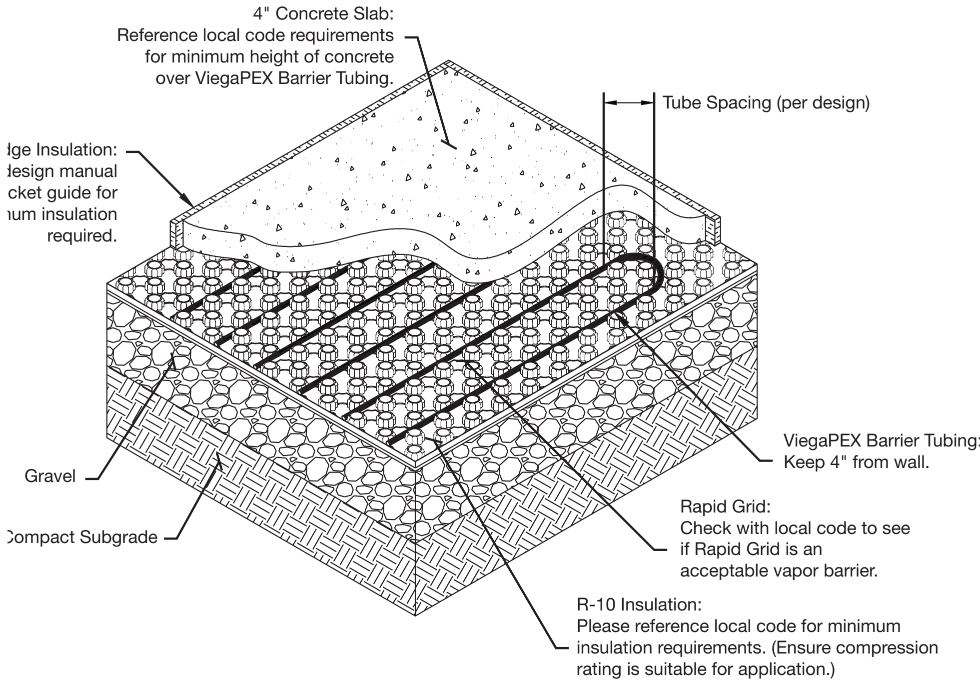


Part Number	Speed	Amps	Watts	HP
56160	3	1.12	130	1/25
	2	1.04	110	1/25
	1	0.78	80	1/25

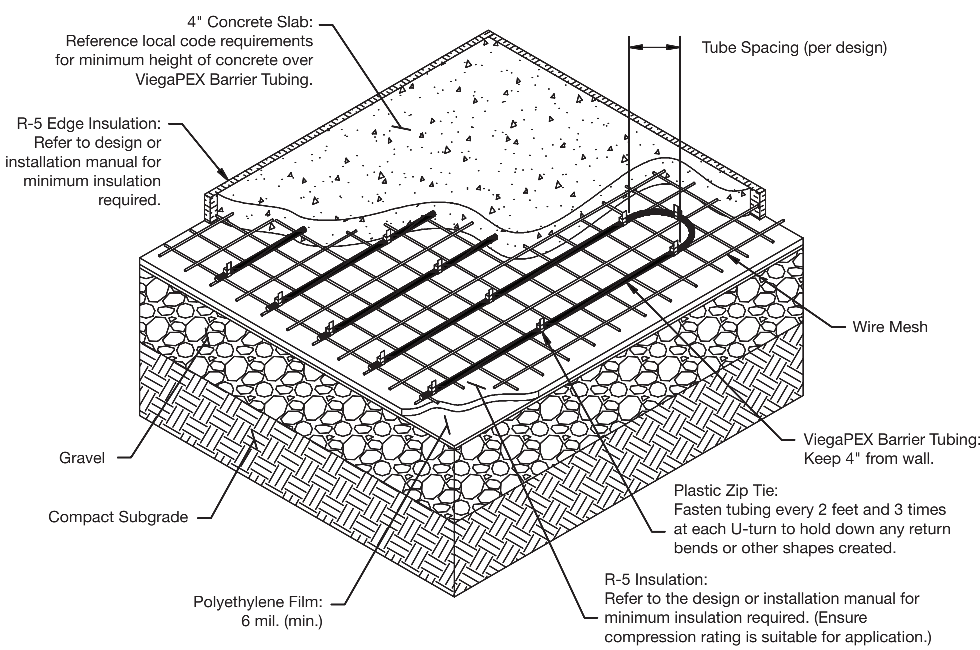
Table 2.8

2.9 Typical cross sections

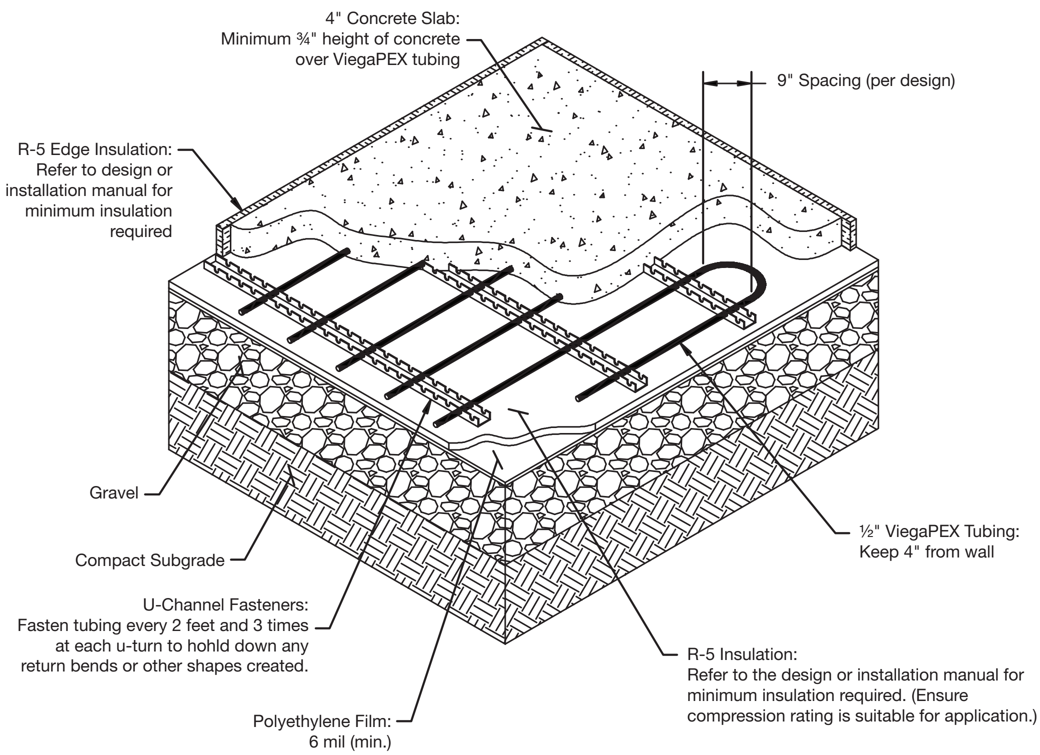
Section through slab on or below grade installation using Rapid Grid



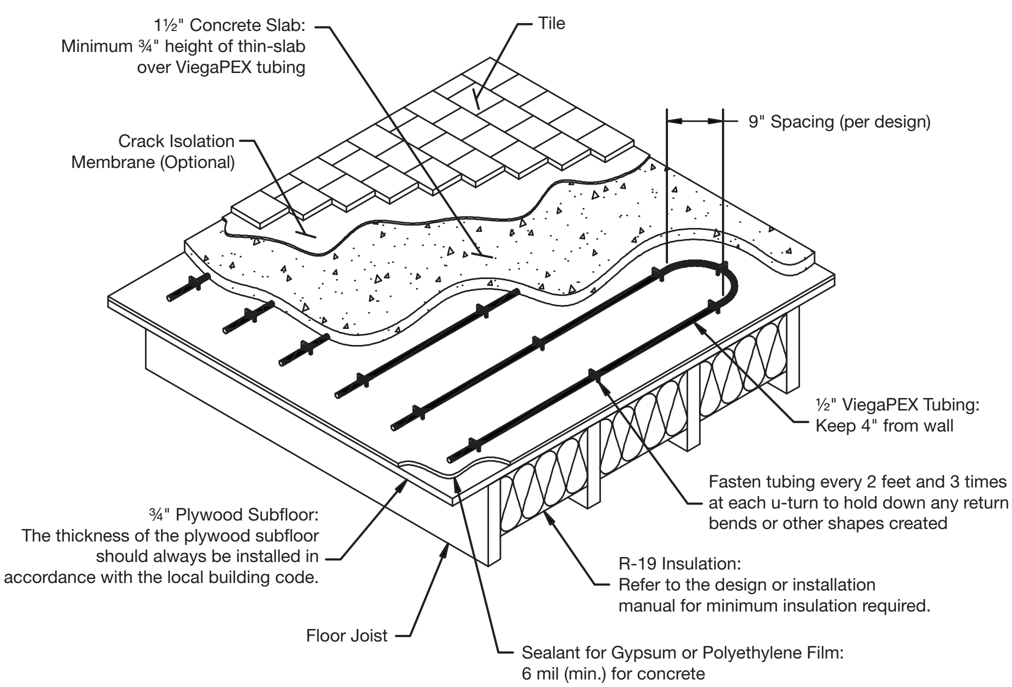
Section through slab on or below grade installation using plastic zip ties



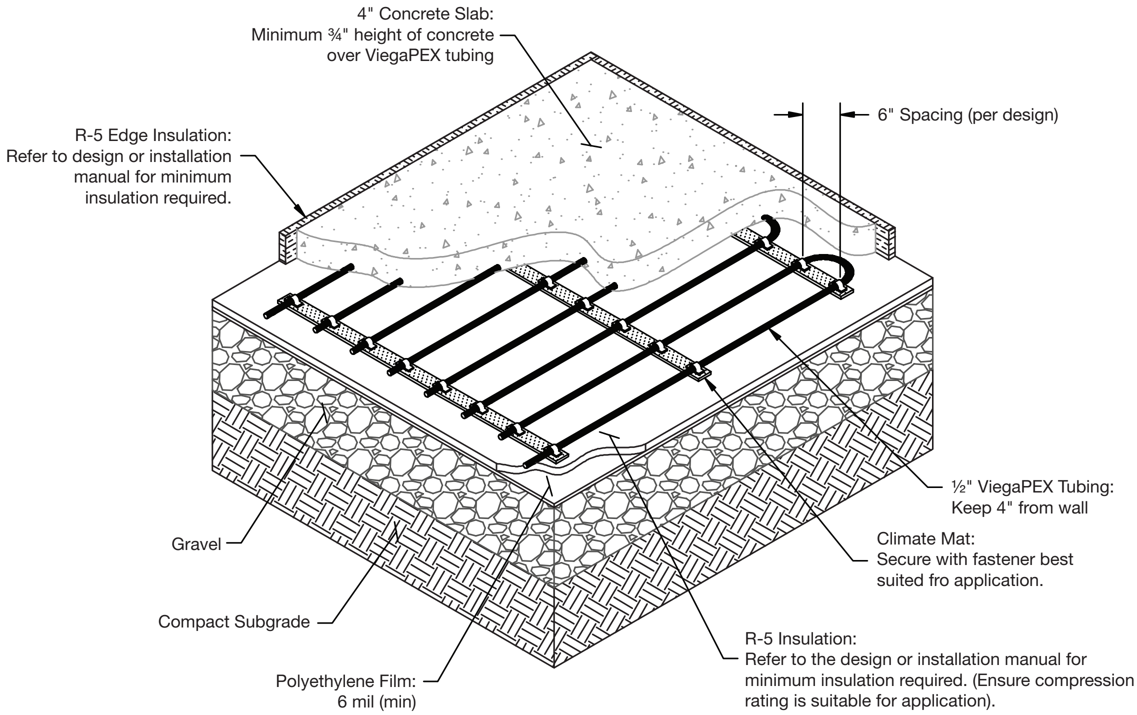
Section through slab on or below grade installation using u-channels



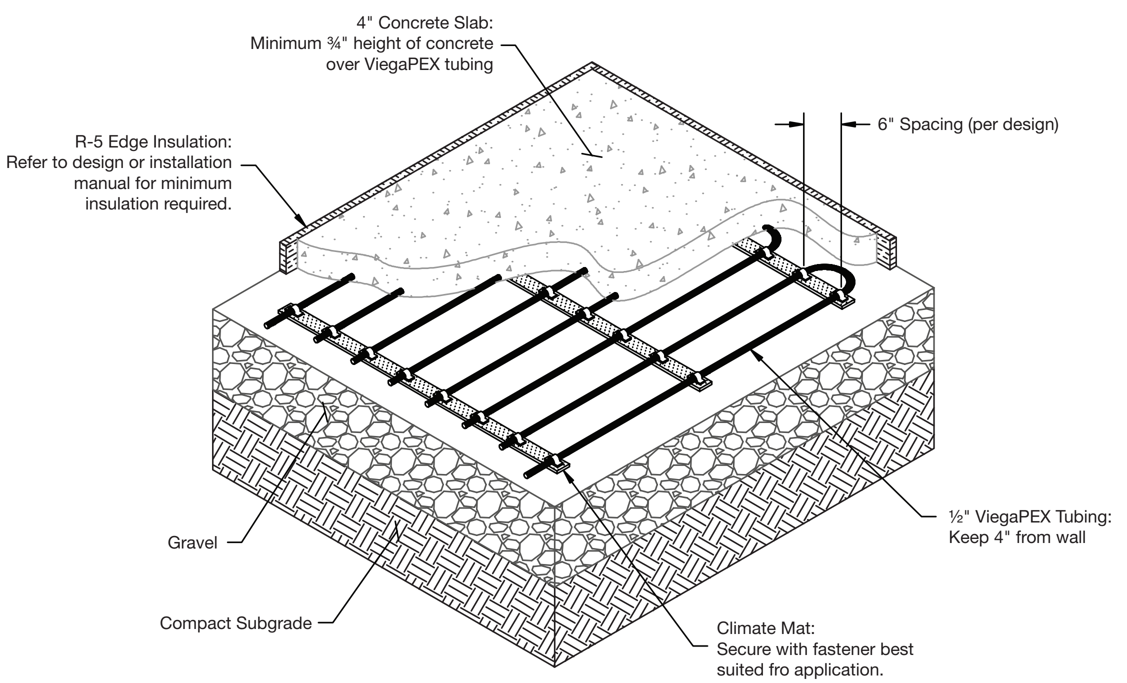
Section through thin-slab installation using plywood staples



Section through slab on or below grade installation using u-channels



Section through thin-slab installation using plywood staples



3.1 Layout Planning

To avoid waste and to have equal circuit lengths, a carefully planned layout should be done. First, determine where the manifold
should be installed. Remember the manifold must be accessible. When calculating the number of circuits, always round up. Keep the length of each circuit in the same room equal.

Maximum Circuit Length		
Tubing	≤25 Btu's / (hr x ft^2)	≥25 Btu's / (hr x ft^2)
3/8"	300'	250'
1/2"	400'	350'
5/8"	500'	450'
3/4"	600'	750'

Calculating number of circuits: Table 3.1

Total amount of tubing ÷ Maximum circuit length = # of circuits

Circuit layout patterns for hydronic radiant floor heating

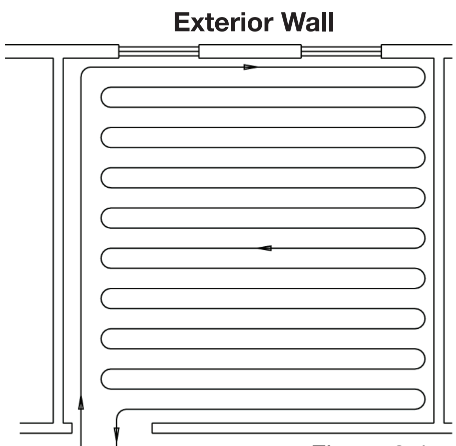


Figure 3.1a

One Wall Serpentine
Room has one exterior wall

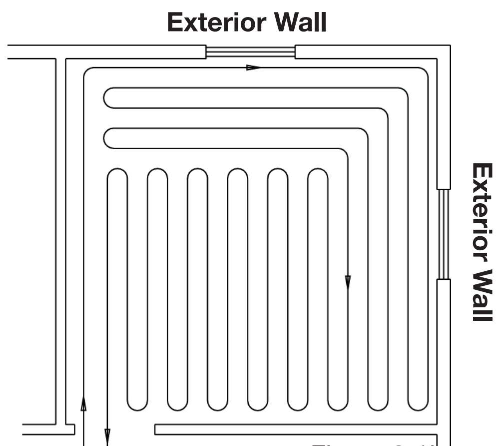


Figure 3.1b

Two Wall Serpentine
Room has two exterior walls

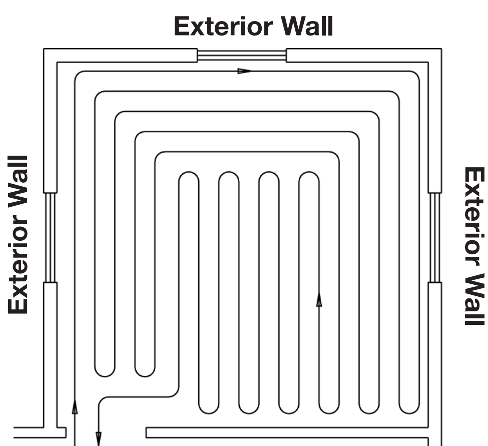


Figure 3.1c

Three Wall Serpentine
Room has three exterior walls

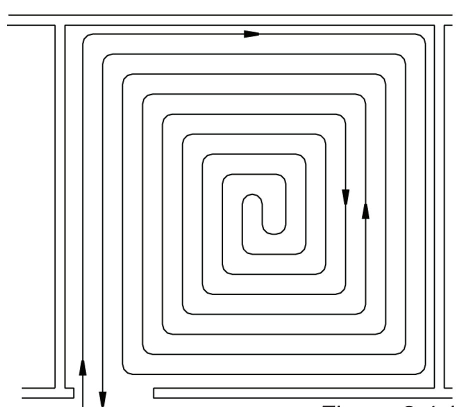


Figure 3.1d

Counter Flow
Room has no exterior walls

Manifold is located in the wall within a manifold cabinet (part number 15800, 15801, 15802)

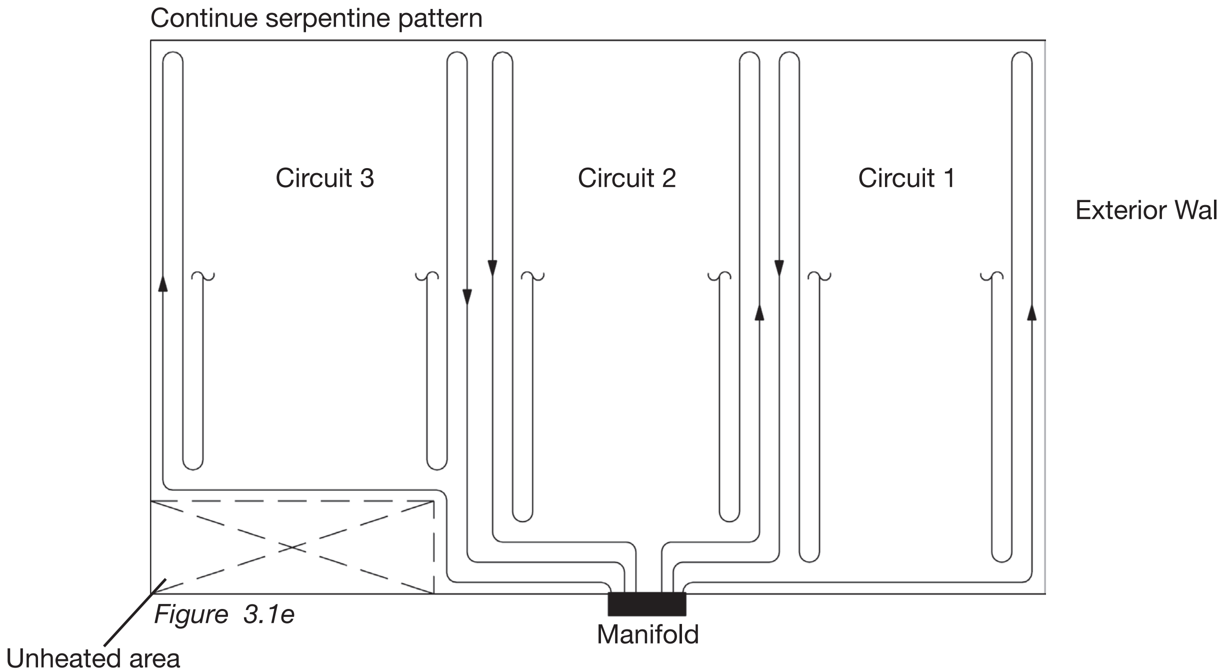


Figure 3.1e

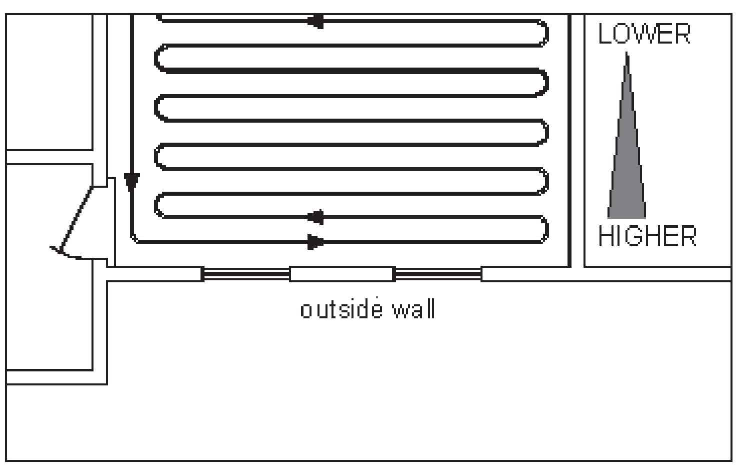


Figure 3.1f

Run supply tubing from red manifold valves into high heat loss areas first (i.e. closest to exterior walls, windows, sliders, etc.) and then into the interior of the room.

Higher water temperatures at the outside wall will provide more BTU output where it is needed.

Continue the circuits, laying them out in the same direction toward the interior of the room.

Tubing layout around joints

Concrete has very little flexibility and will almost always crack. Jointing is one of the best ways to control the inevitable. Joint location, which influences the radiant heating piping design layout is generally specified by the architect.

Typical Joint Locations

- Edge of thermal mass
- Side length 18'
- Sides less than 1:2 ratio
- Doorways
- Bays in L-shaped rooms

Isolation Joints

When installed against the concrete foundation at the perimeter of the slab, the joint material prevents the slab from bonding to the walls. It also allows the slab to expand without cracking during temperature fluctuations.

Control Joints

Control joints force cracks to follow the path of the joint. Without them, random cracks will ruin the appearance and sometimes the usefulness of the slab.

Slabs With Isolation And Control Joints

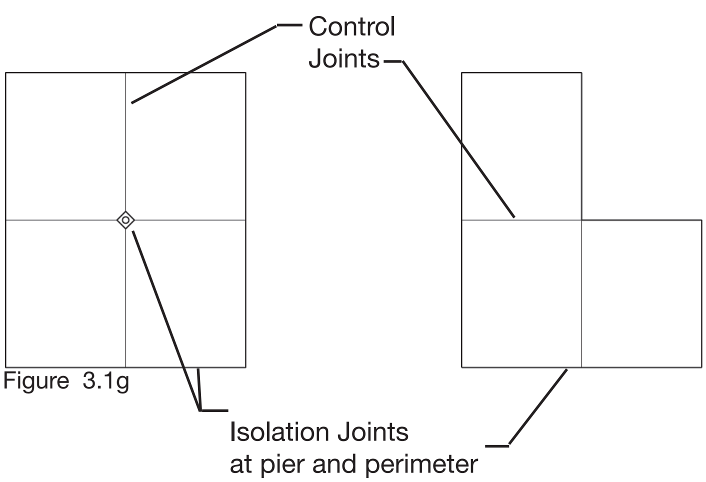


Figure 3.1g

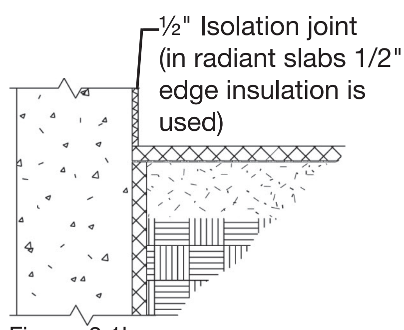


Figure 3.1h

Note:
Building or masonry supply companies sell 1/2" thick isolation joint material that is precut to the thickness of the slab.

Minimize Penetration of Joints

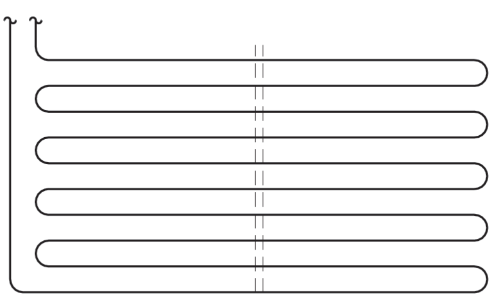


Figure 31i

Incorrect

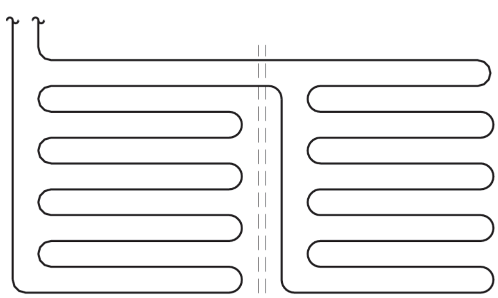


Figure 3.1j

Correct

3.2 Concrete System Installation

Step 1

Installing The Insulation

- Final grade should be accurately leveled.
- Cover grade with a polyethylene film (6 mill minimum).

Insulation Recommendations

- When high water table - required
- Perimeter insulation - required
- At the thermal break - required (Between heated and unheated slabs)
- Edge insulation - required
- In high heat loss conditions
- For small residential slabs (<2000 ft)

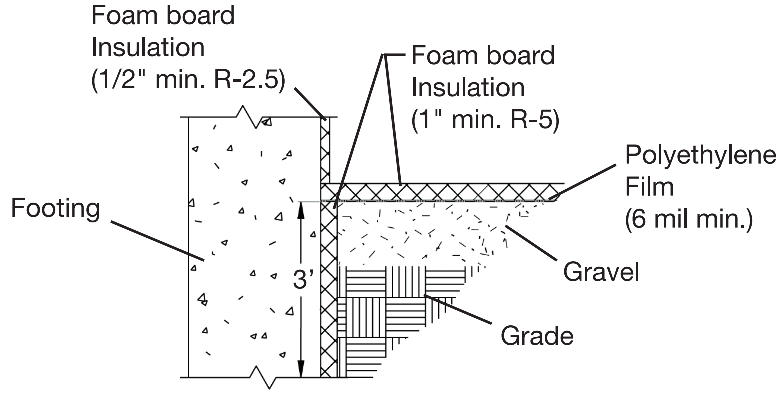


Figure 3.2a

Insulation Benefits

- Increased response time
- Increased energy savings
- Improved thermal conductivity
- Decreased downward heat loss

Note: Weigh down the foam boards to prevent wind uplift. In some jobs this can be done by installing wire mesh as soon as foam boards are placed.

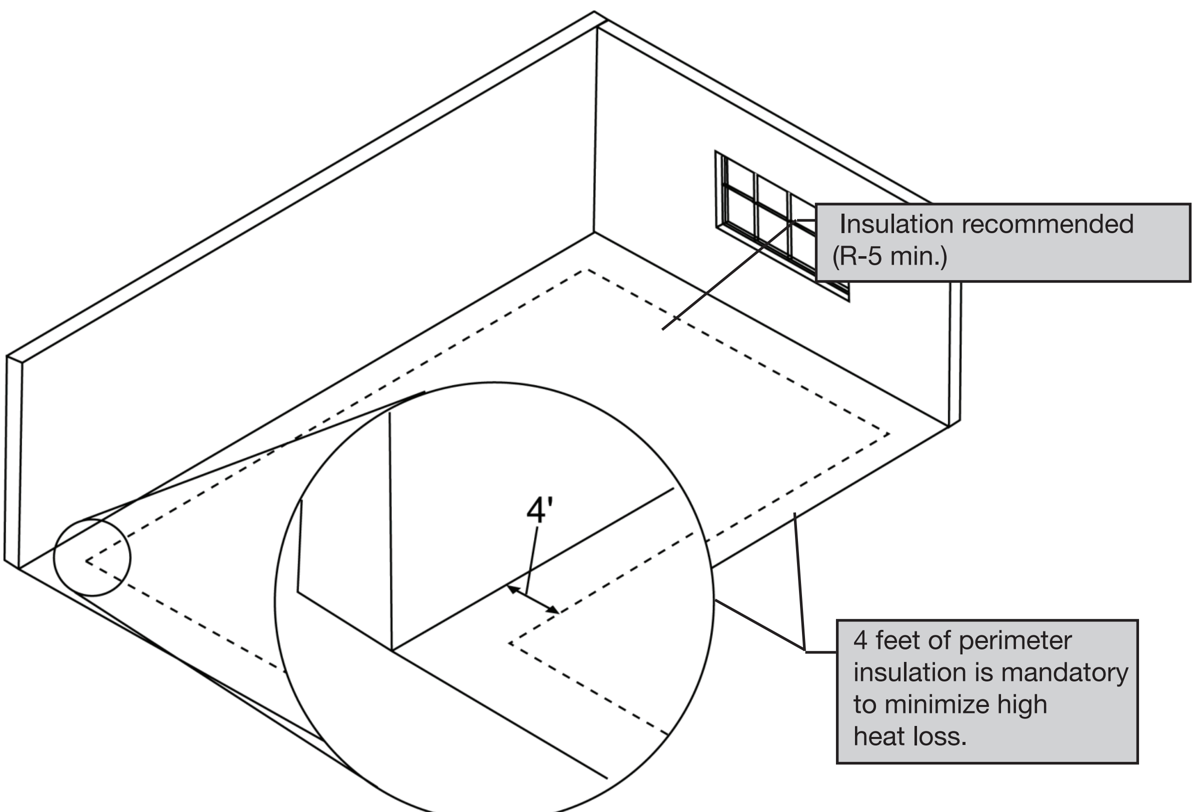


Figure 3.2b

Note: Check with local codes for requirements related to insulation.

Step 2

Installing the Tubing

Fasten tubing every two feet and three times at each u-turn to hold down any return bends or other shapes created.

It’s helpful to mark out portions of each circuit directly on the insulation using spray paint.

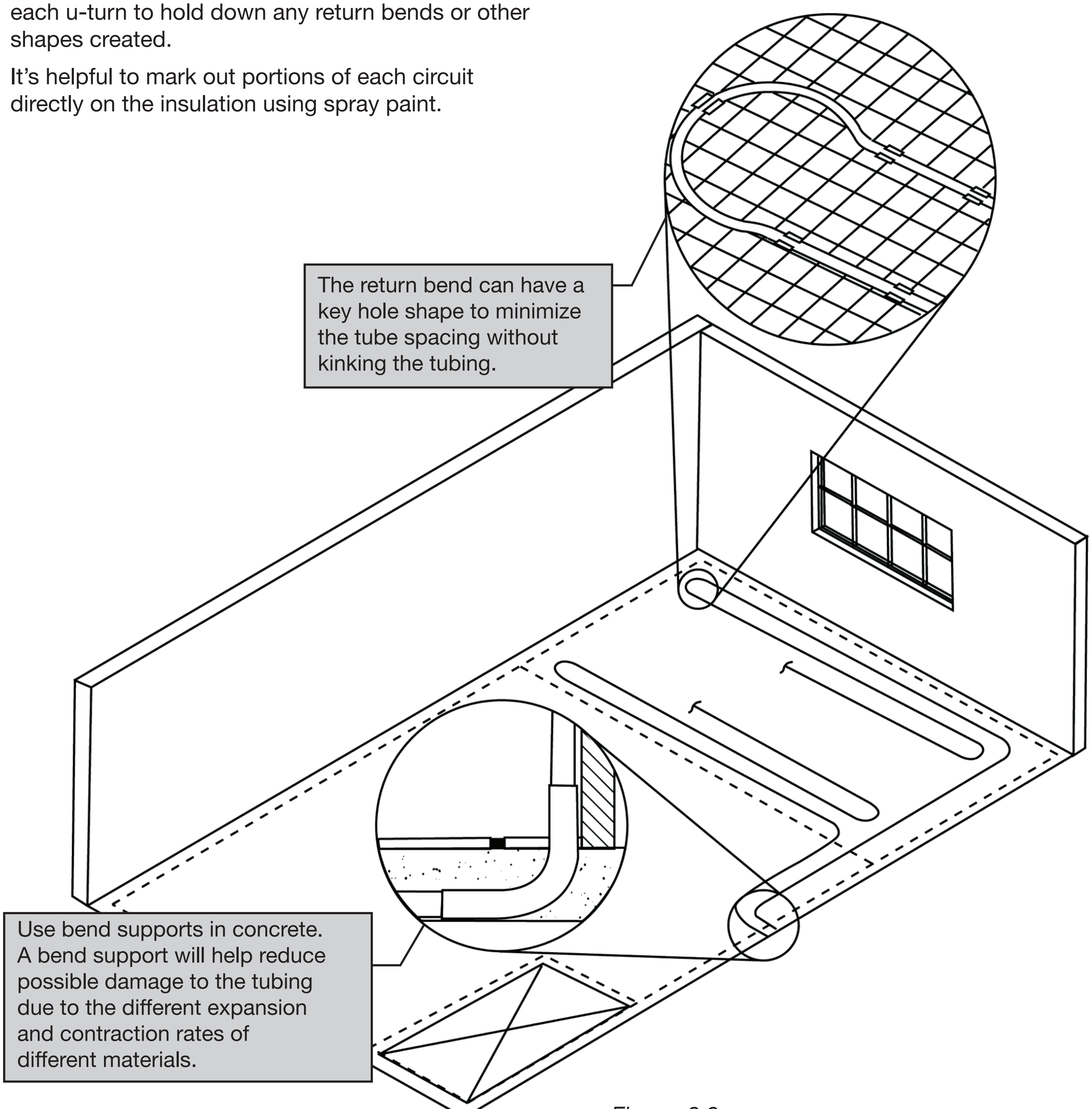


Figure 3.2c

Step 3

Pressurizing the Tubing

Pressurize tubing to 80 psi 24 hours before pour and leave pressurized until slab is cured.

Re-tighten any tubing couplings located in the slab area after at least 12 hours of system pressurization.

Step 4

Warming Up the Slab

It is best to warm the thermal mass up slowly during start-up to help prevent possible shock to the slab. In accordance with DIN 4725 section 4, Viega recommends:

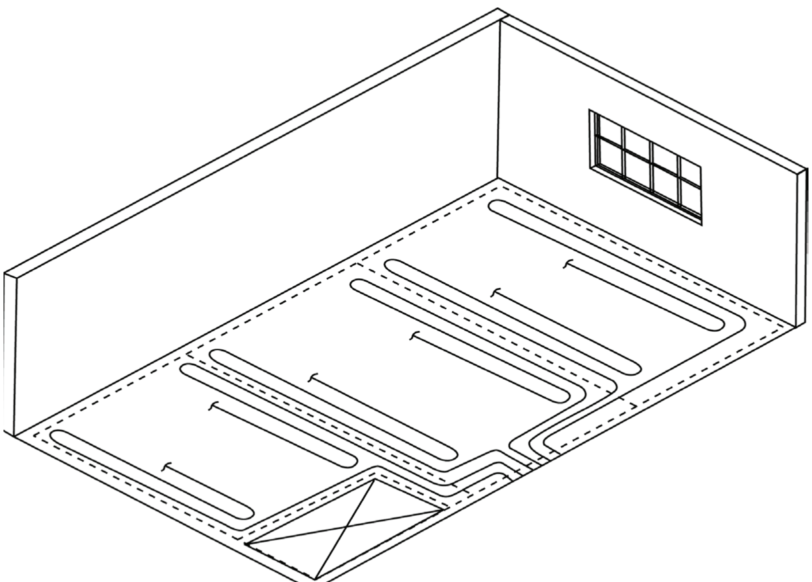
- Start warm up after concrete has reached its final set (curing complete).
- Set supply water temperature to 77°F for the first three days.
- Increase supply water temperature to the set point in gradual increments for the next four days (maximum of a 50°F increase in a period of 24 hours).
- Slab warm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

Step 5

Testing the Concrete for Excessive Moisture

The polyethylene film test: tape a one foot square of 6 mil clear polyethylene film to slab, sealing all edges with plastic moisture resistant tape. If, after 48 hours, there is no "clouding" or drops of moisture on the underside of the film, the slab can be considered dry enough for finish floor applications.

Drying times vary considerably with location, season, interior temperature/ humidity, etc. Follow the finish flooring manufacturer's recommendations.



Concrete Thin-Slabs

The following may be added to the mixture for flowability, and reduced shrinkage to minimize cracking; super plasticizer, water reducing agent, fiberglass reinforcing.

Gypsum Thin-Slabs

Gypsum Thin-Slabs are usually installed after the walls have been closed in with drywall or other finish materials. The highly flowable Gypsum mix fills in any gaps between the dry wall and the subflooring reducing air leakage and sound transmission under walls.

Note:
Some installation methods call for the Thin-Slab to be constructed before any exterior walls or interior partitions are erected.

To prevent bonding, all edges of the base plates that will be in contact with the concrete slab should be coated with a suitable release agent compatible with PEX tubing.

Use a minimum of R-19 insulation under the plywood subfloor (refer to section 2.7 Typical Cross Sections).

Note: All tubing must be pressure tested prior to and during pour. (Refer to section 4.2 Pressure Testing.)

4.1 Mixing equipment and manifolds

Hydronic mixing block includes:

- Connection fittings
- Mixing device with reset control
- 3 speed circulator (low head)
- Air vent
- Pressure temperature sensor
- Mounting bracket
- Outdoor sensor

Enhanced mixing station includes:

- Ball valves
- Circulator pump (low head)
- Diverting valve with temperature high limit
- Mounting brackets
- ECM motor technology, reduces power consumption by up to 50%
- 7 different settings
- 3 boiler connection types

Base mixing station includes:

- Ball valves
- 3 speed circulator pump (high head)
- Diverting valve with temperature high limit
- Mounting brackets
- 3 boiler connection types

1¼" Stainless manifold includes:

- 2 stainless manifold configurations
- Shut-off/balancing/flow meter
- Shut-off/balancing
- 2 - 6⅝" - Spacing brackets (for compact remote mounting)
- 2 to 12 - Outlets per manifold
- 2 to 12 - Flow meters / balancing valves on supply header for flow adjustment from 0-2 GPM
- 2 to 12 - Shut-off valves on return manifold designed to receive powerheads (part number 15061, 15070; 2 wire powerhead & part number 15064, 15069 4 wire powerhead)
- Built-in purge valves and air bleeders
- 1¼" NPT union connections
- 1" NPT removable end caps

4.2 Single temperature radiant system

To modulate system fluid temperature as the outdoor temperature changes (outdoor reset) Viega has a couple of options:

- The hydronic mixing block may be selected to incorporate mixing, control and outdoor reset in one easy to install package.
- The basic heating control may be used in conjunction with a mixing station to modulate system fluid temperature based on outdoor temperature.

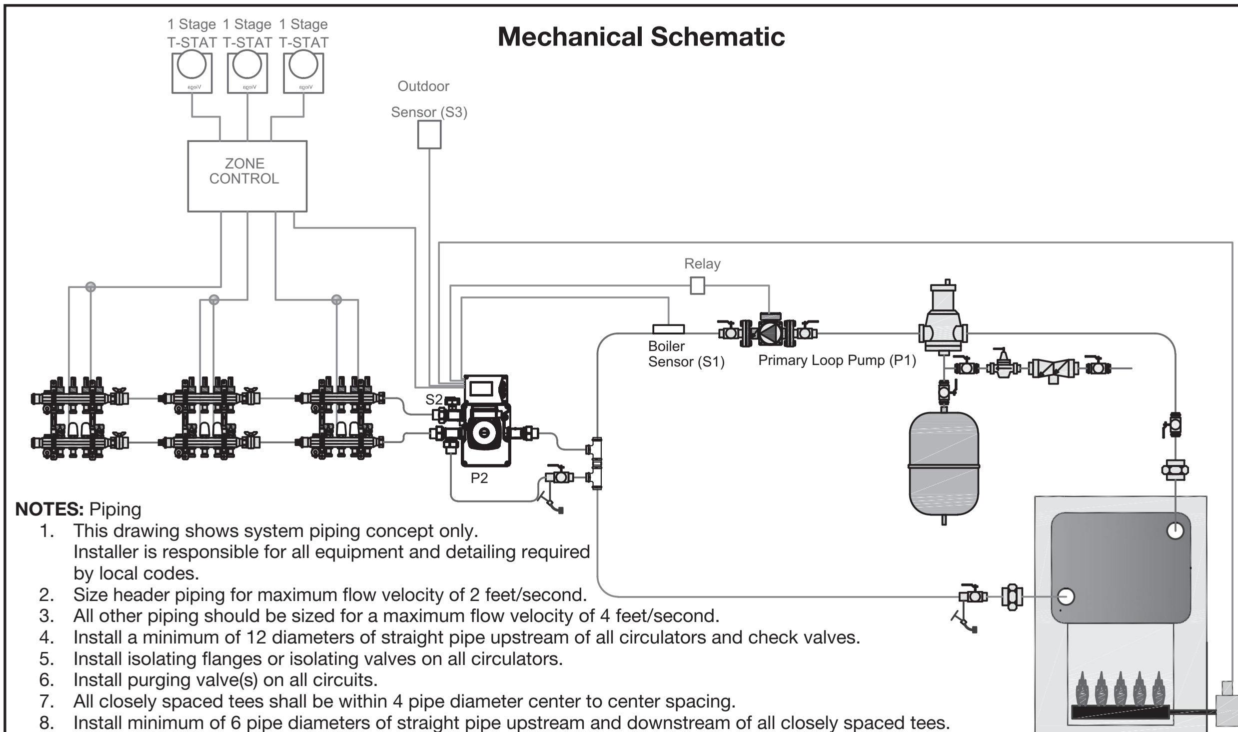
Single or multiple zones can be used by adding thermostats, zone controls, zone valves and or powerheads as necessary.

Material	Quantity	Part Number
Mixing Station	1	12121 - 12123 - 12125
Enhanced Mixing Station	1	12151 - 12152 - 12153
Hydronic Mixing Block	1	56160
Basic Heating Control	1	16015
Indoor Sensor	1	16016
Three Position Actuator for Station	1	18003
1¼" Stainless Manifold, # Outlets*	1	15900-15910 15700-15710

*Based on job requirements

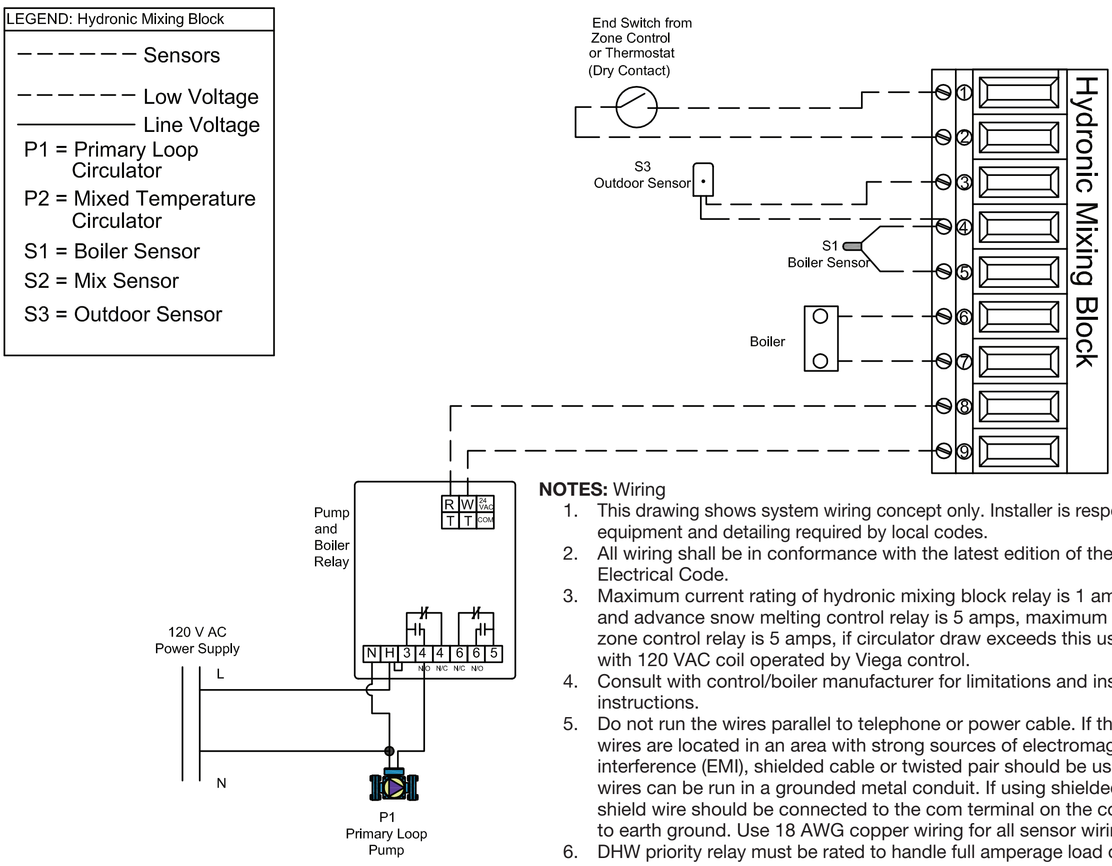
Primary Loop Sizing*		
Copper Pipe Size (inches)	Flow Rate (GPM)	Heat Carrying Capacity (BTU/h)
¾	4	40,000
1	8	80,000
1¼	14	140,000
1½	22	220,000
2	45	450,000

Single Temperature: Hydronic Mixing Block



NOTES: Piping
1. This drawing shows system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. Size header piping for maximum flow velocity of 2 feet/second.
3. All other piping should be sized for a maximum flow velocity of 4 feet/second.
4. Install a minimum of 12 diameters of straight pipe upstream of all circulators and check valves.
5. Install isolating flanges or isolating valves on all circulators.
6. Install purging valve(s) on all circuits.
7. All closely spaced tees shall be within 4 pipe diameter center to center spacing.
8. Install minimum of 6 pipe diameters of straight pipe upstream and downstream of all closely spaced tees.
9. Differential pressure bypass valve prevents flow noise under partial load conditions (some zone valves closed).
10. Set differential pressure bypass valve to delta P of distribution system with all zones open + 1 psi.
11. Not all components may be required depending on control strategy (i.e. constant circulation).

Electrical Schematic

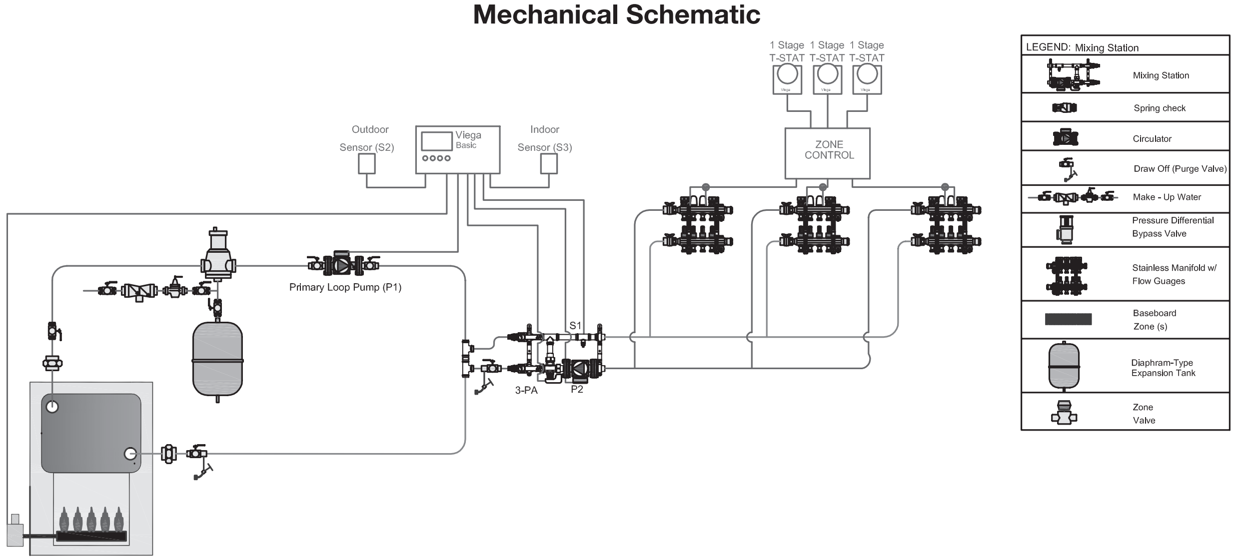


NOTES: Wiring

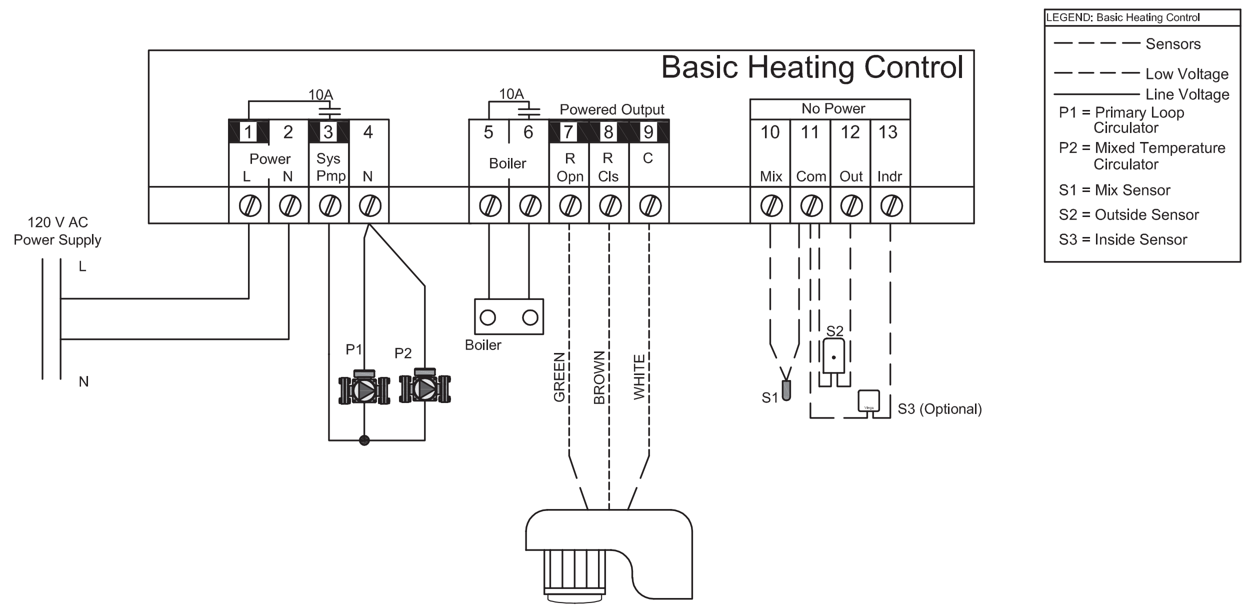
1. This drawing shows system wiring concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All wiring shall be in conformance with the latest edition of the National Electrical Code.
3. Maximum current rating of hydronic mixing block relay is 1 amps, basic and advance snow melting control relay is 5 amps, maximum current rating zone control relay is 5 amps, if circulator draw exceeds this use pilot relay with 120 VAC coil operated by Viega control.
4. Consult with control/boiler manufacturer for limitations and installation instructions.
5. Do not run the wires parallel to telephone or power cable. If the sensor wires are located in an area with strong sources of electromagnetic interference (EMI), shielded cable or twisted pair should be used or the wires can be run in a grounded metal conduit. If using shielded cable, the shield wire should be connected to the com terminal on the control and not to earth ground. Use 18 AWG copper wiring for all sensor wiring.
6. DHW priority relay must be rated to handle full amperage load of zone circulator relay center.
7. Other configurations are possible, but all space heating zone circulators must turn off when DHW mode is on or heat source needs to be sized for multiple loads.

Single Temperature: Basic Heating Control

Mechanical Schematic



Electrical Schematic



4.3 Multiple temperature radiant system

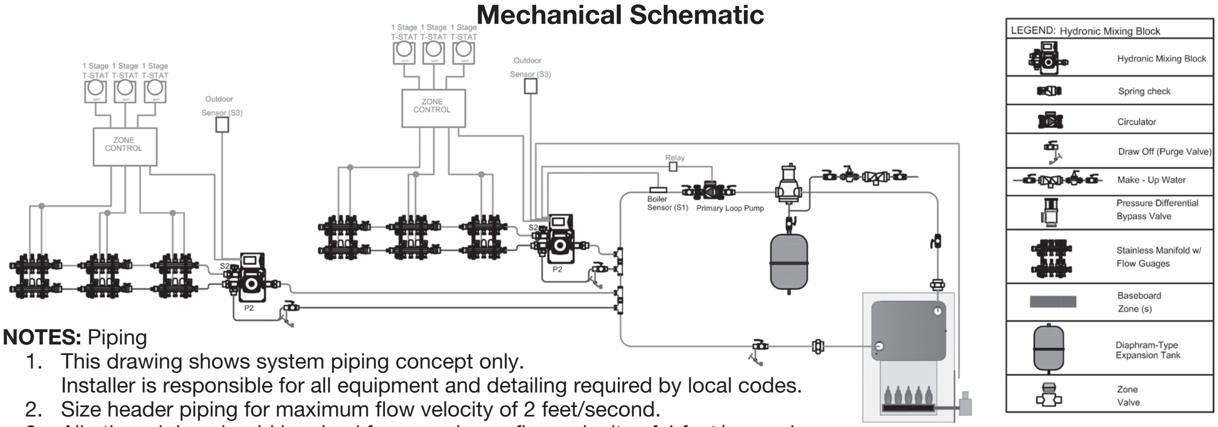
NOTE: If the heat loss and required water temperature varies throughout a building, a multiple water temperature system may be required. To add an additional temperature system, pipe in another hydronic mixing block or mixing station with the necessary controls.

Material	Quantity	Part Number
Mixing Station	2	12121 - 12123 - 12125
Enhanced Mixing Station	2	12151 - 12152 - 12153
Hydronic Mixing Block	2	56160
Basic Heating Control	2	16015
Indoor Sensor	2	16016
Three Position Actuator for Station	2	18003
1¼" Stainless Manifold, # Outlets*	2	15900-15910 15700-15710
Zone Control	2	18060 - 18062
Thermostats	*	18050 - 15116 - 15117 - 15118
Powerheads	*	15061 - 15064 - 15069 - 15070

*Based on job requirements

Multiple Temperature: Hydronic Mixing Block

Mechanical Schematic



NOTES: Piping

1. This drawing shows system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. Size header piping for maximum flow velocity of 2 feet/second.
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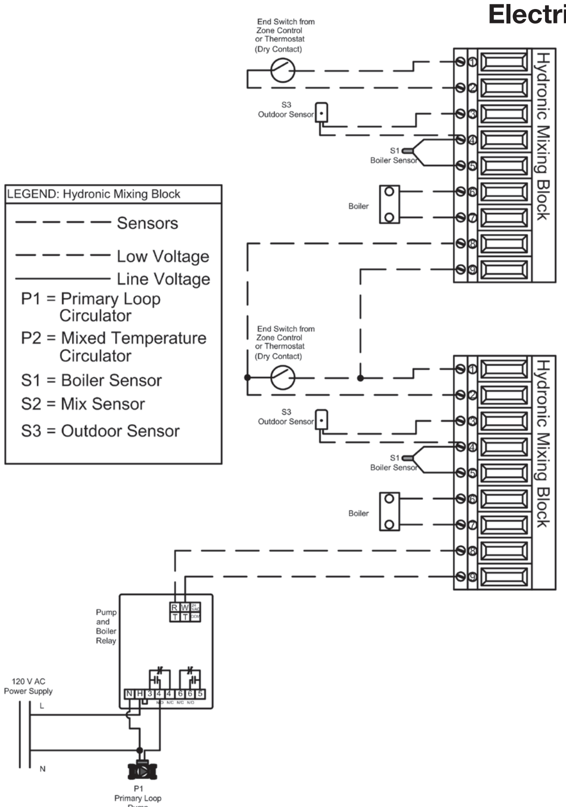
4. Install a minimum of 12 diameters of straight pipe upstream of all circulators and check valves.
5. Install isolating flanges or isolating valves on all circulators.
6. Install purging valve(s) on all circuits.
7. All closely spaced tees shall be within 4 pipe diameter center to center spacing.
8. Install minimum of 6 pipe diameters of straight pipe upstream and downstream of all closely spaced tees.
9. Differential pressure bypass valve prevents flow noise under partial load conditions (some zone valves closed).
10. Set differential pressure bypass valve to delta P of distribution system with all zones open + 1 psi.
11. Not all components may be required depending on control strategy (i.e. constant circulation).

Electrical Schematic



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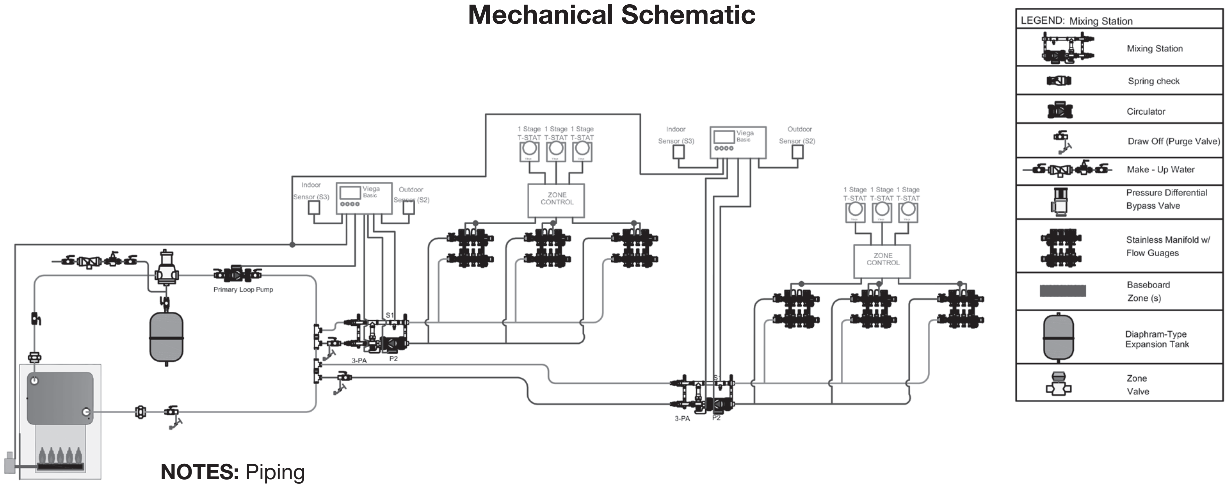
4. Consult with control/boiler manufacturer for limitations and installation instructions.
5. Do not run the wires parallel to telephone or power cable. If the sensor wires are located in an area with strong sources of electromagnetic interference (EMI), shielded cable or twisted pair should be used or the wires can be run in a grounded metal conduit. If using shielded cable, the shield wire should be connected to the com terminal on the control and not to earth ground. Use 18 AWG copper wiring for all sensor wiring.
6. DHW priority relay must be rated to handle full amperage load of zone circulator relay center.
7. Other configurations are possible, but all space heating zone circulators must turn off when DHW mode is on or heat source needs to be sized for multiple loads.

Multiple Temperature: Basic Heating Control

Mechanical Schematic



NOTES: Piping

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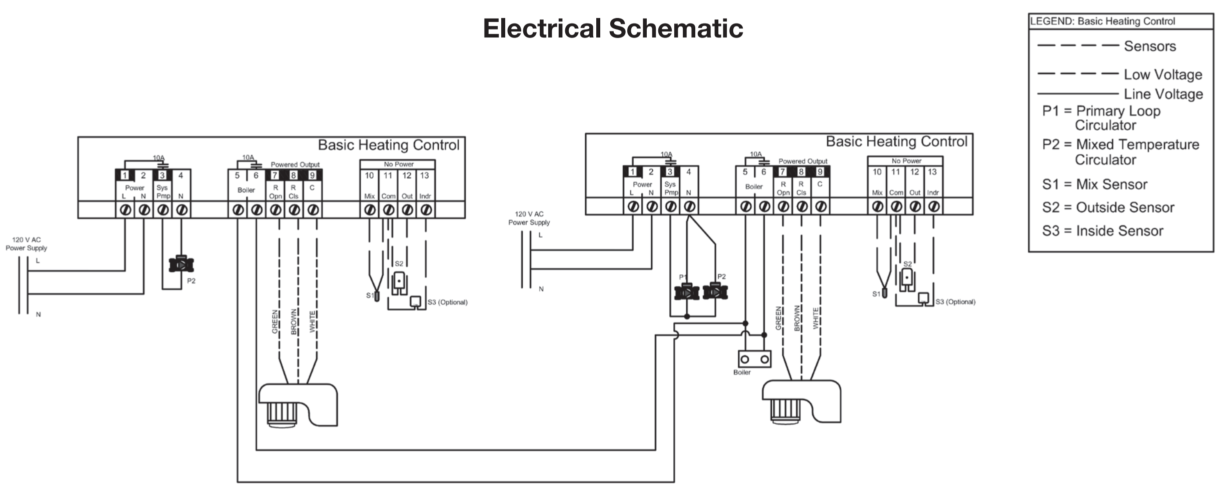
11. Not all components may be required depending on control strategy (i.e. constant circulation).

Electrical Schematic



NOTES: Wiring

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6. DHW priority relay must be rated to handle full amperage load of zone circulator relay center.
7. Other configurations are possible, but all space heating zone circulators must turn off when DHW mode is on or heat source needs to be sized for multiple loads.

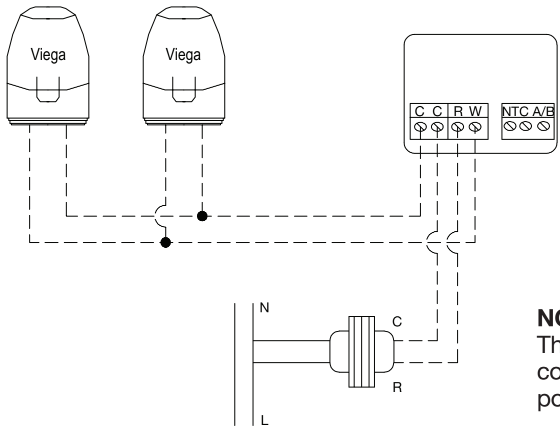
4.4 Zone wiring

A manifold system allows any one or more of the circuits to be adapted for control by a thermostat. The following are typical zone wiring schematics.

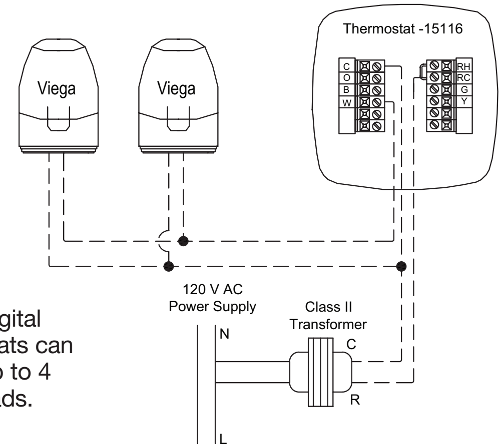
Detailed wiring diagrams are provided with products.

Important Note:
Installation by a licensed electrician is recommended. Installation and use of this equipment should be in accordance with provisions of the U.S. National Electric Code, applicable local code and pertinent industry standards.

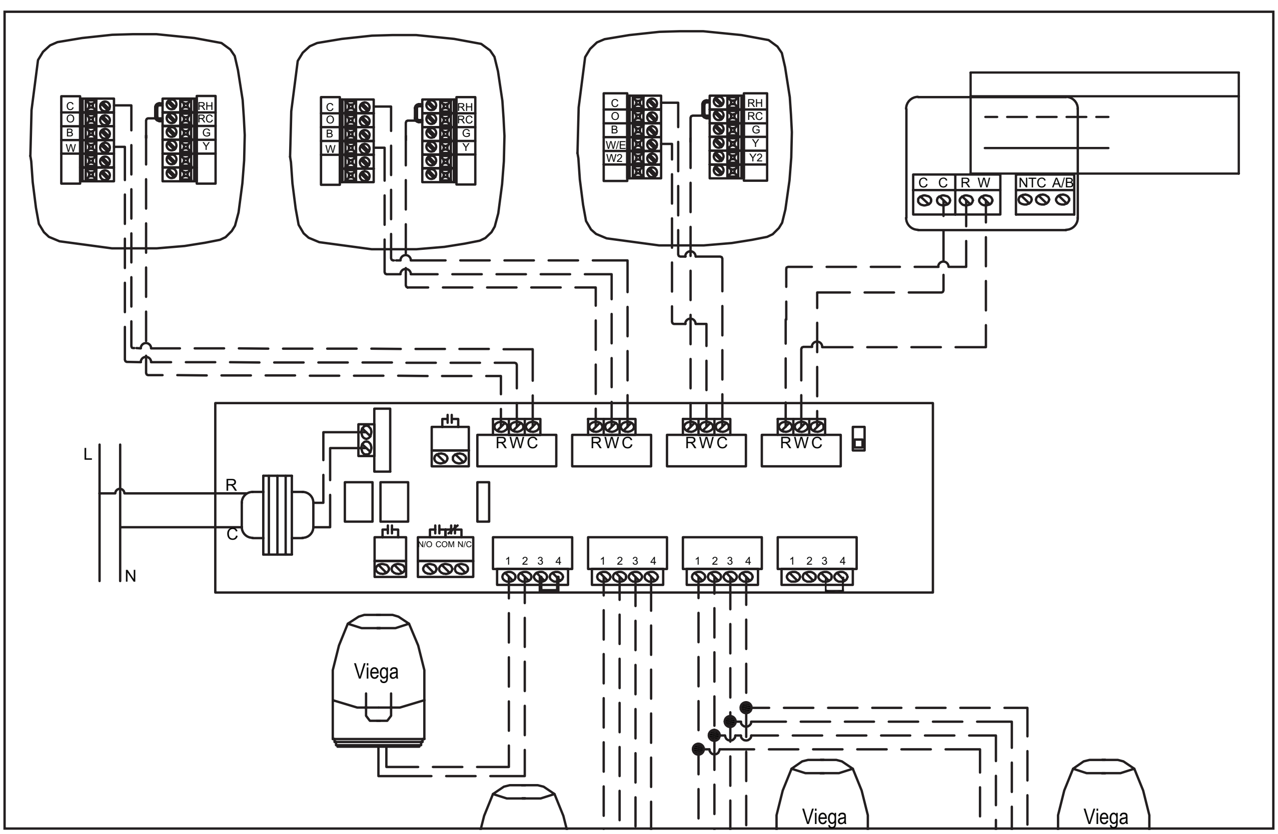
Wiring schematic: One-zone application



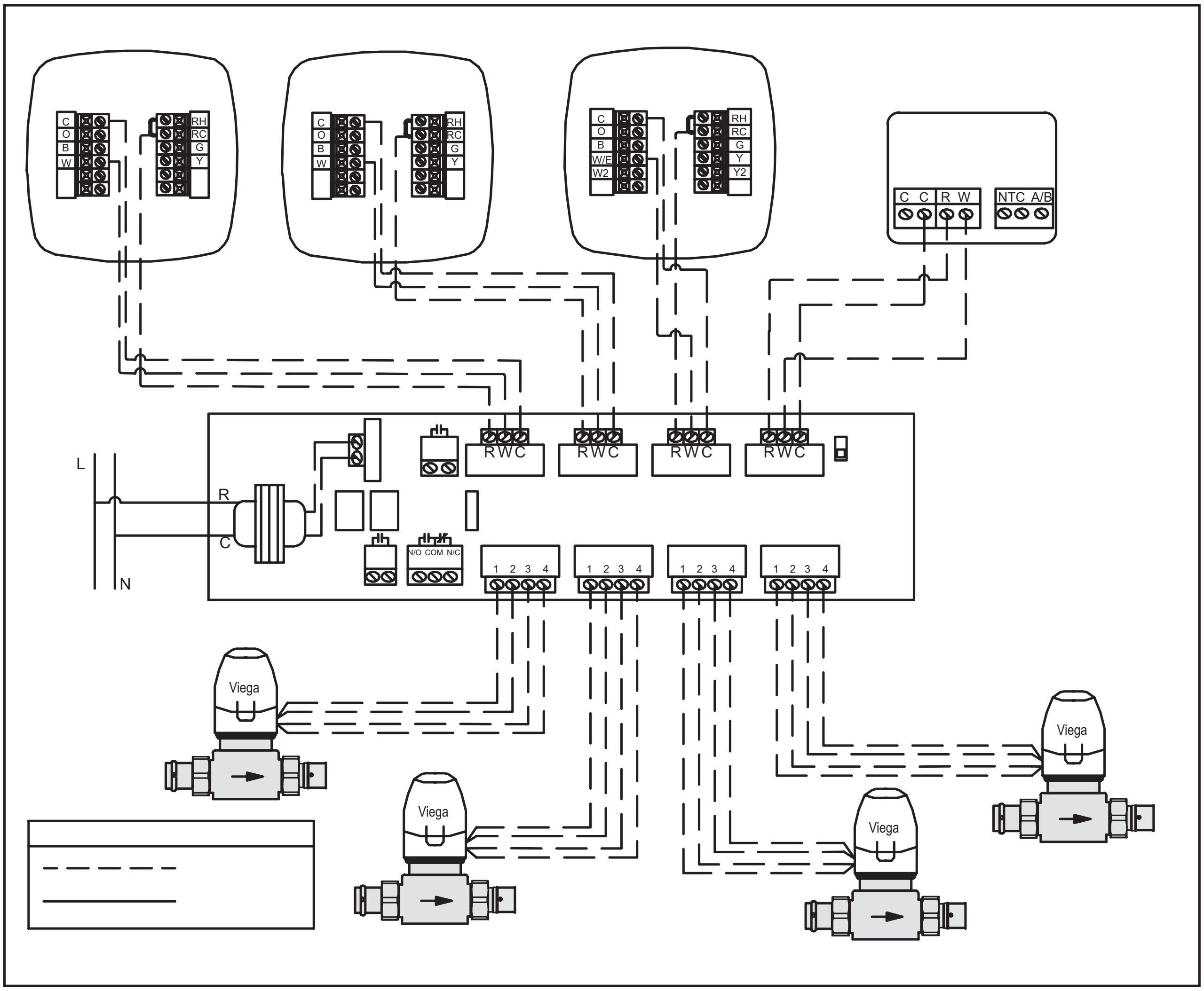
NOTE: Digital Thermostats can control up to 4 powerheads.



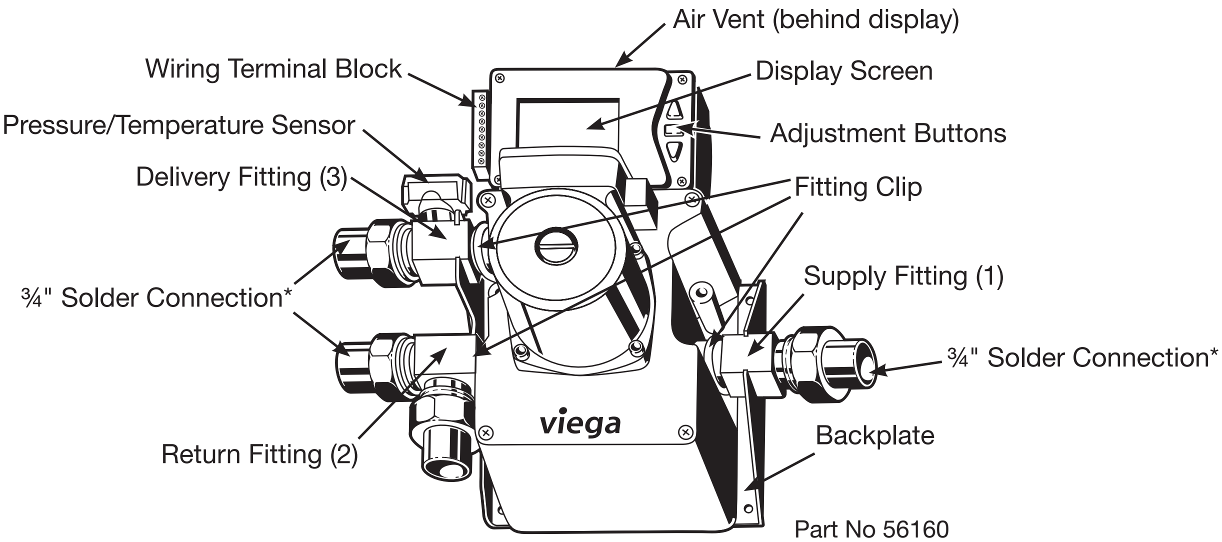
Wiring schematic: Multi-zone application using Viega powerheads



Wiring schematic: Multi-zone application using Viega zone valves



5.1 System start-up for hydronic mixing block



Pressure testing

When piping is complete, test the hydronic mixing block. Ensure air vent cap is tight before testing.

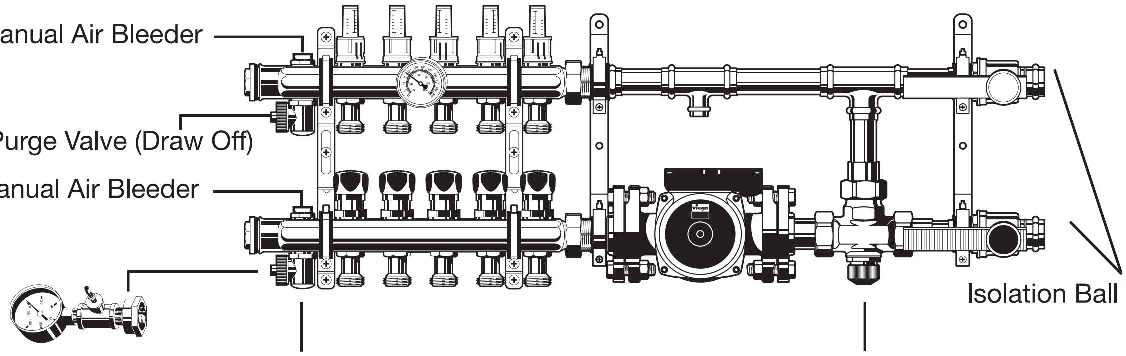
Pressurize the system to a maximum of 100 psi for one hour. Once the system maintains 100 psi for one hour, carefully remove air pressure from the system and fill with fluid. Inspect all piping and fitting joints for leaks.

Filling and purging

When testing is complete, purge the hydronic mixing block.

1. Shut the power off to the boiler.
2. Purge with only cool water, if the boiler is hot it should be cooled down prior to purging, this is done to protect the floor coverings from surface temperatures above 85°F.
3. Plug in the Hydronic Mixing Block, allow it to run through its initial setup and bring you to the STATUS screen.
4. From the STATUS screen push the middle rectangular button.
5. DEFAULTS/PURGE
6. Select PURGE
7. Select ACTIVATE
   - Selecting ACTIVATE will cause the screen to turn purple, at which time the internal valve will open, once the valve is open the screen will blink purple and start a 30 minute timer to allow for purging
   - If more time is needed, ACTIVATE may be selected as many times necessary to complete system purging
   - If less time is needed purge can be cancelled by selecting CANCEL
8. Allow the Hydronic Mixing Block to be filled with fluid from the supply side piping.
9. Close the valve on the return piping to the boiler.
10. Open the purge valve to allow trapped air to be eliminated.
11. Continue to allow fluid to run into the block and out the purge valve until all air is removed from the system.
12. Once purging is complete, return all valves to normal operating position.
13. Open the air vent cap to allow air to escape under normal operation.
14. Once the Hydronic Mixing Block, boiler and piping has been purged and properly pressurized, restart the boiler.

5.2 System start up for mixing stations



Pressure testing

Before the finish floor is installed the radiant system must be pressure tested. Air or water may be used as the medium. The following procedure is recommended by Viega. Check the local building code for compliance or additional test requirements.

1. Double check all connections to manifold to ensure proper seal.
2. Connect manifold pressurization kit (1) to any purge valve (2).
3. Pressurize the system to 100 psi to detect potential nail or screw penetrations.
4. The system should hold the 100 psi for a minimum of 1 hour.

Filling and purging

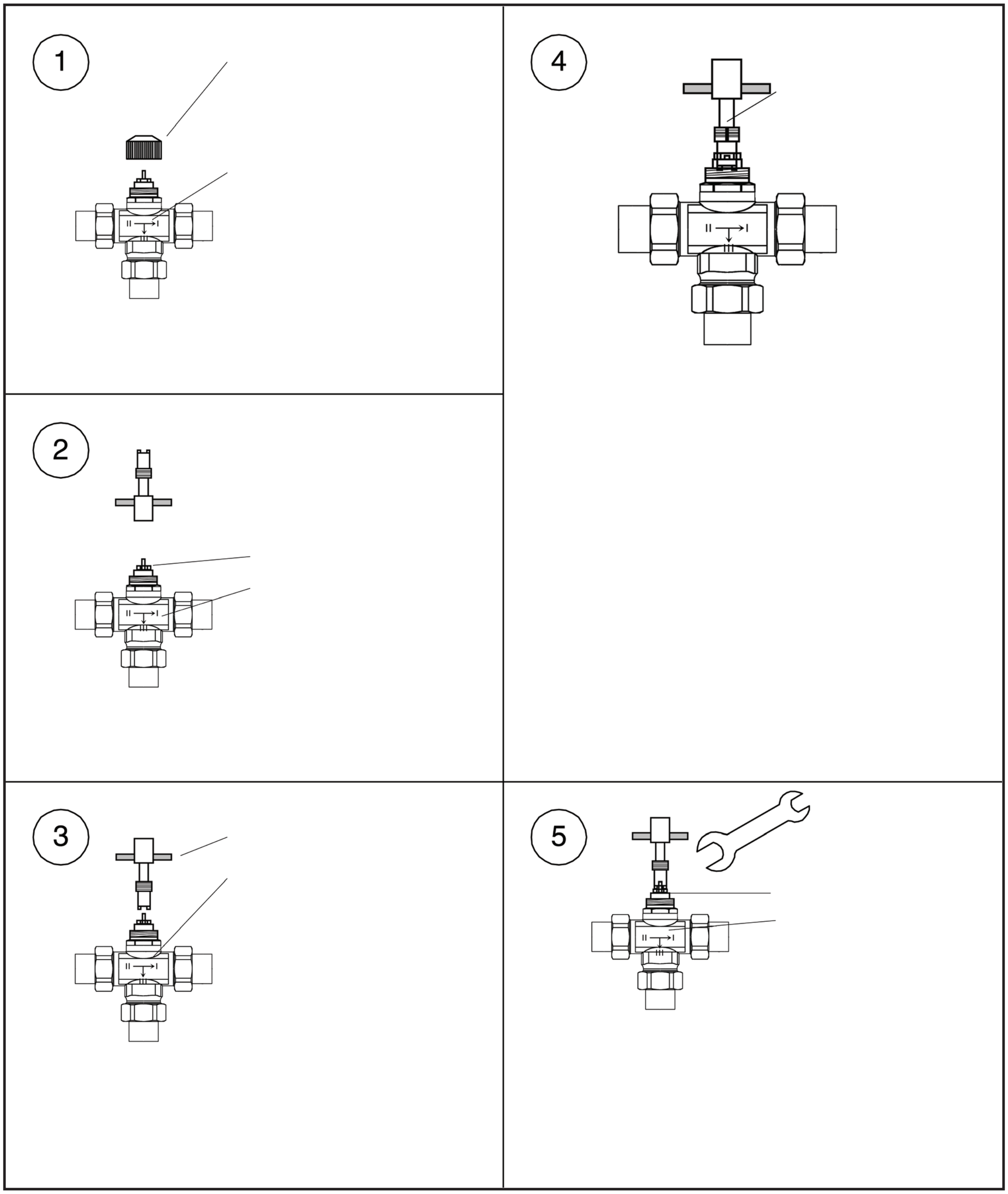
1. Attach drain hose to purge valve hose connection on return header and open valve.
2. Close all but one circuit. Close isolation ball valve on boiler return line. Remove plastic dust cap or temperature controller from 3-way valve, and make sure that high limit kit is fully open.
3. Open boiler fast fill valve to purge circuit. After purging first circuit, close red balancing valve and open next one. Continue with one circuit at a time until all circuits have been purged.
4. Close purge valve and open all balancing and boiler valves. Reset high-limit kit, and reinstall temperature controller or actuator onto 3-way valve.
5. Any remaining air pockets in the system will be eliminated through the automatic air vent after a few hours of constant circulation.

NOTE: If the system must be purged again in the future for any reason, the high limit kit must be re-opened during purging for full flow.

5.3 Adjusting the high-limit kit (mixing station)

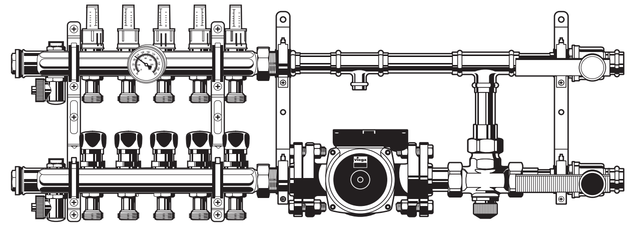
Operation

The mixing station is provided with a preinstalled temperature high-limit kit. This kit is installed into the three-way valve to allow a maximum supply water temperature to be set. This kit must be unscrewed when purging the system and should then be set according to the instructions below.



5.4 Initial balancing

Many times it is not possible to design the system using equal circuit lengths, so the system must be balanced in order to ensure adequate flow to each circuit on a manifold.



Procedure:

1. Start with all valves wide open.
2. Turn the flow meter/balancing valve clockwise, decreasing the flow until the design flow is met.

6.1 Choosing a finished floor

There are three common types of finished floors used in residential construction: wood floors, tile/ vinyl and carpet.

When picking a finished floor, the lower the R-value, the better radiant heat will work. When using tile, the R-value will be low and therefore will work very well with your radiant system (Appendix A on page 44 lists some common tiles and their R-values). Vinyl flooring is another common choice for kitchens and baths and has a low R-value.

Using carpet over radiant heating requires careful planning. Viega's recommendation for a covering over a radiant system is to not exceed a total of a 2.5 R-value (the carpet pad plus the carpet itself). Remember that the pad and the carpet are insulators and will restrict the heat from getting into the room, so keeping the R-value of the pad and the carpet low is a must (Appendix A on page 44 lists some carpet and pad R-values). It may be necessary to add supplemental heat or install hydronic baseboards in rooms with heavy carpeting (see Viega's combiflex system).

There are many questions regarding hardwood flooring over radiant heating. Armed with knowledge and a few precautions, hardwood floors and radiant heat will work well together. There are two important issues:

1. Floor surface temperatures
2. Moisture

Floor Surface Temperatures

For many builders, a reluctance to install hardwood floors over radiant heat stems from problems associated with incorrect control of the floor surface temperatures.

- Today, modern insulation and building techniques allow a radiant floor to stay cooler.
- The floor surface temperature should not exceed 85°F (refer to 2.4 Calculating the floor surface temperature on page 9).

Also be careful when using multiple or high R-value area rugs over hardwood flooring. Your radiant heating system must be designed with this additional R-value taken into account in order to perform properly. If the system was designed for bare wood flooring, adding area rugs may lead to a situation where heat output is diminished.

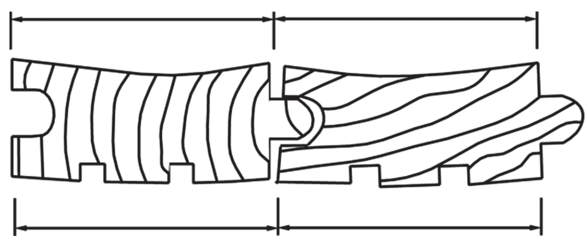
Moisture

Allow the radiant system to run for at least a week before installing the hardwood. This will ensure that the subfloor is dry. Wood flooring should be acclimated to the job site before installation. When checking the moisture content of the subfloor and wood flooring with a moisture meter, aim for a reading of 6% to 8%. Moisture will affect the hardwood floor with or without a radiant system.

- Moisture absorption causes wood to swell.
- Moisture loss causes wood to shrink.

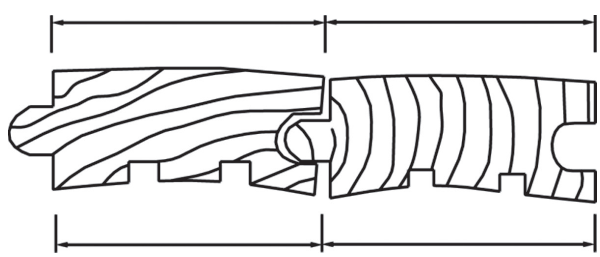
If the moisture content of the wood is relatively high near the bottom of the plank, cupping upward will occur exaggerating cracks.

Dry Shrinkage



If the moisture content is relatively high near the top surface of the plank, it will crown downward on the edges.

Wet Expansion



Sources from below:

- Inadequate moisture barrier
- Ground water wicking through the slab
- Unsealed subfloor

Sources from above:

- High relative humidity

Both solid plank flooring and engineered wood floors are acceptable choices over radiant heating.

Choosing narrower planks and harder woods minimizes dimensional change in the wood. Engineered wood flooring usually has less expansion and contraction and can be a good choice to minimize gaps between planks.

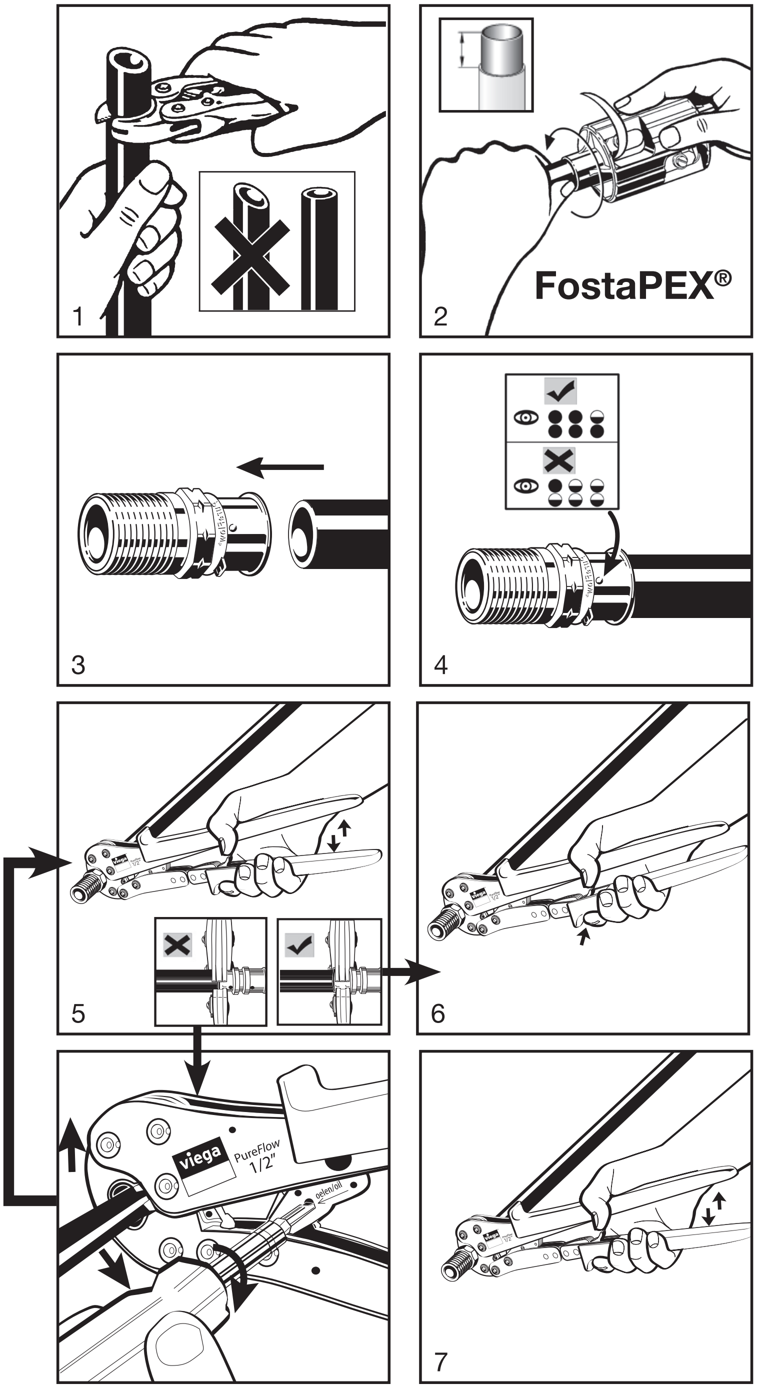
NOTE: Follow the flooring manufacturer's installation manual or NOFMA's (National Oak Flooring Manufacturers Association) manual.

Appendix A - R-Value Table Floor Coverings

	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	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

Appendix B - Making a Press Connection

Follow these steps when you make a fitting connection with VieagPEX Barrier or FostaPEX 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 Barrier tubing, 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.

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 ensure a consistent leakproof connection. It may be necessary to rotate the tool locator ring to avoid interference between the ring and tool.

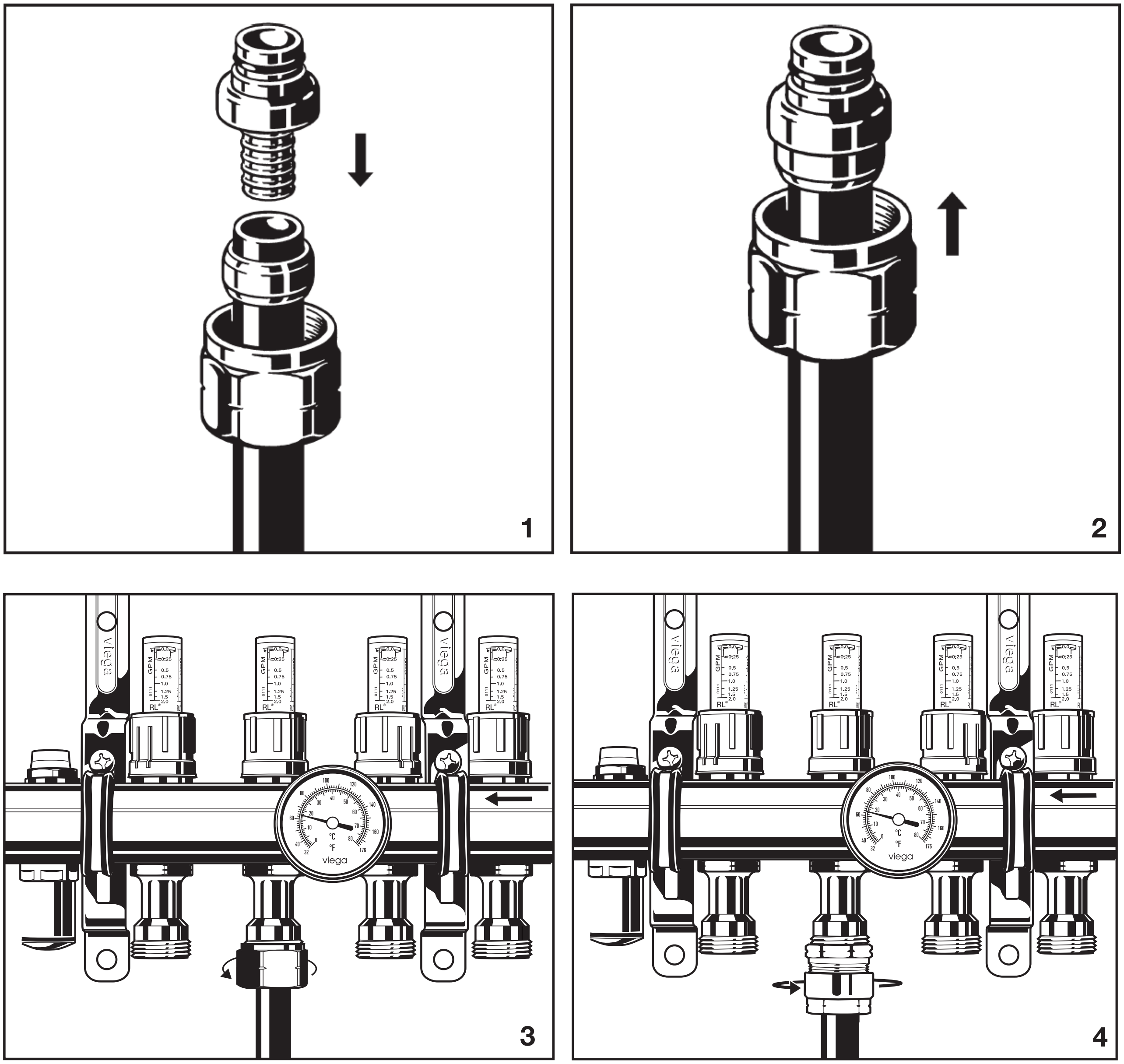
6. Close handles, using trigger to reduce grip span if desired.

7. Extend handle and continue ratcheting until automatic tool release occurs at proper compression force.

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.

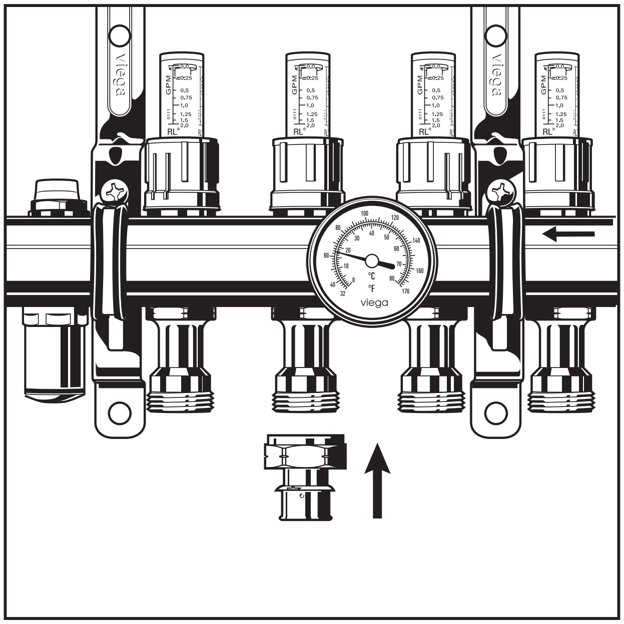
*Zero Lead identifies Viega® products meeting the lead free requirements of NSF 61-G through testing under NSF/ANSI 372 (0.25% or less maximum weighted average lead content).

SVC Compression Adapter ⁵⁄₁₆" - ¾"

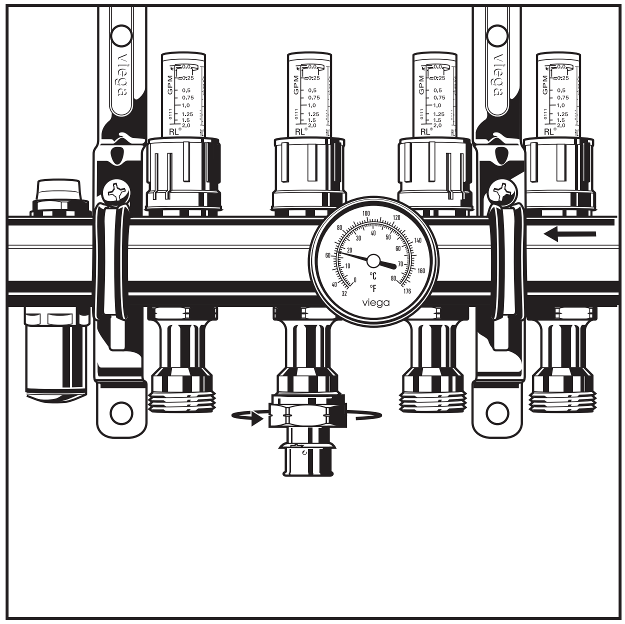


1. Square off tubing to proper length. Slide compression nut up tubing and slip brass ferrule over tubing.
2. Slide tubing over end of SVC adapter, pushing it on fully until tubing is flush with shoulder of fitting.
3. Insert SVC adapter into seat (manifold or other fitting) and tighten compression nut with wrench. Re-tighten compression nut slightly after 30 mins.
4. For ¾" connections, connect adapter to manifold before making connection.

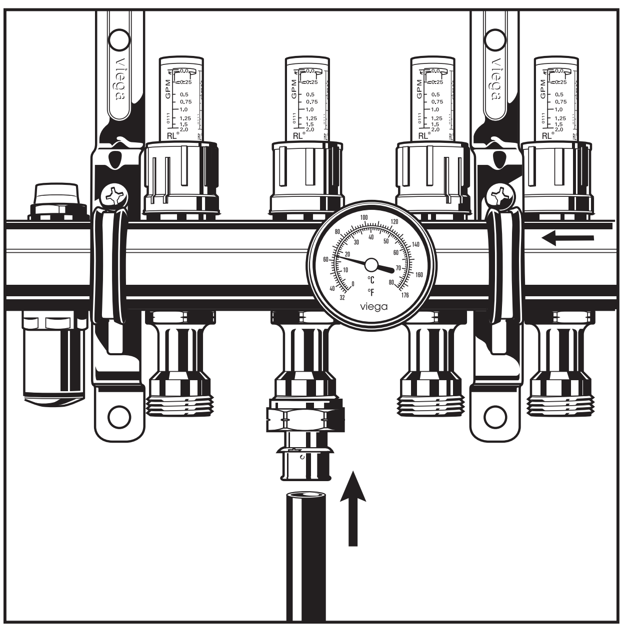
SVC Press Adapter ⁵⁄₁₆" - ¾"



1. Insert SVC adapter into seat (manifold or other fitting).



2. Tighten nut onto seat to secure press adapter.



3. Ensure full tubing insertion at view holes and make press connection.

4 Inch Slab on or below Grade Application with 6" Tubing Spacing

Based on 68°F room temperature with ½" ViegaPex Barrier tubing with R5 insulation below the slab.

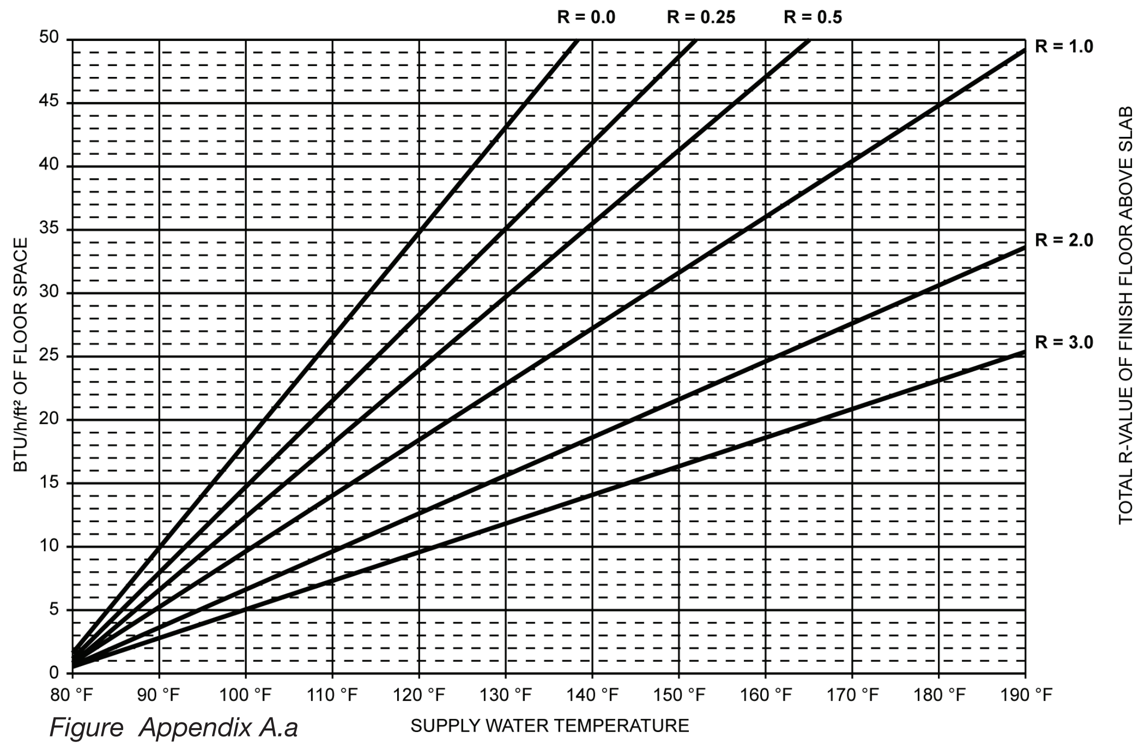


Figure Appendix A.a

4 Inch Slab on or below Grade Application with 9" Tubing Spacing

Based on 68°F room temperature with ½" ViegaPex Barrier tubing with R5 insulation below the slab.

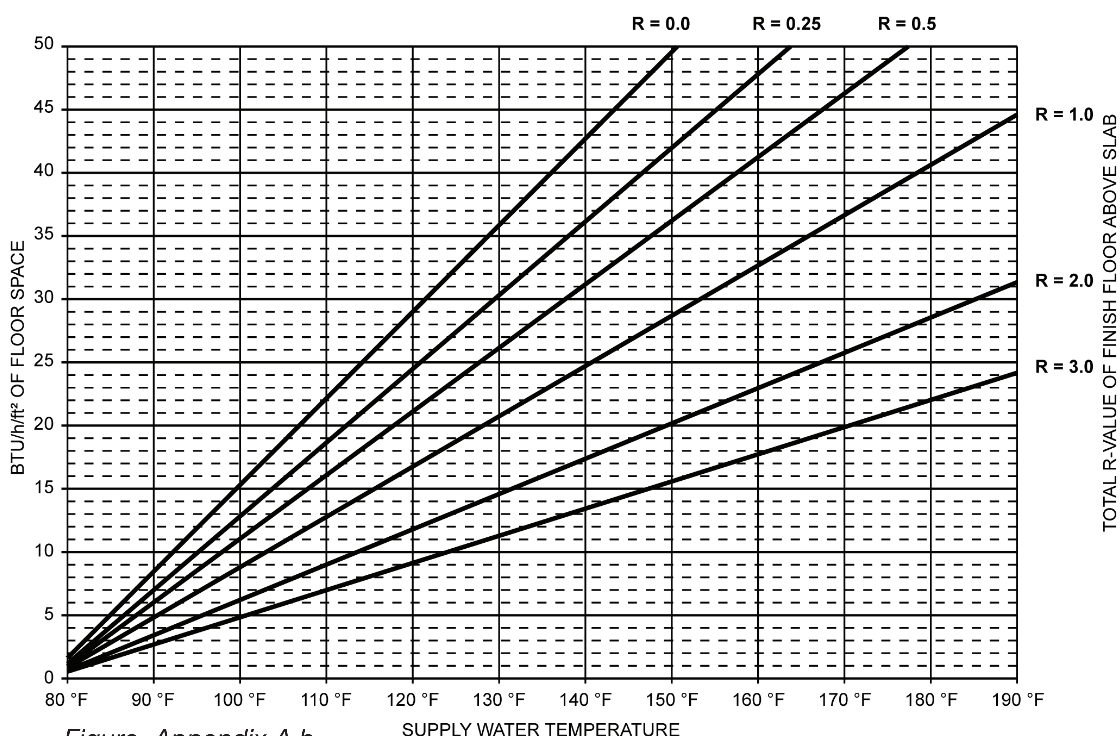


Figure Appendix A.b

4 Inch Slab on or below Grade Application with 12" Tubing Spacing

Based on 68°F room temperature with ½" ViegaPex Barrier tubing with R5 insulation below the slab.

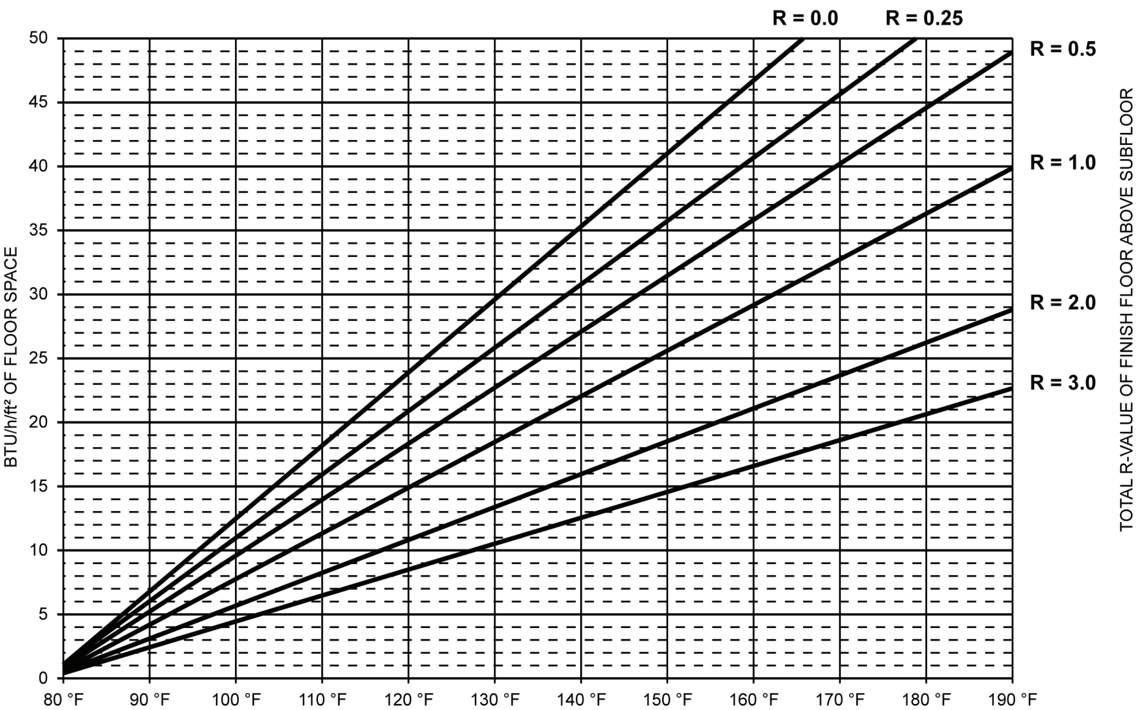


Figure Appendix A.c

1½ Inch Thin-Slab with 6" Tubing Spacing

Based on 68°F room temperature with ½" ViegaPex Barrier tubing with R19 insulation below the subfloor.

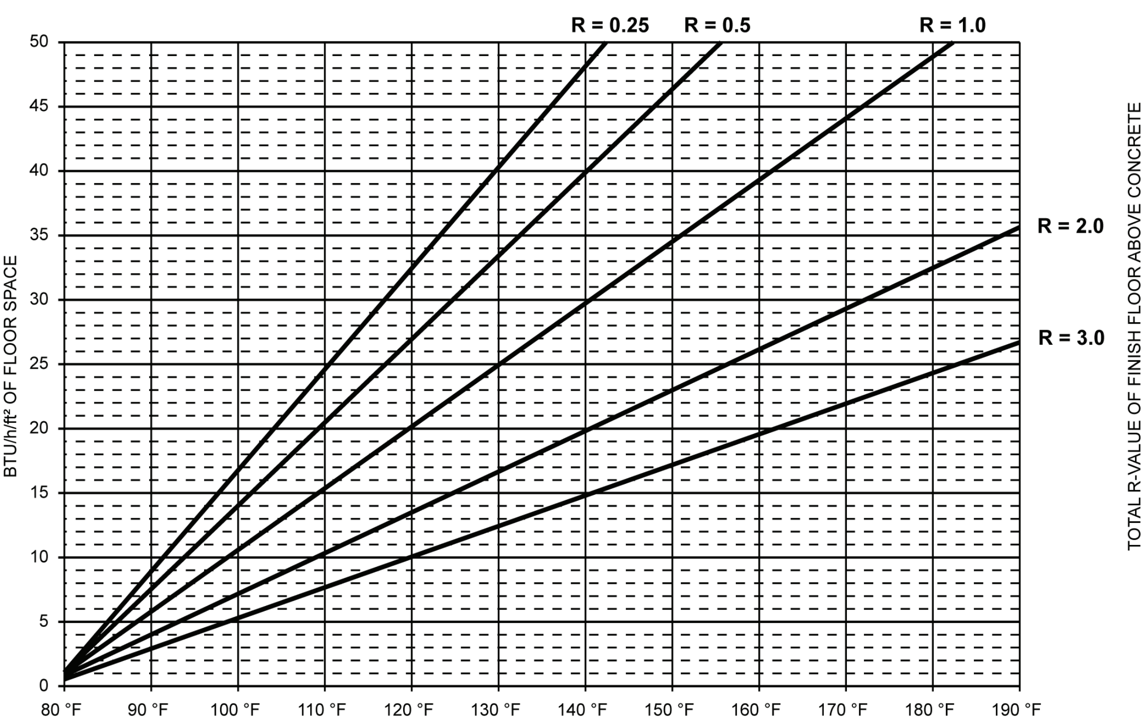


Figure Appendix A.d

1½ Inch Thin-Slab with 9" Tubing Spacing

Based on 68°F room temperature with ½" ViegaPex Barrier tubing with R19 insulation below the subfloor.

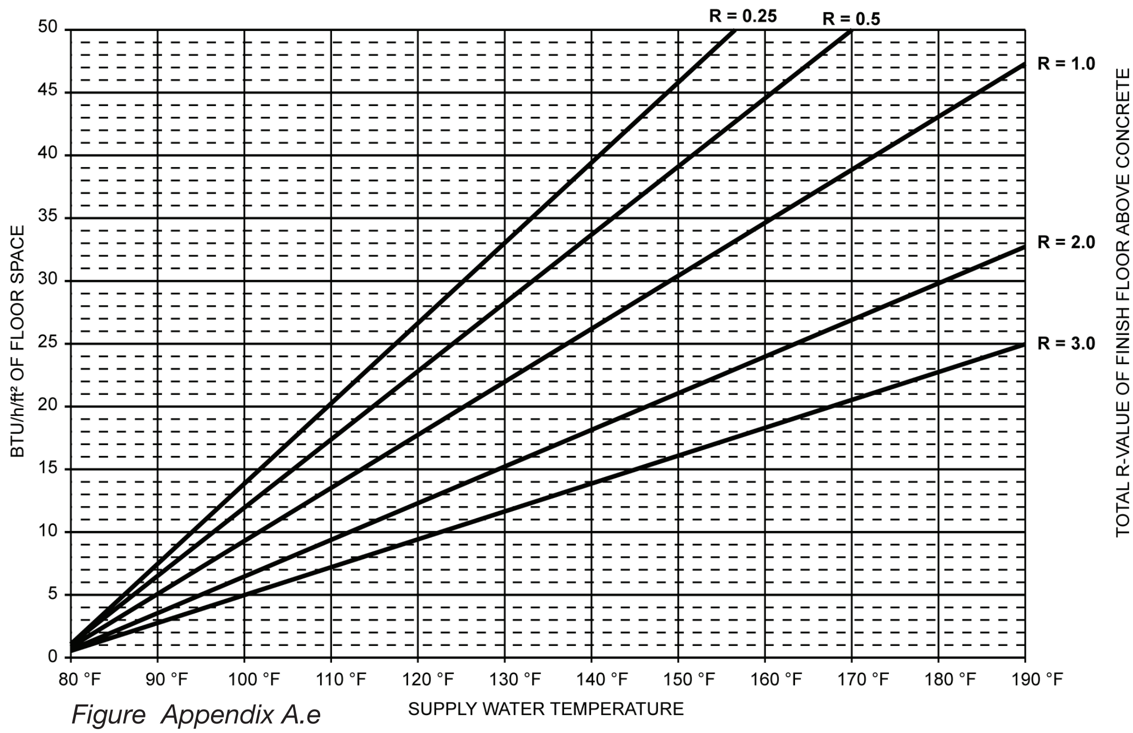


Figure Appendix A.e

1½ Inch Thin-Slab with 12" Tubing Spacing

Based on 68°F room temperature with ½" ViegaPex Barrier tubing with R19 insulation below the subfloor.

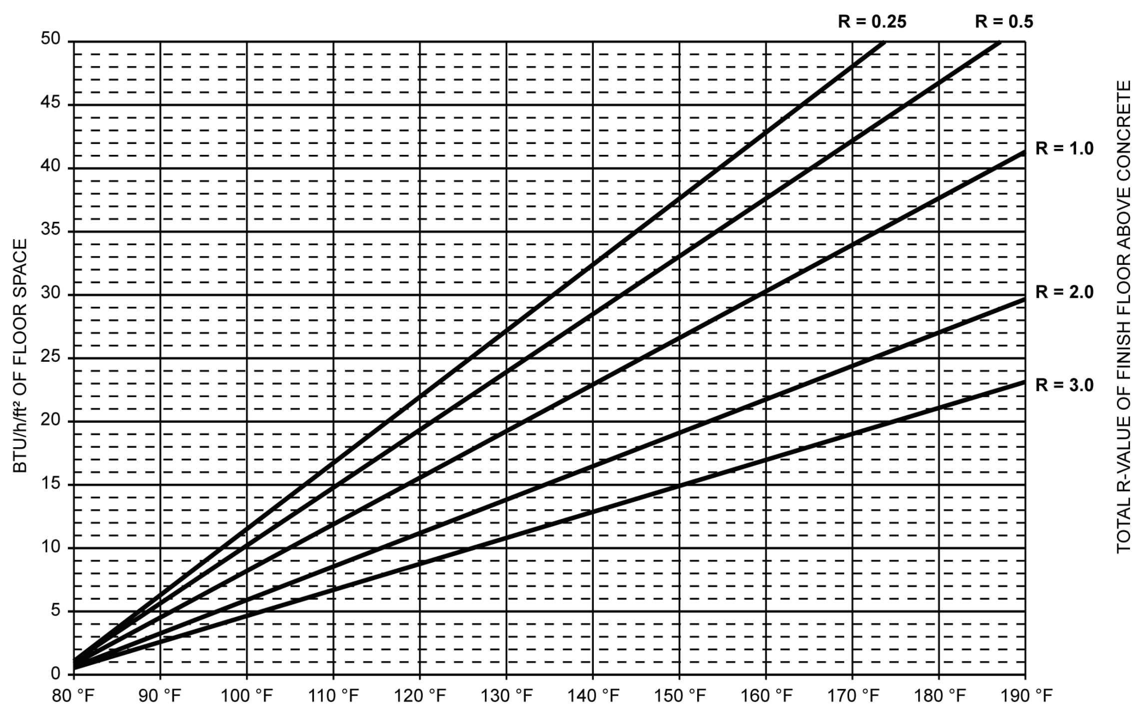


Figure Appendix A.f

Section thru fibrous expansion joint (typical)

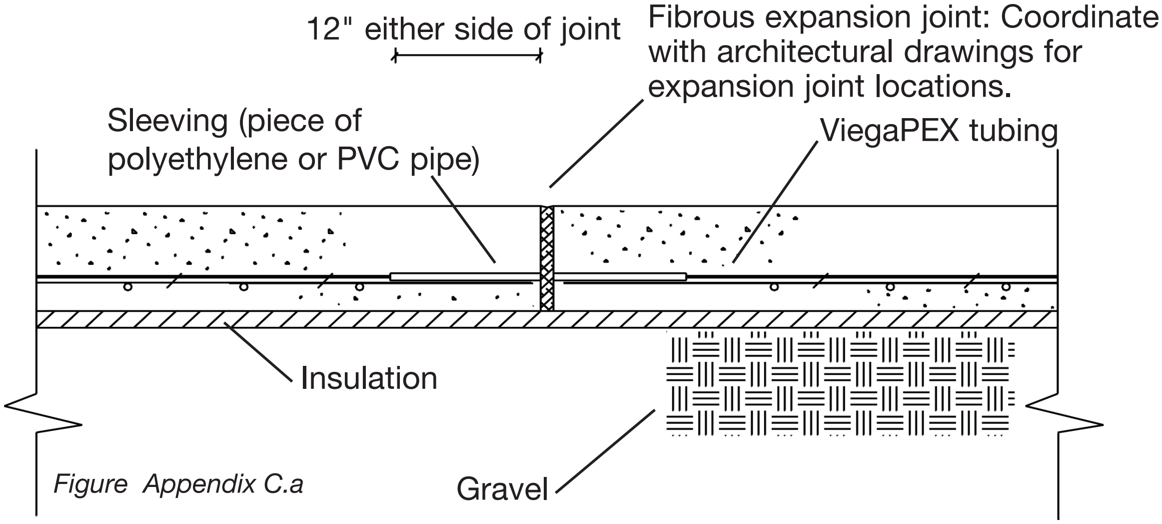


Figure Appendix C.a

Section thru metal expansion joint (typical)

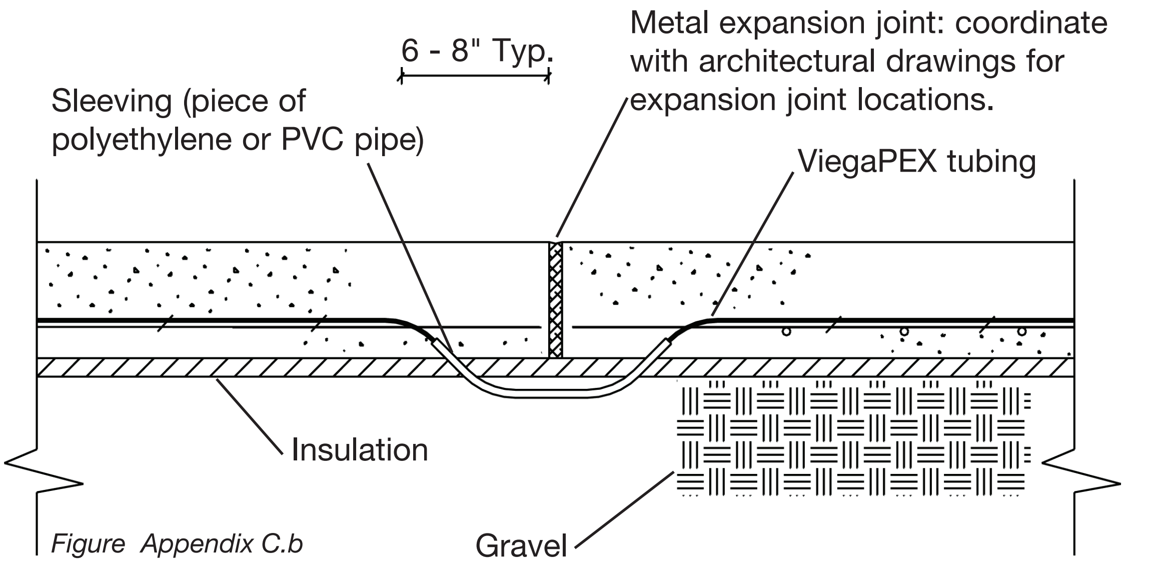


Figure Appendix C.b

Section thru control joint (typical)

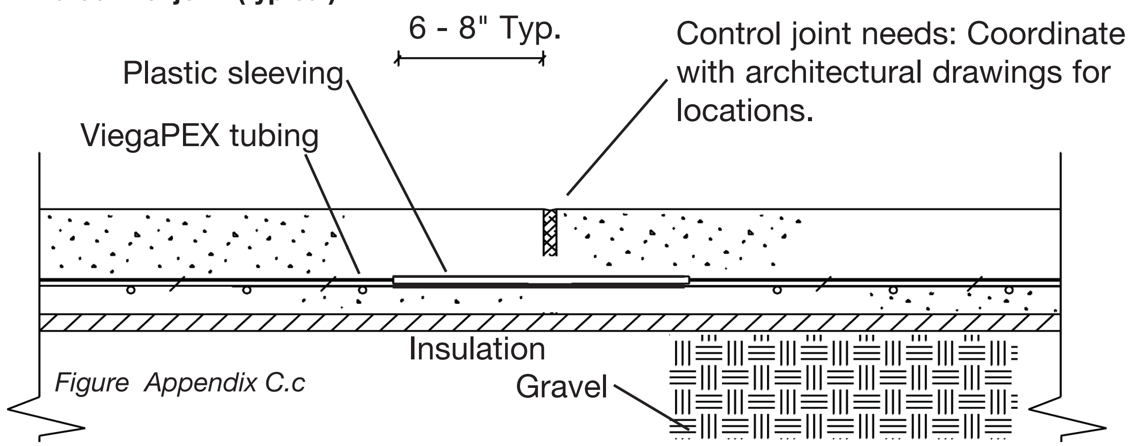


Figure Appendix C.c

Appendix D - Making a Material List

Concrete system material worksheet

Use the first worksheet to select the material for the installation of the concrete system. Then, select the appropriate worksheet below to create a piping and control material list. These charts are intended for conceptual purposes; there may be variations in each job.

Material	Net Heated Area (ft.)	Multiplier	Estimated Amount
Rapid Grid		0.125	
Point Fasteners			
6" spacing		1.1	
9" spacing		0.75	
12" spacing		0.47	
Tubing			
6" spacing		2.2	
9" spacing		1.5	
12" spacing		1.1	

Piping and controls material worksheet

One-room application material worksheet:

Material List	
Products	**Quantity**
Hydronic Mixing Block	
Enhanced Mixing Station	
Mixing Station	
Actuator	
1¼" Stainless Manifold, # Outlets	
Basic Heating Control	
Indoor Sensor	
ViegaPEX Barrier Tubing	
Zone Control	
Thermostat	
Powerhead	
FostaPEX Tubing	
PEX Press Adapters	
Compression PEX Adapters	
Repair Couplings	
Repair Coupling Wrap	

Multiple-room application material worksheet:

Material List	
Products	**Quantity**
Hydronic Mixing Block	
Enhanced Mixing Station	
Mixing Station	
Basic Heating Control	
Actuator	
1¼" Stainless Manifold, # Outlets	
Zone Control	
Thermostat	
Powerhead	
ViegaPEX Barrier Tubing	
FostaPEX Tubing	
PEX Press Adapters	
Compression PEX Adapters	
Zone Valve	
Repair Couplings	
Repair Coupling Wrap	

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