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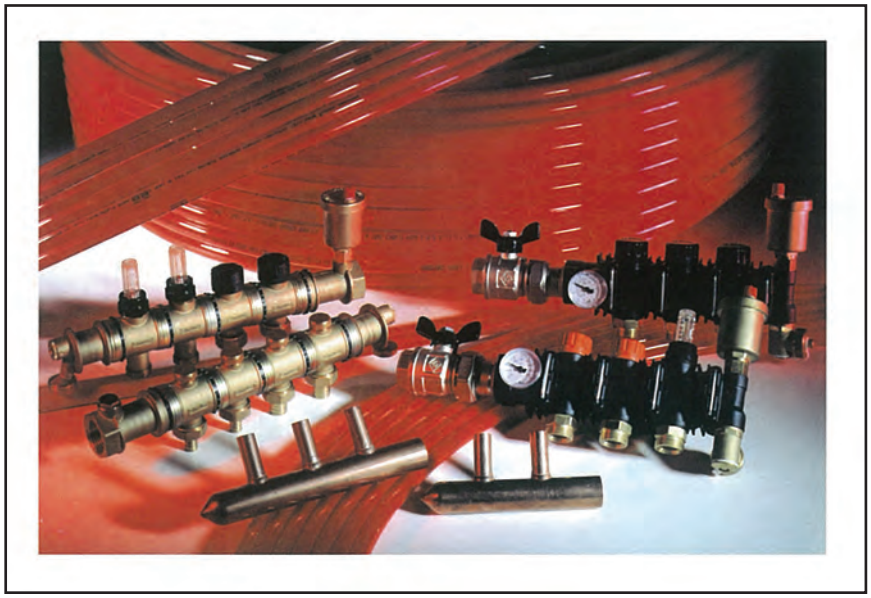

INSTALLATION INSTRUCTIONS

RADIANT FLOOR HEAT INSTALLATION GUIDE

GETTING STARTED

At Krell Distributing, we custom design, package and ship each system!
To get started we will need a few basic details:

1. A floor plan. You can E-mail, fax, or snail-mail it to us.
2. The kind of fuel you plan to use.
3. The insulation values of your home.
4. The type of system you are interested in.
5. A daytime and evening phone number so that we can reach you to discuss your options.

Tools you will need:

1. An uncoiler
2. Crimp tool
3. Pneumatic staple gun

Krell Distributing will loan these at no charge (with deposit)

If you need additional information:

www.krelldistributing.com
Phone: 315.471.7553
Fax: 315.471.7558
Toll-Free: 1.888.441.7553

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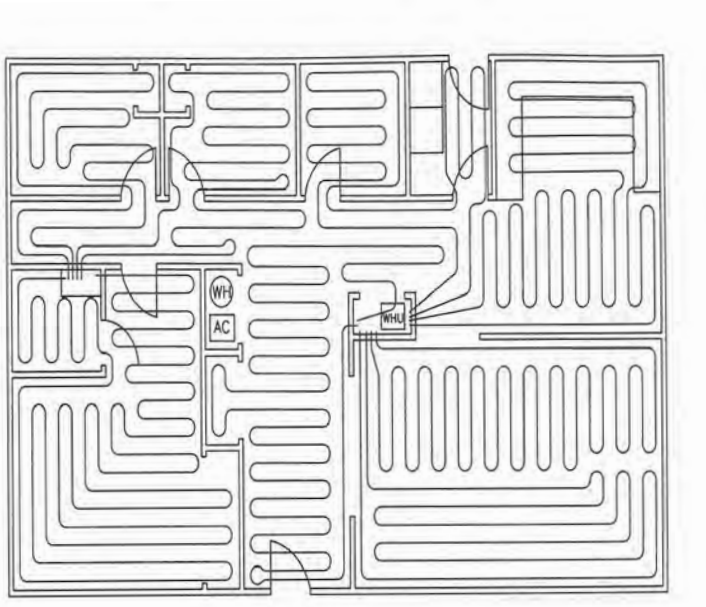
SYSTEM BASICS

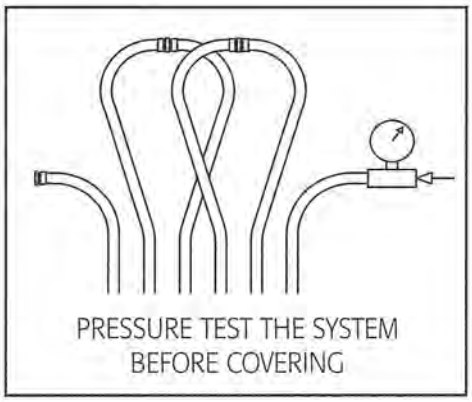
A hydronic radiant floor heating system is really quite simple. Heated water is circulated through PEX tubing installed in or under the floor of the building. As the heated water warms the floor, it becomes a huge radiant-heat radiator. Since radiant heat energy passes through air readily and radiates in all directions, it warms the human body and objects in the building without relying on the conduction of heat by air as with forced air systems. The warmth that is felt from the sun easily describes the radiant heat of a floor heating system. Even though the sun is millions of miles away, the radiant (also referred to as infrared) heat waves pass through those millions of miles of space and are readily absorbed by the skin. Radiant heating systems offer increased comfort levels while generally allowing for lower building air temperatures.



A RADIANT FLOOR HEATING SYSTEM USES THE HEATED FLOOR PANEL TO RADIATE HEAT INTO THE HOME OR BUILDING

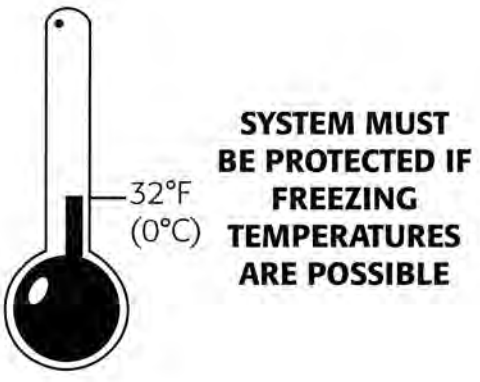
To provide the necessary heat output from a radiant floor system, there must be a sufficient amount of tubing installed in or under the floor and the temperature of the heated water must be within a range that will supply the needed output without overheating the floor. A floor that's too warm will be as much a detriment to system comfort as one that is too cool. A properly designed system will maintain a comfortable floor temperature while supplying the required heat output.

The system must be pressure tested before the loops are embedded in the slab or otherwise covered. As a minimum, the internal system pressure should be raised to 50 psig and held for at least 30 minutes. If it is a warm day and the sun has warmed the PEX tubing loops, there will be a slow expansion of the tubing that will show as a pressure decrease in the system. Depending on the ambient temperature, the pressure decrease could be significant and may require re-pressurizing the system back to 50 psig and maintaining for longer than 30 minutes. As long as the temperature remains relatively constant, the pressure will stabilize if the system is leak-free.


PRESSURE TEST THE SYSTEM BEFORE COVERING

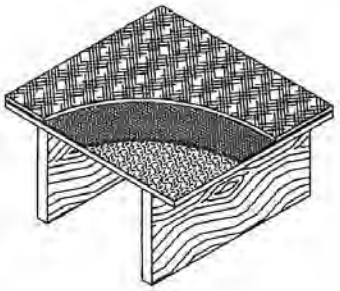
If, after 2 hours test time the pressure cannot be stabilized, then there is probably a leak. Find and repair the leak and retest. It is paramount to system integrity that the loops are leak-free before covering. If a loop tube has been damaged during installation it is recommended to replace the entire loop and not install a repair coupling. Repair couplings are intended as a "last resort" repair during the pour when it is impossible to replace a damaged loop.

DO NOT fill the system with water if there is **any** possibility that freezing conditions might occur. If the system is filled with plain water (no antifreeze), and freezing temperatures are encountered, the tubing will likely burst at expansion joints or at naturally occurring voids in the concrete. While PEX tubing out of the slab is not prone to freeze damage, tubing encased in concrete will likely burst from the expansion of the water as it turns to ice. The resulting pressure increase inside the tubing will seek a point of least resistance and burst the tubing at that point. Substantial slab damage can also result.

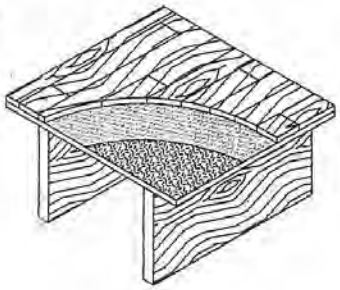


FLOOR COVERINGS

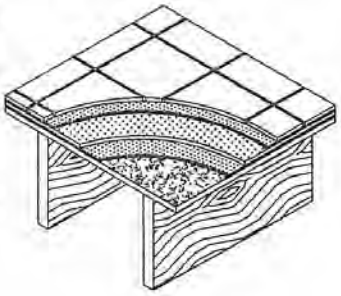
The main misconception regarding floor coverings tends to center on whether or not carpet or wood can be used over a radiant floor.



Carpet and pad generally requires the highest supply fluid temperature.



Hardwoods are the most popular floor covering to use over a radiant floor system.



Tile and other stone floor coverings generally require the lowest supply temperature. The more conductive the floor covering the lower the required supply water temperature.

Virtually any floor covering can be used if the insulative value (R-value) for that covering is accounted for in the radiant design and installation process. In a radiant floor heating system, the floor is the room's heat source. The floor gives off heat (energy) to the room because it is warmer than the surroundings-hot moves to cold. If we want to maintain a room temperature of 70°F, the floor has to be warmer than 70°F. The warmer the floor, the more energy it will emit into the space. So, the higher the heating load, the warmer the floor needs to be. The room does not care what the floor type is, or what the construction details are as long as the required floor surface temperature is achieved.

There is a limit to how hot we can make the floor. In theory we could heat any room with the use of a radiant floor heating system. The limiting factor is human comfort. The maximum temperature we can allow the floor surface to reach is 85°F. Temperatures above this point become too warm for our bodies and in turn make the floor uncomfortable to stand on. This 85°F floor limit in turn limits the maximum BTU output of the floor to around 45BTU/sq.ft., based on room temperature.

RADIANT HEAT WITH WOOD FLOORS

Not all species of wood are good candidates for an installation over radiant heating. It's best to follow the manufacturer's recommendation for a species' suitability over radiant heat. When possible, choose a species that is known for its stability. Quartersawn or rift-sawn flooring is preferable to plain sawn in the search for stability. Narrow strip flooring is also a better choice than plank flooring, because narrow boards expand and contract less than wide boards do. Using narrow boards also means there are more seams in a floor to take up movement. Because of its dimensional stability, laminated flooring is another good choice.

Styles of wood flooring that are best for radiant heat installation are as follows:

Laminated/Engineered Wood Flooring
It is more dimensionally stable than solid wood flooring.

Floating Floors, Laminated/Engineered or Solid tend to move as a unit to help accommodate moisture content changes.

Certain Species are known for their inherent dimensional stability such as American cherry, American walnut, mesquite, teak and others. Other species such as maple and Brazilian cherry are unstable.

Quartersawn or Rift Sawn Wood Flooring
are more dimensionally stable than plain sawn wood flooring. Narrow boards-(2¼ inches or less) are the best choice of solid wood flooring over radiant heat.

With radiant heat, the heat source is directly beneath the flooring, so the flooring may gain moisture or dry out faster than a similar floor in a home with a conventional heating system. Wood flooring can be installed over radiant heat as long as you understand radiant heat and how it can impact wood flooring, what precautions to take, and what type of wood flooring to use.

Find more information on using wood flooring with radiant heat at WWW.KRELLDISTRIBUTING.COM. Click on "hardwood floor radiant."

PEX TUBING LOOPS

For panels with more than one loop, the length of individual loops within the panel should be within 10% to prevent inconsistent heat output. Even though individual loops connected to the same manifold can be adjusted at the manifold with built-in balancing valves, it is better to have consistent loop lengths. Balancing individual loops can be a tedious trial and error task unless individual flow meters are used on each loop increasing system cost.

Maximum loop lengths for the different sizes of PEX tubing are shown in the chart on the right.

RECOMMENDED AND MAXIMUM TUBE LENGTHS IN FEET

		Rec.	Max.
3/8”	PEX	200	250
1/2”	**PEX**	**250**	**350**
5/8”	PEX	400	500
3/4”	PEX	500	600

Typical loop spacing is 8” minimum. Loops spaced too far apart will lead to cold spots between the loops and can also require higher supply water temperatures and will lower panel output.

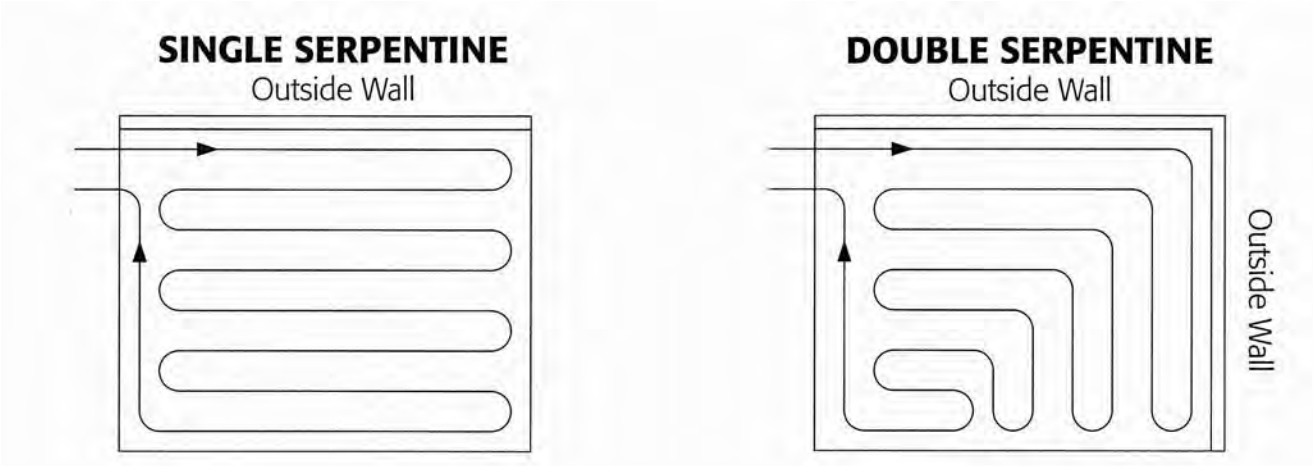
LOOPS SPACED TOO FAR APART LEAD TO HOT AND COLD SPOTS AND POOR PERFORMANCE.
THE SPACING DICTATED BY THE SYSTEM DESIGN MUST BE FOLLOWED.

Always mark both ends of the tubing loops during placement. The marking must indicate which end is the send and which is return and it should also be marked with some form of loop number or other identifier when numerous loops are connected to the same manifold. A permanent marker is usually sufficient or a flag of tape can be attached to the portion that will be trimmed off when connected to the manifold. This is an important step and is critical if the manifolds will not be placed immediately.

PEX TUBING LOOPS

Alternately, the loops can be connected to the manifold immediately but the loops must still be identified as to manifold position for balancing and other adjustments.

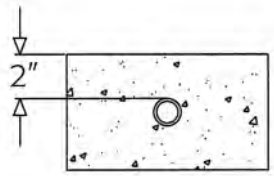
Individual PEX tubing loops must always be run in a continuous length from the manifold, through the layout, and back to the manifold. This is especially important for systems where the tubing will be cast into concrete or other material. **DO NOT** connect shorter lengths of tubing together to make up needed loop lengths. Some connections are allowed in systems where the tubing is not "cast-in," however, fittings in the loops must be kept to a minimum.



The rule is that the supply side of each loop (with the hottest water) is installed towards the exterior wall or walls and the cooler part of the loop (as it is returning to the manifold), is installed towards the room's center or interior walls. The design may also require closer spacing near the outside walls, commonly called perimeter banding, to account for higher heat loss.

SLAB INSTALLATION

Ideally, the PEX tubing loops should be placed about 2 inches below the top surface of the slab. This is usually accomplished by installing risers that hold the re-bar or re-mesh at a constant height, or during the concrete pour, by hand pulling the reinforcement (with PEX tubing attached) to the desired level.



NOTE: All fill material below a radiant slab must be free of sharp objects that can damage the PEX tubing. If gravel is specified for under slab fill, it must not have sharp edges. Smooth pea gravel is recommended.

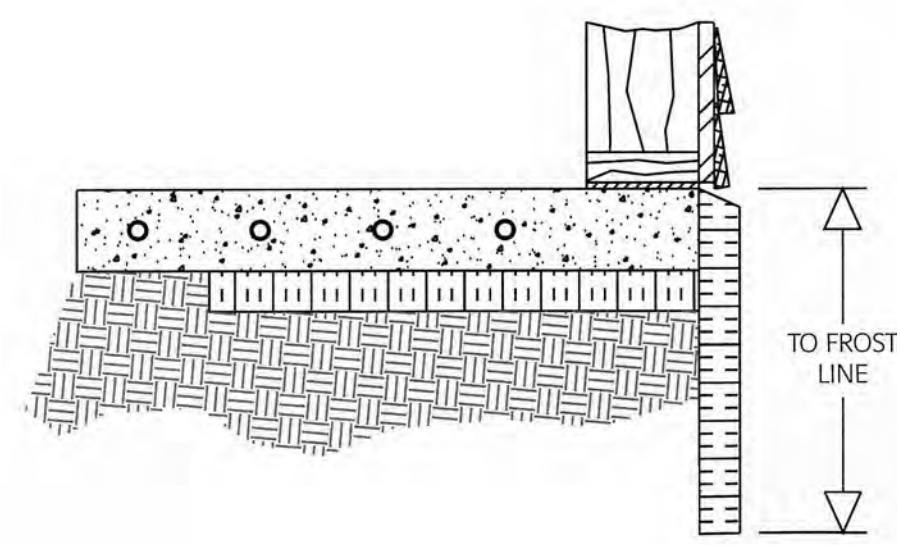
INSULATION

Exposed slab edges must be insulated for efficient system operation. The most common edge insulation is 1 to 2 inch thick, closed-cell Styrofoam extending down to at least the prevailing frost line. The system design should specify the type and thickness of edge insulation.

If edge insulation to the prevailing frost line is impossible or impractical, at the very least, edge insulation should fully cover the exposed slab edge and extend into the ground at least a few inches.

SLAB SHIELD INSTALLATION INSTRUCTIONS

1. Cut material to desired length and roll out in place directly over stone or gravel.
2. Cut second run of material and overlap 3 inches over the first run of material.
3. Use duct tape and bandage the seams every 12 inches.
4. Lay meshing and tubing directly over product.
5. Pour slab.

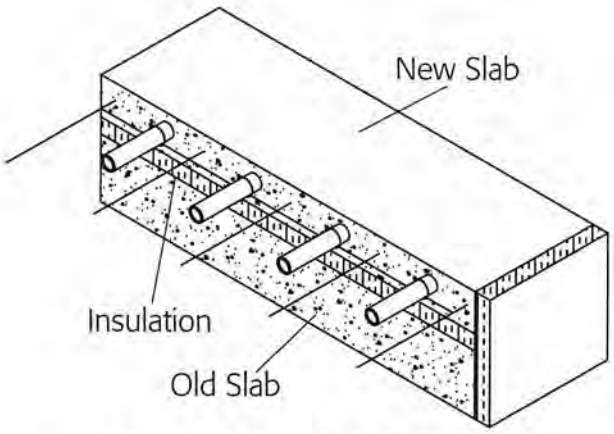


SLAB INSTALLATION

When attaching insulation to the slab forms prior to pouring, adjust the form position outward the thickness of the insulation so that the outer wall does not sit partially on the insulation.

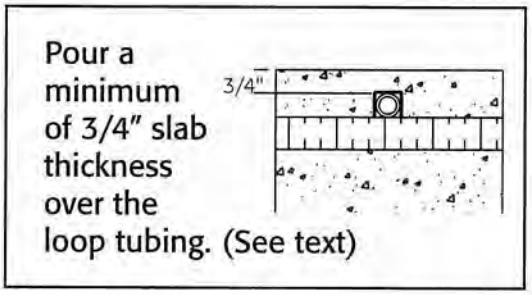
OVER AN EXISTING SLAB

For existing or new applications, a new slab can be installed over an existing one to provide for a radiant heating panel. Insulation should be installed between the new and existing slabs helping drive the heat upwards to insure that the system reacts properly to changes in the temperature of the living space. This is very important when coverings such as carpet and pad are used over the new slab. If insulation between the slabs is omitted, the thermal mass increases substantially and the system will be sluggish in responding to changes in room temperature.



NOTE: Omission of insulation between the new slab and the old slab will substantially increase the thermal mass, making response times very sluggish.

For the most part, a slab over slab is installed like a slab system except that the new slab, since it is generally only about 2 inches thick, may not contain steel reinforcement and the tubing loops may be attached directly to the insulation. Too much slab thickness over the tubing will cause sluggish response to changes in room temperature.



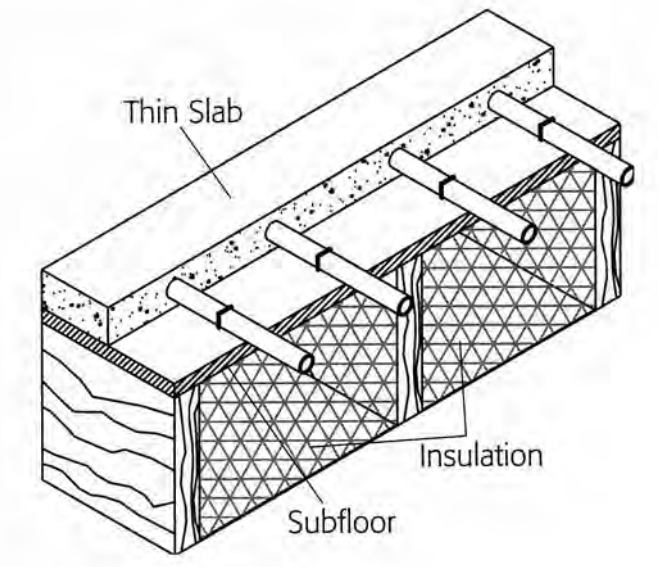
When installing the tubing in a poured slab over an existing slab, the tubing can be anchored by:

1. Attaching a re-mesh or re-bar laid over the existing slab as described in the slab installation section; or
2. Attaching directly to the insulation with staples.

NOTE: Allow slab to cure for one month prior to turning heat on for the first time.

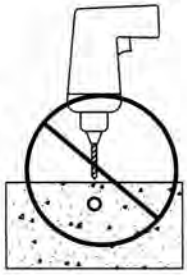
SLAB INSTALLATION

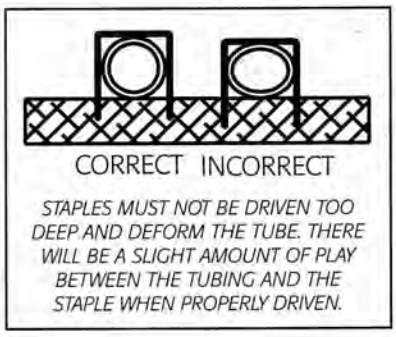
POURED UNDERLAYMENT/THIN SLAB OVER SUSPENDED FLOOR



When installing a poured floor underlayment/ thin slab over a suspended wood floor, attach the PEX tubing directly to the wood sub-floor with staples or clamps every 2 to 3 feet along straight runs.

Do not drill or drive fasteners into the poured floor as you can puncture the tubing causing a leak. Inform the other construction trades of the presence of the tubing to minimize the risk of damage during further construction.

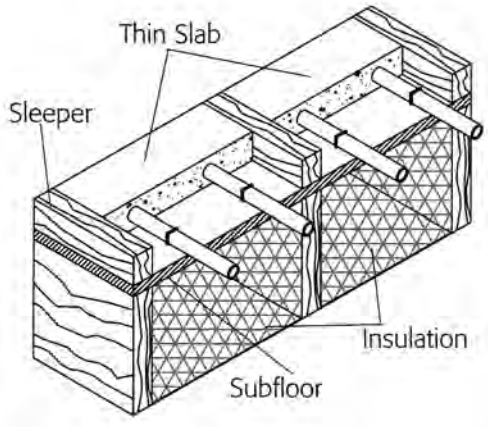




POURED UNDERLAYMENT/THIN SLAB OVER SUSPENDED FLOOR WITH SLEEPERS (OR NAILERS)

When the finished floor over the heated panel requires nailing (such as hardwood), 2x2 sleepers are installed between the tubing runs and the underlayment/thin slab is poured over the tubing and screed level with the sleepers.

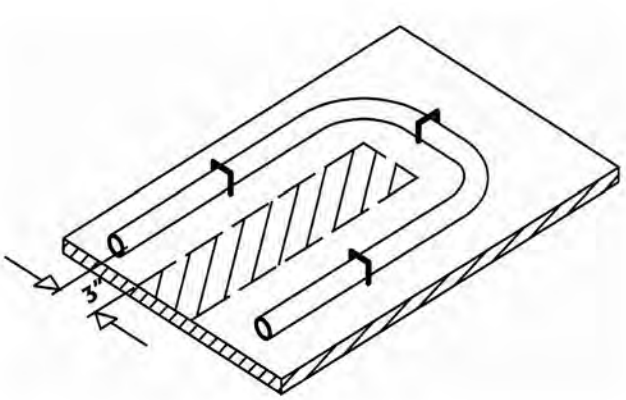
Other than the attachment of sleepers to the sub-floor, installation of this type of panel is identical to the Poured Underlayment/Thin Slab Over Suspended Floor.



SLAB INSTALLATION

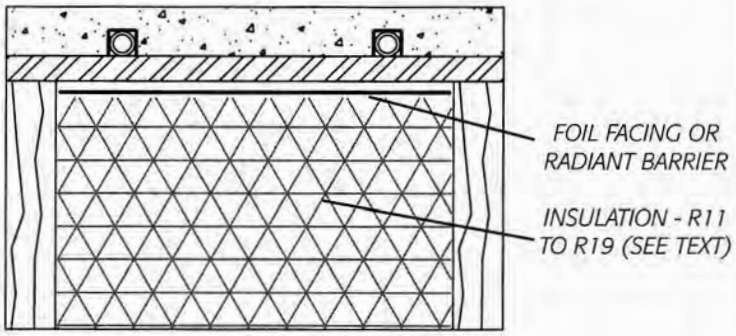
If interior walls are to be set on the poured underlayment/thin slab, keep the PEX tubing at least 3 inches away from the wall locations. Before laying out the tubing loops, mark out the wall locations on the sub-floor to insure accurate placement.

The joist spaces below the heated floor must be insulated. If the floor is over an unheated space, install a minimum R19 insulation. Foil faced insulation is preferred and the foil face is installed towards the heated side. If the space below is heated, install a minimum R11 insulation. As a general rule, the R-value of the insulation below a suspended panel should be at least 4 times the R-value of the material covering the tubing (including the poured material and any floor coverings).

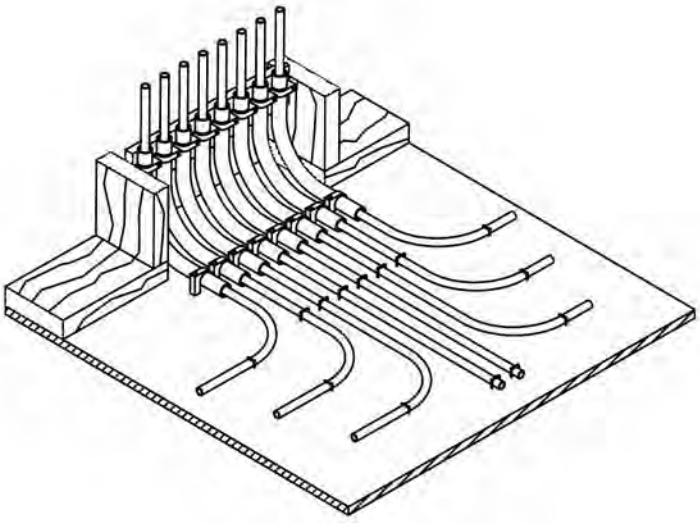


MARK WALL LOCATIONS ON THE SUBFLOOR AND KEEP PEX TUBING LOOPS AT LEAST 3 INCHES AWAY FROM THEM.

NOTE! Insulating below a radiant floor panel is important even when the space below it is heated. The insulation "drives" the heat upwards since radiant heat emits from both sides of the heated panel. If no installation is installed, the panel will emit radiant energy equally in both directions and the space above the floor will not be heated properly. Foil faced insulation or a separate radiant barrier can significantly improve insulation performance since it reflects infrared waves directly.

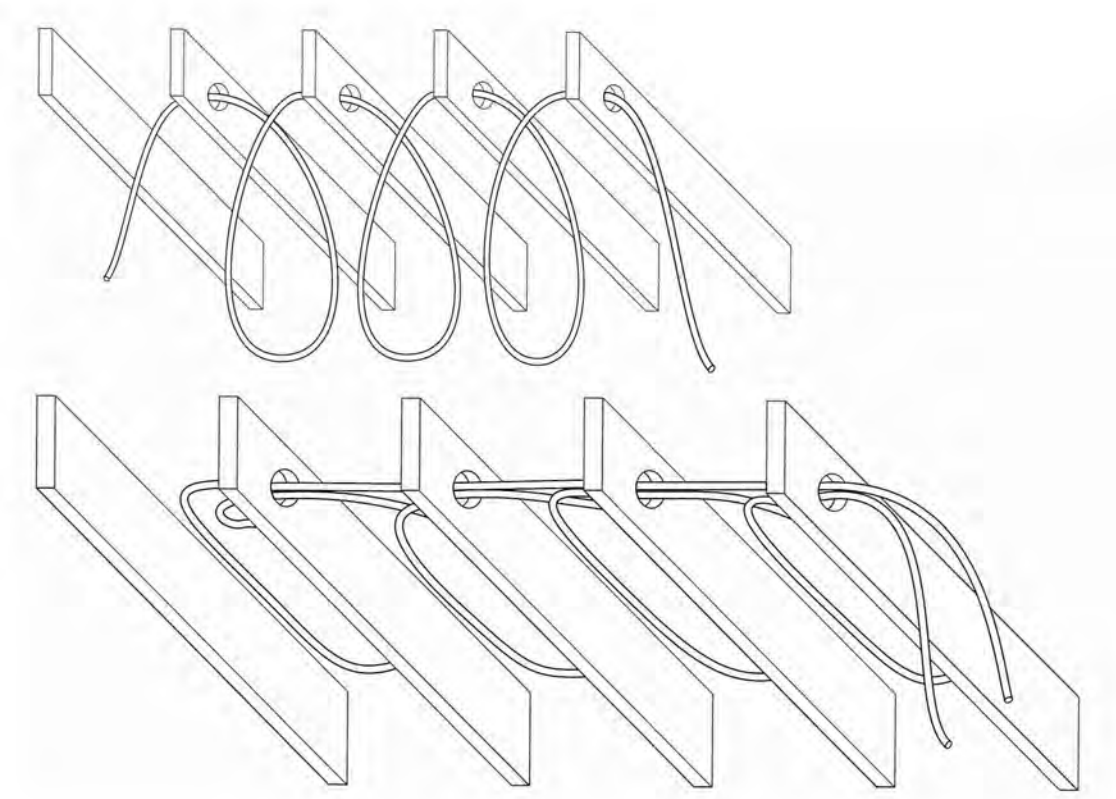


*We recommend and stock ¼ inch thick foil faced insulation.

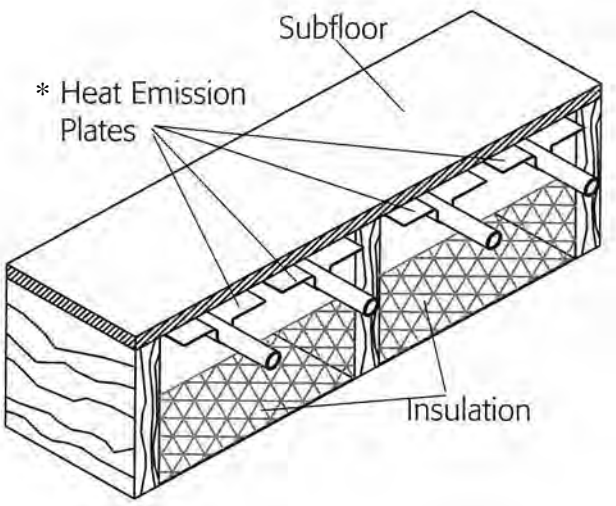


NOTE! Install plastic elbows to direct the tubing loops up to the manifolds. A 1x4 installed between studs provides a surface to clamp to. Staple or clamp tubing to sub-floor every 3-4 feet along straight runs and within 12 inches on each side of turns and in the middle of the arc for turns greater than 90°.

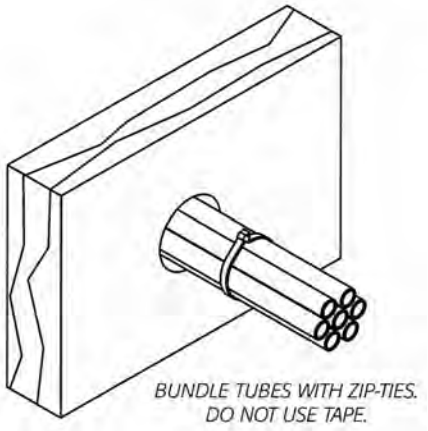
INSTALLATION BELOW THE SUB-FLOOR



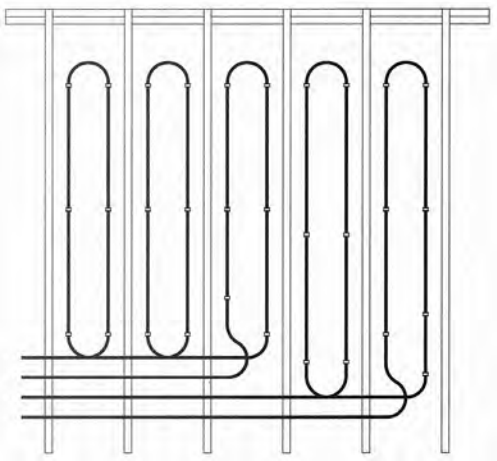
Holes through joists for tubing bundles must be sufficiently sized to allow free movement of the tubing. Single tubes or a bundle must NOT fit tight in holes through joists or noise may occur during expansion and contraction. Holes must not be so large as to compromise the strength of the joist.



*¼ inch foil faced insulation may be used in lieu of plates.



INSTALLATION BELOW THE SUB-FLOOR



Drill two series of holes in the joists to the far bay. The first one should be 6-8 inches from the band joist or joist support. The second should be 4-8 inches away from the first.

Begin by pulling the PEX tubing down the second series of holes drilled, as shown. Create a hanging loop in the PEX that is 4-6 feet long in the third bay from the end. Create another hanging loop in the next bay of the same length.

Do not pull the PEX straight through to the far joist bay. Depending on the ambient air temperature at the time of installation and the joist spacing, the PEX tubing may kink when trying to pull a new loop.

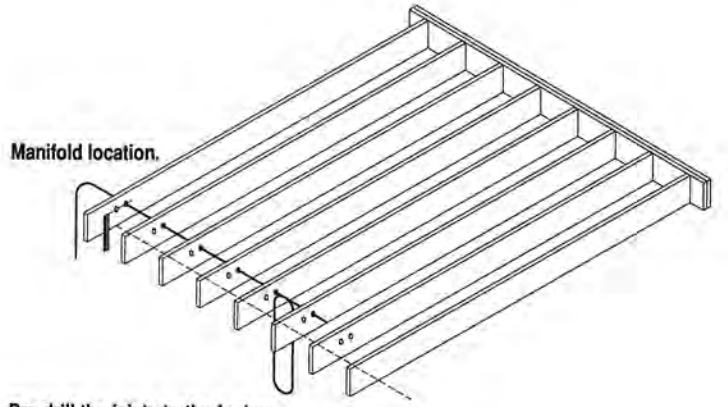
In the last bay, pull enough PEX to fill this bay and return to the manifold. When enough PEX has been pulled, return the PEX back down the other series of holes to the manifold.

Install the PEX in the far bay using either Lock-Downs or plates.

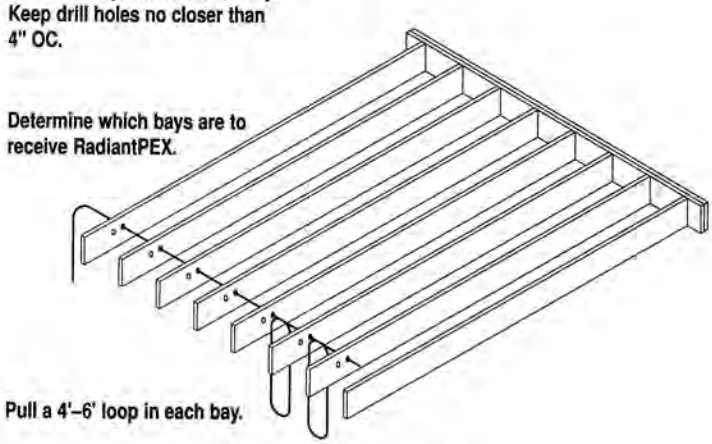
If extra tubing is required, pull from the previous bay. Likewise, if extra tubing is left over, push it back through the joist and into the previous bay.

Second Circuit

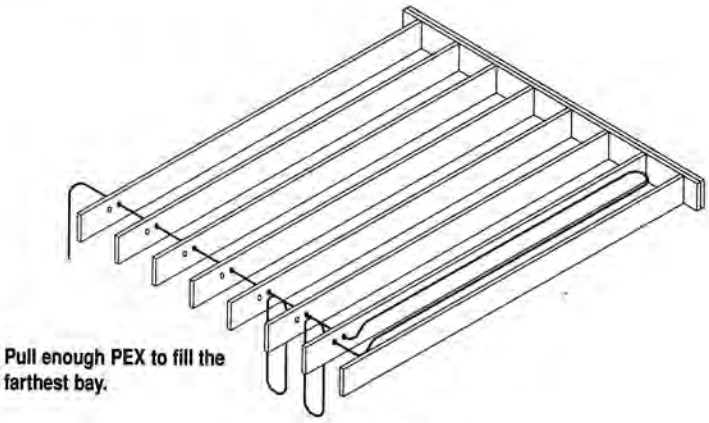
The second circuit will need to pick up the remaining section of the last joist bay left by the first circuit.



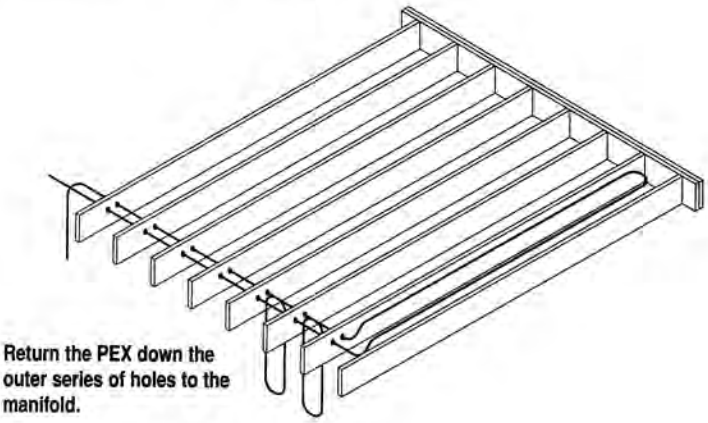
Pre-drill the joists to the far bay. Keep drill holes no closer than 4" OC.



Pull a 4'–6' loop in each bay.



Pull enough PEX to fill the farthest bay.



Return the PEX down the outer series of holes to the manifold.

INSTALLATION ABOVE THE SUB-FLOOR

Climate Panel

Application Benefits

• Fast installation

• No logistic problems associated with poured concrete

• Tubing is visible during nailing of wood finish flooring

• Low thermal mass means fast, dynamic response and minimal flywheel effect

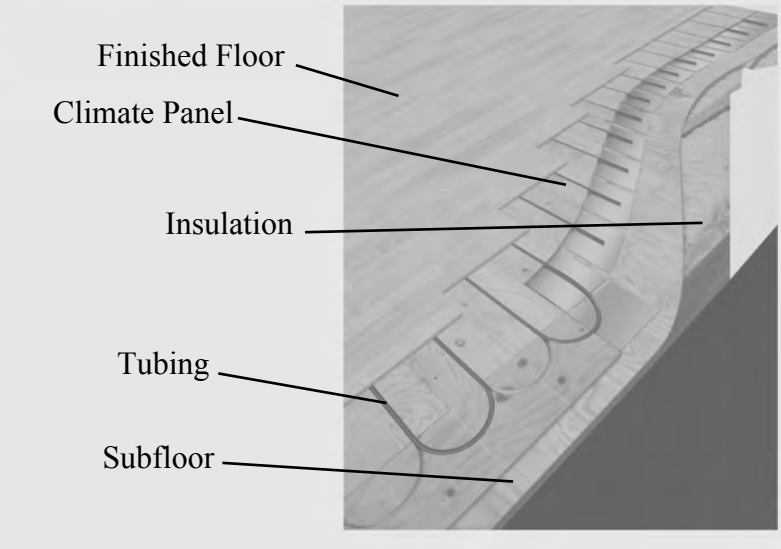
• Compatible with hardwood flooring

• Raises Floor only ½”

Wood Subfloor:
Ideal for wood frame construction, Climate Panels add no moisture to the building structure

No weight buildup reduces structural concerns.

Existing Concrete:
A Climate Panel System on top of an existing concrete floor is a simple retrofit solution.

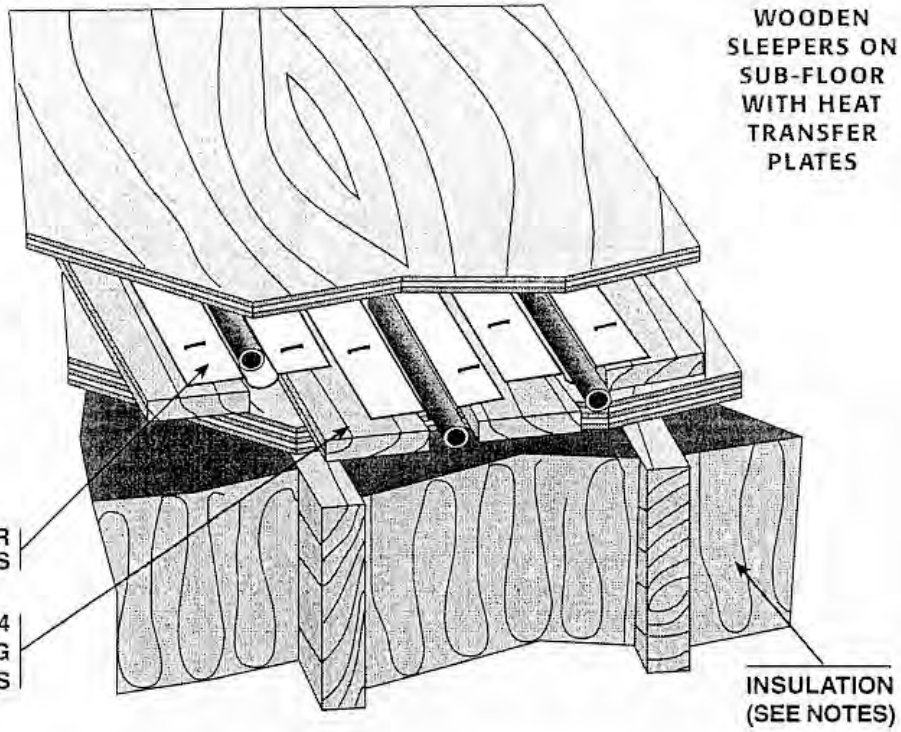


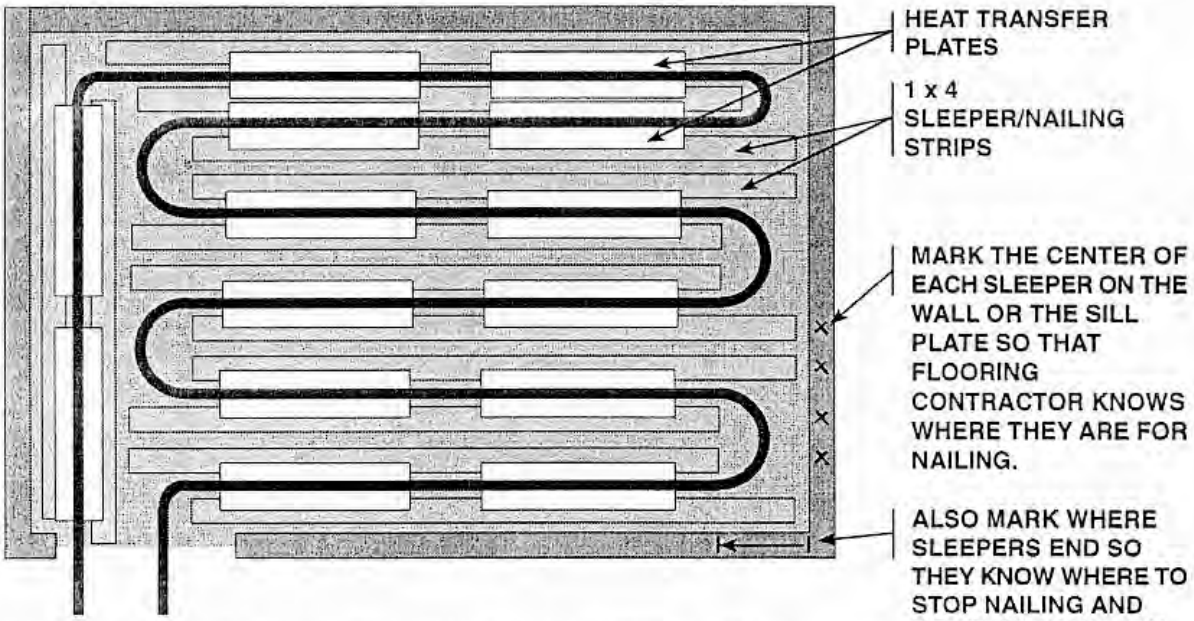
For complete information and installation go to:
www.VIEGA.com

INSTALLATION ABOVE THE SUB-FLOOR

CONSTRUCTION DETAILS, SUSPENDED FLOOR, SUBFLOOR SANDWICH

IMPORTANT NOTES REGARDING INSULATION:
Sandwich, suspended floor systems must be insulated in the joist spaces below. Insulation, not less than twice the combined R value of the material above the radiant tubes shall be installed below the floor. The sub-floor material below the tubing can be added to the value of the insulation.



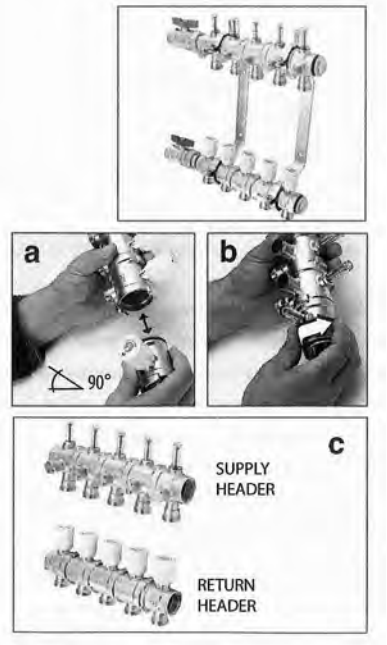


Typical layout of sub-floor sandwich. Heat transfer plates should be stapled down to the sleepers and should have at least a 2" gap between them. Ends of loop should be "bowed out" slightly so as to avoid expansion noise

MANIFOLD CONNECTIONS

MODULAR MANIFOLDS

A complete manifold consists of both a supply and return header. The M-8000 Modular Manifold header consist of End pairs and Expansion pieces, for both supply and return. Each piece of the End pair has one side female threads for connecting to the other manifold components and one side bayonet style connection for attachment End piece (for a two station manifold) or an Expansion piece (more than two station manifolds) (photo). End pairs and Expansion pieces should connect supply to supply or return to return, only, however; all connections are made in the same way as described below (a through c).



a) Align the male end (with EPDM o-ring, remove the protective, clear, plastic cover) of one piece with the female end of the second piece, with bayonet style connection so that the male end groves are 90 degrees off center from the female end slots.

b) Insert the male end into the female end and twist the pieces into alignment making sure that the male end grooves and female end slots engage.

c) Repeat steps a.&b. above for all pieces of each manifold header (supply and return). Each header must have 1 End pair and from 0 to as many Expansion pieces as required for the project (12 maximum for 1-1/4" manifolds & 10 maximum for 1" manifolds), connected in between the End pairs.

COPPER MANIFOLDS

Copper manifolds are a very popular choice for ease of installation and value. These manifolds come with PEX tube ready crimp ball valves pre- soldered for you. Please contact a Krell representative for information on copper manifolds.

SYSTEM FILLING AND AIR ELIMINATION

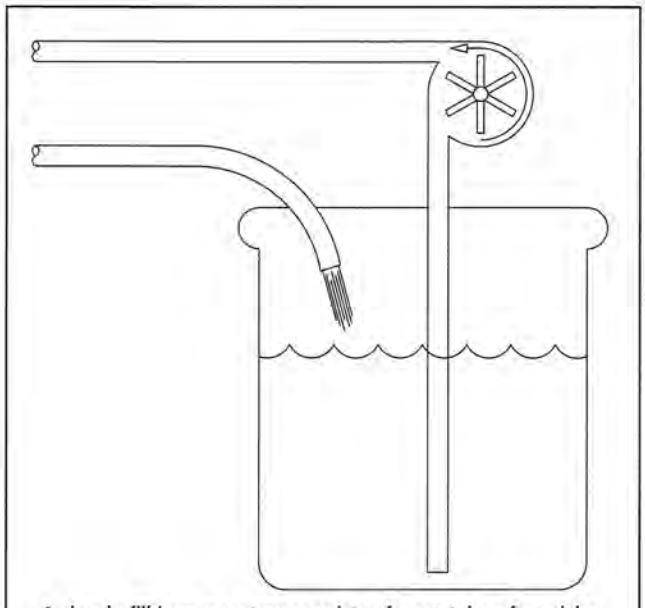
Loop and zone isolation valves are important for purging air from the system as they allow individual control of purge flow to develop the needed fluid velocity to force out air.

To affect the most efficient purging, each zone and loop should be purged individually. The key to purging is to create a high velocity flow through the tubing to force air out of the system. Circulation pumps are generally low flow and won't provide the needed velocity. By bringing fresh cold water into the system via the pressure reducing valve or fast fill bypass this velocity is achieved. Direct the incoming water to isolated zones and individual loops using isolation ball valves. This water/air mixture exits the system via boiler drains located on the end of the manifolds, or at the boiler return.

Systems requiring anti-freeze (snow melt or systems with piping exposed to the elements) can be purged with the use of a purge cart. A purge cart consists of an in line pump, hoses, and a container for mixing water/anti-freeze solution. The fluid is pumped into the system and returned back to the container, the air has been removed when no more bubbles are present in the container, proceed to the next loop or zone. If anti-freeze is required, please contact Krell Distributing for advice on the proper type.

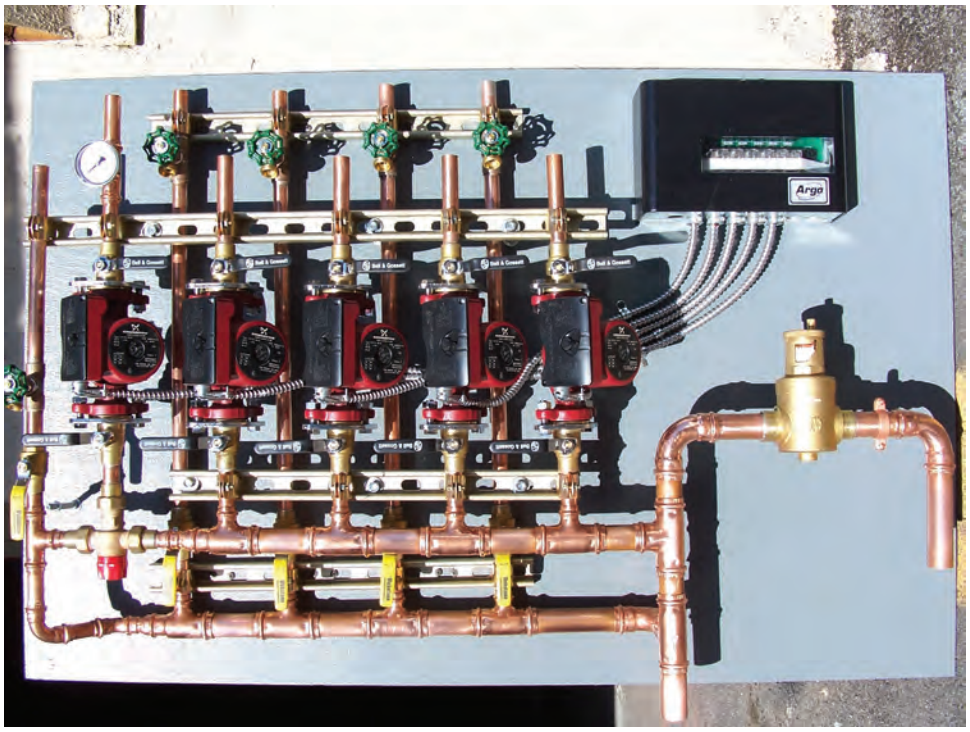
Never use anti-freeze in a boiler equipped with and aluminum heat exchanger without checking manufacturer's instructions.

When all manifolds and loops have been purged, the system can be filled and run tested. Small amounts of air remaining in the system will eventually vent, an enhanced air separator on the main supply piping will accomplish this.



A simple fill/purge system consists of a container for mixing the water and antifreeze, a motor-driven pump and hoses to connect to the radiant system.

PRE-FAB PANELS



To simplify the radiant heating boiler and zoning piping Krell Distributing will custom design a prefab piping module for your system. The entire assembly is mounted on a thick, durable plywood sheet to be bolted to the wall.

Each Module is shipped with all the components necessary for any number of zones and wiring from a zone control relay to each zone pump.

The do-it-yourselfer will only need to bring 120 volts to the panel, thermostat wire to the control box, and thermostat wire from the control panel back to the boiler.

Prefab Piping Modules greatly simplify the labor required to field pipe the system, and the module is expandable for future zones.

Pricing is based on the size and complexity of the job and is dependent on the individual system requirements.

The panel shown is for a 5 zone system. Easily expandable for additional zones, panels can be furnished from a one zone system up to as many as are required.

PROJECT NOTES

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WE HOPE THIS MANUAL GIVES YOU SOME INSIGHT ON INSTALLING RADIANT FLOOR HEATING.

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Our system design team: John Krell, Matt Krell, and Ken Stoneburg have combined experience of over 100 years. No other company on the internet can match that level of experience. We are a company dedicated to providing individual service and information to answer all of your needs. We ship prepaid from our 20,000 square foot warehouse located in Syracuse, New York.

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