Hydronic System
Installation Guide

Version 3.1, Dec 2014

About Us

HeatLink is a multi-system supplier of potable water and radiant hydronic heating/cooling and snow melt systems. For over 20 years we have created comfortable and efficient heating, cooling and plumbing systems for residential and commercial construction.

HeatLink's radiant heating systems create a comfortable and energy efficient environment for living. Our snow melt systems create safer public and private spaces that reduce liability for property owners, reduce maintenance, and ensure accessibility. Our well engineered plumbing systems provide peace of mind for property owners through extensive warranty protection, and enable quick and efficient installations for builders and contractors.

History

HeatLink began as a family owned business developed to service a number of industries including HVAC. The company grew to meet the needs of builders, contractors, and architects and began designing and installing radiant heating systems in 1985. Since 1985 HeatLink has grown into an industry leading designer and manufacturer of radiant heating, cooling, and potable water systems.

HeatLink has developed and manufactured a long list of industry firsts such as the "TwistSeal" tool-less manifold in 1996. The company began manufacturing PEX-a tubing in 1998 and now supplies the highest quality PEX-a systems to customers throughout North America and parts of Europe and Asia.

HeatLink works with a network of experienced and successful partner agencies to meet the design, system installation and training needs of the construction industry, designers, and architects.

Solutions

HeatLink in an industry leader in providing a broad range of potable water and radiant heating/cooling and snow melt systems for customers throughout the world. Our focus from our inception remains on creating well engineered and energy efficient solutions that are easy to install and last a lifetime.

Company Description

Our innovative plumbing and heating systems help provide a comfortable and worry free environment for people in residential and commercial work and living spaces. We continue to design quiet and energy efficient heating and potable water systems that are easy to install and last a lifetime. HeatLink was built on a strong family work ethic and a value system that remain the foundation for our continuing growth and industry leadership role.

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1. System Selection

The first determining factor will be the type of system installation.

1.1 Wet (poured) systems - primary heating

Of primary concern at this stage is the selection of the type of installation you require. When making your decision, take into account the highest efficiency versus the easiest installation method versus the least structural impact. With the use of either concrete or gypsum, the thermal mass of the floor will bring the most fuel efficiency and greatest comfort. While there may be slower recovery times, the high mass ensures a more even heat output, and in turn the floors retain their heat longer. This is caused by the large inertia that is stored in the slab. Other things to bear in mind are:

- concrete versus gypsum pours on plywood subfloor (i.e. main and second floor) (see section 5)
- fastening of tubing for the basement pour utilizing tie-strap mesh versus tracking, and
- the addition of full versus partial cover of insulation, and the requirement for expansion stripping.

1.2 DryBelow™ (staple-up) or DryAbove™ (clip-down) - primary heating

Radiant heating is often dismissed as an option when there is a concern about the load bearing ability of the structure. However, it is still possible to have radiant heating in these circumstances, by either placing the tubing within the joist cavity (using the DryBelow™/staple-up method), or between plywood strips (using the DryAbove™/clip-down method) on top of the subfloor. In either case, you will require the addition of HeatLink® heat transfer plates. These plates aid in the heat transfer process by distributing the heat over a wider area (than the area directly above a narrow tube), and also increase the heat transfer from tube to floor as the plate draws heat from the entire circumference of the tube.

- DryBelow™ (staple-up) (see section 6)
- DryAbove™ (clip-down) (see section 7)

1.3 Partial systems - secondary or supplemental heating

It is becoming more common to see a combination of heating systems used in buildings. In some situations, the radiant portion of a heating system is used as a heating supplement to another system (such as radiant in the basement floor with forced air, and baseboard on the other levels). In other circumstances, a floor-warming supplement might be used to address human comfort issues instead of actually heating the home. An example would be under a tile or slate floor where the purpose is to remove the chill from the surface, with a minimal effect on the room temperature.

2. Site Preparation

2.1 Cleanup

Clear the floor of debris whether it is a dry or wet install. In the case of a staple up, this could also mean grinding off any nails that penetrate through the floor into the work area.

2.2 Tools

A HeatLink® PEX Tubing Dispenser (e.g. #10003) is highly recommended to increase efficiency and decrease labor. You will also need a drill, a scaffold (rolling style for staple-up), wrenches, PEX Tubing Cutter #10100, hammer and screw driver.

3. Manifold

3.1 Choosing the manifold

Residential and light commercial applications will usually require the TwistSeal® Mini (40 mm) manifold, the multi-port manifold, or 76100 series stainless steel manifold. For heavy commercial and industrial installations the TwistSeal® (55 mm) manifold or 76200 series stainless steel manifold is recommended.

3.2 Location

Select a central location, which will allow for permanent access to the manifold location, (a closet is common), however with the use of custom enclosures it may be possible to use a wall in a hallway or room. The key consideration is to allow for the concentration of the uncontrolled heat from the leader pipes.

3.3 Support

The quantity of modules (loops) will determine the width of the wall cavity. Use of the TwistSeal® manifold should be kept in mind, as it will keep options open for future additions and deletions. Sufficient space should be allowed for any future extra loops that might be added. While installing, place the manifold high enough to allow for easy access to the tubing. Also, leave 8" of clearance above the top of the manifold for control wiring.

Option 1:
Install a ½" plywood strip (notched into the back of a 2×4) in the stud wall.

Option 2:
Install a prefabricated metal rough-in enclosure (71000 Series), complete with bracket, tappings and predrilled supply pipe locations There are several sizes available, depending on the required number of loops.

3.4 Manifold installation

- Make sure that the work area is completely clear of dust and debris.
- Follow the assembly instructions included with the manifold.
- Manifolds are not to be installed upside down.
- Secure the manifold to the backing support.
- Lubricated o-rings are easily contaminated by dirty working conditions.

3.5 PEX to manifold connection

Follow the PEX tubing to manifold instructions included with the manifold.

4. PEX Tubing Installation

4.1 Heating tubing

- Install HeatLink® PEX tubing ⅜", ½", ⅝", ¾", and 1" according to the manufacturer's recommendation.
- All tubing should be kept in their original packaging material until installation and must not be exposed to direct sunlight. All tubing is produced with a UV stabilizer but this instruction should still be followed.
- Please take care that a minimal bending radius of 6 times the diameter is obtained. For example, at 68˚F or 20˚C, there should be a:
  - 2-¼" (57 mm) radius for ⅜" PEX,
  - 3" (77 mm) radius for ½" PEX,
  - 3-¾" (95 mm) radius for ⅝" PEX,
  - 4-½" (115 mm) radius for ¾" PEX, and
  - 6" (153 mm) radius for 1" PEX.
- For under-floor double loop installations where the tubing is being run in the joists (through, not underneath), it is important to crossover the tubing to ensure it does not kink or collapse (see section 6).
- Sharp kinks in the tubing wall can be repaired using hot air by heating the tubing to transparency and allowing the thermal memory to return the wall to its original shape and diameter. A flame or torch must never be used to repair kinks.
- Care should be taken during installation not to damage the tubing with sharp objects such as nails or wires.
- The use of hard binding wires or tape for tying PEX tubing to rebar or wire mesh in not allowable, only soft breakable wire ties or plastic tie-straps should be used.
- Tubing must not be connected directly to a boiler or hot water tank. Allow for a minimum of 12" to 18" (30 to 50 cm) of solid pipe before the transition to PEX.

4.2 Heating tubing expansion joint crossings (see page 20)

When PEX heating tubing crosses expansion joints, their flexibility must be ensured by appropriate measures such as, the use of pipe sleeves made of closed cell pipe insulation, polybutylene, PVC or ABS. The sleeve must be approximately 1' (30 cm) long, split open and pushed over the top of the PEX heating tubing. Coverage should extend 6" on either side of the joint.

4.3 Entering/Exiting concrete slabs

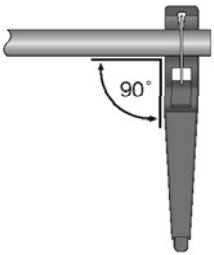
When entering or exiting a concrete slab the PEX tubing should always be protected by a conduit elbow (86000 Series), or a tubing sleeve.

4.4 Couplings

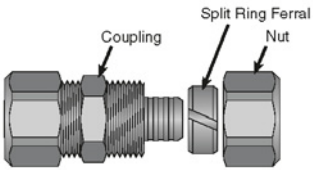
Should a joint be required in a heating loop, exercise care to ensure the coupling is installed correctly. The end of the PEX tubing must be cut squarely to ensure it seats tightly against the flange of the insert fitting. Disassemble the coupling to be used. Slide a nut and a split ring ferrule onto each tubing end. Place the insert fitting into the tubing and ensure that both tubings are seated correctly. Tighten both nuts. For WET installations only, wrap all couplings with PVC tape or compatible material before the topping-pour, to prevent any possible corrosion. (See WET Installation.)

Compression Coupling Instructions

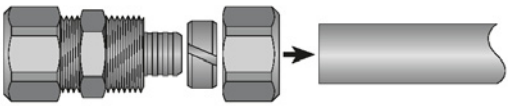
Step 1. Ensure that both PEX tubing ends have been cut at a 90˚ angle.



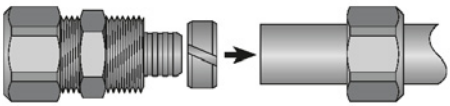
Step 2. Disassemble coupling by unscrewing the nut and removing the split ring ferral from both sides.



Step 3. Fit the nut over one of the PEX tubing end.

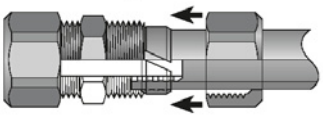


Step 4. Place the split ring ferral on the PEX tubing.

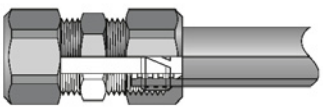


Step 5. Fit the tubing onto the coupling as far as possible (ie. up to the line as indicated).

Step 6. Using two wrenches tighten the nut onto the coupling.



Step 7. Repeat steps 3 through 6 with the other PEX tubing.



Protection

If the brass coupling is to be embedded in concrete, protect it by completely wrapping it with electrical tape or electrical shrink tube.

4.5 Pressure test

For the pressure test, use at least 80-100 psi (550-690 kPa) hydrostatic pressure or 60-80 psi (415-550 kPa) air pressure. This test must be performed for a minimum of 12-24 hours before the placement of the topping. Special care must be taken to check and retighten all joints and connections. During the pouring of the topping, the tubing must be left under pressure so that possible damage to the tubing can be immediately detected.

- In cold environments, a hydrostatic test must be properly freeze protected before testing. **A test pressure of 80 psi for a minimum of 24 hours before, during and after the enclosure is required.**
- Be aware of how temperature can affect air tests. Rising air temperature increases pressure, falling air temperature decreases pressure.

5. Wet Installation

A Wet Installation requires the tubing to be immersed in a wet mass, or topping-pour. Some recommended topping-pours include: concrete, light-weight concrete, and gypsum.
Below are some points to consider when commencing a Wet installation:

- For a Wet install on plywood, HeatLink tracking should be spaced at:
  - 40" apart for concrete, and
  - 30" apart for gypsum.
- When fastening tubing to mesh or rebar, only soft breakable wire ties or plastic tie-straps should be used to secure the tubing every 2' to 3'. Loops bends must be supported with a tie at each end and the top of the bend. Usage of any other tie material requires pre-approval from HeatLink.
- If the pour exceeds 3", it is recommended that the tubing be raised or chaired up into the top 2" of the pour.
  - if the design requirements specify lowering the tubing below 3", pre-approval/calculations are needed (e.g. warehousing where bolts are to be drilled/inserted into the floor).
- When installing tubing in a bathroom floor, ensure that the tubing is not too close to the toilet flange and seal.
- Ensure that all tubing is kept clear of floor space below cabinets, refrigerators and stoves. Large objects above a floor-heated space will interfere with efficient heat transfer. In some cases, appliances above, or food products within cabinets, could be overheated.

5.1 Expansion stripping

For Wet installations (excluding gypsum pours), ensure expansion stripping is fastened against the base of all interior and exterior walls. For residential applications where there is a concrete foundation, expansion stripping can be omitted for basements only.

5.2 Ground insulation/Vapor barrier

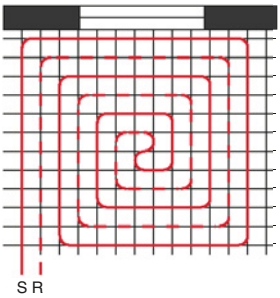
It is highly recommended to include a full coverage of 1" to 2" (25 to 50 mm) closed-cell high-density ground barrier insulation for all slab-on-grade or basement projects. In addition to reducing the amount of downward heatloss that could occur in such floor heating projects, there is a substantial benefit in utilizing a ground barrier insulation for any projects where response times or night set-back thermostats are desired. By reducing the amount of downward heat loss (and consequently the amount of additional thermal mass being created by heating of the soil below the slab), both the heating-up periods and cool-down periods will be greatly reduced.

- For projects where there is a concern of wet soil conditions, a minimum 6-mil vapor barrier must be installed, in addition to a full coverage of ground barrier insulation. This is imperative as any water movement, or the presence of a high water table, can trigger the transfer of the majority of the heat output downward, with only a minimum of heat being discharged upwards into the heating space.
- Snow melting projects require a minimum of 2" (50 mm) of closed-cell high-density insulation.

5.3 Tubing Laying Techniques

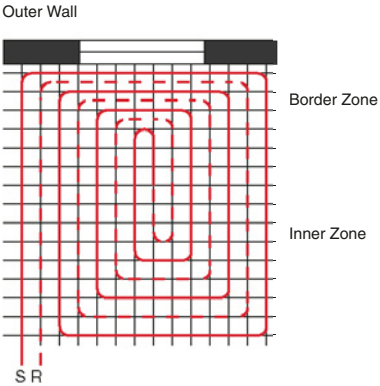
Counter Flow Loop

For use on wire mesh or rebar.



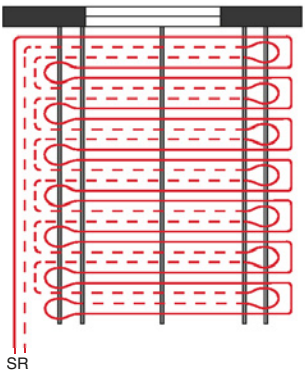
Border Counter Flow Loop

Perimeter border zone (tighter spacing), and inner zone (wider spacing).



Double Counter Flow Loop

This is the recommended installation method for tracking.



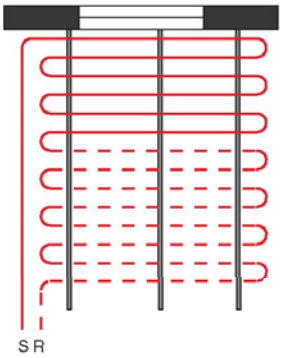
Notes:

1. Allow for sloppy or large radius turns where piping makes a single spacing pass, especially for any spacing less than 6" (150 mm) (see examples).
2. For tubing spacings of 4" (100 mm) or less, an additional track at the loop end is recommended to ensure even spacing.

Wet Installation

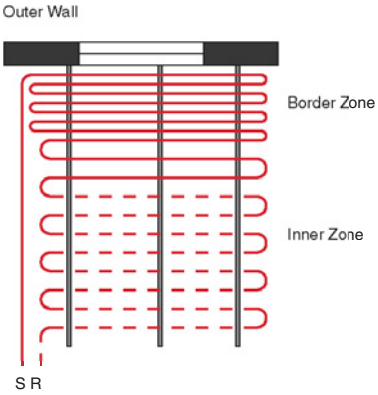
Serpentine Loop

Only recommended for floor surface areas where the temperature drop from supply to return tubing transition is not critical (i.e. low occupancy areas).



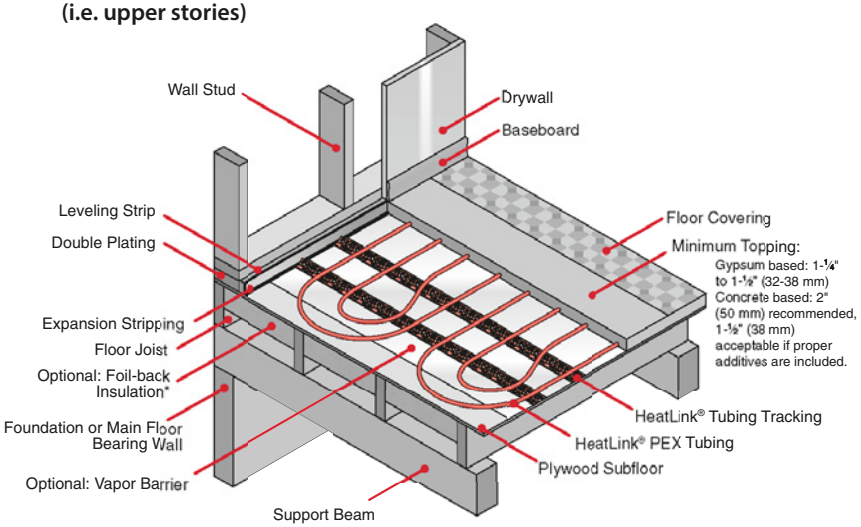
Border Serpentine Loop

Perimeter border zone requires tighter spacing, and the inner zone requires wider spacing. This is recommended for areas of high heat loss on perimeter, and where a floor surface temperature drop in the inner zone is not critical (i.e. carpeted areas or low occupancy areas).



5.4 Wet Installation - Top of Subfloor

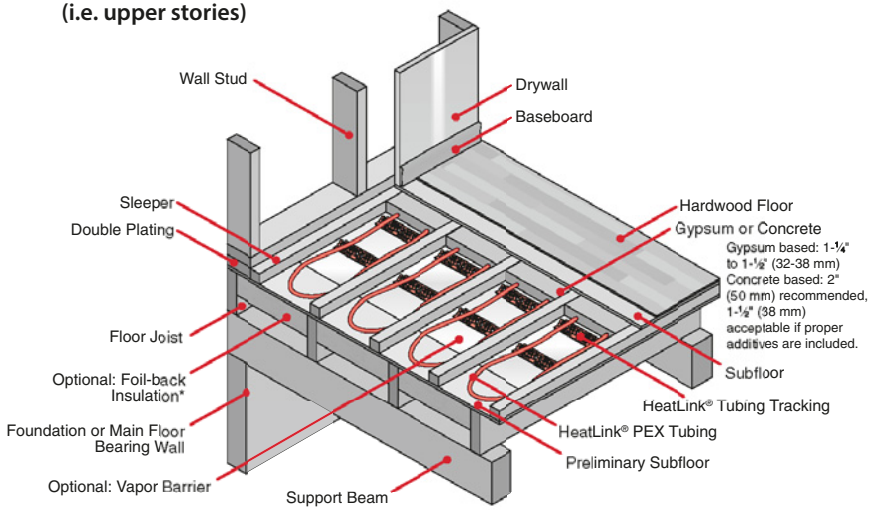
HeatLink® Wet Installation on Top of Subfloor (i.e. upper stories)



Notes:

1. Insulation is recommended where the space below should not receive any heat. (e.g. wine cellars).

HeatLink® Wet Installation on Top of Subfloor with Sleepers for Solid Hardwood Flooring (i.e. upper stories)

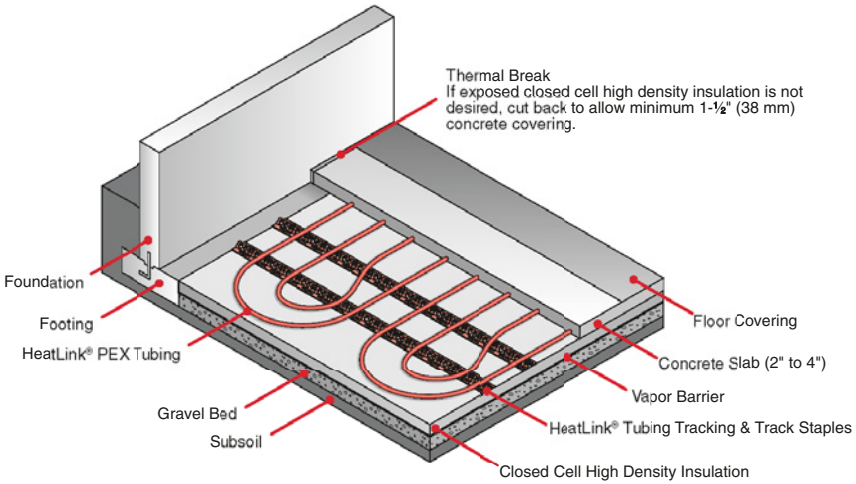


Notes:

1. Sleepers should be added after laying the tubing to maintain the tubing spacing.
2. Insulation is recommended where the space below should not receive any heat. (e.g. wine cellars).

5.5 Wet Installation - Slab on Grade

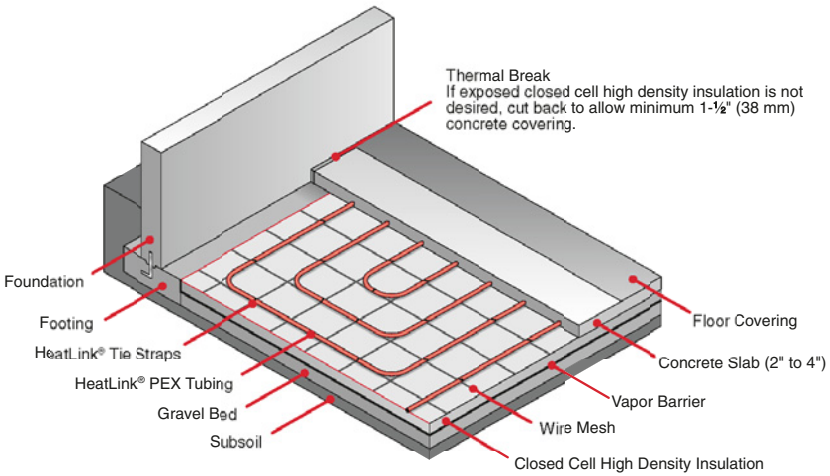
HeatLink® Wet Installation for Ground Floor (i.e. basements, or slab-on-grade applications)



Notes:

1. If piping is to be placed directly on the gravel bed without a layer of closed cell high density insulation, wire mesh or rebar and plastic tie straps should be used instead of tubing tracking and track staples.
2. For applications where a high water table or soil moisture content is present, an insulation layer plus vapor barrier must be provided!

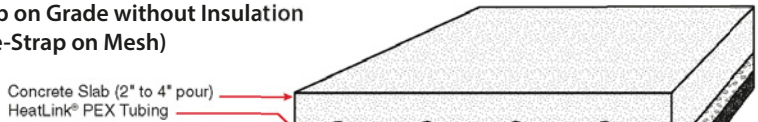
HeatLink® Wet Installation for Ground Floor (i.e. basements, or slab-on-grade applications)



Notes:

1. For applications where a high water table or soil moisture content is present, an insulation layer plus vapor barrier must be provided!

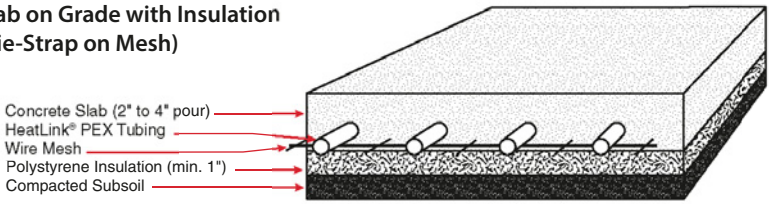
Slab on Grade without Insulation (Tie-Strap on Mesh)



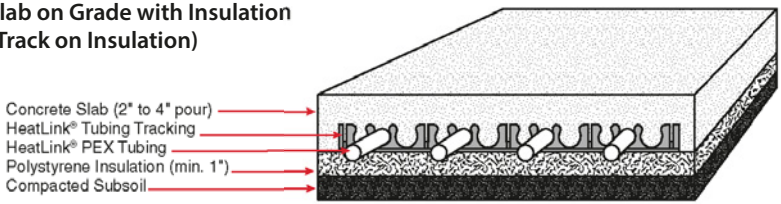
Notes:

1. Extruded polystyrene insulation is not shown, but is highly recommended.

Slab on Grade with Insulation (Tie-Strap on Mesh)



Slab on Grade with Insulation (Track on Insulation)

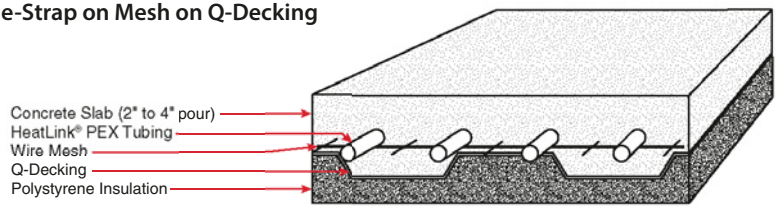


Notes:

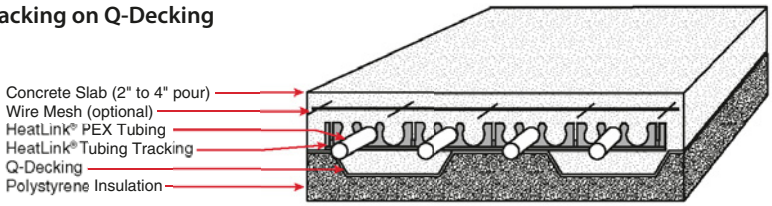
1. For any moisture which may be present in the subsoil, both a vapor barrier plus "closed cell" polystyrene insulation is required.

5.6 Wet Installation - Q-Decking

Tie-Strap on Mesh on Q-Decking

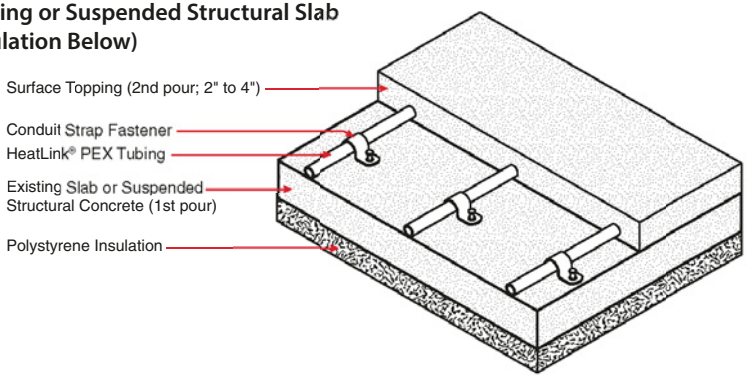


Tracking on Q-Decking

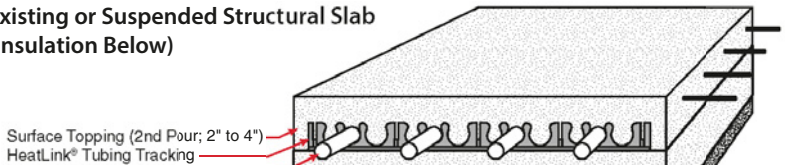


5.7 Wet Installation - Existing or Suspended Structural Slab

Existing or Suspended Structural Slab (Insulation Below)



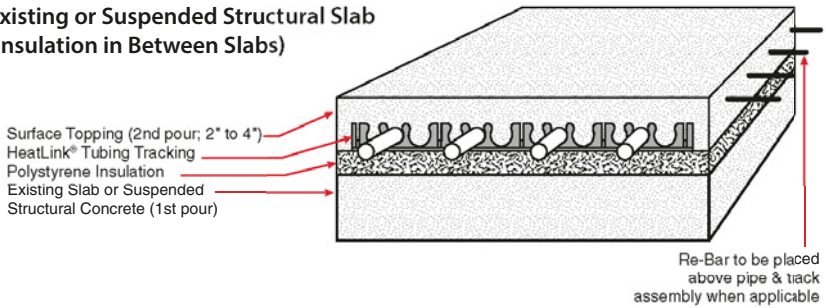
Existing or Suspended Structural Slab (Insulation Below)



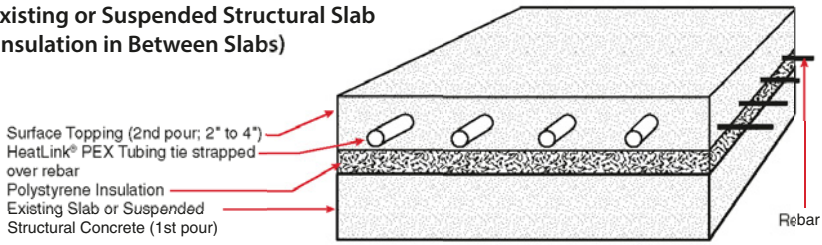
Notes:

1. For unstressed slabs, tracking to be fastened to existing slab with power actuated nails, pin-drill setting, or glue (i.e. PL700 or tub surround equivalent).
2. For stressed slabs (structural concrete), fasten tracking to existing slab with glue (i.e. PL700 or tub surround equivalent).

Existing or Suspended Structural Slab (Insulation in Between Slabs)

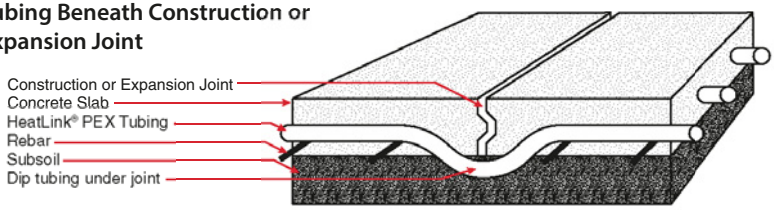


Existing or Suspended Structural Slab (Insulation in Between Slabs)

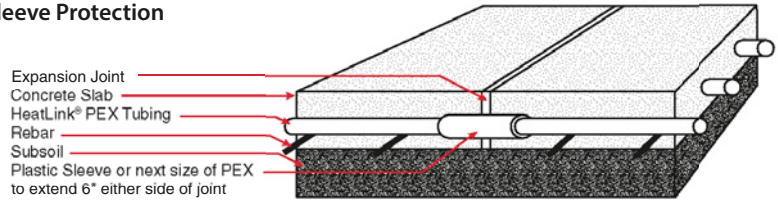


5.8 Wet Installation - Joints

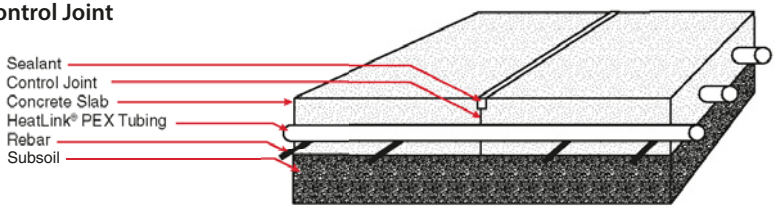
Tubing Beneath Construction or Expansion Joint



Sleeve Protection

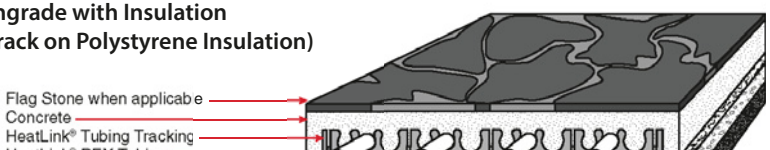


Control Joint

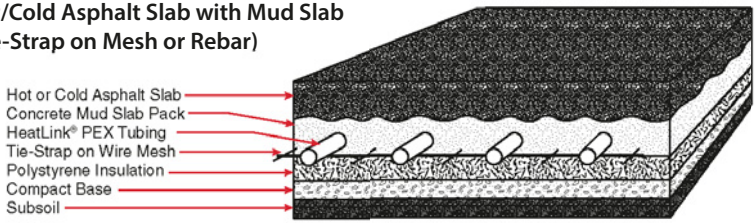


5.9 Wet Installation - Snow Melt

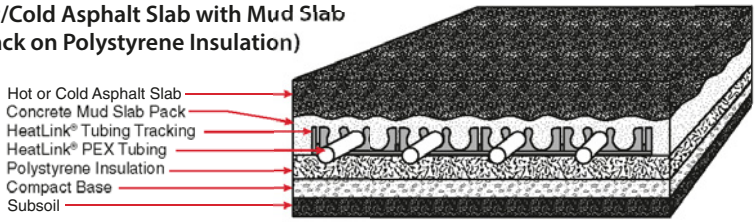
Ongrade with Insulation (Track on Polystyrene Insulation)



Hot/Cold Asphalt Slab with Mud Slab (Tie-Strap on Mesh or Rebar)



Hot/Cold Asphalt Slab with Mud Slab (Track on Polystyrene Insulation)

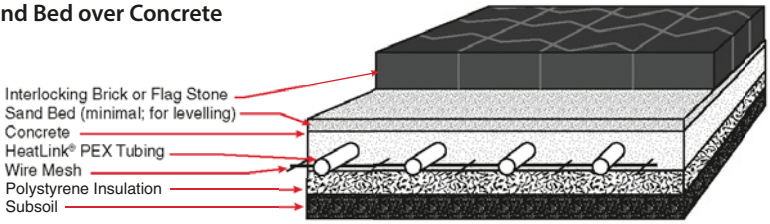


Notes:

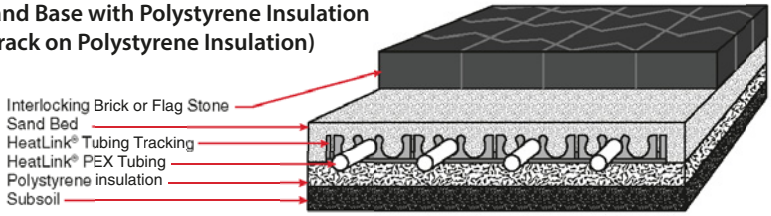
1. For any moisture which may be present in subsoil, both a vapor barrier plus polystyrene insulation is required.
2. Confirm topping depths and PEX spacing with your heating designer.

Wet Installation

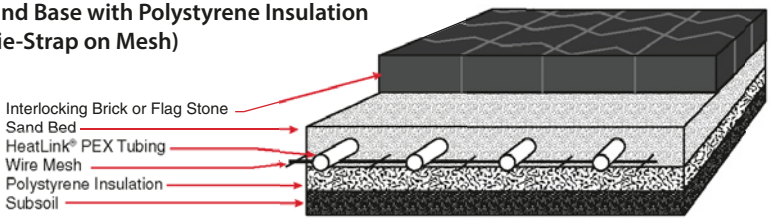
Sand Bed over Concrete



Sand Base with Polystyrene Insulation (Track on Polystyrene Insulation)



Sand Base with Polystyrene Insulation (Tie-Strap on Mesh)

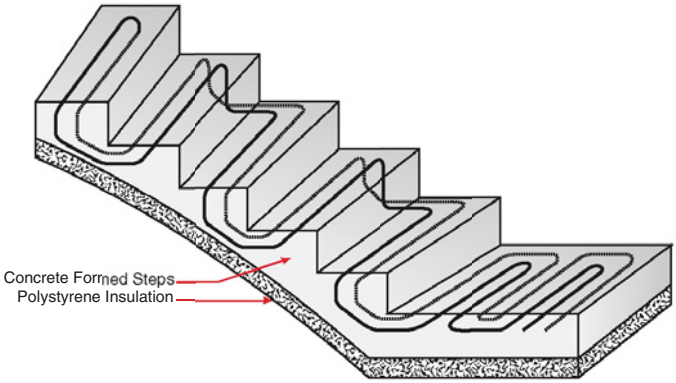


Notes:

1. For any moisture which may be present in subsoil, both a vapor barrier plus polystyrene insulation is required.
2. Confirm topping depths and PEX spacing with your heating designer.

5.10 Wet Installation - Snow Melt Stairs

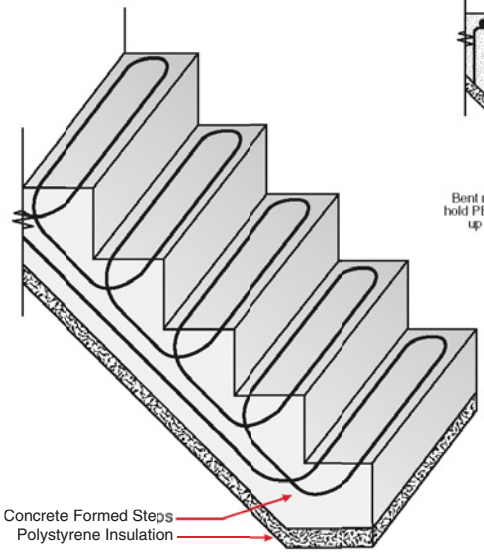
Stair Method 1:



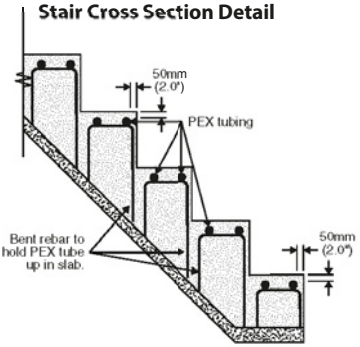
Notes:

1. Tubing must run parallel to steps.
2. Evenly space two tubes per step ensuring outer tubing is no more than 2" from edge of step.
3. Keep tubing no lower than 2" below tread surface.
4. Loop length is critical; please confirm with your heating designer.

Stair Method 2:



Stair Cross Section Detail



Notes:

1. The piping pattern shown is similar to that of an under subfloor or dry system. **It is critical that placement of the tubing to the leading edge of the steps is no more than 2" from the front and top of the step.** This will allow as much heat as possible to migrate to the step edges to prevent an ice cap from forming on the leading edge of the step. A 1-½" maximum distance is important when a paving stone or cast slab is placed on the step; the final distance from tubing to finished stone edge should be no more than 2".

6. DryBelow™ Installation

6.1 Heat transfer plates

The number of heat transfer plates required can be estimated by:

Room Width (ft) × Room Length (ft) × 0.55 = Number of Heat Transfer Plates

Fasten plates by stapling them to the underside of the subfloor. Ensure gap spacing does not exceed 6" (150 mm). At the end of each joist space (at the tubing bend), set the first two plates well back (heat transfer plates must be installed 12" (310 mm) from loop ends and crossovers), and fasten on a slight diagonal. This will ensure there is minimal tension on the tubing wall from any expansion or contraction of the piping. *Adjust plate gap spacing between 3" to 6". Gap spacing can be manipulated to eliminate the need for trimming the plates (see also note 6.4.6 & 6.5.8).*

6.2 Insulation

Fasten a minimum of 1-½" (40 mm) foil-backed insulation with foil facing piping and heat transfer plating directly under the subfloor (a high insulation R-Value of R-20 or higher is recommended to prevent downward heatloss). Install foil-backed insulation as close to the tubing and plate assembly as is possible, to ensure the development of an air cavity is minimal.

An alternate method is to fasten only the foil to underside of the subfloor (foil face against piping and plates), and then place some batt insulation against the foil. If this method is used, ensure that the batt insulation is fitted securely to the bottom of the foil and will not fall to the bottom of the joist space (thereby creating an air cavity). Spray foam insulation can be used in place of the batt insulation. Direct contact of the PEX tubing and spray foam is not recommended. The foil will then also keep the foam from getting between the tubing, heat transfer plates, and the subfloor.

6.3 DryBelow™ installation guidelines

- The tightest bend radius for PEX is 6 times the outside diameter.
- Use protective sleeves when penetrating floors, laminated wood, or metal studs.
- Drill holes at least ¼" (5 mm) larger to provide free movement of tubing.
- Protect tubing with steel plate if it is within 2" (50 mm) of a stud, plate or nailing surface (see Figure 1).
- When running HeatLink® PEX be sure to install at least 6" (150 mm) from any gas appliance vent piping, or 12" (300 mm) from any recessed light fixtures (see Figure 2).
- If HeatLink® PEX is notched or cut, section of PEX must be cut out and replaced.
- Beneath cabinets, refrigerators and stoves, insulation should be placed between the subfloor and tubing to prevent overheating those areas.

Figure 1

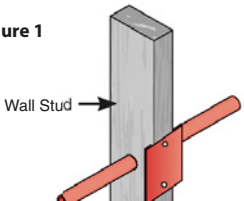
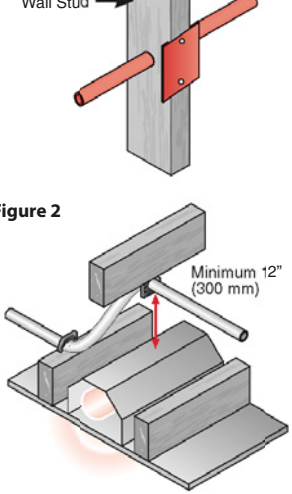
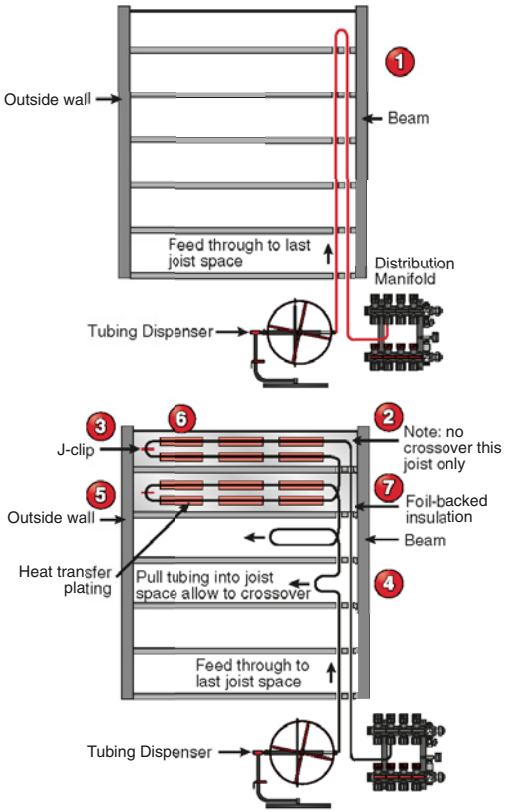


Figure 2

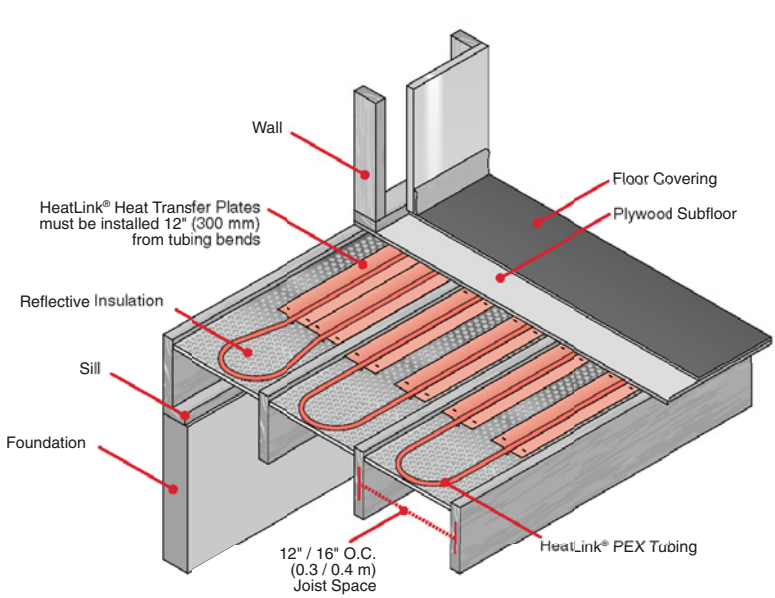


6.4 Two tubings per joist space

1. Spooling tubing from the dispenser, go first through the hole furthest from the beam to the last joist cavity being supplied by the loop. Then lead the tubing directly back to the distribution manifold. Attach tubing to distribution manifold, and secure.
2. Pull the tubing into the first joist space. (Note: There is no tubing crossover in the first space only.)
3. Using J-Clips, temporarily attach the tubing to the bottom of the subflooring. The J-Clips remain in place until the heat transfer plating is installed.
4. Proceed to pull the tubing into each remaining joist space. (Note: Allow tubing to crossover as shown to prevent kinking.)
5. Pulling the tubing into the joist spaces, proceed with the installation of heat transfer plating.
6. Begin plating on one row of one joist. After completing the first row of plates, plate gap spacing can be adjusted from 3" to 6" (75 to 150 mm) for the second row, to ensure that the last plate in a joist cavity does not have to be cut.
7. Place a minimum of 1-½" (40 mm) foil-backed insulation tight against the tubing and plate assembly, or alternatively staple a foil to subfloor and then add some minimum R-12 (R-20 recommended) batt insulation.



HeatLink® DryBelow® Double Loop Installation for Under Subfloor Applications
(i.e. between the floor joists)

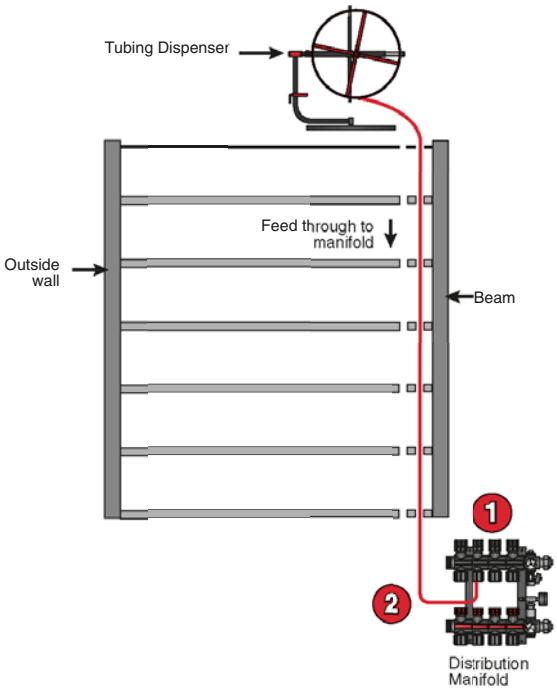


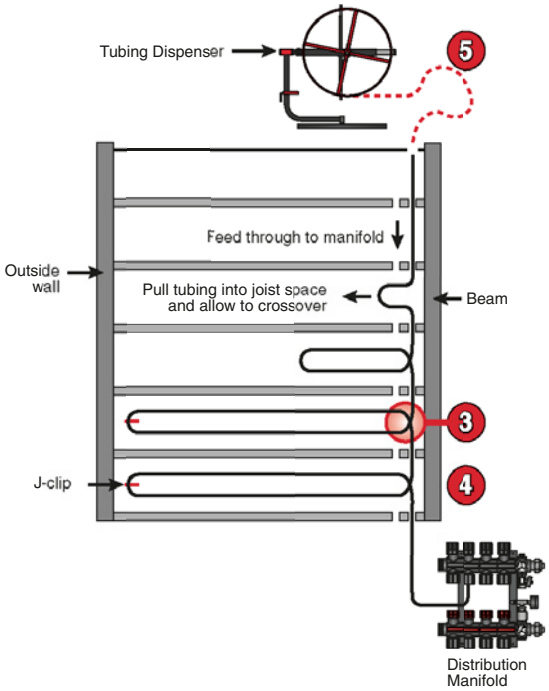
Notes:

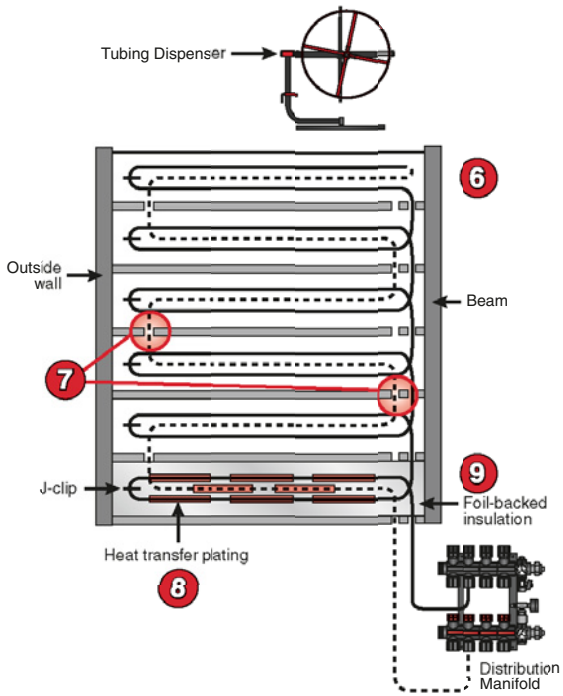
1. Foil should be fastened directly under the subfloor to ensure that a minimal air cavity is created. (Foil face should be placed against the tubing and heat transfer plating.)
2. Non-Barrier PEX tubing is preferred to ensure elimination of expansion/contraction noises. If HeatLink® O_2 Barrier PEX Tubing is required, then a modulating indoor/outdoor controller is required. (Alternatively, a silicone based adhesive can be placed between the plate and tubing.)

6.5 Three tubings per joist space

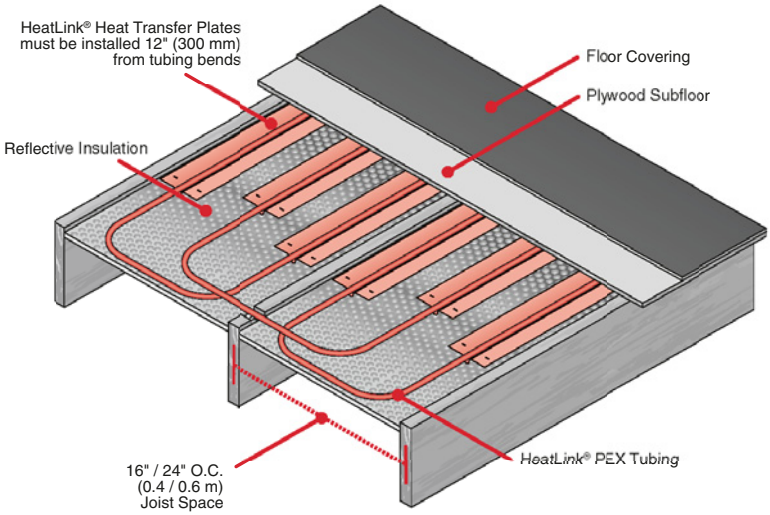
1. After drilling holes in the joist; pull the tubing off the dispenser and through the holes in the joist to the manifold.
2. Fasten tubing in the manifold (see assembly instructions included with the manifold)
3. Pull tubing into the joist space, allowing for the tubing to cross over. Continue to pull tubing into the length of the joist space.
4. Once all the cross over loops have been pulled, measure the total distance of all joist spaces in the loop, plus any additional tubing from the loop back to the manifold.
5. Pull the corresponding amount of tubing off the tubing dispenser and cut the tubing.
6. Begin feeding the cut end of the tubing through each length of the joist to create the third line.
7. String the third line through all the joist spaces and return to the manifold.
8. Begin plating on one row of one joist. After completing the first row of plates, plate gap spacing can be adjusted from 3" to 6" (75 to 150 mm) for the second row, to ensure that the last plate in a joist cavity does not have to be cut.
9. Place a minimum of 1-½" (40 mm) foil-backed insulation tightly against the tubing and plate assembly, or alternatively staple a foil to subfloor and then add some minimum R-12 (R-20 recommended) batt insulation.




Tubing Dispenser
5
Feed through to manifold
Outside wall
Pull tubing into joist space and allow to crossover
Beam
3
J-clip
4
Distribution Manifold


Tubing Dispenser
6
Outside wall
Beam
7
J-clip
9
Foil-backed insulation
Heat transfer plating
8
Distribution Manifold

HeatLink® DryBelow™ Triple Loop Installation for Under Subfloor Application
(i.e. between the floor joists)



Notes:
1. Foil should be fastened directly under the subfloor to ensure that a minimal air cavity is created. (Foil face should be placed against the tubing and heat transfer plating.)

7. DryAbove™ Installation

7.1 Approximate Material Requirements

Stk#	Description	Room Width (ft)		Room Length (ft)	Multiplier	Remarks	TOTAL
87024	Heat Transfer Plates		×		0.55	The multiplier is applied to the room square footage.	Number of Heat Transfer Plates
87205	EndBend™(s)		OR		1.5-*serpentine* 2.256-*double counter flow*	The multiplier is applied to either room width or length to which the tubing is laid perpendicular.	Number of EndBend™ (s)
87305	SpacerClip™(s)	# of plates + # of EndBend™(s)				The number of Heat Transfer Plates plus the number of EndBend™(s)	Number of SpacerClip™(s)
(Third Party)	Perimeter Edging		+		2	The multiplier is applied to the sum of the room width and length.	Footage of Edging Strips
(Third Party)	Sleeper Strips		×		1.5	The multiplier is applied to the room square footage.	Footage of Sleeper Strips
20x05 Series	½" HeatLink® PEX Tubing	As per HeatLink® Heatloss & Analysis Calculations					

7.2 Installation

1. Determine the manifold location. It is *recommended* that manifolds be installed before the tubing is laid.
2a. The direction of strip hardwood floor must be determined before starting. Tubing **must** be laid perpendicular to it. Use a serpentine loop pattern with strip hardwood floors (see pages 35-36). For other floor coverings the tubing direction doesn't matter.
2b. If necessary, add edging for a carpet nailing strip.
3. Install perimeter edging on the two sides of the room (parallel with the tubing pattern). Secure edging and sleepers to the subfloor with either nails or staples, as per the local building code. See the field example on pages 34-35 for suggestions.
4. Install the first EndBend™ against the perimeter edging.
5. Use a 4' × 8' × ¾" sheet of plywood, and set cut width to 6-¾". This will result in 7 - 6-¾" Sleeper Strips. Install the first Sleeper Strip in line with EndBend™.

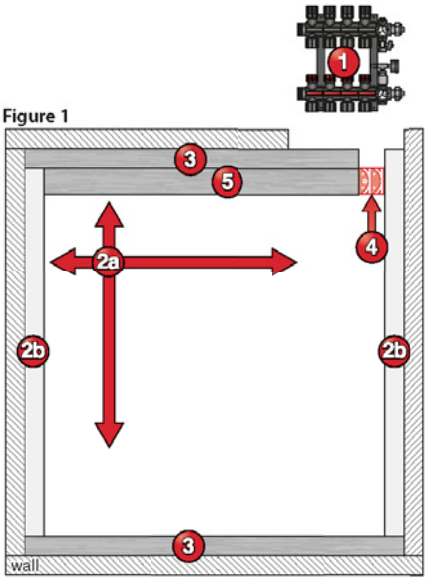


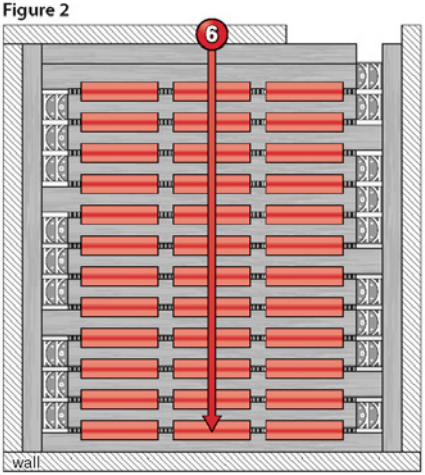
Figure 1

6 The SpacerClip™ and plate installation should be done together.

a) Sleeper the room:
- Use 6-¾" sleepers with a 1-¼" space between each and an EndBend™ as required.
- The 1-¼" space can be measured by using the SpacerClip™s, or alternatively using plywood or small blocks cut to 1-¼".
  Tip: Install the sleeper loose enough that the SpacerClip™ or block can be moved.

b) Plating the room:
- Plates should be placed starting 2" from the EndBend™ and nailed on only one edge (this will allow for plate expansion).
- Insert SpacerClip™s into the 1-¼" slot, about 1" from the end of the plate.
- The next plate should be started about 1" from the other side of the SpacerClip™.
- The final plate may need to be cut; **remove all sharp and rough edges**.
- Alternatively, gap spacing between plates can be adjusted between 3" to 6" to eliminate the need to trim the plates.

Figure 2



7. Install tubing. Use the serpentine pattern when solid hardwood is the finished flooring. For all other flooring including floating or engineered wood, laminate flooring, carpet, tiles, etc., a double counter flow loop pattern is preferred. (see Figure 7 and 8 on pages 36-37) Place tubing into groove between Sleeper Strips, press into the SpacerClip™ (which will hold the tubing in place), bend through EndBend™ and repeat.
   - To facilitate installation of PEX tubing, a tubing dispenser is recommended. One end of the tubing roll can then be connected securely to the distribution manifold. Tubing can then be laid by uncoiling off the dispenser (see Figure 3).
   - Non-Barrier PEX tubing is preferred to ensure elimination of expansion / contraction noises. If HeatLink® O2 Barrier PEX tubing is required, then a modulating indoor / outdoor controller is required. (Alternatively, a silicon based adhesive can be placed between the plate and tubing.)
   - To ensure supply and return tubing enters and exits out of the same side of the room, it is preferable to have an even amount of passes (this requires an odd amount of sleepers). If joist space access below is available, this may not be a concern.
8. Perform a pressure test on the complete tubing and manifold assembly. (The pressure test is to remain until all floor coverings are completed.) (see Figure 4)
   - When the finished floor is carpet or floating hardwood, the covering can be ¼" plywood or hardboard. If a thin-set tile is to be the finished floor, use cement board. Ensure tubing pattern is clearly marked (chalked) on the subfloor covering, to avoid nailing into tubing below.

Figure 3

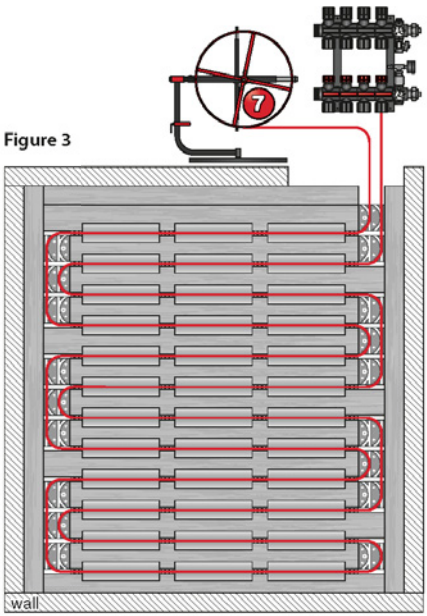
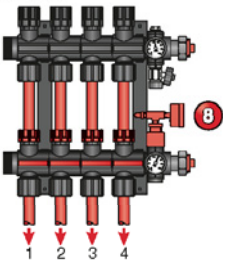


Figure 4



7.3 Optional Insulation

For areas where the space below should not receive any heat, fasten a minimum of 1-½" (40 mm) foil-backed insulation with foil facing the subfloor directly under the subfloor (a high insulation R-Value of R-20 or higher is recommended to prevent downward heatloss). Spray foam insulation can be used in place of the batt insulation.

7.4 Installation Example

If solid hardwood will be the finished floor, lay tubing perpendicular to the direction of the hardwood. For other floor coverings, tubing can be laid in either direction.

Edging around the perimeter of a room is a function of the room size. The number of sleepers must be an even and whole number to ensure that the supply and return piping enters and exits on the same side of the room. An even amount of sleepers provides an even amount of tubing passes. To simplify calculations, do them in inches. When the math is done, *round down* to the next even number. The required edging can be calculated as follows.

1. Determine the number of sleepers first

Divide the length of the wall (to which the tubing are laid perpendicular) by 8" to get the required number of sleepers. (As each sleeper is 6-¾" wide, and a spacing of 1-¼" wide is allowed between sleepers for running the tubing, 8" is used in the calculation.) For the above right example: 141" ÷ 8" = 17.625*. Hence, after rounding down, the number of sleepers required for the room is 16, and the tubing will have 16 passes. For the below right example: 96" ÷ 8" = 12 sleepers.

*Note: 17.625 falls between 18 and 16. However, the room length (11' 9" or 141") precludes the selection of 18, as 18 × 8" = 144", and is greater than 141".

2. Edging Calculation

Using the above results, the perimeter length covered by the sleepers can be determined by multiplying the number of sleepers by the same 8". For the example in Figure 5, the perimeter covered by the sleepers (the sleeper coverage length) is 16 × 8" =128". To determine the edging, subtract the sleeper coverage length from the actual wall length to be covered by edging (141"-128" = 13"). This figure can be divided by 2 to get the edging width for both ends of the room (13" ÷ 2 = 6-½" on each end 2). For the example in Figure 6, the sleeper coverage equals the room width (12 × 8"= 96"). Therefore no extra edging is needed; cut a sleeper in half to use on each side 3.

Hints

- If the standing wall is exposed to an unheated area (or outside), or has a window, use a narrower edging for this wall.
- For multiple loops, perimeter edging needs to be spaced appropriately to allow for the supply and return piping. (See Figures 7b, 8b.)
- If access to the ceiling below is possible, the supply and return runs can alternately be drilled through the floor to the joist cavity below. Manifolds are normally positioned on the same level as the tubing. However, if access to the ceiling below is possible, alternatively the manifolds can be positioned in the level below.

Figure 5 - Example Room Installation: hardwood

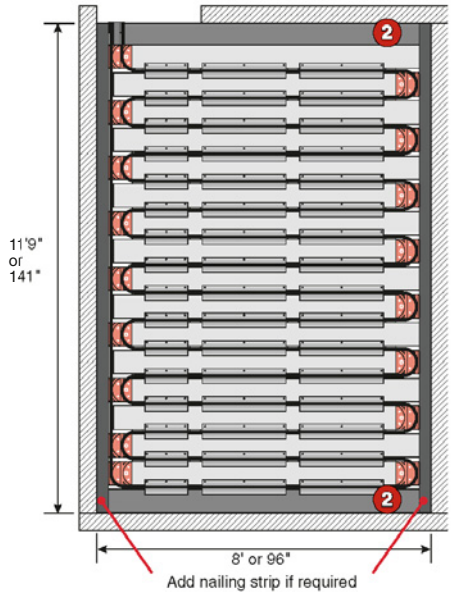


Figure 6 - Example Room Installation: other

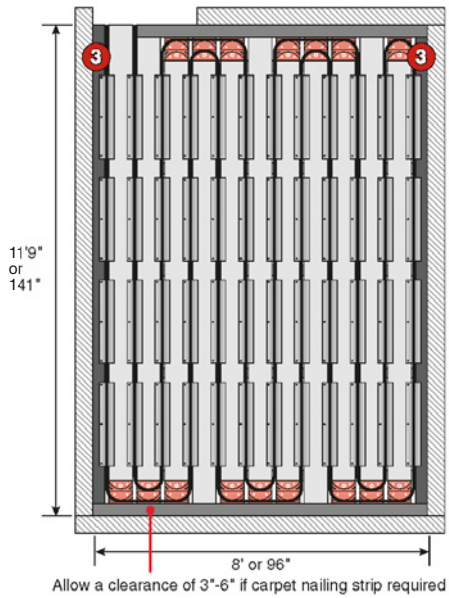


Figure 7a - 1 loop

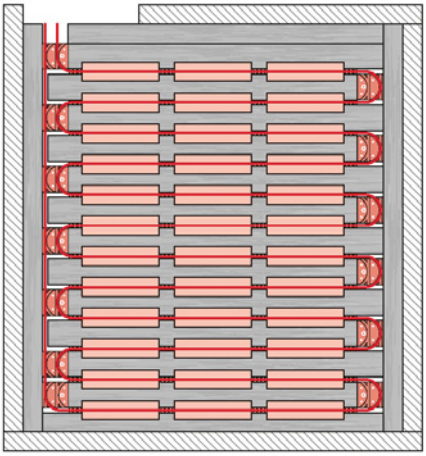
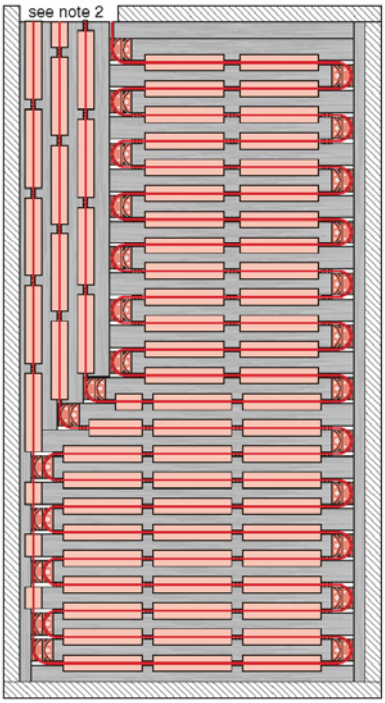


Figure 7b - 2 loops



Notes:

1. Serpentine loop pattern (as shown in Figure 7a/b) is primarily used when solid hardwood is the floor covering.
2. For multiple loop rooms, each tube entering the room needs 1-¼" spacing for the SpacerClip™. It may not be possible to nail hardwood flooring in these supply-return areas, since the direction of the floor boards will be the same as the tubing.

Figure 8a - 1 loop

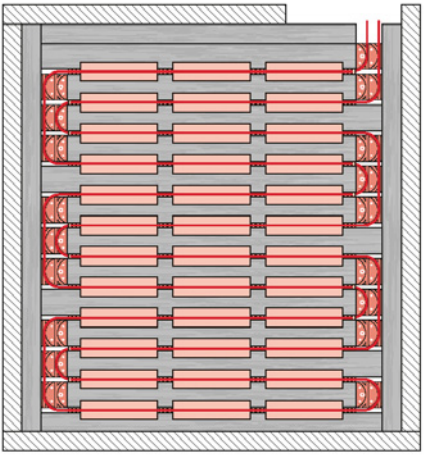
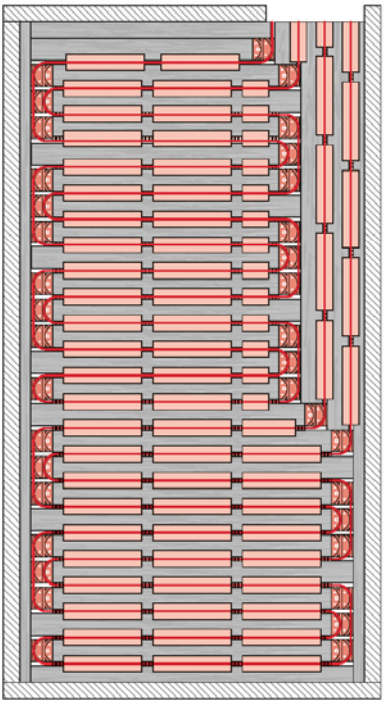


Figure 8b - 2 loops



Notes:

1. Double Counter Flow loop pattern (as shown in Figure 8a/b) is the preferred installation method.

8. Startup of Heating System

Be climate wary! Before the system startup, ensure floor heating piping is protected from freezing. This is a **must** if outside temperatures could ever decrease to or below 32°F (0°C), see section 8.2 for details.

8.1 Startup guidelines

Number of days after topping is poured	Supply Water Temperature
Approx. 8-10 days	Supply water temperature can be increased to 60°F (15°C).
Approx. 10-16 days	Supply water temperature can be increased to 77°F (25°C).
Approx. 16 days	Supply water temperature per day can be increased by approx. 9°F (5°C) to reach the projected maximum temperature.
Approx. 16-18 days	Normal heating operations can commence.
Approx. 18-20 days	Under normal heating conditions, the flooring can be laid*.

Notes:
1. These are standard industry recommendations, please confirm the above with your topping supplier.
2. Carpet, PVC (linoleum) or parquet must not be laid on the floor topping until the concrete is fully cured and the moisture content is stable. The surface temperature of the topping should be 60-65°F (15-18°C).

Approximately 8-10 days after the topping pour, the supply water temperature can be heated up to 60°F (15°C). During days 10-16, the supply water temperature can be heated up to 77°F (25°C). Normal heating operations can commence approximately 16-18 days after the topping pour. (Note: By day 18-20, under normal heating conditions, the flooring can be laid. These are standard industry recommendations, please confirm the above with your topping supplier).

After approximately 16 days, the supply temperature per day can be increased by approx. 9°F (5°C) to reach the projected maximum temperature.

- Carpet, PVC (linoleum) or parquet must not be laid on the floor topping until the concrete is fully cured and the moisture content is stable. The surface temperature of the topping should be 60-65°F (15-18°C).
- Ensure floor heating tubing is protected from freezing for system start-up at outside temperature below 32°F (0°C). (See below)

8.2 Chemical treatment

Inhibitors
For all systems it is suggested that inhibitors, approved for closed loop hydronic heating systems, be added to the heating fluid for corrosion protection. For calculation of system water content in the particular PEX tubing chosen for your project, please see INFO 5.

Freeze protection
For systems exposed to freezing temperatures the addition of glycols with built-in inhibitors (that are approved for hydronic heating systems) to the heating fluid is required. A minimum of a 30%-35% (maximum 50%) glycol/water mixture for combination system corrosion plus freeze protection is required. For calculation of system water content in the particular PEX tubing chosen for the project, please see INFO 5.

Water analysis
A water analysis should be performed annually (i.e. check corrosion inhibitor and glycol levels) to ensure the warranty for HeatLink components, and for the longevity of the system.

9. Warranty Requirements

9.1 Pressure test

For the pressure test, use at least 80-100 psi (550-690 kPa) hydrostatic pressure or 60-80 psi (415-550 kPa) air pressure. This test must be performed for a minimum of 12-24 hours before the placement of the topping.
Special care must be taken to check and re-tighten all joints and connections. During the pouring of the topping, the tubing must be left under pressure so that possible damage to the tubing can be immediately detected.

9.2 Corrosion protection

For all systems it is suggested that inhibitors, approved for closed loop hydronic heating systems, be added to the heating fluid for corrosion protection. For calculation of system water content in the particular PEX tubing chosen for your project, please see INFO 5.

9.3 Freeze protection

It is recommended for all systems exposed to freezing temperatures that glycols with built-in inhibitors (that are approved for hydronic heating systems) be added to the heating fluid. A minimum of a 30%-35% (maximum 50%) glycol/water mixture for combination system corrosion, plus freeze protection, is needed. For a calculation of the system water content in the particular PEX tubing chosen for the project, please see INFO 5.

9.4 System fill / Air purge (loop-by-loop fill)

It is suggested that an isolation valve be installed at each supply/return manifold header. To fill the system you will need to have a minimum of 40 psi water available. As well, obtain a 5 gallon pail and 5' of hose, complete with a hose connection end. ***Each loop must be filled individually!***

Step 1 Isolate the supply and return piping with valves installed in front of each manifold header.

Step 2 Connect the hose to the hosebib on the return manifold and drop the end into a 5 gallon pail.

Step 3 Close all the supply and return manifold valves isolating all the loops.

Step 4 Open the isolation valve on the supply pipe to allow water pressure into the supply header. (Note: return isolation valve remains closed.)

Step 5 Open the first loop's return valve. Open the first loop's supply valve to allow water to flow into the loop . Watch the hose in the pail until you observe a steady stream of water (no air or spitting). Close loop #1's supply valve. Repeat Step 5 for each loop until all loops are filled with water, and air is purged from tubing. Purging is complete when there is no more air and/or spitting.

9.5 Maintenance

The following maintenance should be performed on an annual basis to ensure the warranty for HeatLink components, and for the longevity of the system:

1. Inspect the system for leaks and erosion of metal/plastic components
2. Retighten plastic nuts as needed
3. Water analysis (i.e. check corrosion inhibitor and/or glycol levels)
4. Sidestream filters should be cleaned at least once a year or when clogged

At 10-year intervals the Shut-off Shaft Assemblies in the supply manifold and the O-ring in the return manifold should be replaced.

10. Basic Control Wiring Requirements

10.1 Control selection
(see the StatLink guide)

10.2 Zone control
Determine if there are to be individual thermostats for each loop, or if there is to be one thermostat controlling multiple loops. For single-zone multiple loops, allow sufficient space at the manifold cavity to permit the installation of the zone valve.

10.3 Minimum wire rough-in
Even if the customer has not requested individual thermostats, it is recommended that you rough in a minimum of 3 wires to each loop location for future upgrade capability.

11. Heatloss/Design

11.1 Proper plans

Architectural plans, with all dimensions including elevations with window and door specifications, insulation specifications and grade/ below grade information, are required.

11.2 Floor coverings

Ascertain that all floor coverings allow for specific heatload calculations, i.e. carpet versus tile or hardwood.

Carpet

- Use only brand name products where the manufacturer has confirmed the suitability for floor heating. Choosing products with a minimal thermal resistance will help ensure that feedwater temperatures remain within an acceptable range. In order to maximize the heat transfer characteristics of a product, it is preferable to glue carpet instead of stretching it.
- All adhesives used must be suitable for floor heating. Under no circumstances should adhesives made of bituminous material be used. Needle-felt carpets and carpets with jute backs have proven to be acceptable.

Quarry tile/Ceramic tile

- All tile work should be installed according to industry standards. Expansion joints and control joints in the floor topping should continue through into the tile floor. Under no circumstances are tiles to cross over these joints. The expansion/control joints in the tile floor need to be permanently elastic.
- At a joint between a wall tile and a heated floor, ensure that the wall tile terminates at ¼" (6 mm) above the top surface of the finished floor. This joint may be filled with permanently elastic material.

Vinyl/Plastic flooring

- All vinyl/plastic flooring should be installed according to industry standards.
- All expansion and control joints should continue through the flooring to reduce damage caused by movement of floor slab. All joints are to be permanently elastic. All adhesives used must be expressly approved for floor heating applications. Adhesives with a bituminous base are not to be used for any purpose.

Hardwood flooring

- All hardwood flooring should be installed according to industry standards and as per manufacturer instructions. Shrinkage can and will occur in most

hardwood regardless of the heating system chosen. However, due to the presence of a low temperature heated mass in direct contact with the hardwood, the normal shrinkage that may take place over a 6 to 24 month period can be greatly accelerated with a radiant floor heating system if the proper installation techniques have not been followed.

- There are many types of hardwood flooring available including solid planks as well as laminates. In most regions of North America laminate flooring is gaining acceptance as more types/brands and finishes become available. (Laminate flooring has several advantages over other types of hardwood flooring especially when used in conjunction with a radiant floor heating system. Due to the layers being manufactured at right angles to each other (i.e. similar process as plywood sheathing), shrinkage is nearly eliminated.
- If solid hardwood stripping is desired, and an acceptable laminate flooring cannot be used, it is imperative that the hardwood has been "acclimatized" to the region where it is being installed. Sometimes a flooring supplier will receive a shipment of hardwood from a manufacturer and then send it out to a job site within several days or weeks. This may not be sufficient time for the hardwood to acclimatize to the particular region, especially in a "dry" climate area. Hardwood must not exceed 6% to 8% moisture content at the time of installation. It is our recommendation that all hardwood be placed on site and the floor temperature increased before flooring installation to ensure the proper moisture content is achieved.
- Control selection is especially critical for installations with hardwood to ensure that proper modulation of the supply water temperature is possible. Modulating controls will provide the lowest possible supply water temperature for the given outside temperature. As well, maximum floor surface temperature should not exceed 85°F to 90°F (30°C to 32°C). With the variance in humidity levels through the various seasons in a given year, supplemental humidification may have to be provided to ensure relative humidity can be maintained at 40% to 45%. For further information and clarification for your particular project, please contact your HeatLink® representative.
- **In all cases of using nail-down hardwood, the installer must be aware of the potential for tubing damage. Tubing locations must be marked to ensure against nails being hammered into the tubing.**

11.3 Shortages

Where the heatloss has indicated a shortage in a particular room, an alternative heat source should be selected to make up for the shortage. This could be as simple as a towel warmer in the bath, or as complex as a fan with heat coil.

12. System Design and Installation

12.1 The mains

PEX tubing mains are recommended to reduce labor and architectural impact. For a slab-on-grade installation, the mains can be buried below or within the slab. For a wet or dry on plywood application, the mains can be installed within the joist cavity. Always allow for the expansion and contraction of the mains, as the temperature fluctuates. It is recommended that the tubing be allowed free movement and is not fastened directly to the floor joists.

12.2 Requirements of a hydronic control system

The intent of a hydronic heating control system is to achieve heating comfort, system protection, energy saving and ease of use.

Heating comfort is achieved by:

- keeping proper system temperatures, and
- directing the right amount of heat when and where you want it.

System protection is achieved by:

- protecting the primary heat source (e.g. boiler) from corrosion and thermal shock, and
- reducing equipment cycling.

Energy saving is achieved by:

- running the system at the lowest water temperature possible,
- turning off the system when no heat is demanded, and
- minimizing boiler short cycling.

Ease of use is achieved by:

- running automatic functions in lieu of manual settings, and
- providing easy and consistent wiring and installation procedures.

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