



# Infloorboard III

## Installation Guide



Rapid Response Time

America's Authority on Radiant Heating Systems and Solutions for over 30 Years



# Infloorboard III Installation Guide

## Table of Contents

	Introduction .....	3
	Advantages of Infloorboard III .....	5
<i>DESIGN &amp; PERFORMANCE</i>	Design & Performance .....	6
	Floor Coverings R-Values .....	7
	System Output .....	8
	Importance of LoopCAD Layouts .....	8
	Estimating Required Number of Infloorboard III Boards .....	9
	Tubing and Loop Lengths .....	9-10
	<i>INSTALLATION</i>	Installation - Understanding the Product .....
	How to Space the Boards .....	12
	Aligning and Attaching the Boards .....	13-14
	Subfloor Requirements: Wood Subfloors .....	15
	Equipment for Installation over Wood Subfloors .....	16
	Installing Tubing in Grooves .....	17
	Example Layout and Installation .....	18-19
	Connections at Manifold .....	20
	Infloorboard Installed over Wood Subfloor .....	21
<i>FLOOR COVERING INSTALLATION</i>	Carpet over Infloorboard III - Wood Subfloor .....	22
	Vinyl over Infloorboard III - Wood Subfloor .....	22
	Thinset Tile or Stone over Infloorboard III - Wood Subfloor .....	23
	Mortar Set Tile or Stone over Infloorboard III - Wood Subfloor .....	24
	Laminate Flooring over Infloorboard III - Wood Subfloor .....	25
	Engineered Floated Wood over Infloorboard III - Wood Subfloor .....	25
	Strip Hardwood over Infloorboard III - Wood Subfloor .....	26-27
	Other Wood Options over Infloorboard III - Wood Subfloor .....	28
	Application of Infloorboard III to Walls or Ceiling .....	29
	Installing Infloorboard III over Concrete - Important Cautions .....	30
	Installation Details of Infloorboard III over Concrete .....	31
	Flooring Except Strip Wood on Infloorboard III over Concrete .....	32
	Strip Wood on Infloorboard III - Concrete Subfloor .....	33
	Infloorboard III Cautions and Limitations .....	34
<i>DESIGN SERVICES</i>	Infloor LoopCAD Design Services .....	35-37
<i>SPECIFICATIONS</i>	Specifications .....	38-40

# Introduction

With Infloorboard III, the hydronic radiant heating that everyone loves is now more efficient, more responsive, and compatible with standard construction practices. Ideal for new construction and remodeling alike: low profile, light weight and rapid response. Infloorboard III delivers a genuine advance in the best heating system you can buy... hydronic radiant heat.

## Why it works so well

Non-structural Infloorboard III is designed specifically for subfloor applications. Infloorboard III is constructed of a dense composite wood board covered with aluminum that spreads the heat evenly and quickly from the hydronic tubing. Infloorboard III heats rapidly and is easy to control with setback thermostats for maximum energy efficiency. It contains just enough thermal mass to be effective, but not so much that it is difficult to control.

No other product offers this combination of performance, ease of installation and cost-effectiveness. Infloorboard III is typically glued and screwed, or stapled to a wood subfloor. Then PEX tubing, which will carry warm water, is snapped into the groove. Heat is transferred from the tubing to the aluminum and the board. Infloorboard III is manufactured from FSC certified plywood. The board is grooved and then laminated with a substantial top layer of highly conductive aluminum to efficiently disperse and transfer heat away from the groove to the surface area of the whole board.



## Acceleration

Acceleration is a measure of how fast a radiant heating system responds. Aluminum is approximately 1,000 times more conductive than wood. The layer of aluminum on Infloorboard III, and down into the groove, significantly enhances both the transfer of heat and evenness of heat distribution of the board. *See Illustration A-1 to see how the heat transfers through Infloorboard III.* The thin profile and metal layer contribute to the superior acceleration and deceleration of Infloorboard III.

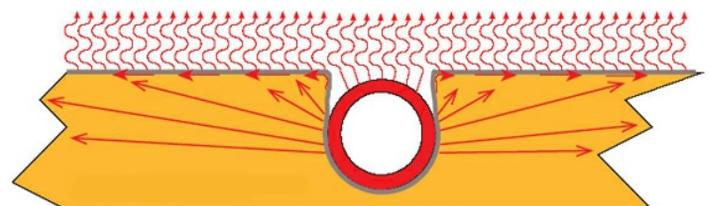


Illustration A-1



## Introduction *Continued*

Traditional radiant heating systems in concrete work well, but they must first charge a large thermal mass before heat will begin to radiate from the panel. They accelerate and decelerate very slowly due to the large thermal mass, and they can be hard to control. Infloorboard III, being thin, but relatively dense, and aided by its conductive aluminum layer, responds very rapidly. This results in greatly improved response time, with almost no overheating since there is almost no "thermal lag" to overcome. Infloorboard III can be controlled with standard set-back thermostats.

### **Infloorboard III Warmcoat**

Infloorboard III Warmcoat aluminum top layer provides multiple benefits. It is highly conductive. This Warmcoat aluminum layer is also moisture resistant. When the edges and grooves of Infloorboard III are sealed using silicone caulking, it provides significant moisture protection for the board. And it provides a barrier to the transmission of any out gassing from the board. Infloorboard III is manufactured to meet the Federal Housing Authority (FHA) and California Air Resources Board (CARB) formaldehyde out gassing standards.

### **Advantages of Infloorboard III**

Hydronic radiant heating is the most comfortable and efficient way to heat your home or building, with numerous construction

### *Rapid Response Time*

*Light weight for easy installation*

- Avoid the moisture, weight, and mess of gypsum cement or concrete.
- Radiant installations, big or small, can be easily scheduled with no lost time for concrete curing.

benefits and unsurpassed flexibility in zoning. For many years, typical applications for radiant systems involved embedding tubing in concrete slabs or pouring "lightweight concrete" over tubing stapled to subfloors. The lack of good alternatives to these types of systems permitted designers to overlook the limitations and disadvantages of concrete systems.

Infloorboard III provides that alternative. It is designed for the application of hydronic radiant tubing over a variety of construction types. Infloorboard III may be used in new construction and is also advantageous in the growing retrofit market. While only adding 3/4" to the existing floor height, Infloorboard III provides a superior performing radiant heating system. In addition, application of the system is made easy because only two types of pieces are required for installation.

### *Construction Friendly*

Infloorboard III avoids joist upsizing, double plating, and hardwood nailing strips associated with gypsum-based concrete radiant heating systems. Also, Infloorboard III eliminates substantial drying costs required by moisture-laden concrete and gypsum-based cement. Time is money. Infloorboard III eliminates scheduling and curing delays.

### *Cost Friendly*

Infloorboard III is installed using conventional construction practices and commonly used tools. With a layout plan, the two board panel patterns can be systematically arranged on the subfloor. Not only are the boards light weight - they are also easy to handle, cut and attach.

### *Flooring Friendly*

Infloorboard III provides a quality flat surface for floor covering assemblies. Each of these flooring assemblies is supported by detailed drawings and instructions such as those illustrated in our application guide.

- Hardwood
- Engineered Wood
- Tile/Stone
- Carpet
- Vinyl/Resilient Flooring
- Laminate

### *Planet Friendly / Green Product*

Infloorboard III is made from FSC certified plywood, which is manufactured from sustainably managed trees. The glue for the aluminum is a water based adhesive, the aluminum layer contains recycled aluminum and the aluminum layer is a positive barrier to out gassing of formaldehyde.



*Infloorboard III is made from sustainably managed trees.*

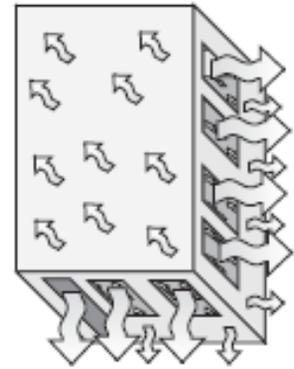




# Design & Performance

## Heat Loss Analysis and System Design

Systematic heat loss and design for the structure to be heated should be done prior to any Infloorboard III installation. As with all floor heating jobs, a detailed and accurate heat loss must be calculated in order to determine proper design conditions. This may be provided by a design service (see *Design Services pages*). Refer to the 1999 Radiant Panel Association Guidelines for the Installation of Radiant Panel Systems for standards on insulation and heat loss.



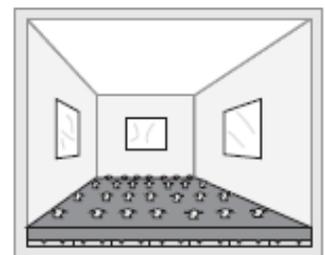
*Illustration A-2: Account for all heat losses of the building.*

### Installer's Note

Perform the heat loss analysis of the structure at the design stage. This way, selection of floor coverings can be made with the system requirements in mind. If the heat loss is too high, add insulation or auxiliary heat. In a very high heat loss room, Infloorboard III can be added to the walls or ceilings for extra heat.

## R-Value of Floor Coverings

While Infloorboard III will work with a wide variety of floor coverings, it is important to realize that all floor coverings offer a resistance to heat transfer typically measured by their R-Value. As with all radiant systems, the higher the R-Value of the floor covering, the higher the average water temperature it takes to overcome this resistance and to generate the desired amount of heat. If the R-value of any covering on top of Infloorboard III is excessive, as with any radiant heating system, performance will be compromised due to lack of heat transfer, or would require exceeding the 150 F° maximum supply water temperature for Infloorboard III.



*Illustration A-3: Always account for the resistance of floor coverings.*

### Installer's Note

Remember average water temperature means the average of the supply and return water temperatures flowing to and from the loop. Most typically, Infloorboard III is designed with a 20F° temperature drop. This means the supply water temperature would typically be 10F° higher than the average water temperature.



## Typical R-Values of Flooring Coverings and Materials

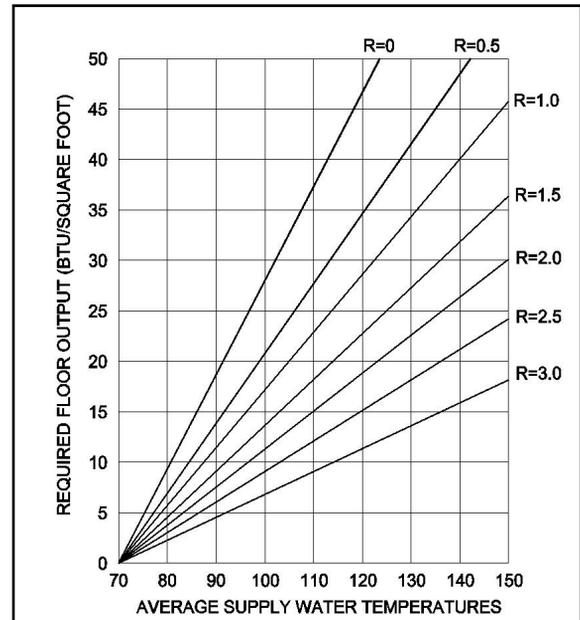
Material	Typical R-Value	R-Value Per Inch	Typical Thickness
Plywood	0.825	1.1	0.75
Plywood Underlayment (1/4")	0.275	1.1	0.25
Softwood	0.825	1.1	0.75
Sheet Vinyl	0.2	1.6	0.125
Vinyl Composition Tile (VCT)	0.2	1.6	0.125
Linoleum	0.4	1.6	0.25
Linoleum	0.2	1.6	0.125
Dense Rubber Flooring	0.25	1.3	0.325
Recycled Rubber Flooring	1.1	2.2	0.5
Cork	1.125	3	0.375
Cork/MDF/Laminate	1.175	2.35	0.5
Brick	3.375	2.25	1.5
Marble	0.4	0.8	0.5
Ceramic Tile	0.25	1	0.25
Thinset Mortar	0.05	0.4	0.125
MDF/Plastic Laminate	0.5	1	0.5
Laminate Floor Pad	0.3	1.92	0.16
Engineered Wood	0.25	1	0.25
Engineered Wood	0.375	1	0.375
Engineered Wood	0.625	1	0.625
Engineered Wood	0.75	1	0.75
Engineered Wood Flooring Pad	0.2	1.6	0.125
Engineered Bamboo	0.72	0.96	0.75
Oak	0.638	0.85	0.75
Ash	0.75	1	0.75
Maple	0.75	1	0.75
Pine	0.975	1.3	0.75
Fir	0.9	1.2	0.75
Carpet Pad/Slab Rubber 33 lb.	0.32	1.28	0.25
Carpet Pad/Slab Rubber 34 lb.	0.48	1.28	0.375
Carpet Pad/Slab Rubber 35 lb.	0.64	1.28	0.5
Carpet Pad/Waffle Rubber 25 lb.	0.62	2.48	0.25
Carpet Pad/Waffle Rubber 26 lb.	1.24	2.48	0.5
Hair Jute	1.94	3.88	0.5
Hair Jute	1.25	3.88	0.325
Prime Urethane	1.4	4.3	0.325
Prime Urethane	2.15	4.3	0.5
Bonded Urethane	1.35	4.2	0.325
Bonded Urethane	2.1	4.2	0.5
Carpet	0.7	2.8	0.25
Carpet	1.05	2.8	0.375
Carpet	1.4	2.8	0.5
Carpet	1.75	2.8	0.625
Carpet	2.1	2.8	0.75
Wool Carpet	1.575	4.2	0.375
Wool Carpet	2.1	4.2	0.5



## System Output

Chart C-1 can be used to estimate system output with different floor coverings. This chart shows the steady state performance of Infloorboard III. To the left are the BTU/Sq. Ft./Hour. The diagonal lines represent the resistance of the floor coverings on top of Infloorboard III. Along the bottom is the average water temperature required to achieve the output. The chart is read by selecting the correct BTU requirement and then moving horizontally until you find the line indicating the correct R-Value of the floor assembly on top of Infloorboard III. At that point, drop down vertically to see average water temperature. See the previous page for a list of estimated floor covering R-Values.

Chart C-1



## Installer's Note

Learn about the resistance of intended floor coverings at the design stage and make sure they are within the requirements of the system. Realize also that your calculation should include the resistance of the whole flooring assembly above the Infloorboard III. If you are unfamiliar with hydronic design, good practice and the physics of hydronic heat transfer, you should not design a Infloorboard III system.

## LoopCAD Layout and Design Services

Infloor Heating Systems provides complete system designs, LoopCAD layouts, for Infloorboard III installation. Proper installation is key to the success of a radiant heating system, so we happily provide a LoopCAD layout, specific to your project, with every system we sell. You can view an example of a past design on Page 37 . All Infloorboard III systems should be installed by qualified installers.



LoopCAD layouts are particularly useful for first-time installers.

### Estimating the Number of Boards

For simple and fast installation, it is highly recommended that a full Infloorboard III layout be used, indicating the precise panel and tubing layout. This can be provided through Infloor. A full plan is recommended for the first few jobs. Contact your Infloor representative about getting a layout and a design. The following calculations can be used for estimating the required number of boards. For experienced installers, calculate the net square footage of each room and multiply by the following factors:

**Straight - 0.0805 and Supercombo - 0.0494**



Supercombo board has a curved channel.

**Example:** For a 600 sq. ft. room, multiplying 600 by 0.0805 gives approximately 49 Straight boards. Multiplying 600 by 0.0494 gives 30 Supercombo boards. *It is always recommended that an additional 5%-10% material excess be added to the estimation for waste.*

Doing an exact layout will give the most accurate estimate of boards needed. The above percentages are estimates based on many jobs not an individual job. Large rooms use fewer Supercombos and more Straights. Small rooms typically have fewer Straights and a larger number of Supercombos.

### Tubing and Loop Lengths

Infloorboard III is designed for use with 1/2" nominal ASTM F-876 PEX (cross-linked polyethylene), with an average outer diameter measuring 0.625 inch. Loops shall never be over 350 feet including the leaders to the manifolds. For areas with heat loss greater than 25 BTU/sq.ft., loops shall never be over 250 ft. This is due to high pressure drops and water velocity, as shown in the following chart C-2\* (grayed area over 25 BTU/sq. ft). Friction losses in the chart are approximate; actual friction losses depend on fluid viscosity and temperature.

*\*The shaded area in the 350' loop in Chart C-2 on the following page indicates a high pressure drop. It is recommended to use the shorter 250' loop length in this case, as shown in the second chart, Chart C-3. Once the room square footage is determined, multiply the total by 1. Example: For a 600 sq.ft. room, multiplying 600 by 1 gives 600 lineal feet of 1/2" PEX tubing.*

### Notice Loop Lengths

- Notice that loop lengths should never be over 350'. For heat loss areas over 25 BTU/sq.ft., loop lengths should not be over 250'.
- Since the tubing is 12" on center, a 350' loop will cover a maximum of 350 sq.ft. A 250' loop will cover a maximum of 250 sq.ft Remember to allow for the length to the manifolds.



**Infloorboard III 350' Loops with a 20°F Temperature Drop**

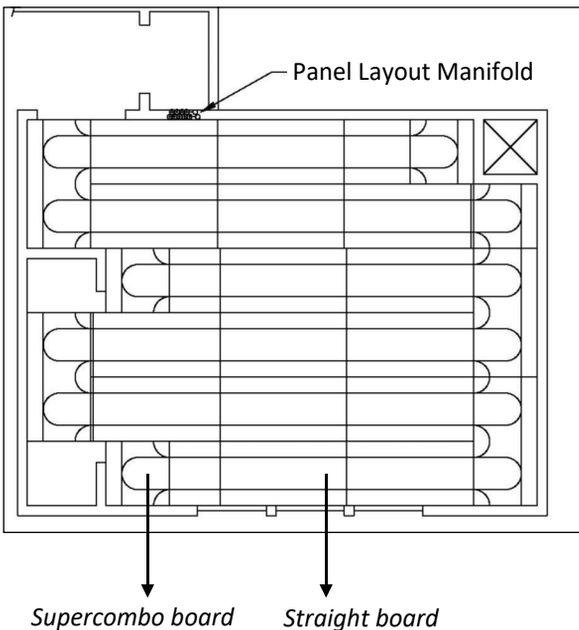
Chart C-2

Length (L)	Flow (GPM)	Pipe ID	Ft of hd (hf)	Velocity ft/sec	BTU/sq ft
350	0.1	0.475	0.24	0.18	2.86
350	0.25	0.475	1.29	0.45	7.14
350	0.5	0.475	4.66	0.91	14.29
350	0.75	0.475	9.86	1.36	21.43
350	1	0.475	16.79	1.81	28.57
350	1.25	0.475	25.37	2.26	35.71
350	1.47	0.475	34.24	2.66	42

**Infloorboard III 250' Loops with a 20°F Temperature Drop**

Chart C-3

Length (L)	Flow (GPM)	Pipe ID	Ft of hd (hf)	Velocity ft/sec	BTU/sq ft
250	0.1	0.475	0.17	0.18	4
250	0.25	0.475	1.92	0.45	10
250	0.5	0.475	3.33	0.91	20
250	0.75	0.475	7.04	1.36	30
250	1	0.475	11.99	1.81	40
250	1.05	0.475	13.12	1.9	42



**Installer's Note**  
 Remember average water temperature means the average of the supply and return water temperatures flowing to and from the loop. Most typically Infloorboard III is designed with a 20°F temperature drop. This means the supply water temperature would typically be 10°F higher than the average water temperature.

# Installation

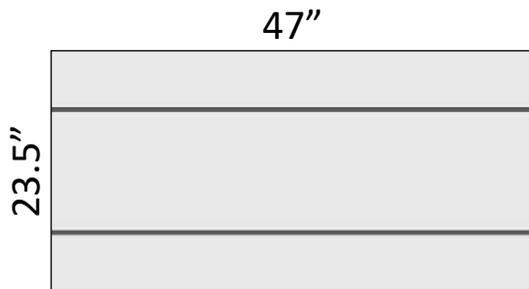
## Understanding the Product

### Components

Infloorboard III comes in two (2) different board configurations. These are "Straight" and "Supercombo." They are assembled to make a channel for the pipe. Each piece measures approximately 23.75" x 47.5". The grooves are centered 11.875" apart. Infloorboard III cuts easily with a circular saw.

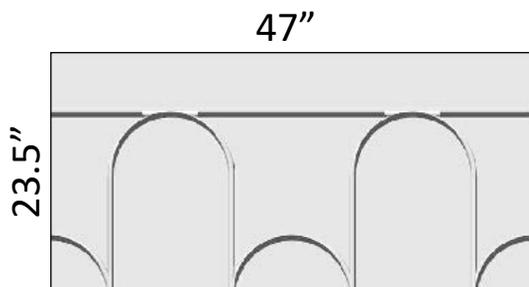
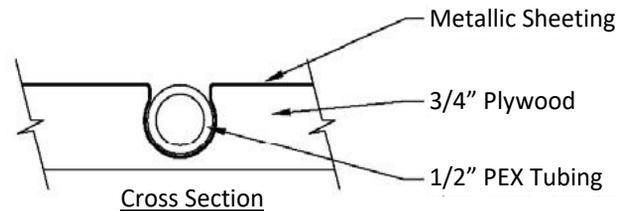
### Always Plan Ahead

- Carefully read and follow the installation instructions.
- Familiarize yourself with the materials and installation methods before you start.
- Use and follow a LoopCAD layout, particularly if you are a first-time installer.



### Straight

These are used about 62% of the time.



### Supercombo

These are used when a bypass and or a return is needed, usually about 38% of the time. Supercombos are perforated to maintain the conductivity of the metal in areas not used. The tubing is "walked" into the channels that are to be used.

### Note on Board Dimensions

These boards are cut from 4'x8' sheets of PLUS and are therefore a nominal 2'x4' dimension since some material is lost in the cutting. Each board actually measures: 47"x 23.5" and tubing is spaced 11.75" on center and one quarter radius turns measure 5.875" from edge.



## Product Shipping Information

Infloorboard III is made with FSC Certified plywood from sustainably managed forests, with an aluminum with recycled content bonded with a water based low VOC adhesive.

- Nominal dimensions: Each board is 23.5" x 47" x 3/4" thick, or 7.83 square feet a board
- Weight: Approximately 2.2 lbs. per square foot, 17.5 lbs. per board
- Pallet Size: 4' x 4' x 32" tall (2 Infloorboard III boards to a row, 37 rows high)
- Approximate Pallet Weight: 1310 lbs.
- Approximate Truckload Quantities: Approx. 20,008 square feet
- Pallet Appearance: Shrink wrapped, corner protected, color coded corners by part #
- Recommended Product Mix: Straight 62%, Supercombo 38%, Allow 5%-10% extra for waste

## Instructions for Proper Storage and Moisture Contact

*Infloorboard III should always be stored in a temperate, dry place (40°F-90°F). Avoid prolonged exposure to sunlight. Do not store in a damp location. Be sure to follow all instructions elsewhere in this manual regarding protecting the board from prolonged moisture contact. If these instructions are not followed, expansion of greater magnitude could create undesirable effects.*

## Estimating the Number of Boards

The actual width of each board is 23.5", which provides for installing the boards with a slight gap in between boards, to allow for expansion at different temperatures and for normal variances in humidity in a finished home. When aligning straights with the Supercombo ends, use a piece of tubing, as shown in the following section, a slight gap of approximately 1/32" will naturally occur between the straight boards. This is normal. Try to allow a similar 1/32" inch gap between the ends of all boards, but always make sure all grooves align, as described in the following section.

### Installer's Note - Make Sure Boards are Accurately Cut

*Since Infloorboard III is a modular system, the boards are manufactured to tight tolerances in groove spacing and squareness of the sides and ends. When cutting Infloorboard III, make sure to cut them squarely and align them carefully so that subsequent pieces will fit correctly. This is not difficult, but attention to this easy step will prevent major problems.*



### How to Align the Grooves Correctly

The easiest way to assure the grooves for the tube are correctly aligned between boards is to cut 6" pieces of 1/2" ASTM F-876 PEX tubing and use them as alignment tools. To do this, get the boards close to the desired alignment and press a piece of tubing in each groove, lapping 3" into the groove of each board, as shown below. After the board is attached, these should be removed.



*Use 6" pieces of tubing to align the grooves between the boards properly.*

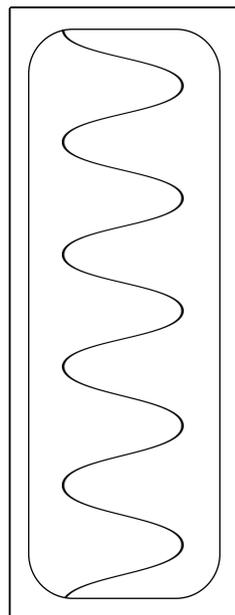
### Attaching Infloorboard III to a Subfloor

#### Gluing Patterns

Each Infloorboard III board should be glued to a wooden subfloor using construction adhesive type glue at a minimum 1/8" bead in the gluing pattern below. **Every board should be glued.**

#### Tips for Gluing

- Glue may be applied to underside of board or to the floor.
- Avoid getting glue in the groove or where it may come in contact with the tubing. Many glues can damage PEX tubing.



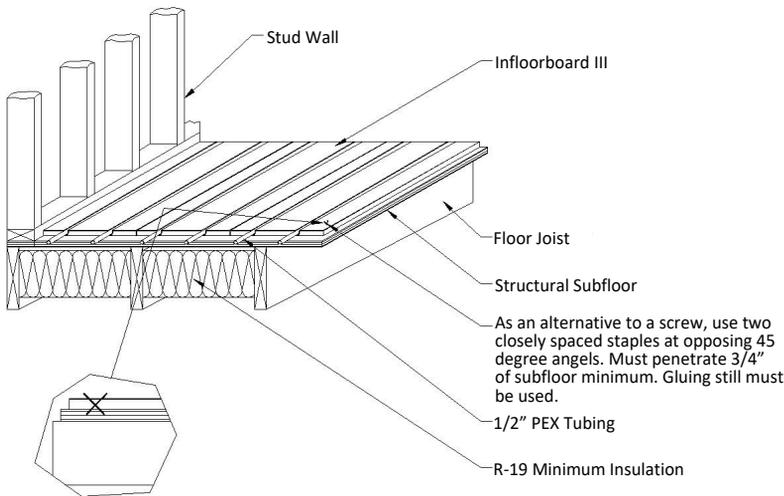
**Glue Pattern**





### After Gluing, Screw or Cross Staple Boards to Subfloor

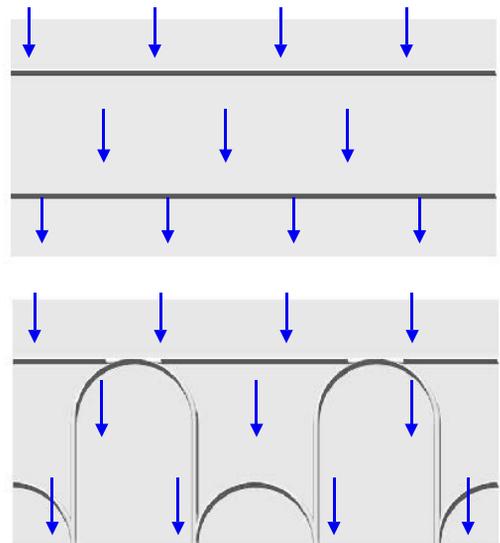
After you have glued Infloorboard III, the boards should be screwed or cross-stapled to the subfloor. On full size pieces (23.5" x 47"), 11 screws should be used, 8 on the perimeter and 3 in the middle, or as a general rule, 12" O.C. for the perimeter and 16" O.C. for the interior. This pattern is shown below. As an alternative to gluing and screwing, Infloorboard III may be installed by gluing and stapling, as shown below. When installed with this method, it is very important that the board is glued and stapled with the same quantity of glue and staple points as shown in the screwing pattern. The boards should also be cross stapled as shown for extra strength. Cross stapling means two (2) staples are put closely together at opposing 45° angles, as shown below.



**Cross-stapling Infloorboard III**

### Nailing or Cross-stapling Pattern:

Attach Infloorboard III boards at locations shown below by blue arrows.



## Overview of Floor Surface Requirements

*Note: See also the specific application drawings and notes for installing Infloorboard III, on pages that follow in this manual.*

### **Subfloor Requirements - General**

**The surface of the subfloor must be flat:** The requirement for flatness is defined as the maximum difference between two adjacent high points and the intermediate low point. The maximum acceptable difference in level is 3/16 of an inch in a 10-ft. radius.

**Fill excessive voids or low areas using a leveling compound:** Allow the leveling compound to dry thoroughly before beginning the installation. Check with the leveling compound manufacturer to be sure it is appropriate for the application. High areas can be ground down or floated over with a self-leveling compound. The surface of the floor must be clean and dry.

### **Subfloor Requirements - Wood Subfloors**

Wood subfloors must have a stable moisture content, between 6 - 10%. Creaking subfloors must be repaired before installation. If the subfloor sags, inspect the joists below for twists or weakness. If the subfloor is cupped or uneven at the joints, recheck the moisture content of the subfloor to be sure it is in the 6 - 10% range. Check for excessive moisture in the crawl space or basement and look for other signs of a potential water problem. High areas are sanded or planed; low areas are patched or filled with an appropriate leveling compound, or covered with a rigid underlayment. When using a leveling compound, be sure to follow the manufacturer's recommendations, and allow the compound to dry completely before starting to install the floor.

### **Important Note - Infloorboard III and Concrete Subfloor**

*Infloorboard III was initially designed to be installed over a wooden subfloor. Installation over concrete has been successfully done, but requires extra care and an assured dry slab, see and follow instructions, limitations and details later in this manual when installing Infloorboard III over concrete.*

## Equipment Required for Installation over Wooden Subfloor

***The following tools are necessary for the installation of Infloorboard III:***

1. Table or circular saw. A carbide blade is recommended.
2. Electric or cordless drill gun with No. 2 Phillips bit (*if you are screwing down boards*) and 5/8" drill bit for supply and return bury points
3. Sheathing type pneumatic stapler (*if you are cross stapling boards*)
4. Rubber or hard hide mallet
5. Chalk line, marking pencils, and square
6. Vacuum cleaner to clean grooves prior to installation of the tubing
7. 6" pieces of 1/2" PEX tubing for aligning boards
8. Standard construction adhesive, such as Liquid Nails



### Installer's Note - Cutting Infloorboard III

*Infloorboard III cuts easily with a quality carbide circular saw blade. Pieces frequently must be cut to provide an accurate fit for each room. It is important that they be cut squarely to keep the alignment of grooves accurate in the installation. If you are cutting a large number of boards for a complicated space, number them and make a map so you remember where they go.*

## Installing the Tubing into the Grooves

First, vacuum the grooves so there is nothing that will damage the tubing or keep it from going properly into the groove. The use of a tubing uncoiler is recommended. Start at the intended manifold location and allow enough tubing as a "leader" to attach the tubing to the manifold. You may then begin, but make sure you understand the layout and where and how you will return to the manifold.

There is, intentionally, a tight tolerance between the ASTM F-876 PEX tube and the slightly undercut groove. This allows the tubing to be retained in the grooves once it is pushed in place. Usually, this only requires "walking the tubing into the groove" as shown in the photographs below.

Occasionally tubing installation may require the use of a rubber or hide mallet as shown on the previous page to force the tubing in place in the grooves. After installing a loop of tubing, always walk the loop and make sure the tubing is fully in the groove for the entire length of the groove. This is very important! The top of the tubing should be just below the level of the top of Infloorboard III, and fully retained in the groove.

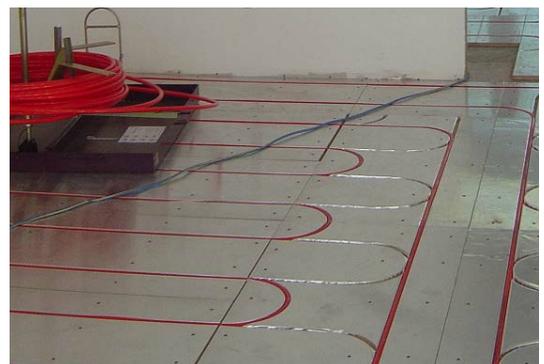
### Installer's Note - Metal and Grooves

*Infloorboard III has an aluminum Warmcoat metal layer that is slit for the grooves. It is designed to be folded down into the grooves and pressed to the side as the tubing is pushed into the groove.*

### **Perforated Style Installation Notes:**

You may receive Supercombo boards that are perforated not slit, this allows you to choose only the grooves you will be using and keep the conductivity of the aluminum intact elsewhere. Align the boards with small pieces of tubing as before during installation.

Then when installing tube "walk" the tubing into the needed perforated channels.

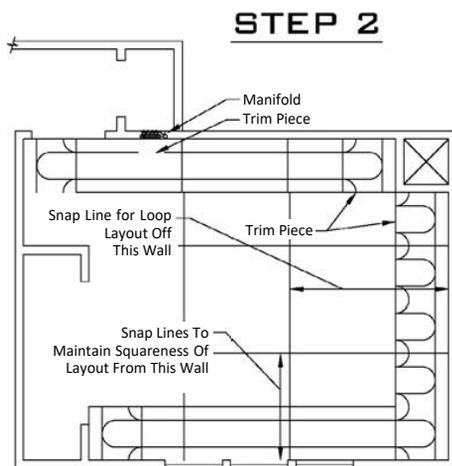
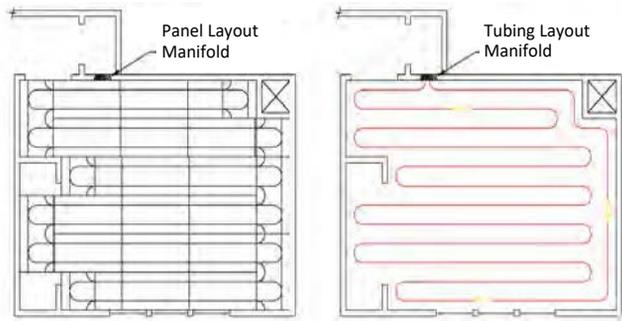




## Example Layout and Installation Steps

### Installation Step 1

Utilizing a plan layout, determine panels needed and tubing lengths required. Be sure to always use good judgment in allowing enough tubing at ends for leaders up to manifolds. A plan should indicate which type of system will be implemented.



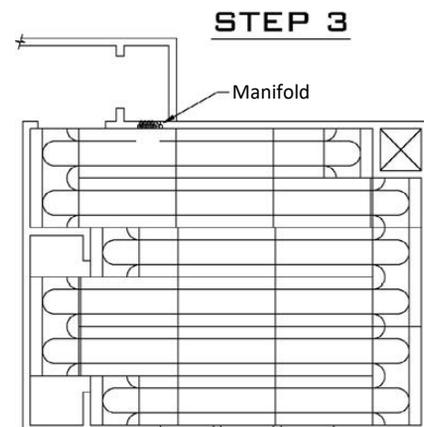
**Step 2:** Snap lines on floor to aid in layout. Begin the Infloorboard III layout by starting at the beginning of the Loop 1 supply run and running boards along the perimeter of the heated space to the area of the highest heat loss.

### Installation Step 2

Begin the Infloorboard III layout by starting at the beginning of the supply run into the space and running board along the perimeter of the heated space to the area of highest heat loss.

### Installation Step 3

Add end pieces and straight pieces, working your way back away from the area of heat loss. Once all boards are in place, drill holes (subfloor with access application) or route leader back to manifold via custom grooves or grout (slab or existing subfloor application) for supply and return leaders to manifolds.

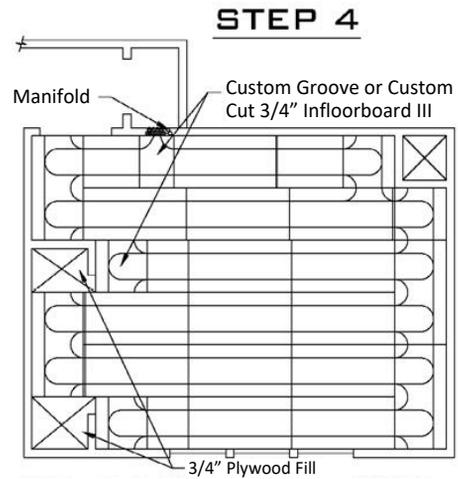


**Step 3:** Add end pieces and straight pieces working your way back away from the area of the heat loss, making sure to line up all the grooves as you go. Once all the boards are in place, drill holes for supply and return leaders to manifolds (*raised floor application*).



**Installation Step 4**

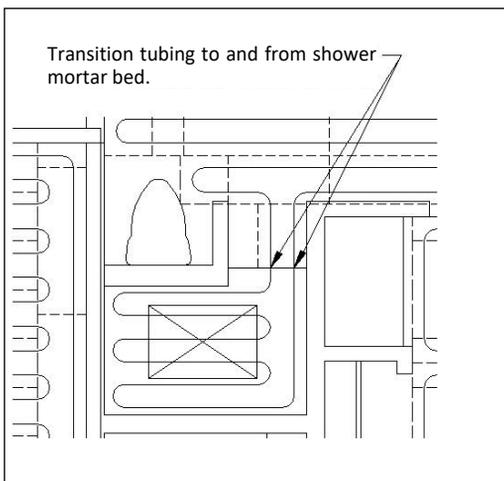
Finish laying out boards according to pattern and do any special grooving as required to get back to manifold. Then add all plywood filler pieces to complete the flooring application. Vacuum the grooves and clear all the debris in preparation for placing the tubing.



**Step 4:** Add all 3/4" plywood fill pieces, including area of leaders to manifold. Route all custom grooves as necessary. Clear all debris from grooves in preparation of laying the tubing in place.

**Installation Step 5**

Feed enough supply tubing to route to manifold through drilled supply hole below the floor or before the start of groove (if groove goes directly to manifold). Tubing may then be "snapped" into grooves after all grooves have been thoroughly cleaned with a vacuum cleaner. Once tubing has been routed back to the return location, cut enough to route to return manifold.



**Special Coverage Areas**

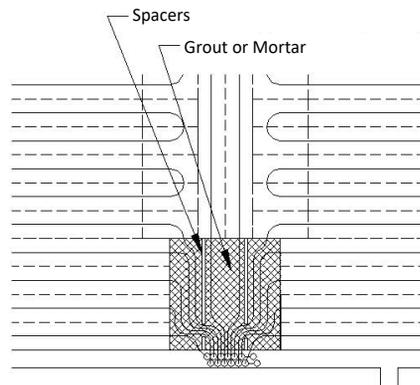
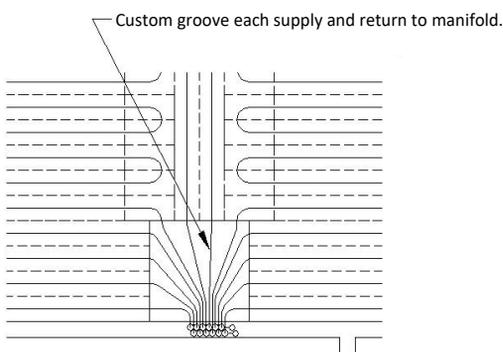
In areas of special coverage, such as shower basins using tile grout as a base, tubing may be routed to and from Infloorboard III in order to accommodate desired coverage.

## Connections at Manifold

Manifolds are usually located in a space with an access panel, near the heating zone they serve, in places like in the back of a closet. The tubing may be routed to the manifold in four ways:

1. Insert tubing directly in the grooves, which works with few loops ending adjacent to the manifold location.
2. Drill holes, dive the tubing under the floor and bring it up again at the manifold.
3. Place solid PLUS or Plywood sheet next to the manifold into which supply and return lines are custom routed to the grooves of the Infloorboard III.
4. Or, tubing may be run out of Infloorboard III, stapled to the subfloor and routed directly to the manifold. A grout may then be used to cover the tubing and level it to Infloorboard III. If needed, sleepers are placed in between tubing to provide a nailing or screwing base for floor coverings. Use nailing plates as necessary to protect tubing from damage.

Depending on how many circuits are on a given manifold, various sizes of sheets or grouting area are required.



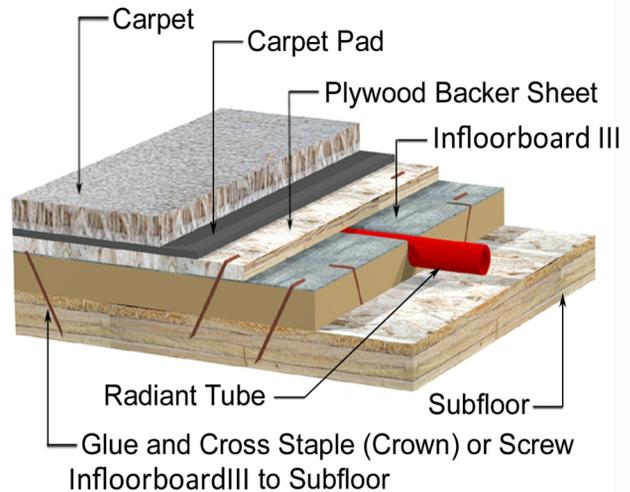
## Infloorboard III Installed over Wood Subfloor

### ***General Installation Requirements for all Flooring over Wood Subfloor***

1. Do not install Infloorboard III without an accurate room-by-room heat loss analysis of the structure to be heated and a design/layout for Infloorboard III that takes into account the resistance and heat transfer of the actual floor coverings. If Infloorboard III cannot provide all the necessary heat, make provisions for additional back up heat.
2. Thoroughly clean all surfaces that Infloorboard III will be applied to. The surface to which Infloorboard III will be attached must be flat and dry prior to installation. See requirements for flatness and moisture. The requirement for flatness is defined as the maximum difference between two adjacent high points and the intermediate low point. The maximum acceptable difference in level is 3/16 of an inch in a 10-ft. radius. Wood subfloors must have a stable moisture content between 6 - 10%. Creaking subfloors must be repaired before installation. If the subfloor sags, inspect the joists below for twists or weakness. If the subfloor is cupped or uneven at the joints, recheck the moisture content of the subfloor to be sure it is in the 6 - 10% range. Check for excessive moisture in the crawl space or basement and look for other signs of a potential water problem. High areas should be sanded or planed, low areas patched or filled with an appropriate leveling compound, or covered with a rigid underlayment. When using a leveling compound, be sure to follow the manufacturer's recommendations, and allow the compound to dry completely before starting to install the floor.
3. Chalk lines square for a reference, as walls may out of square.
4. Lay out boards according to the plan.
5. Secure boards with construction adhesive to the wooden subfloor. Be sure to use adequate adhesive and follow the recommended pattern.
6. Start layout of all pieces by securing a corner to allow for proper alignment.
7. Use 6" lengths of tubing in the grooves, lapping 3" into each board to help align the grooves of the boards.
8. A 1/16" width space shall be used between boards.
9. After gluing boards in place, drill and screw or cross staple Infloorboard III to subfloor, according to the recommended pattern.
10. Once all boards are installed, clean out all grooves with a vacuum.
11. Snap tubing into groove and route to manifold per plan.
12. Follow specific recommendations for each floor covering, and refer to the complete installation manual for further instructions on the installation of the Infloorboard III system.
13. When gluing wood flooring goods to Infloorboard III, first attach a high quality ¼ underlayment plywood and glue to that. Many glues are incompatible with PEX and the aluminum bond has not been long term cycle tested with glue down flooring.

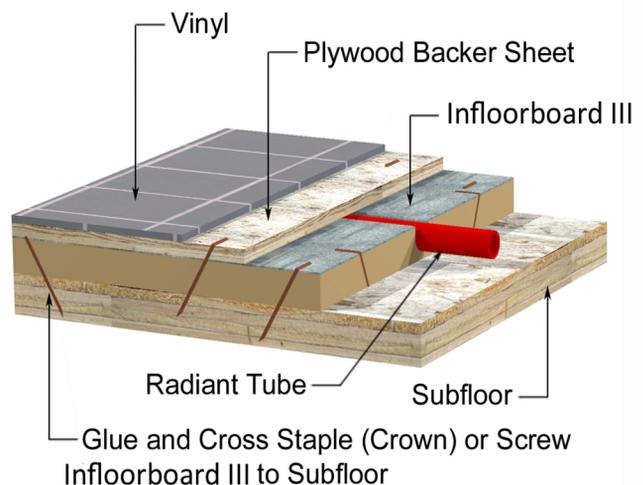
### Carpet Over Infloorboard III

Infloorboard III shall be installed over a wooden subfloor, complying with "General Infloorboard III Installation Requirements For All Flooring Over Wood Subfloor." In addition, the following specific precautions and instructions shall be followed: Carpet and pad may be installed over Infloorboard III. When installing the pad, care should be taken to avoid puncturing tubing. It is advised that a thin layer of underlayment plywood be applied over Infloorboard III prior to carpet and pad installation to protect tubing from point loads. As with all radiant heating installations, a thin slab foam rubber pad and short, high density carpet should be used. If carpet pad is glued, a high temperature latex adhesive must be applied. Glue to underlayment plywood: do not glue to Infloorboard III or to tubing! Maintain 2" minimum tubing clearance from carpet tack strips.



### Vinyl Over Infloorboard III

Infloorboard III shall be installed over a wooden subfloor, complying with "General Infloorboard III Installation Requirements For All Flooring Over Wood Subfloor". In addition, the following specific precautions and instructions shall be followed: When installing vinyl flooring, it is required that a thin layer of underlayment plywood be applied over Infloorboard III. In wet locations, a sealant layer should be added. Underlayment plywood that has a grid printed on it helps locate tubing runs and prevent puncturing the tubing when the plywood is being screwed to the Infloorboard III. In the case of vinyl, use underlayment, filler and glues suggested by the manufacturer for use over radiant heat. Most vinyl flooring is manufactured to an ASTM standard with an upper limit of floor temperatures of 85°F. This limit should be followed. Attach required underlayment with care to not puncture tubing.





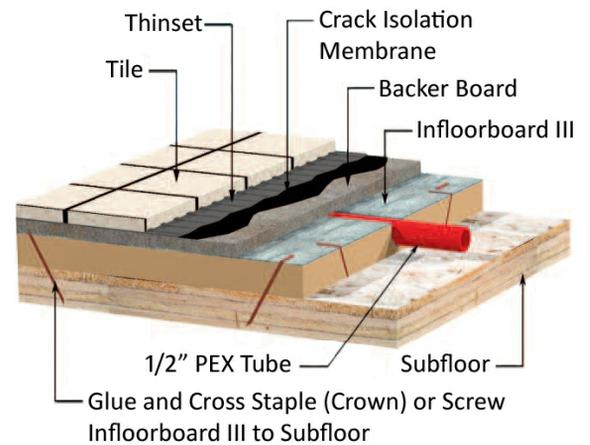
### Thinset Tile Over Infloorboard III

Infloorboard III shall be installed over a wooden subfloor, complying with "General Infloorboard III Installation Requirements For All Flooring Over Wood Subfloor". In addition, the following specific precautions and instructions shall be followed: When installing masonry, tile and stone, backer board shall be used over Infloorboard III. Thin set and screw backer board to the Infloorboard III with thinsets compatible with PEX Pipe. Thin set installation on top of backer board shall then be used following TCA Guidelines. In the kitchen, baths, laundry or any other area where water may be present, water sealant layer (i.e. NobleSeal) shall be used. Where tile or stone is going to be thin-set, anti-fracture membrane (NobleSeal) or equivalent shall be installed over the backer board. Maintain 2" minimum tubing clearance when screwing backer board down. Refer to the complete installation manual for further instructions on the installation of the Infloorboard III system.

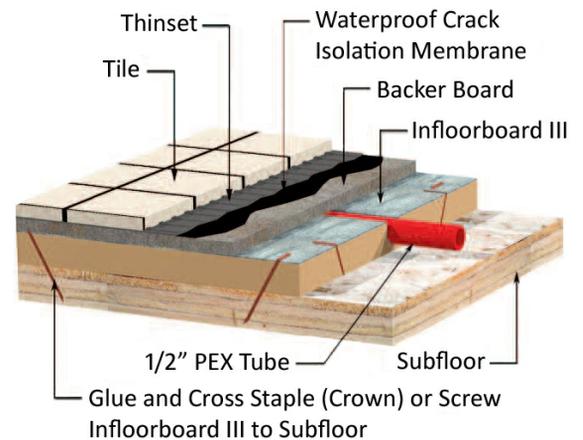
#### Notes On Sealing

*The aluminum layer on the top of each Infloorboard III is highly water resistant. Thus a significant degree of moisture protection can be given to the board simply by using silicon sealant as a caulk between the boards. Properly applied, this will profoundly reduce the likelihood of water transmission into the boards. This is not a substitute for recommended installation methods in wet areas.*

#### Thinset Tile or Stone for areas **unlikely** to be subject to moisture



#### Thinset Tile or Stone for areas **likely** to be subject to moisture



### Installer's Caution

*Do not omit the backerboard layer. Do not thinset directly to Infloorboard III, the aluminum will not provide a good bond. Do not install crack isolation membranes directly to Infloorboard III they will not get a good bond and many of them use materials that are incompatible for contact with PEX pipe.*



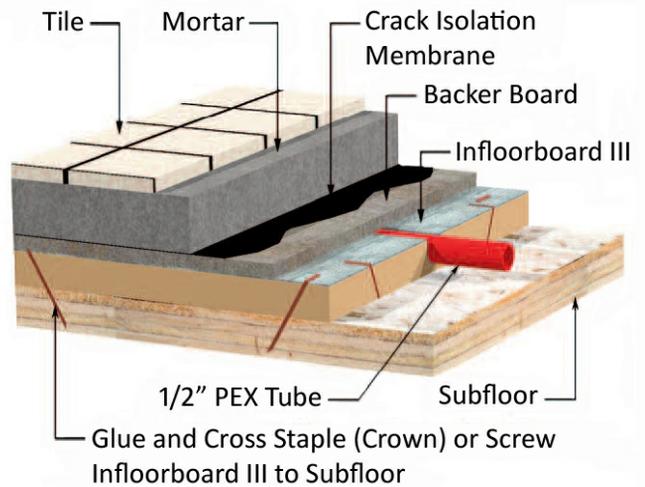
## Mortar Bed Setting of Tile or Stone Over Infloorboard III

Infloorboard III shall be installed over a wooden subfloor, complying with "General Infloorboard III Installation Requirements For All Flooring Over Wood Subfloor." In addition, the following specific precautions and instructions shall be followed: When installing masonry, tile and stone, backer board shall be used over Infloorboard III. Thin set and screw backer board to the Infloorboard III with thinsets compatible with PEX Pipe. The installation on top of backer board shall then be used following TCA Guidelines. A conventional mortar bed shall then be used. In the kitchen, bath, laundry or any other area where water may be present, a water sealant (i.e. NobleSeal) shall be used. Maintain 2" minimum tubing clearance when screwing backer board down. Refer to the complete installation manual for further instructions on the installation of the Infloorboard III system.

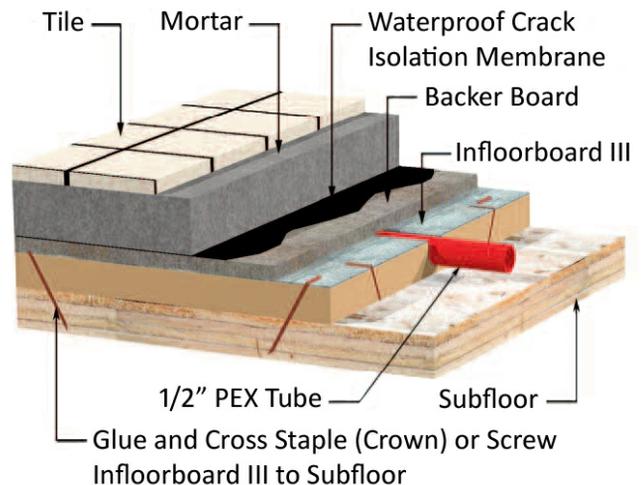
### Notes On Sealing

*The aluminum layer on the top of each Infloorboard III is highly water resistant. Thus a significant degree of moisture protection can be given to the board simply by using silicon sealant as a caulk between the boards. Properly applied, this will profoundly reduce the likelihood of water transmission into the boards. This is not a substitute for recommended installation methods in wet areas.*

### Traditional mortar set tile or stone for areas **unlikely** to be subject to moisture



### Traditional mortar set tile or stone for areas **likely** to be subject to moisture



## Installer's Caution

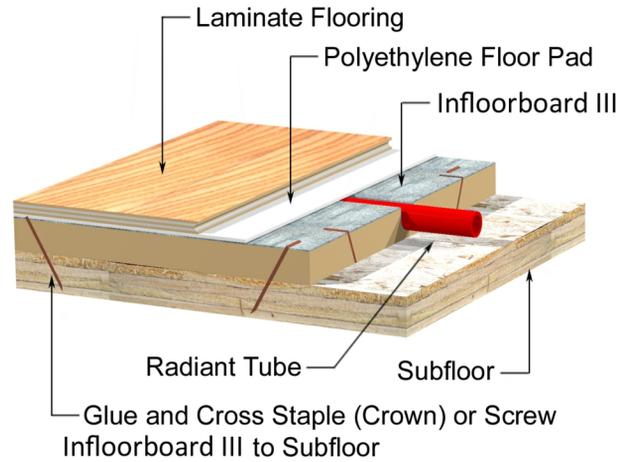
*Do not omit the backer board layer. Do not set directly to Infloorboard III, the aluminum will not provide a good bond. Do not install crack isolation membranes directly to Infloorboard III, they will not get a good bond and many of them use materials that are incompatible for contact with PEX pipe.*



**Infloorboard III to Subfloor**

**Laminate Over Infloorboard III**

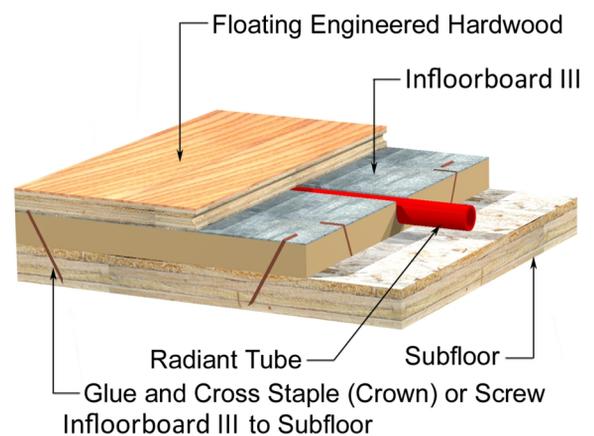
Infloorboard III shall be installed over a wooden subfloor, complying with "General Infloorboard III Installation Requirements For All Flooring Over Wood Subfloor." In addition, the following specific precautions and instructions shall be followed: When installing laminate flooring, it is advised that a thin layer of underlayment plywood shall be applied over Infloorboard III. In wet locations a sealant layer should be added over the underlayment layer of plywood. Many, but not all, laminate flooring products are suitable and recommended by the manufacturer for use with radiant floor heat. Check before installing. Many laminate flooring products have floor temperature limits that need to be observed as well. Install laminate flooring crosswise to Infloorboard III whenever possible. It is recommended that laminate flooring installed over Infloorboard III shall employ controls that gradually adjust water temperature going to the Infloorboard III with a reset curve. A floor temperature limiting sensor can be used to comply with flooring manufacturer's flooring temperature specifications.



**Engineered Wood Over Infloorboard III**

Infloorboard III shall be installed over a wooden subfloor, complying with "General Infloorboard III Installation Requirements For All Flooring Over Wood Subfloor." In addition, the following specific precautions and instructions shall be followed: Many, but not all, engineered wood flooring products are suitable and recommended by the manufacturer for use with radiant floor heat. Check before installing. Many engineered wood flooring products have floor temperature limits that need to be observed as well. Install engineered wood flooring crosswise to Infloorboard III whenever possible. It is recommended that engineered wood flooring installed over Infloorboard III shall employ controls that gradually adjust water temperature going to the Infloorboard III with a reset curve. A floor temperature limiting sensor can be used to comply with flooring manufacturer's flooring temperature specifications.

**Infloorboard III to Subfloor**

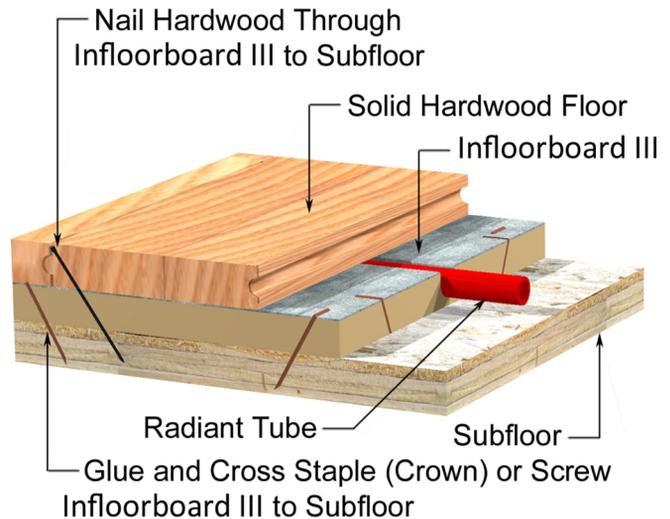


## Traditional Hardwood Installed Directly Over Infloorboard III

A conventional nailed and hardwood type system may be used directly over Infloorboard III, with nailing long enough to penetrate the subfloor, and with the utilization of recommended controls. See also sections on general considerations with the use of traditional wood flooring.

Infloorboard III shall be installed over a wooden subfloor, complying with "General Infloorboard III Installation Requirements For All Flooring Over Wood Subfloor." In addition, the following specific cautions and instructions shall be followed:

1. Care shall be taken to avoid nailing tubing.
2. Hardwood floor joints shall not be installed directly at Infloorboard III joint.
3. Hardwood floor nails shall be long enough to penetrate both hardwood and subfloor.
4. Hardwood floors installed directly over Infloorboard III shall employ controls with a reset curve, that gradually adjust water temperature going to Infloorboard III; the floor will expand and contract gradually with temperature changes. This will reduce the likelihood of warping, gapping or shrinkage problems. The use of a floor temperature limiting sensor is recommended.
5. It is extremely important that the designer know which way it is desired that the strip flooring be aligned prior to the design of Infloorboard III system, since the direction of Infloorboard III should run perpendicular to the direction of the strip flooring.
6. Install strip wood flooring with mallet driven nails and nails penetrating Infloorboard III.
7. Structure humidity shall be kept within the range specified by the flooring manufacturer.
8. The wood flooring shall be installed at the relative humidity recommended by the manufacturer for the climate involved.
9. Use narrower 2"-3 1/2" strips of wood flooring over radiant floors.
10. The lessons of local practice and climate shall be referenced
11. Make sure the heating system has been running and the space has been maintained at least 65F° long enough that temperature and humidity have stabilized to predicted future levels.
12. The flooring product shall be allowed to acclimatize before installation
13. Use woods that are known to be dimensionally stable.



**Infloorboard III to Subfloor**

## **CONSIDERATIONS: Traditional Strip Wood Flooring Over Infloorboard III**

The key to installing wood floors over radiant heat is to give extra care to wood species, wood width and thickness, moisture levels, installation practices, the heat output requirements of your system, and radiant heating control.

**BOARD WIDTH:** Install narrow board widths, preferably 3 inches or less. Avoid boards wider than 4 inches. Narrow boards provide more gaps for expansion and contraction across a floor; therefore, gaps resulting from natural movement are much less noticeable. The maximum recommended board depth is 3/4 inch. Thicker boards add too much resistance to heat transfer.

**DIMENSIONAL STABILITY:** Use quarter sawn wood. It is significantly more dimensionally stable than wood that is plain sawn. Pick a wood that's known for its dimensional stability. American cherry, ash, most softwoods and teak fill this bill, and oak is reasonably stable. By contrast, hickory, maple, madrone, and American beech are known to be less stable.

**AGE & DRYING IN TROPICAL WOODS:** If you are importing tropical or exotic woods, pay close attention to the source, age and how the wood has been dried. Tropical wood needs to dry slowly. Quick drying creates stresses that can affect the wood later as it expands and contracts. If your supplier has stored the wood in your region with no problems for one to two years, surprise stress-related problems are much less likely. Though it can be fun to be unique, avoid pioneering the use of a wood where there is little information on its dimensional stability.

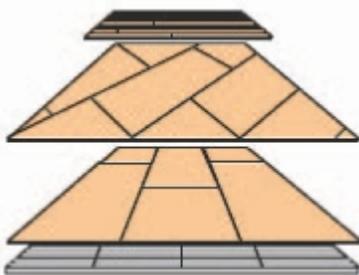
**MOISTURE:** Wood naturally expands and contracts in response to changes in moisture. With this in mind, avoid installing wood flooring during stages like sheet rocking or painting, when significant moisture may be introduced into a structure. Operate the heating system until the humidity in the structure stabilizes to the average level expected for the area in which the wood floor will be installed. Then, allow the wood to acclimatize to this humidity level by "sticking" (usually several weeks) before installation. This will minimize dimensional changes due to moisture. Make sure the wood is dry, since radiant heat itself can be drying. Experienced flooring installers recommend buying wood for radiant at around 6 to 8 percent moisture content. This figure may change somewhat regionally. Use a moisture meter during the construction process, and then use the average of many readings. Remember, the average expected humidity level of a structure is an average of seasonal conditions. So if the structure is expected to average 30 percent humidity in the winter and 50 percent in the summer, the average would be 40 percent. This equates to about a 7.5 percent moisture content in the wood. Most installers consider this average the ideal moisture level at which to install wood flooring. These numbers can vary significantly by region.

**SURFACE TEMPERATURE:** The maximum surface temperature of a wood floor should be limited to 85°F. Use a control strategy that ensures this will not be exceeded. Use an indoor or outdoor reset control that brings the floors to temperature gradually.

### Other Application Options - For Wood Floors Over Infloorboard III

Infloorboard III may be used under traditional strip wood flooring in several ways. A conventional nailed and hardwood type system may be used directly over Infloorboard III, and with controls as described in the previous section. There are many advantages to this method; they include quicker response, lower cost of installation, higher heat output due to lower resistance of flooring, and an indoor or outdoor reset control that brings the flooring through temperature changes evenly, gradually and accurately.

**Optional floating methods for use with traditional strip wood flooring:** 2 layers of 1/2-inch plywood may be floated on top of Infloorboard III and strip flooring nailed to it, as shown below in a method recommended by the National Wood Flooring Association. This method has the advantage that it allows the wood flooring system to float independently from Infloorboard III, but has significant disadvantages in that the 1" extra thickness of wood limits the output of the system. For example, two layers of 1/2" plywood with 3/4" of strip oak flooring has an R-value of about R-2.3. This limits the output of the floor at 150° F water temperature to about 26 BTU/sq.ft. A careful heat loss analysis must be done to see if this method will produce enough heat. If not, another method should be chosen or provisions made for backup heat. A hydronic control strategy that gradually adjusts water temperature going to Infloorboard III with a reset curve is recommended but not required with this method.



- Wood flooring nailed to 2 layers of plywood
- Plywood laid diagonally to first layer attached with 7/8" screws on 6" grid pattern
- First layer of plywood is "floated" on Infloorboard III



Finished flooring assembly of strip wood flooring and plywood "floats" independently on top of Infloorboard III.

### NWFA Double Plywood Floating Method

Clip style floating strip flooring systems must be installed directly over Infloorboard III such that clips will never come in contact with the tubing.

**The use of a floating engineered wood is a preferred method.** This product should have a specific warranty for use over radiant floors. Many manufacturers of these products have such a warranty, as well as having extensive experience both in Europe and North America with radiant heating applications. Edge glued floating engineered wood flooring systems are preferred, since they are dimensionally stable and expand independently from any thermal mass. Infloorboard III should be installed such that the hardwood runs perpendicular to the majority of the tubing runs.

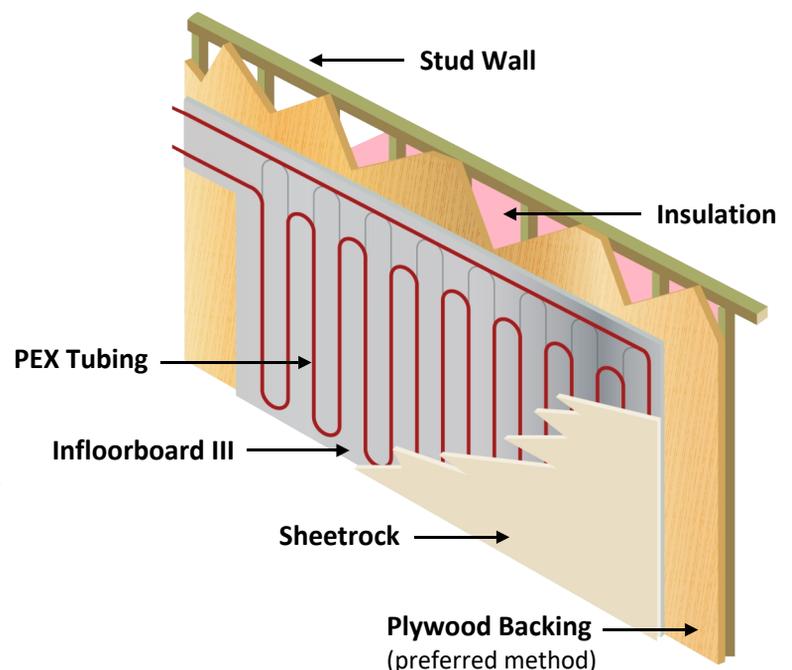
**Glued down wood flooring systems are not recommended** unless a layer of plywood is first screwed down to the Infloorboard III and the wood is attached to the plywood according to the flooring manufacturer's recommendations for installation over radiant heat.

## Application of Infloorboard III to Walls or Ceiling

Infloorboard III may be installed on walls or ceilings as extra heat output areas when the floors cannot provide all the necessary heat. Radiant walls and ceilings may also be used to provide all the heat of a room in certain circumstances when properly designed. The heat output of radiant walls and ceilings is different from floors, due to differences in the strength of the convective component of the heat which is stronger in radiant floor heating than in walls or ceilings. However, since walls and ceilings are typically covered only with the relatively low R-value of 1/2" of sheet rock, and acceptable surface temperatures are higher, the heat output of these systems can be quite substantial. It is very important not to overheat sheetrock or discoloration or damage may occur. For design purposes, use chart C-1 but correct the output in BTU's downward 5% for walls and 10% for ceilings. This is because the convective component of the heat output is lower in wall and ceiling radiant heating systems.

### ***Infloorboard III wall and ceiling systems shall be installed as follows:***

Infloorboard III shall be installed square to framing, attached per page 14 to plywood attached to framing (preferred method), or directly to studs, rafters and/or blocking with as many joints as possible screwed securely to the framing. Infloorboard III shall be secured to plywood or framing on both sides of the grooves on every board. Layout of all pieces shall be started by securing a corner to allow for proper alignment. 6" lengths of tubing shall be temporarily placed in the grooves lapping 3" into each board to help align the grooves of the boards during installation. Once all boards are installed, all grooves shall be cleaned out with a vacuum just prior to tubing installation. Tubing shall be snapped into the groove and routed to manifold per the plan. A 1" minimum tubing clearance from tubing shall be maintained for all nailing. Add steel plate protectors over tubing where tubing crosses studs. Water temperatures shall not exceed 120F° supply water temperatures when Infloorboard III is installed under plaster or sheetrock.





## Installing Infloorboard III Over Concrete

***Successful installations of Infloorboard III over concrete require special care due to the difficulties of sealing concrete, moisture issues and attaching Infloorboard III to concrete.***

All concrete slabs give off supplementary moisture whether above, on, or below grade. This can cause problems for any board product installed over it, including Infloorboard III. Infloorboard III *may be installed over concrete using the following three (3) methods* only when the installing parties are willing to assume full responsibility for the installation issues regarding moisture and attachment of Infloorboard III to concrete.

When installing Infloorboard III over concrete, moisture considerations must be carefully addressed. Remember that while a slab may appear to be, or actually be, dry during one time of year, this may change as environmental conditions change. Below is a procedure for testing the moisture of slabs, including those between floors as in commercial construction. It is the contractor's as well as the installer's responsibility to test all concrete substrates, both new and old, for moisture content to determine whether they are sufficiently dry to install Infloorboard III. Moisture in the concrete should be tested according to ASTM F 1869 (Calcium Chloride Moisture Test using the Quantitative Method). With a calcium chloride test, the maximum acceptable reading is 3 lbs./ 4 hours/ 1,000 Sq. ft. New concrete slabs and basements must be cured for a minimum of 60 days prior to installation. Determine that the existing or new slab is sufficiently dry, and do any sealing of the slab before you proceed with any Infloorboard III installation.

It is strongly recommended that all slabs below grade and slabs on grade be sealed against

moisture penetration before installing Infloorboard III by means of vapor barriers or product such as Hydroment Ultraseal that is a sealant and an adhesive. It is also important that all installations of Infloorboard III over concrete slabs below grade and slabs on grade be insulated against downward heat loss either as shown in the detail below or under the slab or downward at the perimeter according to the Radiant Panel Association recommendations. The increasing use in seismic areas of engineered "Seismic Slabs" means that fewer radiant floor heating systems will be installed with tubing in the slab and there will be more need for the 3 details that follow.

### **Recommendations for floor coverings installed over Infloorboard III that is installed on concrete:**

For details of installation of flooring materials above the Infloorboard III layer, refer to the details on the previous pages for additional information and requirements, but refer to the following page for details of how to install Infloorboard III itself over concrete. So for example tile would be installed over Infloorboard III with a backerboard layer, crack isolation membrane, mortar, etc. as shown on previous pages, but Infloorboard III itself should be installed as according to one of the 3 methods shown below.

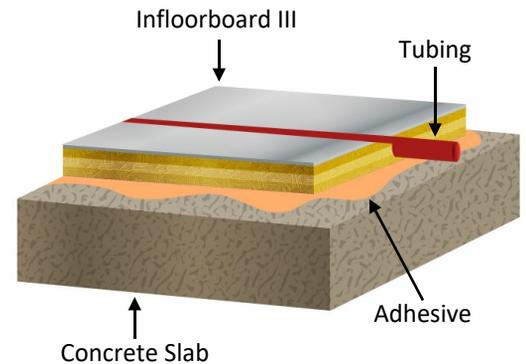
***Installer's Note:*** *When installing traditional strip wood flooring directly to Infloorboard III installed over concrete you must use one of the methods utilizing 5/8" treated T&G plywood under the Infloorboard III to provide adequate nailing.*



## Application Details of Infloorboard III Over Concrete

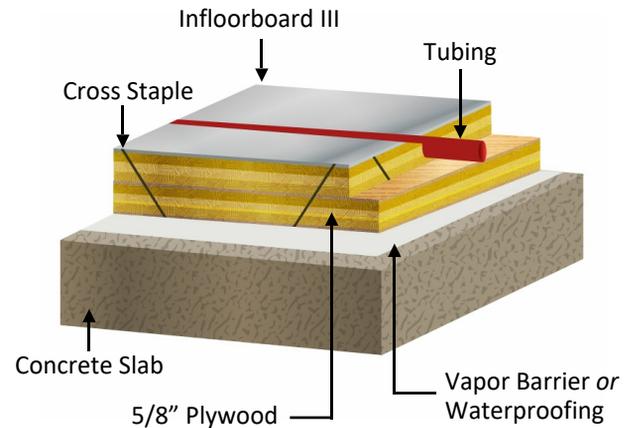
### ***Infloorboard III bonded to concrete using sealant and adhesive***

Infloorboard III may be installed directly over concrete slabs only when the contractor has verified that moisture conditions will be adequately controlled by the use of a sealant on the slab or a vapor barrier under the slab. When using a sealant and adhesive on top of the slab, the sealant may be a combination sealant/wood adhesive such as Hydroment Ultraseal or the sealant and adhesive may be two separate but compatible products.



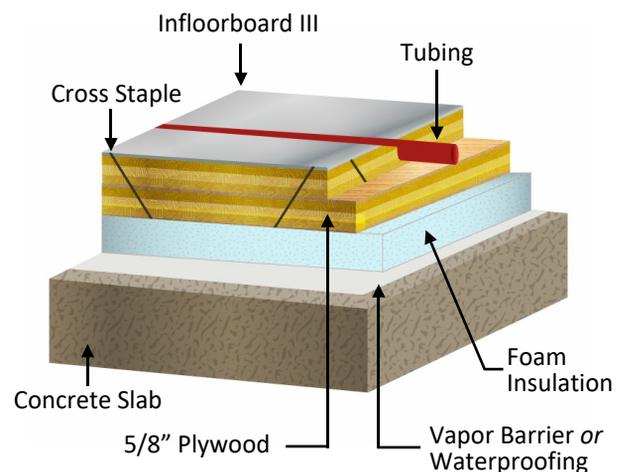
### ***Infloorboard III over plywood and vapor barrier or waterproofing***

Infloorboard III may be installed on 5/8" T&G treated plywood with a vapor barrier or waterproofing over concrete slabs only when the contractor has verified that moisture conditions will be adequately controlled by the use of a sealant on the slab or a vapor barrier over or under the slab.



### ***Infloorboard III over plywood, foam insulation and vapor barrier or waterproofing***

Infloorboard III may be installed on 5/8" T&G treated plywood, over foam and with a vapor barrier or waterproofing over concrete slabs only when the contractor has verified that moisture conditions will be adequately controlled by the use of a sealant on the slab or a vapor barrier over or under the slab.





## **Infloorboard III Application Over Concrete, when using all Regular Flooring, Except Strip Wood Flooring**

### **Installation Over Concrete**

Installation shall comply with one of the three (3) details on Page 31 and installing parties must accept responsibility for and understand all cautions on page 30 regarding moisture and attachment of Infloorboard III to concrete. They should also refer to the complete installation manual for further instructions on the installation of Infloorboard III system. Do not install Infloorboard III without an accurate room-by-room heat loss analysis for the structure to be heated as well as a design/layout for Infloorboard III that takes into account the resistance and heat transfer of the actual floor coverings. If Infloorboard III cannot provide all the necessary heat, make provisions for additional backup heat.

1. Thoroughly clean and level all surfaces where Infloorboard III will be applied.
2. Prevent moisture penetration through slab either by sealing concrete with a vapor membrane such as Hydroment Ultraseal per manufacturer's guidelines or with a continuous unperforated under slab vapor barrier or above slab vapor barrier as shown on page 31.
3. Follow one of the application details on page 31, chalking lines on floor as reference points and lay out boards according to plan.
4. If gluing Infloorboard III to concrete sealed with a membrane, be sure to use adequate adhesive compatible with vapor membrane to glue down Infloorboard III to the membrane.
5. When attaching Infloorboard III to plywood, lay out boards according to plan and glue and screw or glue and cross staple Infloorboard III to plywood. Be sure to use adequate adhesive.
6. Start layout of all pieces by securing a corner, to allow for proper alignment.
7. Use 6" lengths of tubing in the grooves lapping 3" into each board to help align the grooves of the boards.
8. Once all boards are installed, clean out all grooves with a vacuum prior to tubing installation.
9. Snap tubing into groove and route to manifold per plan.
10. Install backerboard when applying tile or vinyl floor goods.
11. Maintain 2" minimum tubing clearance from carpet tack strips or other nailing.
12. Refer to previous drawings for additional details and requirement of flooring installed over Infloorboard III.

## Application of Infloorboard III Over Concrete, with Strip Wood Flooring

### Installation Over Concrete

Installation shall comply with one of the 2 details on Page 31 utilizing 5/8" treated T&G plywood. Installing parties must accept responsibility for and understand all precautions on page 30 regarding moisture and attachment of Infloorboard III to concrete and should refer to the complete installation manual for further instructions on the installation of Infloorboard III system. Do not install Infloorboard III without an accurate room-by-room heat loss analysis for the structure to be heated as well as a design/layout for Infloorboard III that takes into account the resistance and heat transfer of the actual floor coverings. If Infloorboard III cannot provide all the necessary heat, make provisions for additional backup heat.

1. Thoroughly clean and level all surfaces where Infloorboard III will be applied.
2. Prevent moisture penetration through slab either by sealing concrete with a vapor membrane such as Hydroment Ultraseal per manufacturer's guidelines. A continuous unperforated under slab vapor barrier or above slab vapor barrier as shown on page 31 are also acceptable.
3. Follow one of the 2 application details on page 31, use 5/8" T&G treated plywood under the Infloorboard III and lay out boards according to plan.
4. Chalk lines of a square reference point, as construction of walls may be inconsistent.
5. Lay out boards according to plan.
6. Glue and screw or staple Infloorboard III to plywood. Be sure to use adequate adhesive.
7. Start layout of all pieces by securing a corner, to allow for proper alignment.
8. Use 6" lengths of tubing in the grooves lapping 3" into each board to help align the grooves of the boards.
9. Once all boards are installed, clean out all grooves with a vacuum just prior to tubing installation.
10. Snap tubing into groove and route to manifold per plan.
11. Install strip flooring with mallet driven nails and nails penetrating the Infloorboard III.
12. Insulfoam under plywood may be used instead of plywood alone in strip flooring applications as shown on page 31.
13. Hardwood floors installed directly over Infloorboard III shall employ indoor or outdoor type reset controls that gradually adjust water temperature going to the floor.
14. The wood flooring shall be installed at the relative humidity recommended by the manufacturer for the climate involved. Structure humidity shall be kept within the range specified by the flooring manufacturer.
15. Use narrower 2"-3 1/2" strips over radiant floors.
16. The lessons of local practice and climate shall be referenced.
17. Make sure the heating system has been running and the space has been maintained at a minimum of 65 F° for a period long enough that temperature and humidity have stabilized to predicted future levels.
18. The flooring product shall be allowed to acclimatize before installation.



## CAUTIONS AND LIMITATIONS OF USE

### GENERAL CAUTION:

As with any radiant heating system, do not install Infloorboard III without an accurate room-by-room heat loss analysis for the structure to be heated, as well as a design/layout for Infloorboard III that takes into account the resistance and heat transfer of the actual floor coverings. If Infloorboard III cannot provide all the necessary heat, make provisions for additional backup heat.

### INSTALLERS CAUTION:

This manual is deemed to be current at the time of publication. It is the installer's responsibility to install according to the most current Application Guide. This guide does not purport to address all relevant issues; it assumes a knowledge of good practice in both hydronics and construction methods. Installers should always consult all relevant local, regional and national codes, and adhere to good construction practice. Infloorboard III should only be installed by knowledgeable, qualified installers. Infloorboard III installations frequently require the coordination of trades. These are, most typically, mechanical and flooring trades. Any issues regarding this coordination should be worked out in advance. Failure to follow the instructions of this guide, failure to adhere to relevant local, regional and national codes, failure to coordinate trades, and failure to follow good construction practice may cause an unsatisfactory result. See also "limitations of use" elsewhere in this publication. The limitations and instructions of use for PEX pipe and all other hydronic components provided by the manufacturers must also be referenced and followed during installation; this manual does not address many aspects of a hydronic installation.

### LIMITATIONS OF USE:

Infloorboard III is designed for interior use only, and is to be installed only on dry substrata once a structure is closed in, protected from the environment, and will remain dry. Infloorboard III is not intended as, or rated as, a replacement or substitution for a structural subfloor. The BTU output of Infloorboard III is limited by the R-values of the finish goods applied over it and by the recommended and available water temperatures. Infloorboard III is not intended for use with finish goods that are incompatible with the temperatures and conditions present in a radiant heating system. Infloorboard III is not intended as a finish floor, and should be left uncovered and unprotected only during installation.

INFLOORBOARD III IS A PATENTED PRODUCT AND IS SOLD UNDER LICENSE FROM WARM BROTHERS INC.



# LoopCAD Layout Designs

Professional LoopCAD Layouts are provided by:

Infloor Heating Systems

503 Gregg Drive • PO Box 4945, Buena Vista, CO 81211

www.infloor.com • (800) 608-0562

Many poor performing heating systems are often the result of improper design due to inaccurate heat loss calculations on a room-by-room basis, which may result in poor performing, undersized or oversized systems. The type of system must be selected based on the level of sophistication and many factors that affect system output such as insulation values, floor coverings, multi-level interaction, floor temperature limitations, heat source type, as well as many other factors that go into the design process. All these conditions are used with the aid of computer simulation to maximize efficiency and cost effectiveness of a system. Additionally, most radiant heating systems are integrating into a structure in such a manner that they become a permanent part of the building. It is imperative for accuracy and clarity that a proper design be established prior to installation.

### ***Advantages to having a system designed by Infloor Heating Systems are:***

- Consultation on advantages/disadvantages of different systems
- Experience with integrating all types of systems such as solar, geothermal, pool, etc.
- Insuring compatibility of different floor coverings to the system type and space heating needs
- Experienced recommendations on zoning
- Strategic layout of manifolds and tubing based on construction type
- Proper specification of heat source and components to fit construction type
- A record set for the owner and future owners
- Clients can get "apples to apples" bids from prospective installation contractors
- A properly engineered system can save money, time, and headaches
- A system design that best matches the construction type and provides strategic zone control

### ***Benefits to the Owner:***

As an owner, having Infloor Heating Systems design a system that matches the construction type, you will have peace of mind of having a system work perfectly and with the desired functionality in your new or retrofit application. Infloor works with the client to provide all the options including advantages/disadvantages on various type of systems and will work to match a system that best matches the construction type. With Infloor's expertise, options on different heat sources and controls is presented to allow the customer to make good decisions on their comfort system. When it comes time for installation of a system, using an Infloor LoopCAD layout, the owner can get "apples to apples" bids from prospective installation contractors. As a properly designed and installed radiant heating system adds value to the home, an Infloor plan provides a permanent record of the system for resale or for future renovations. With an Infloor designed system, owners can rest easy knowing they will have the most comfortable heating system that can be provided at their budget.



## Infloor LoopCAD Layout Design Services Continued

### **Benefits to the Architect or Designer:**

As is often required by building departments, an Infloor LoopCAD layout may be used as a complete mechanical system that can be incorporated into submittal plans. A "complete heating system design" may be used as a selling feature to clients. Having worked on thousands of different types of construction, Infloor can offer expert advice for the integration of the mechanical system into the design as well as advice on which type of system is best suited for different types of construction. Infloor may provide information on integration of the system into the building controls if applicable. Consultation is available on how systems will work with different floor coverings, ceiling heights, window configurations and multi-level, multi-zoned homes and buildings.

### **Benefits to the Installer:**

With a complete Infloor LoopCAD layout design, the installation contractor can quickly get material takeoffs for bids. All components including distribution piping are already sized including exact circuit lengths. Infloor provides balancing data for all circuits in a clear concise table. Spend less time fumbling with design aspects and more time getting systems installed. Infloor plans are a good selling feature when speaking to prospective clients as having "plans engineered to ensure proper operation." With a plan the client will know exactly what they are getting prior to work, which saves time for you and the client in the long run. You will also be providing the owner with a clear, permanent record of the system.

### **The Infloor LoopCAD Design Advantage:**

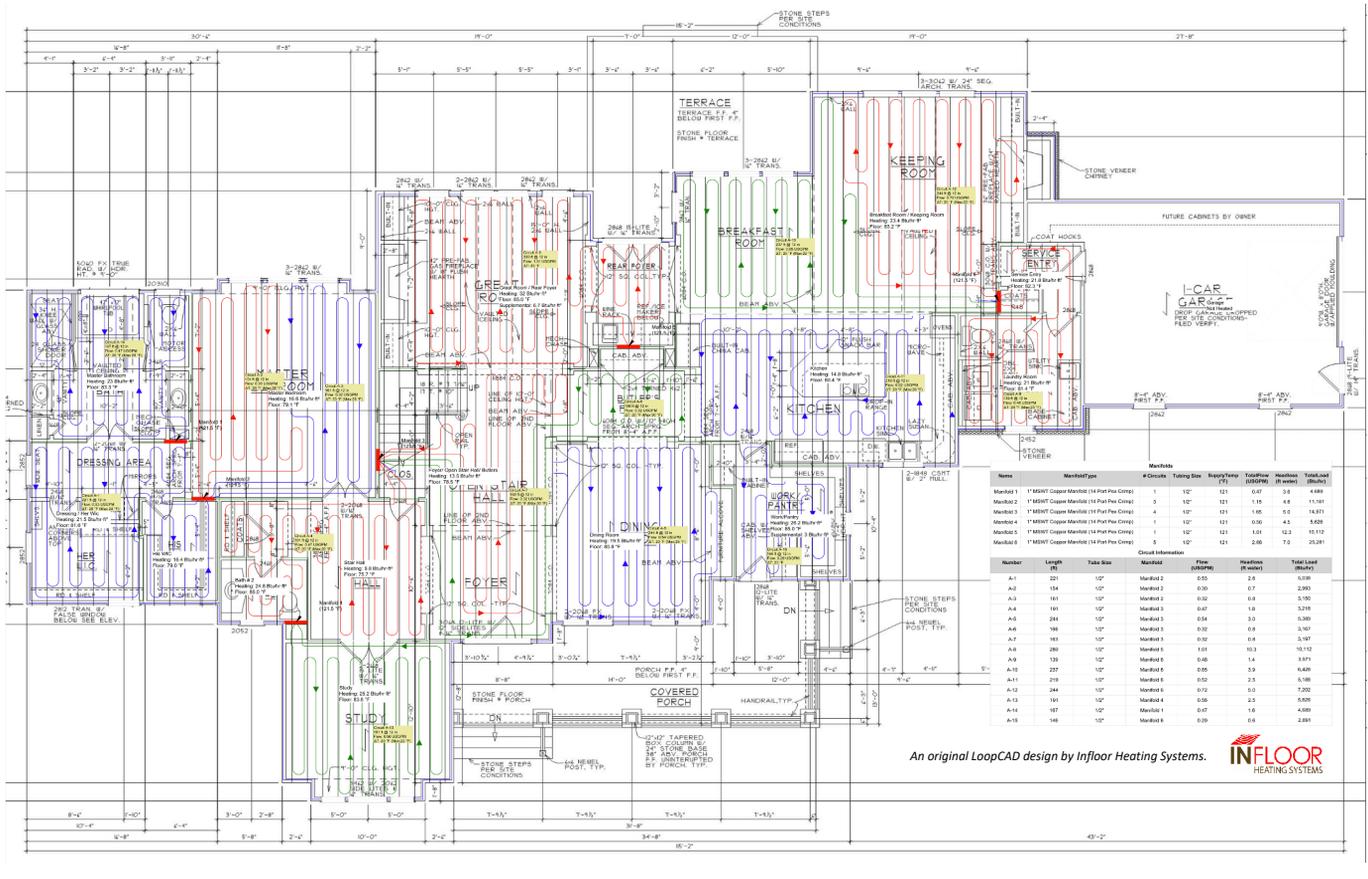
As a national leader and independent source of design and consultation, Infloor Heating Systems works with homeowners, architects, installation contractors, distributors, and manufacturers to design custom or production radiant heating systems for a variety of both residential and commercial buildings. With over 30 years of experience in the radiant industry and having designed thousands of systems throughout the U.S., Infloor has the experience and knowledge to design a perfect operating system that best matches the type of construction.

### **An Infloor LoopCAD Design - What you get:**

1. Full size sheets showing the plan view of tubing layout including locations of manifolds, heat source, and components.
2. System balancing data - computer simulation report that summarizes zones, flows, water temperatures, tube lengths which allows the installer to properly bid, install and balance the system for optimal performance.
3. Complete component schematic including specifications on heat sources, pumps, valves, manifolds, expansion tank, etc. and sizing of distribution piping.
4. Installation notes and details.
5. System controls page providing controls schemes.



# LoopCAD Layout Example

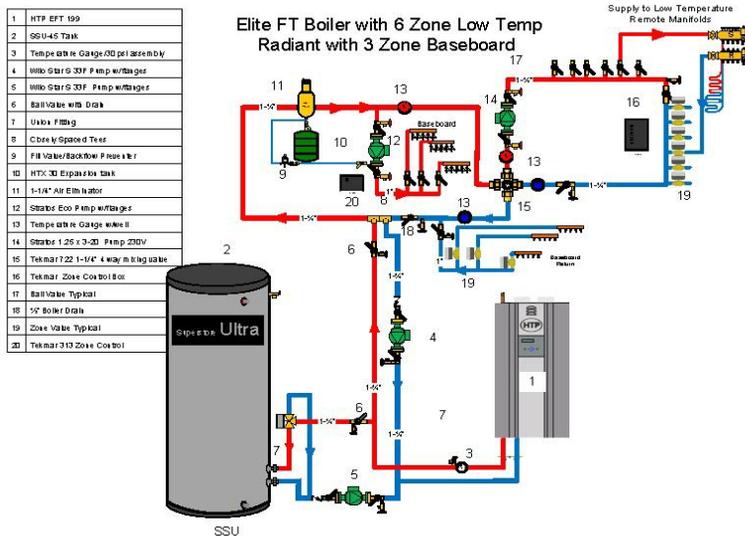


An original LoopCAD design by Infloor Heating Systems.

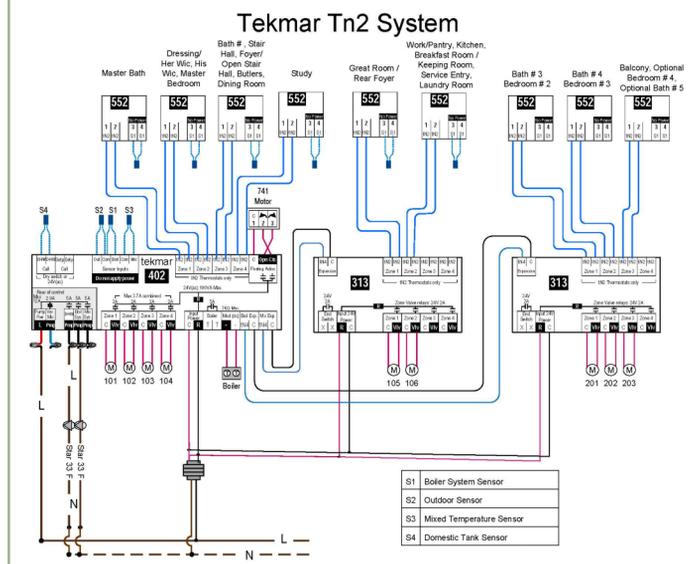
## Mechanical Room Installation Drawings

Mechanical room installation schematics showing arrangement of components and wiring of controls.

Mechanical Room and Boiler



Energy Management Control Systems Diagram





# Standard Specifications

## Infloorboard III Modular Non-Structural Radiant Board System

### Part 1 - General

#### 1.01 - General

- A. Provide all labor, materials, transportation, equipment and services to install Infloorboard III non-structural modular board system as indicated by the contract documents and these specifications
- B. Examine all contract documents for instructions, terms and conditions related to the installation of Infloorboard III Non-Structural Radiant Board System. Provide all work as described and required and support and accommodation of related work.

#### 1.02 - References

- A. Radiant Panel Association Guidelines for the Design and Installation of Radiant Heating Systems, applicable sections of sections 16.2 and 19.3
- B. SFI (Sustainable Forestry Initiative Inc.) certification (substratum board supplier used in manufacture of Infloorboard III)
- C. American Society For Testing Materials (ASTM) Standard Specification For Cross Linked Polyethylene (PEX) Tubing
- D. International Building Code (ICC) E. Uniform Building Code (UBC)
- F. Uniform Mechanical Code (UMC)
- G. Applicable local modifications and codes that apply in project jurisdiction

#### 1.03 - Submittals

- A. Verification of SFI certification substrata board supplier used in manufacture of Infloorboard III
- B. Verification of compliance with RPA Standard Guidelines or local code requirements for heating system design sufficient to supply heating needs of the structure or portion of heating needs as specified by contract documents.
- C. Installation plan showing tubing layout, manifold locations, installation notes, and other system components shall be submitted for approval as specified under the terms and conditions of the Contract Documents. No installation work shall be initiated before such approval is obtained.

#### 1.04 - Delivery, Storage Handling and Quality Control

- A. The General Contractor and, if different, the receiving sub-contractor shall ensure that the Infloorboard III modular boards are received in good condition and installed without damage and installed in accordance with construction documents, the then current Infloorboard III Installation Manual and applicable code.
- B. Infloorboard III boards shall be stored indoors in a temperate (40°F-90°F), dry location. It should always be stored in a temperate, dry place (40F°-90F°). Avoid prolonged exposure to sunlight. Do not store in a damp location. Be sure to follow all instructions in the Infloorboard III Installation Manual regarding protecting the board from prolonged moisture contact.
- C. PEX tubing before and after installation shall be protected from prolonged exposure to UV light according to the tubing manufacturer's requirements.

# Standard Specifications

## Infloorboard III Modular Non-Structural Radiant Board System

### 1.05 - Site Conditions Required For Installation of Infloorboard III

- A. Infloorboard III shall only be installed on a subfloor, indoors in enclosed dry structures.
- B. The surface of the subfloor must be flat: The requirement for flatness is defined as the maximum difference between two adjacent high points and the intermediate low point. The maximum acceptable difference in level is 3/16 of an inch in a 10-ft. radius.
- C. Wood subfloors must have a stable moisture content, between 6 - 10%. Creaking subfloors must be repaired before installation
- D. When installing Infloorboard III over concrete, It is the contractor's as well as the installer's responsibility to test all concrete substrates, both new and old, for moisture content to determine whether they are sufficiently dry to install Infloorboard III. Moisture in the concrete should be tested according to ASTM F 1869 (Calcium Chloride Moisture Test using the Quantitative Method). With a calcium chloride test, the maximum acceptable reading is 3 lbs./ 4 hours/ 1,000 Square. ft. New concrete slabs and basements must be cured for a minimum of 60 days prior to installation.

### 1.06 - Limited Warranty

- A. Infloorboard III warrants that its non-structural modular board product are free from defects in material and workmanship in the manufacturing process for the structure in which they are installed.

## Part 2 - Originating Manufacturer and Related Products

### 2.01 - Approved Board Manufacturer

- A. Infloorboard III shall be manufactured solely by Infloorboard III or by Infloorboard III's approved manufacturer. No other modular radiant boards may be substituted.

### 2.02 - Tubing

- A. Tubing Installed in Infloorboard III non-structural modular boards shall be third party certified to and manufactured to ASTM F-876.
- B. The PEX tubing shall have PPI issued design and pressure ratings of 200°F @ 80 PSI, 180°F @100 PSI and 73.4°F at 160 PSI.
- C. The PEX tubing shall be nominal 1/2" ID in accordance with ASTM F-876 and shall never have loops longer than 350'.



# Standard Specifications

## Infloorboard III Modular Non-Structural Radiant Board System

### Part 3 - Job Execution and Sequencing

#### 3.01 - Preparation

- A. The Infloorboard III non-structural modular board shall be installed according to the contract documents and the then current Infloorboard III Installation Manual.

#### 3.02 - Modular Board Installation

- A. Using a layout plan, install the Infloorboard III boards to the subfloor as required by the contract documents and the then current Infloorboard III Installation Manual. Follow recommended floor assemblies, gluing and attachment patterns contained in Infloorboard III Installation Manual.
- B. Reference planned direction of any wood flooring before installation and align straight boards at 90° from direction of wood flooring.
- C. Perform custom routing and drilling before installation of tubing.

#### 3.03 - Tubing Installation

- A. Channels shall be dry, clean and free of any debris before tubing is installed.
- B. The tubing shall be pressed into the channels until it is flush with the top of the board.
- C. Installation shall follow construction documents, and approved plan for tubing layout, manifolds controls and mechanical room.
- D. Tubing shall be pressurized with air or water in accordance with codes or to a minimum of 60 PSI and maintained through completion of all stages of construction that might damage tubing.
- E. Contractor must follow all manufacturer requirements for the care and handling of the tubing.

#### 3.04 - Subsequent to Tubing Installation

- A. Care shall be taken to protect tubing from damage, debris and prolonged exposure to UV light until covered by flooring goods. Tubing shall be vacuumed before cover.
- B. Flooring goods shall be installed with care to avoid damaging tubing. Particular care must be taken where tubing goes under sill, door jams and radius into walls for manifolds. Inform the other trades of location of tubing and protect tubing from damage with metal plates if necessary.
- C. Check tubing pressure test frequently and keep under test during any stages of installation and construction that might damage tubing.
- D. Finish installation and connect to mechanical components as required by construction documents, all codes and good practice.



## Bringing You The Very Best In Radiant Heating

***Infloor Heating Systems*** is a pioneer in the radiant heating industry, designing and providing systems since 1984. Infloor specializes in electric and hydronic radiant heating, snowmelt systems, and energy-saving solutions such as solar and geo thermal additions. The benefits of radiant heating are superior to conventional forced-air and baseboard systems. Radiant heating is energy-efficient, reducing gas and electric bills, eliminates duct work and duct losses, creates a quieter home, and is a healthier way of living for those with allergies. Infloor Heating Systems is proud to offer premium, innovative radiant heating systems and products designed to improve your everyday living and comfort.



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