



**ecowarm**

**RADIANT BOARD™**

*Aluminum Laminated Radiant Floor System*

*HIGH PERFORMANCE*

*COST-EFFECTIVE*

*CONTRACTOR FRIENDLY*



# **INSTALLATION MANUAL 2018**

866-341-1854  
TOLL-FREE

[www.ecowarmradiantheat.com](http://www.ecowarmradiantheat.com)

U.S. PATENT #6,533,185 and patents pending

## APPLICATION AND INSTALLATION MANUAL – TABLE OF CONTENTS

<b>INTRODUCTION</b>	3
ADVANTAGES OF ECOWARM RADIANT BOARD™	5
DESIGN AND PERFORMANCE	6
FLOORING GOODS R-VALUES	7
SYSTEM OUTPUT	8
IMPORTANCE OF CAD LAYOUTS	8
ESTIMATING REQUIRED NUMBER OF ECOWARM RADIANT BOARDS™	9
TUBING AND LOOP LENGTHS	9-10
<b>INSTALLATION</b>	
UNDERSTANDING THE PRODUCT	11-12
HOW TO SPACE THE BOARDS	12
ALIGNING AND ATTACHING THE BOARDS	13-14
SUBFLOOR REQUIREMENTS: WOOD SUBFLOORS (See also CEMENT, below)	15
EQUIPMENT FOR INSTALLATION OVER WOOD SUBFLOORS	16
INSTALLING TUBING IN GROOVES	17
EXAMPLE OF LAYOUT AND INSTALLATION	18-29
CONNECTIONS AT MANIFOLD	20
ECOWARM RADIANT BOARD™ INSTALLED OVER WOOD SUBFLOORS	21
CARPET OVER ECOWARM RADIANT BOARD™ - WOOD SUBFLOORS	22
VINYL OVER ECOWARM RADIANT BOARD™ - WOOD SUBFLOORS	22
THINSET TILE or STONE OVER ECOWARM RADIANT BOARD™ - WOOD SUBFLOORS	23
MORTAR SET TILE or STONE OVER ECOWARM RADIANT BOARD™ - WOOD SUBFLOORS	24
LAMINATE FLOORING OVER ECOWARM RADIANT BOARD™ - WOOD SUBFLOORS	25
ENGINEERED FLOATED WOOD OVER ECOWARM RADIANT BOARD™ - WOOD SUBFLR	25
STRIP HARDWOOD OVER ECOWARM RADIANT BOARD™ - WOOD SUBFLOORS	26-27
OTHER WOOD OPTIONS OVER ECOWARM RADIANT BOARD™ - WOOD SUBFLOORS	28
GLUE AND NAIL DOWN WOOD FLOORS	29
APPLICATION OF ECOWARM RADIANT BOARD™ TO WALLS OR CEILING	30
INSTALLING ECOWARM RADIANT BOARD™ OVER CONCRETE, IMPORTANT CAUTIONS	31
INSTALLATION DETAILS for ECOWARM RADIANT BOARD™ OVER CONCRETE	32
FLOORING, EXCEPT STRIP WOOD, ON ECOWARM RADIANT BOARD™ OVER CONCRETE	33
STRIP WOOD OVER ECOWARM RADIANT BOARD™ OVER CONCRETE SUBFLOOR	34
<b>OTHER</b>	
ECOWARM RADIANT BOARD™ CAUTIONS AND LIMITATIONS OF USE	35
ECOWARM RADIANT BOARD™ DESIGN SERVICES	36-39
<b>SPECIFICATIONS</b>	SP1-SP4
<b>RECOMMENDED PRODUCTS</b>	44

### INSTALLER CAUTION:

This manual is deemed to be current at the time of publication. It is the installer's responsibility to install our product according to the most current Ecowarm Radiant Board™ Installation Manual. This guide does not purport to address all relevant issues; it assumes the installer's knowledge of good practices in both hydronics and construction methods. Installers should always consult all relevant local, regional and national codes, and adhere to good construction practices. Ecowarm Radiant Board™ should only be installed by knowledgeable, qualified installers. Ecowarm Radiant Board™ 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 in this guide, failure to adhere to relevant local, regional and national codes, failure to coordinate trades, and failure to follow good construction practices may cause an unsatisfactory result, for which we are not liable. See also "Limitations of Use" elsewhere in this publication. Other manufacturers' limitations and instructions of use – for PEX pipe and other hydronic components – shall also be referenced and followed during installation; this manual does not address many aspects of a hydronic installation.

Ecowarm Radiant Board™ APPLICATION & INSTALLATION MANUAL ©August 2018, Version 18  
Ecowarm Radiant Board™ is sold under license from WARM BROTHERS INC.

U.S. PATENT #6,533,185 AND OTHER PATENTS PENDING

# INTRODUCTION



Ecowarm Radiant Board™ – the hydronic radiant heating everyone loves – is now more efficient, more responsive, more environmentally responsible and, as always, compatible with standard construction practices. Ideal for new construction and remodeling alike: low profile, light weight, and with a rapid response performance. Ecowarm Radiant Board™ offers today's consumer genuine advances in the best heating system you can buy. . . hydronic radiant heat.

## WHY IT WORKS SO WELL

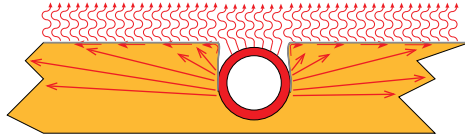
Non-structural Ecowarm Radiant Board™ is designed specifically for subfloor applications. Ecowarm Radiant Board™ is constructed of 6 to 7-ply plywood covered with aluminum that spreads heat evenly and quickly from warm water circulating through hydronic tubing. Ecowarm Radiant Board™ heats rapidly and is easy to control using setback thermostats for maximum energy efficiency. It contains just enough thermal mass to be effective and to allow for easy temperature control. This is the only available FSC\*-certified radiant board on the market. \*Wood is harvested from sustainably managed forests.

No other product offers our unique combination of performance, cost-effectiveness, ease of installation, and environmental prudence. Ecowarm Radiant Board™ is typically glued and screwed, or glued and stapled, to a wood subfloor. Then 1/2" PEX tubing, which will carry warm water, is walked into the groove. Heat is transferred from the tubing to the conductive aluminum layer and the board.

### *Quick Response*

- *Low profile, light weight , for easy installation*
- *Avoid the moisture, weight and mess of installing in gypsum, cement or concrete*
- *Radiant installations, big or small, are easy to schedule, with no lost time waiting for concrete to cure*

Ecowarm Radiant Board™ is manufactured from 6 to 7-ply plywood, cut to a versatile size, grooved with one of two patterns – Straight or Supercombo – and then laminated with a substantial top layer of highly conductive aluminum (with recycled content, adhered with a water-based glue that is no-VOC when dried) to efficiently disperse and transfer heat away from the groove, to the entire surface area of the board.



**Illustration A-1:  
Board cross-section,  
radiant heat disbursed**

## ACCELERATION

Acceleration is the measure of how quickly a radiant heating system responds. Aluminum is approximately 1000 times more conductive than wood. Thus, the layer of aluminum on Ecowarm Radiant Board™, which extends down into the groove, significantly enhances both the transfer of heat and the evenness of the board's heat distribution. Illustration A-1 shows how the heat transfers through Ecowarm Radiant Board™. The thin profile and metal layer contribute to the superior acceleration and deceleration of Ecowarm Radiant Board™.

Traditional radiant heating systems in concrete work well, but they must first charge (heat) a large thermal mass before heat will begin to radiate from the panel. They also accelerate and decelerate very slowly due to the large thermal mass, which can make these systems hard to control. Ecowarm Radiant Board™, being thin but relatively dense, and aided by its conductive aluminum layer, responds very rapidly. This results in greatly improved response times, with almost no overheating since there is almost no “thermal lag” to overcome. The heating performance of Ecowarm Radiant Board™ can be controlled with standard set-back thermostats.

## ECOWARM RADIANT BOARD™ WARMCOAT™

The Ecowarm Radiant Board™ Warmcoat™ aluminum top layer provides multiple benefits. It is highly conductive, and also moisture resistant. Sealing the edges and grooves of Ecowarm Radiant Board™ with silicone caulking provides significant moisture protection for the board. Sealing also provides a barrier to the transmission of any outgassing from the board. Ecowarm Radiant Board™ is manufactured to meet the Federal Housing Authority (FHA) and California Air Resources Board (CARB) formaldehyde outgassing standards. Because we use a benign water-based glue (that is no-VOC when dried) to adhere our Warmcoat™ aluminum layer, which impedes outgassing, Ecowarm Radiant Board™ has virtually no detectable levels of formaldehyde outgassing.



## ADVANTAGE OF ECOWARM RADIANT BOARD™

Hydronic radiant heating is the most comfortable and efficient way to heat your home or building, with many construction benefits and unsurpassed flexibility in zoning. For many years, typical radiant systems involved embedding tubing in concrete slabs or pouring “lightweight concrete” over tubing stapled to subfloors. Designers overlooked the limitations and disadvantages of concrete systems due to a lack of good alternatives. Now Ecowarm Radiant Board™ provides that alternative. It is designed for the application of hydronic radiant tubing over a variety of construction types, may be used in new construction and also the growing retrofit market. While only adding 3/4” to the existing floor height, Ecowarm Radiant Board™ provides a superior performing radiant heating system. And application of the system is easy: only two board designs are required for installation.

### **CONSTRUCTION FRIENDLY**

Ecowarm Radiant Board™ eliminates the need for joist upsizing, double plating and hardwood nailing strips associated with gypsum-based concrete radiant heating systems. Also, Ecowarm Radiant Board™ eliminates substantial drying costs required by moisture-laden concrete and gypsum-based cement. Ecowarm Radiant Board™ eliminates scheduling and curing delays. Time is money.

### **COST FRIENDLY**

Ecowarm Radiant Board™ 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**

Ecowarm Radiant Board™ provides a quality flat surface for floor covering assemblies. Each of these flooring assemblies, below, is supported by detailed drawings and instructions such as those illustrated in our Installation Manual.

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

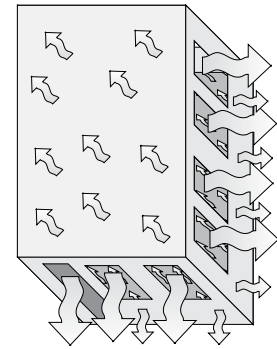
### **PLANET FRIENDLY – UNIQUELY GREEN**

Ecowarm is currently the only FSC certified™ radiant board product available, made from 6 or 7-ply USA plywood. The aluminum layer contains recycled content, and is adhered with a water based adhesive (no-VOC on drying).

# DESIGN AND PERFORMANCE

## HEAT LOSS ANALYSIS AND SYSTEM DESIGN

Systematic heat loss and design for the structure to be heated should be done prior to any Ecowarm Radiant Board™ 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.



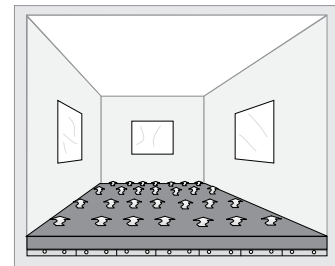
**Illustration A-2:**  
Account for all heat losses of the building

### DESIGNER'S NOTE

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

## R-VALUE OF FLOOR ASSEMBLIES

While Ecowarm Radiant Board™ 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 a 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 Ecowarm Radiant Board™ 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 recommended supply water temperature for Ecowarm Radiant Board™.



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

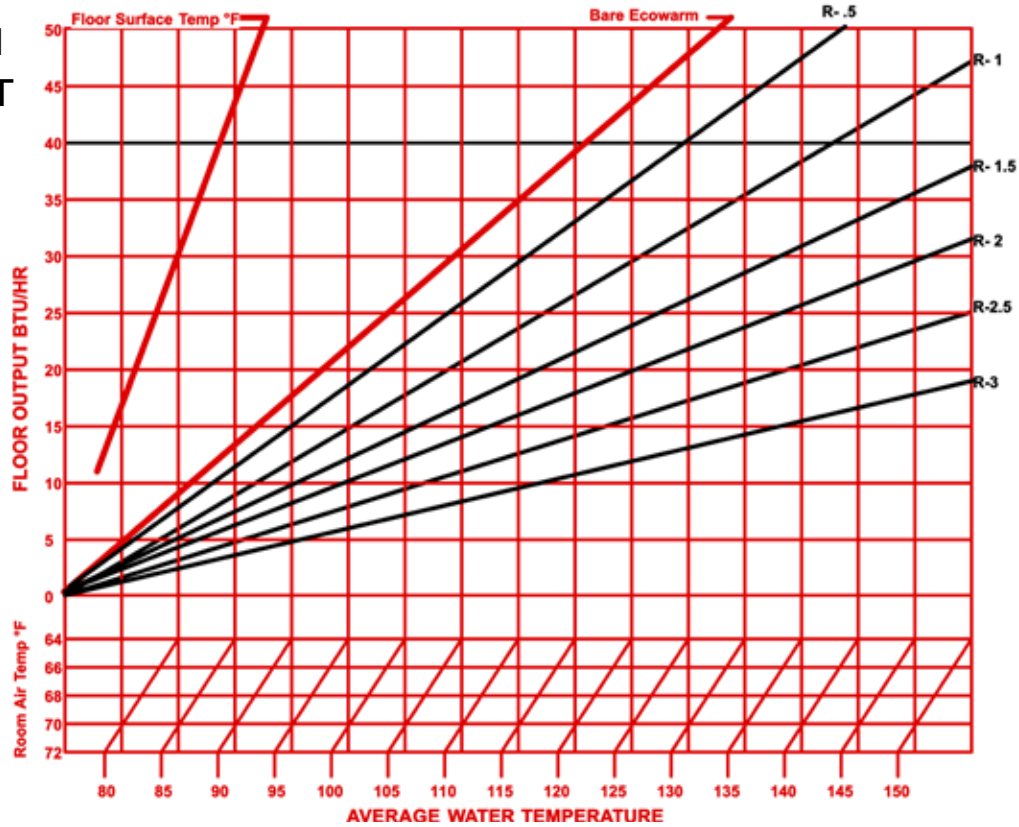
### DESIGNER'S NOTE

Remember, average water temperature means the average of the supply and return water temperatures flowing to and from the loop. Most typically, Ecowarm Radiant Board™ 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.

## TYPICAL R-VALUES OF FLOORING GOODS AND MATERIALS

Material	Typical R-Value	R-Value Per Inch	Typical Thickness
Plywood	0.825	1.10	0.750
Plywood Underlayment (1/4 )	0.275	1.10	0.250
Softwood	0.825	1.10	0.750
Sheet Vinyl	0.200	1.60	0.125
Vinyl Composition Tile (VCT)	0.200	1.60	0.125
Linoleum	0.400	1.60	0.250
Linoleum	0.200	1.60	0.125
Dense Rubber Flooring	0.250	1.30	0.325
Recycled Rubber Flooring	1.100	2.20	0.500
Cork	1.125	3.00	0.375
Cork/MDF/Laminate	1.175	2.35	0.500
Brick	3.375	2.25	1.500
Marble	0.400	0.80	0.500
Ceramic Tile	0.250	1.00	0.250
Thinset Mortar	0.050	0.40	0.125
MDF/Plastic Laminate	0.500	1.00	0.500
Laminate Floor Pad	0.300	1.92	0.160
Engineered Wood	0.250	1.00	0.250
Engineered Wood	0.375	1.00	0.375
Engineered Wood	0.625	1.00	0.625
Engineered Wood	0.750	1.00	0.750
Engineered Wood Flooring Pad	0.200	1.60	0.125
Engineered Bamboo	0.720	0.96	0.750
Oak	0.638	0.85	0.750
Ash	0.750	1.00	0.750
Maple	0.750	1.00	0.750
Pine	0.975	1.30	0.750
Fir	0.900	1.20	0.750
Carpet Pad/Slab Rubber 33lb	0.320	1.28	0.250
Carpet Pad/Slab Rubber 33lb	0.480	1.28	0.375
Carpet Pad/Slab Rubber 33lb	0.640	1.28	0.500
Carpet Pad/ Waffle Rubber 25 lb	0.620	2.48	0.250
Carpet Pad/Waffle Rubber 25 lb	1.240	2.48	0.500
Hair Jute	1.940	3.88	0.500
Hair Jute	1.250	3.88	0.325
Prime Urethane	1.400	4.30	0.325
Prime Urethane	2.150	4.30	0.500
Bonded Urethane	1.350	4.20	0.325
Bonded Urethane	2.100	4.20	0.500
Carpet	0.700	2.80	0.250
Carpet	1.050	2.80	0.375
Carpet	1.400	2.80	0.500
Carpet	1.750	2.80	0.625
Carpet	2.100	2.80	0.750
Wool Carpet	1.575	4.20	0.375
Wool Carpet	2.100	4.20	0.500

SYSTEM OUTPUT



**HOW TO USE THIS CHART:** First, calculate the heating output required in BTU/hr/sq.ft. Proceed horizontally right until you intersect the R-Value line of your floor covering(s), then drop straight down vertically to the horizontal line of desired room temperature, then angle down to the left to read the average required water temperature. For example, if you need 15 BTU/hr/SF with an R-.5 floor covering and a 70°F room temperature, you'll need 93°F average water temperature. A larger version of this chart is appended at the back of this manual, or download it from <https://ecowarmradiantheat.com/performance/>

DESIGNER'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 Ecowarm Radiant Board™. If you are unfamiliar with hydronic design, good practices and the physics of hydronic heat transfer, you should not design a Ecowarm Radiant Board™ system. Consult MEG for design assistance: p. 36-39.

CAD LAYOUT & DESIGN SERVICES

Third party services can provide complete system design and CAD layouts for the installation of Ecowarm Radiant Board™. Contact your Ecowarm Radiant Board™ distributor for details. For a description of our design team services, see pages 36-39. All Ecowarm Radiant Board™ systems should be installed by qualified installers.



Custom CAD layouts are particularly useful for first time installers.



## ESTIMATING THE REQUIRED NUMBER OF BOARDS

For simple and fast installation, it is highly recommended that a full Ecowarm Radiant Board™ layout be used, indicating the precise panel and tubing layout. This can be provided through Ecowarm. A full professionally drawn plan is recommended for your first few jobs. Contact us about doing a layout and a design. The following calculations can be used for estimating the required number of boards. For experienced installers, calculate the net heated floor square footage of each room and multiply by the following factors: *Straight*  $\times 0.0805$  *Supercombo*  $\times 0.0494$  (rule of thumb: 62% of a job Straight, 38% Supercombo).

**EXAMPLE:** A 600 sq. ft. room. Multiply 600 by 0.0805 to get approximately 49 Straight boards, and by 0.0494 to get 30 Supercombos. We always recommend adding another 5%-10% material excess to your estimation to account for waste. Doing an exact layout will give you 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 use fewer Straights and a larger number of Supercombos.

## TUBING AND LOOP LENGTHS

Ecowarm Radiant Board™ 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 exceed 350 feet, including sufficient leaders to the manifolds. For areas expecting a heat loss of greater than 25 BTU/Sq.Ft., loops shall never exceed 250 ft. This is due to high pressure drops and water velocity, as shown in Chart C-2\* on the following page (gray area = more than 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 chart C-2 on the following page indicates a high pressure drop. It is recommended that you use the shorter 250' loop length in this case, as shown in the second chart. 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 exceed 350'. For heat loss areas over 25 BTUs/Sq.Ft., loop lengths should not exceed 250'.*
- *Since the tubing is placed 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 length to reach the manifolds.*

**ECOWARM RADIANT BOARD 350' LOOPS 20°F TEMPERATURE DROP**

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	42.00

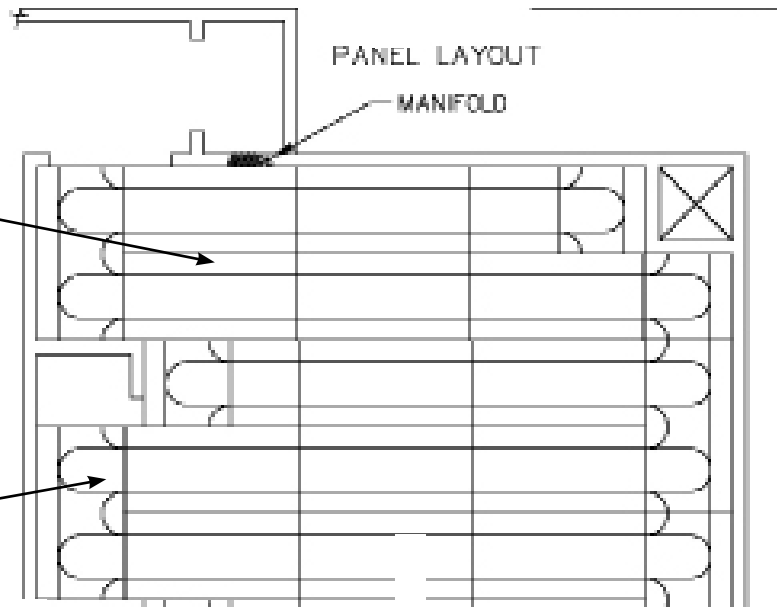
**ECOWARM RADIANT BOARD 250' LOOPS 20°F TEMPERATURE DROP**

250	0.1	0.475	0.17	0.18	4
250	0.25	0.475	0.92	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	1.90	42

Straight



Supercombo



**DESIGNER'S NOTE**

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

# INSTALLATION

## *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 CAD layout, particularly if you are a first time radiant board installer.*

## UNDERSTAND THE PRODUCT

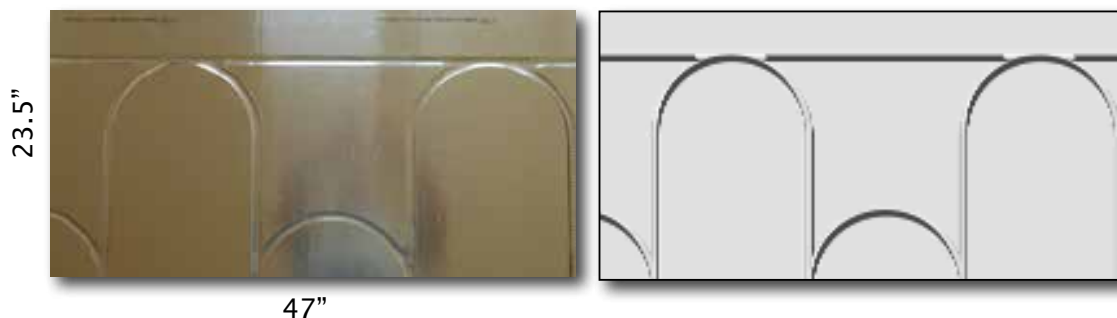
### COMPONENTS

Ecowarm Radiant Board™ comes in two different board configurations: STRAIGHT and SUPERCOMBO. The boards are installed, according to a layout plan, to create a pre-determined channel for the PEX tubing. Ecowarm Radiant Board™ cuts easily with a circular saw.

### STRAIGHT – USED ABOUT 62% of the time



### SUPERCOMBO – USED ABOUT 38% of the time for BYPASS or RETURN needs



**ECOWARM RADIANT BOARD™** is the only radiant board product available with FSC® certified plywood from sustainably managed forests. The heavy aluminum layer is bonded with a water-based adhesive that is no-VOC when dry. Cut from standard 4' x 8' plywood, both our Straight and Supercombo finished boards measure 47" x 23.5".

**1/2" PEX TUBING** is spaced 11.750" on center. One-quarter radius turns measure 5.935" from the edge. Tubing is walked into pre-slit grooves in the Straight boards or into pre-perforated grooves of the SuperCombo. See also loop length, precaution guides.

## USE THE CORRECT TUBING

Ecowarm Radiant Board™ has a slightly undercut groove and is designed to use ASTM 876-877 regular 1/2" PEX. Do not use PEXALPEX because it won't rebound into the undercut board, but will remain ovoid and will protrude above the top of the board. NOTE: Please adhere to loop length limitations.



## UNDERSTAND HOW TO SPACE THE BOARDS

The actual width of each board is 23.5", which provides for installing the boards with a slight gap in between boards: This allows the boards to expand in different temperatures, and accounts for normal variances in humidity in a finished home. When aligning Straights with Supercombo boards, use a 6" piece of tubing as a guide, as shown on the next page. 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: CUT YOUR BOARDS ACCURATELY

Since Ecowarm Radiant Board™ is a modular system, the boards are manufactured to tight tolerances in groove spacing and as to the squareness of the sides and ends. When cutting Ecowarm Radiant Board™, make sure to cut the boards squarely and to carefully align the boards so that subsequent pieces will fit correctly. This is not difficult, but attention to this easy step will prevent major problems. See tips for groove alignment, p. 13.

### PRODUCT SHIPPING / STORAGE

**Nominal dimensions:** Each board is 23.5" x 47" x 3/4" thick, or 7.83 square feet a board

**Weight:** Approximately 2.3 lbs. per square foot, 18 lbs. per board

**Pallet Size:** 4' x 4' x 32" tall (2 ECOWARM RADIANT BOARDS™ to a row, 37 rows high)

**Approximate Pallet Weight:** 1370 lbs.

**Approximate Truckload Quantity:** Approx 20,008 square feet

**Pallet Appearance:** Shrink wrapped, corner protected, with color coded corners by part #

**Recommended Product Mix:** Straight 62%, Supercombo 38%. Additional 5%-10% for waste.

### PROPER STORAGE AND MOISTURE CONTACT

Ecowarm Radiant Board™ 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 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.

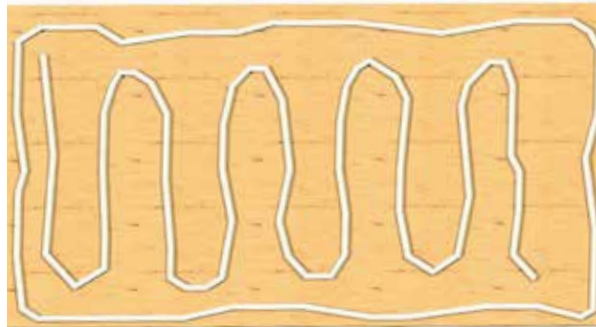
## USE THIS METHOD TO ALIGN THE GROOVES

The easiest way to assure the grooves for tubing are fully aligned between boards is to cut 6" pieces of 1/2" ASTM F-876 or -877 PEX to use as alignment tools. Place the boards close to the desired alignment, then press a piece of 6" tubing into each groove, lapping 3" into the grooves of each board, as shown. After the boards are attached, remove the guides.



## HOW TO ATTACH ECOWARM RADIANT BOARD™ TO A SUBFLOOR

Each Ecowarm Radiant Board™ should be glued to the wooden subfloor using low VOC construction adhesive-type glues at a minimum 1/8" bead. Use the gluing pattern shown here.



### *Tips For Gluing*

- *Avoid getting glue in the groove or where it may come into contact with the tubing.*
- *Use only recommended glues. Many glues can damage PEX tubing.*



*After gluing and placement, the boards are cross stapled or screwed to the subfloor*

## AFTER GLUING BOARDS: SCREW OR CROSS STAPLE TO THE SUBFLOOR

After you have glued Ecowarm Radiant Board™, using the proper glue applied in the proper pattern, the boards should be screwed or cross-stapled to the subfloor.

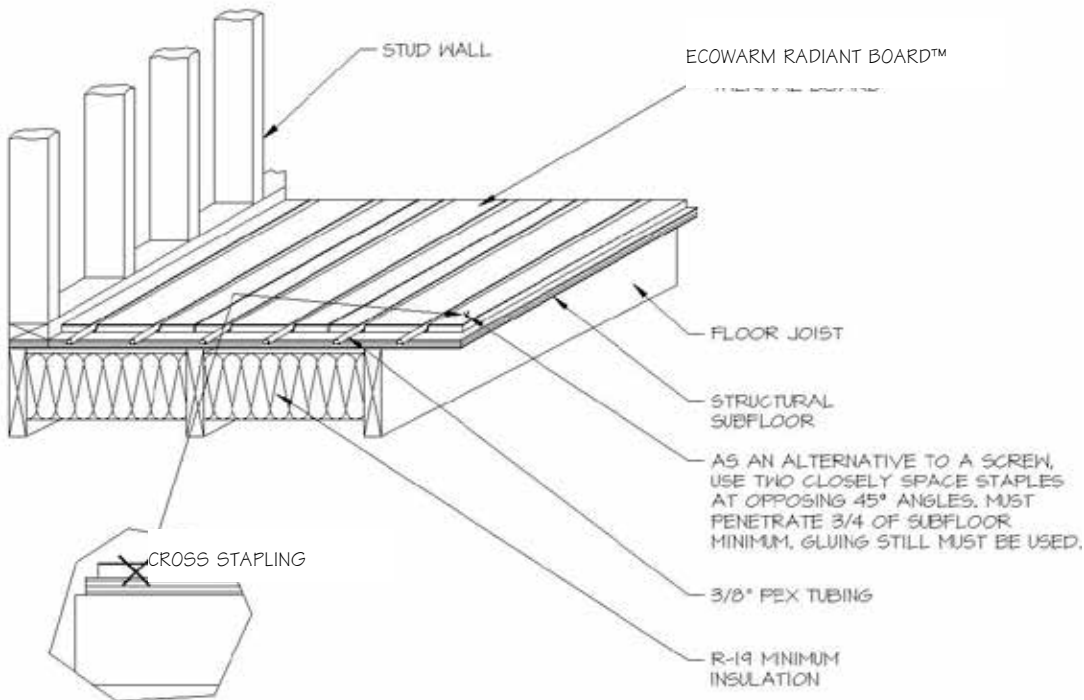
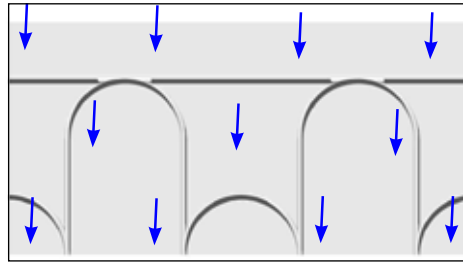
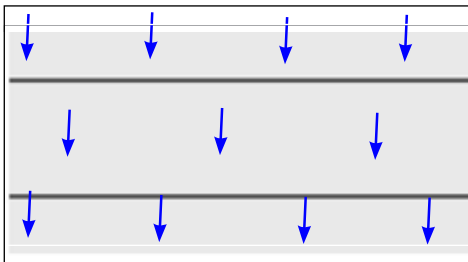


**SCREWS:** On full size pieces (23.5" x 47"), 11 screws should be used: 8 on the perimeter and 3 in the middle or, as a general rule, 12" O.C. for the perimeter and 16" O.C. for the interior. Pattern is shown below.



**STAPLES:** As an alternative to gluing and screwing, Ecowarm Radiant Board™ may be installed by gluing and stapling, as shown below, and then cross stapled as shown for extra strength. Cross stapling means 2 staples are put closely together at opposing 45° angles, as shown below.

**Attach Ecowarm Radiant Board™ to subfloor at locations shown by blue arrows**



## OVERVIEW OF FLOOR SURFACE REQUIREMENTS

NOTE: See also the specific application drawings and notes for installing Ecowarm Radiant Board™ 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.

**FIRST, FILL EXCESSIVE VOIDS OR LOW AREAS USING A LEVELING COMPOUND:** High areas can be ground down or floated over with a self-leveling compound. Check with the leveling compound manufacturer to be sure it is appropriate for the application. Allow the leveling compound to dry thoroughly before you begin the installation. The surface of the subfloor 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 to be sanded or planed; low areas are to be 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: CONCRETE SUBFLOORS with Ecowarm Radiant Board™**

Ecowarm Radiant Board™ was initially designed to be installed over a wood subfloor. Installation over concrete has been successfully done, but requires extra care and an assured dry slab. Please consult and follow the instructions, limitations and details later in this manual when installing Ecowarm Radiant Board™ over concrete.

## EQUIPMENT REQUIRED FOR INSTALLATION OVER A WOOD SUBFLOOR

The following are necessary for the installation of Ecowarm Radiant Board™:

- A table or circular saw. A carbide blade is recommended.
- Caulking gun for 1/8" bead of adhesive.
- Electric or cordless drill gun (if you are screwing down boards) with a No. 2 Phillips bit and 5/8" drill bit for supply and return bury points.
- Sheathing type pneumatic stapler (if you are cross stapling boards).
- Rubber or hard hide mallet – possibly needed to apply tubing to groove.
- Chalk line, marking pencils and a square.
- Vacuum cleaner to clean grooves prior to installation of the tubing.
- Pre-cut 6" pieces of 1/2" PEX for aligning grooves.
- A tubing uncoiler is recommended for installing tubing.

### INSTALLERS NOTE: CUTTING Ecowarm Radiant Board™

Ecowarm Radiant Board™ cuts easily with a quality carbide circular saw blade. Pieces must frequently 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 or use a plan so you remember where they go.







## INSTALLING TUBING IN THE GROOVES

First, vacuum the grooves so there is nothing that will damage the tubing or prevent it from properly going 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 laying your tubing, 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 or -877 PEX tube and the slightly undercut groove. This allows the tubing to be retained in the grooves once it is pushed into place. Usually, this only requires “walking” the tubing into the groove, as shown. 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 entire loop and make sure the tubing is fully in the groove for the entire length of it. This is very important! The top of the tubing should be just below the level of the top of the Ecowarm Radiant Board™, and fully retained in the groove.

### INSTALLER'S NOTE: Ecowarm Radiant Board™ ALUMINUM AND GROOVES

#### **BOARD TYPE INSTALL:**

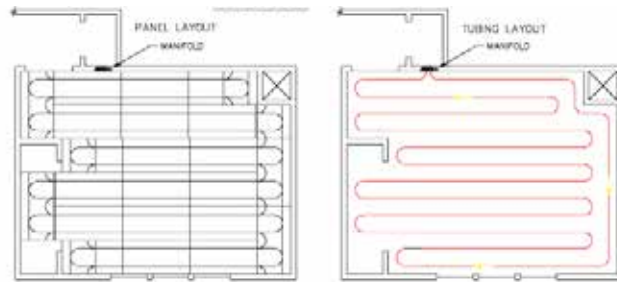
Ecowarm straight boards are fully clad with aluminum on top and in the grooves. Usually the tubing may be walked into the slightly undercut grooves but may occasionally require the use of a leather or rubber mallet to fully seat the tubing. The Super Combos are made differently. The aluminum layer is indented and perforated. This allows you to use only those grooves designated by your tubing layout, allowing the intact aluminum to maintain its full conductivity. Use a 6” piece of tubing to help align the grooves of the boards. When placing tubing in super combo boards install the tubing by “walking” it into only those channels designated in the system layout plan.



## EXAMPLE LAYOUT AND INSTALLATION: BOARDS AND TUBING

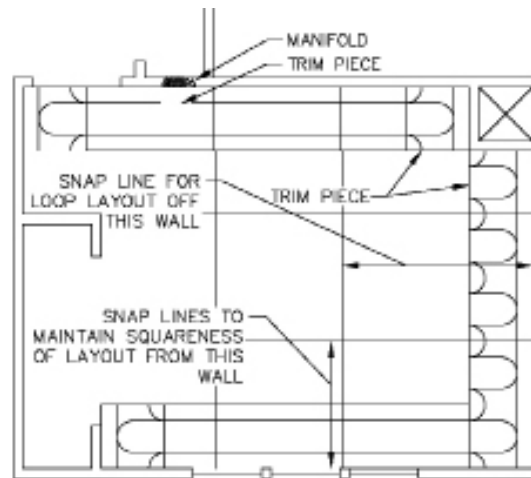
### **INSTALLATION STEP 1:**

Utilizing your layout plan, determine the number and type of boards you'll need and tubing lengths required. Be sure to allow for enough tubing at the ends to serve as leaders up to the manifolds.



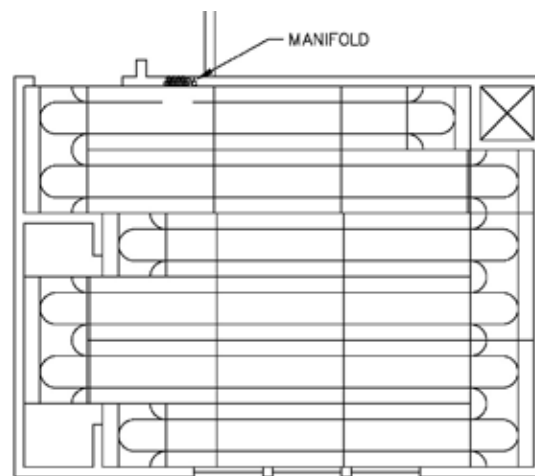
### **INSTALLATION STEP 2:**

Begin your Ecowarm Radiant Board™ layout by starting the board at the beginning of the supply run into the space, then running boards along the perimeter of the heated space to the area of highest heat loss.



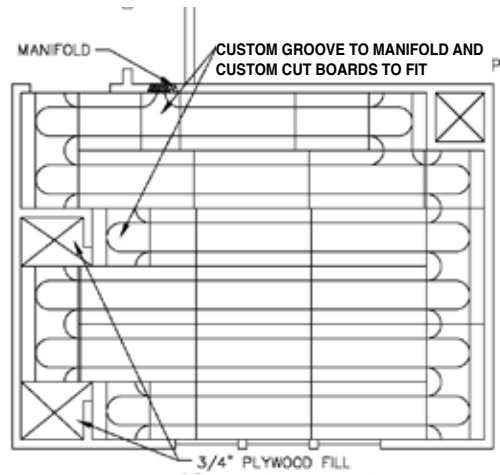
### **INSTALLATION STEP 3:**

Add end pieces and straight pieces, working your way back away from the area of highest heat loss. Once all the boards are in place, confirm your tubing route allows for supply and return leaders to the manifold(s). Route the leader to the manifold, either via the existing panels, custom grooves, grout (slab or existing sub-floor application) or by drilling holes into the subfloor for access.



**INSTALLATION STEP 4:**

Finish laying out your Ecowarm Radiant Board™ pieces according to your design layout, and do any special grooving necessary to route the tubing back to the manifold.



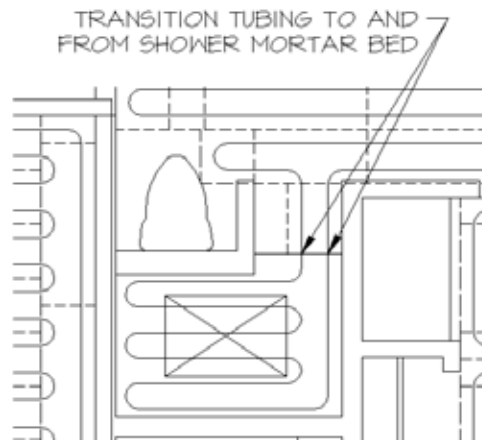
**INSTALLATION STEP 5:**

Feed enough supply tubing to route to your manifold through a drilled supply hole below the floor, or before the start of groove (if the groove goes directly to the manifold). After every groove has been thoroughly cleaned with a vacuum cleaner, tubing may then be “snapped” into the grooves, per your layout plan. Once tubing has been routed back to the return location, cut enough tubing to route it to the 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 Ecowarm Radiant Board™ in order to accommodate the desired coverage.

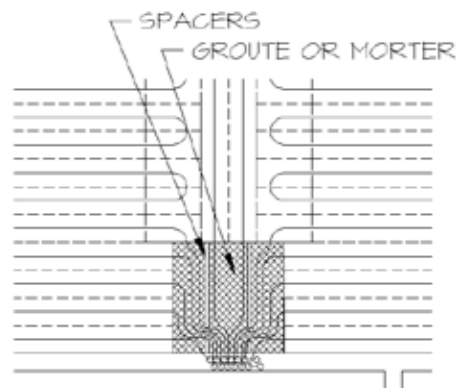
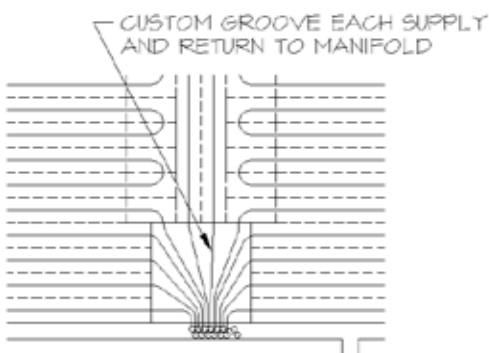


## CONNECTIONS AT THE MANIFOLD

Manifolds are usually located near and above the heating zone they serve, in such places as the back of a closet. Route tubing to the manifold in one of four ways:

1. Insert the tubing directly from the grooves: this works when just a few loop ends are adjacent to the manifold location.
2. Drill an access hole, dive the tubing under the floor, and bring it back up at the manifold, assuring you've allowed enough leader length of tubing.
3. Place a solid Ecowarm Radiant Board™ or plywood sheet next to the manifold into which supply and return lines are custom-routed to the grooves of the Ecowarm Radiant Board™.
4. Finally, tubing may be run out of Ecowarm Radiant Board™, stapled to the subfloor, and routed directly to the manifold. Use grout to cover the tubing and level it to the Ecowarm Radiant Board™. If needed, spacers may be placed between the tubing to provide a nailing or screw-in base for the floor coverings. Use nailing plates as necessary to protect tubing from damage.

Depending on how many circuits are included on a given manifold, various sizes of grooved sheets or grouting areas may be required.



## ECOWARM RADIANT BOARD™ INSTALLED OVER A WOOD SUBFLOOR

### **GENERAL INSTALLATION REQUIREMENTS FOR ALL FLOORING OVER WOOD SUBFLOOR**

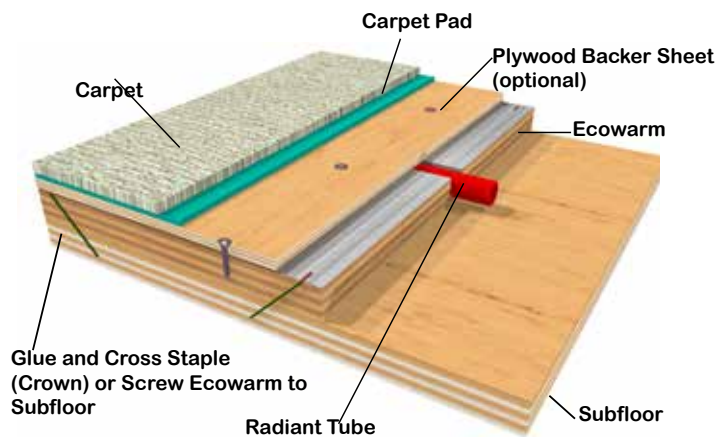
1. Do not install Ecowarm Radiant Board™ without an accurate room-by-room heat loss analysis of the structure to be heated and a design/layout for Ecowarm Radiant Board™ that takes into account the resistance and heat transfer of the actual floor coverings. If Ecowarm Radiant Board™ cannot provide all the necessary heat, make provisions for additional back up heat.
2. Thoroughly clean all surfaces that Ecowarm Radiant Board™ will be applied to. The surface to which Ecowarm Radiant Board™ 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 be 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 Ecowarm Radiant Board™ to subfloor, according to 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 Ecowarm Radiant Board™ system.

# COVERINGS

## **CARPET** **over Ecowarm Radiant Board™**

Ecowarm Radiant Board™ shall be installed over a wooden subfloor, complying with “General Ecowarm Radiant Board™ Installation Requirements For All Flooring Over Wood Subfloor”.

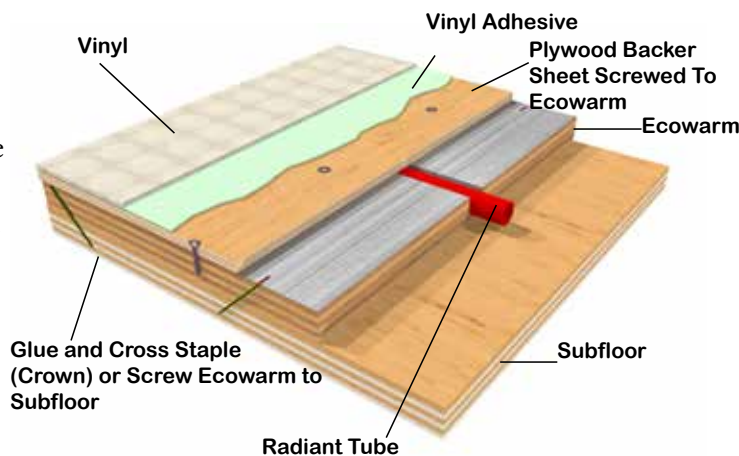
In addition, the following specific precautions and instructions shall be followed: Carpet and pad may be installed over Ecowarm Radiant Board™. When installing the pad, care should be taken to avoid puncturing tubing. As with all radiant heating installations, to allow for adequate heat transfer, a thin slab foam rubber pad and short, high density carpet should be used. If the carpet pad is glued, first install the optional plywood backer sheet, since removal of the bonded pad in the future may damage and compromise the aluminum layer. Maintain a 2” minimum tubing clearance from carpet tack strips. While optional, it is advised that a thin layer of underlayment plywood be applied over Ecowarm Radiant Board™ prior to carpet and pad installation to protect the tubing from point loads such as a piano. Without this thin underlayment, thin carpet and pad may eventually show striping where the tubing is and, while less likely, tubing may be vulnerable to puncture from sharp cleats, golf shoes etc.



## **VINYL** **over Ecowarm Radiant Board™**

Ecowarm Radiant Board™ shall be installed over a wooden subfloor, complying with “General Ecowarm Radiant Board™ Installation Requirements For All Flooring Over Wood Subfloor”.

In addition, the following specific precautions and instructions shall be followed: When installing vinyl flooring, we require that a thin layer of underlayment plywood be applied over Ecowarm Radiant Board™. In wet locations, a sealant layer should also be added. Underlayment plywood with a grid printed on it helps locate tubing runs and prevent puncturing of the tubing when the plywood is being screwed to the Ecowarm Radiant Board™. 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 OR STONE over Ecowarm Radiant Board™**

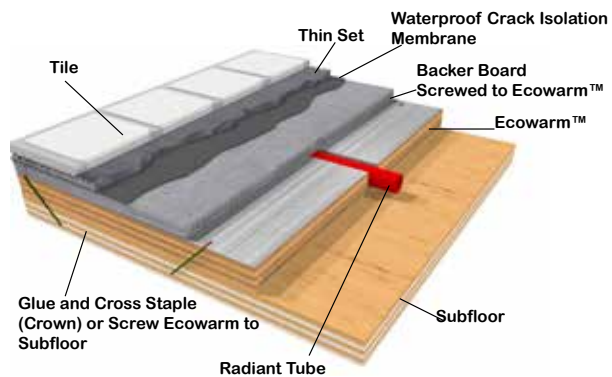
Ecowarm Radiant Board™ shall be installed over a wooden subfloor, complying with “General Ecowarm™ Installation Requirements For All Flooring Over Wood Subfloor”. In addition, the following specific precautions and instructions shall be followed: When installing masonry, tile or stone, backer board shall be used over Ecowarm™. Thin set and screw the backerboard to the Ecowarm™ with a thinset compatible with PEX tubing. Thinset installation on top of backerboard shall follow TCA Guidelines. In the kitchen, baths, laundry or any other area where water may be present, a 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 backerboard. Maintain 2” minimum tubing clearance when screwing backer board down. Refer to the complete installation manual for further instructions on the installation of the Ecowarm™ system.

### *Notes On Sealing*

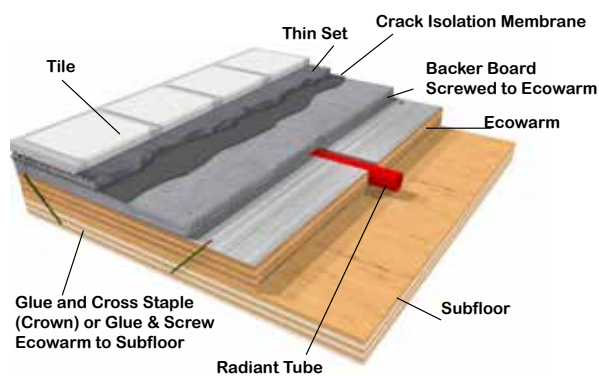
The aluminum layer on top of each Ecowarm Radiant Board™ is highly water resistant. Thus, a significant degree of moisture protection is provided simply by using a silicon sealant as a caulk between the boards. Properly applied, this will profoundly reduce the likelihood of water transmission into the boards.

This is not a substitute, however, for our recommended installation methods in wet areas.

### **THINSET TILE OR STONE** for areas *likely* to be subject to moisture



### **THINSET TILE OR STONE** for areas *unlikely* to be subject to moisture



#### **INSTALLER'S CAUTIONS :**

Do not omit the backerboard layer. Do not thinset directly to Ecowarm Radiant Board™. Do not install crack isolation membranes directly to Ecowarm Radiant Board™ – they may not get a good bond and many use materials incompatible for contact with PEX.

## **MORTAR BED SETTING OF TILE OR STONE over Ecowarm Radiant Board™**

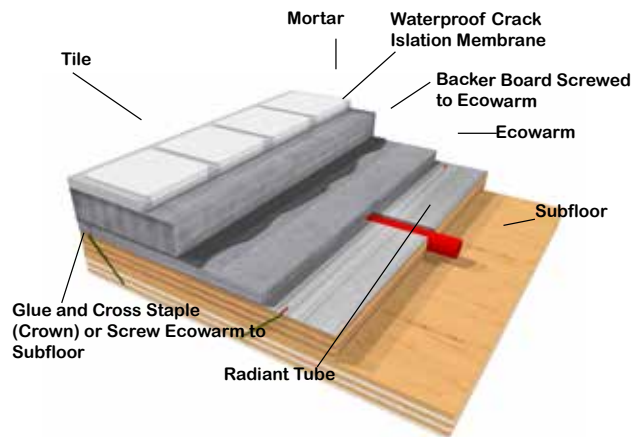
Ecowarm Radiant Board™ shall be installed over a wooden subfloor, complying with “General Ecowarm Radiant Board™ Installation Requirements For All Flooring Over Wood Subfloor”. In addition, the following specific precautions and instructions shall be followed: When installing masonry, tile and stone, backer board shall be used over Ecowarm Radiant Board™. Thin set and screw backerboard to the Ecowarm with thin-sets compatible with PEX Pipe. The installation on top of backerboard 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 EcoWarm™ system.

### *Notes On Sealing*

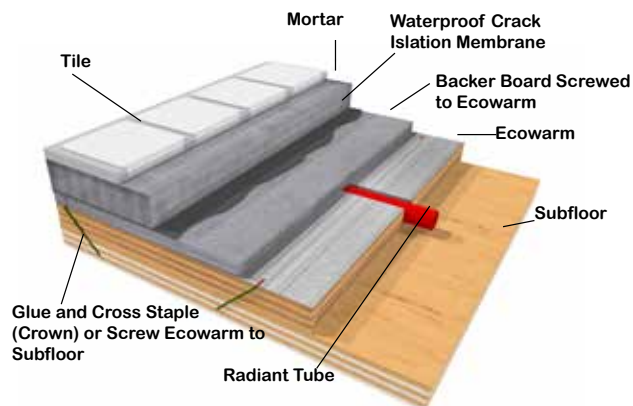
*The aluminum layer on top of each Ecowarm Radiant Board™ is highly water resistant. Thus, a significant degree of moisture protection is provided simply by using a silicon sealant as a caulk between the boards. Properly applied, this will profoundly reduce the likelihood of water transmission into the boards.*

*This is not a substitute, however, for our recommended installation methods in wet areas.*

### **TRADITIONAL MORTAR SET TILE OR STONE** *for areas **likely** to be subject to moisture*



### **TRADITIONAL MORTAR SET TILE OR STONE** *for areas **unlikely** to be subject to moisture*



### **INSTALLER'S CAUTIONS :**

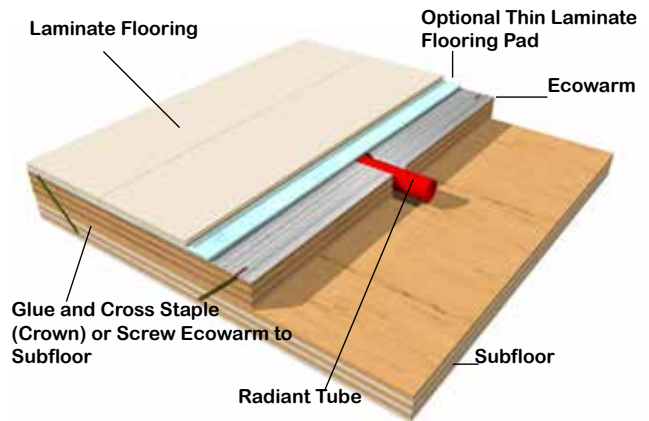
Do not omit the backerboard layer. Do not thinset directly to Ecowarm Radiant Board™. Do not install crack isolation membranes directly to Ecowarm Radiant Board™ – they may not get a good bond and many of them use materials that are incompatible for contact with PEX.



## **LAMINATE** **over Ecowarm Radiant Board™**

Ecowarm Radiant Board™ shall be installed over a wooden subfloor, complying with “General Ecowarm Radiant Board™ Installation Requirements For All Flooring Over Wood Subfloor”. In addition, the following specific precautions and instructions shall be followed:

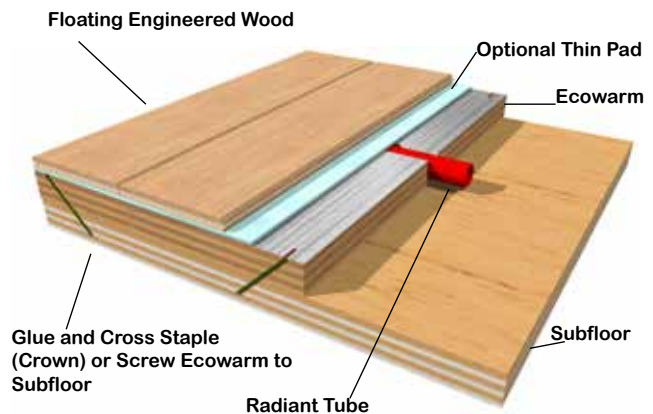
When installing laminate flooring, a thin layer of underlayment plywood may optionally be applied over Ecowarm Radiant Board™. In wet locations, a sealant layer should be added over an underlayment layer of plywood. Many, but not all, laminate flooring products are suitable and recommended by the manufacturer 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 Ecowarm Radiant Board™ if possible. It is recommended that laminate flooring installed over Ecowarm Radiant Board™ shall employ controls that gradually adjust water temperature going to the Ecowarm Radiant Board™ with a reset curve. A floor temperature limiting sensor can be used to comply with flooring manufacturer’s flooring temperature specifications.



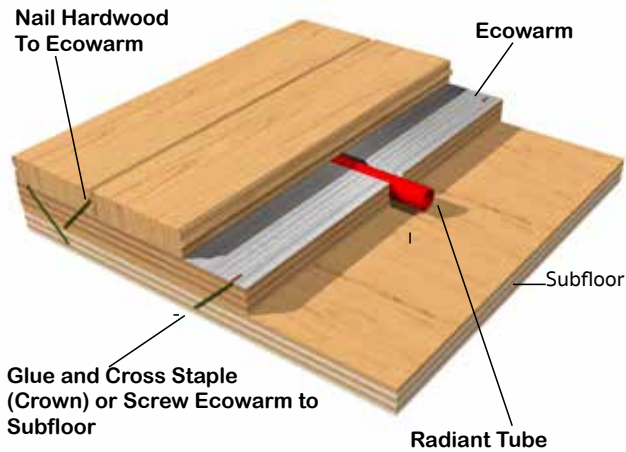
## **ENGINEERED WOOD** **over Ecowarm Radiant Board™**

Ecowarm Radiant Board™ shall be installed over a wooden subfloor, complying with “General Ecowarm Radiant Board™ 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 Ecowarm Radiant Board™ whenever possible. It is recommended that engineered wood flooring installed over Ecowarm Radiant Board™ shall employ controls that gradually adjust water temperature going to the Ecowarm Radiant Board™ with a reset curve. A floor temperature limiting sensor can be used to comply with flooring manufacturer’s flooring temperature specifications.



## **TRADITIONAL HARDWOOD Installed directly over Ecowarm Radiant Board™**



A conventional nailed hardwood floor may be installed directly over Ecowarm Radiant Board™, using nails long enough to penetrate the subfloor, and with the utilization of recommended setback controls.

See also sections on general considerations with the use of traditional wood flooring. Ecowarm Radiant Board™ shall be installed over a wood subfloor, complying with “General Ecowarm Radiant Board™ Installation Requirements For All Flooring Over Wood Subfloor”.

In addition, the following specific cautions and instructions shall be followed:

1. Extreme care shall be taken to avoid nailing tubing.
2. Hardwood floor joints shall not be installed directly at a joint of Ecowarm Radiant Board™.
3. Hardwood floor nails shall be long enough to penetrate both hardwood and subfloor.
4. Hardwood floors installed directly over Ecowarm Radiant Board™ shall employ controls with a reset curve that will gradually adjust the water temperature going to Ecowarm Radiant Board™; 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 the desired installed direction of wood strip flooring prior to the design of Ecowarm Radiant Board™ system, since the direction of Ecowarm Radiant Board™ should run perpendicular to the direction of the strip flooring.
6. Install strip wood flooring with mallet driven nails of sufficient length to penetrate Ecowarm Radiant Board™.
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 local climate where the structure is located.
9. The use of narrower 2” to 3 1/2” strips of wood flooring is recommended over radiant floors, not wide planks.
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 at least 65F° long enough that temperature and humidity have stabilized to predicted future levels before installing hardwood flooring over Ecowarm Radiant Board™.
12. The flooring product shall be allowed to acclimatize before installation.
13. Use woods that are known to be dimensionally stable.

## CONSIDERATIONS FOR INSTALLING TRADITIONAL STRIP WOOD FLOORING OVER ECOWARM RADIANT BOARD™

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

**BOARD WIDTH / DEPTH:** 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, any 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, madronne and American beech are known to be less stable.

**AGE & DRYING OF 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 to maintain its integrity upon installation. 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, the wood is much less likely to present surprise stress-related problems. Though it can be fun to be unique, please avoid pioneering the use of a wood for which 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 such stages of construction as sheet rocking or painting, when significant moisture may be introduced into a structure. Before installation, 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 flooring over 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.

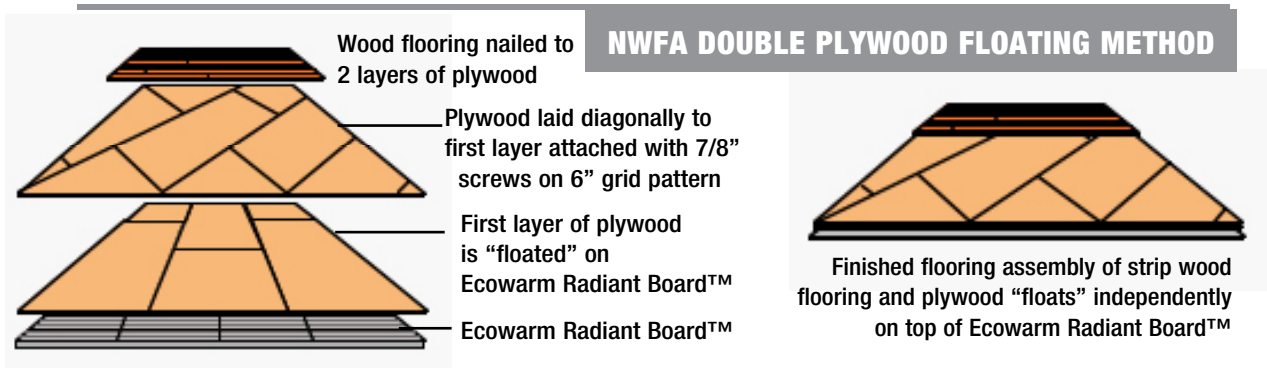
**SURFACE TEMPERATURE:** The maximum surface temperature of a wood floor should be limited to 85°F. Use a control strategy that ensures this will not be exceeded. Use an indoor or outdoor reset control that gradually brings the floors to temperature.

## OTHER APPLICATION OPTIONS

### FOR INSTALLING WOOD FLOORS OVER ECOWARM RADIANT BOARD™

Ecowarm Radiant Board™ may be used under traditional strip wood flooring in several ways. A conventional nailed and hardwood type system may be used directly over Ecowarm Radiant Board™, with controls as described in the previous section. There are many advantages to this method: quicker response, lower cost of installation, higher heat output due to lower resistance of flooring, and an indoor or outdoor reset control that gently 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 Ecowarm Radiant Board™ and strip flooring then nailed to it, as shown below in a method recommended by the National Wood Flooring Association (NWFA). This method has the advantage that it allows the wood flooring system to float independently from Ecowarm Radiant Board™, but it also has significant disadvantages in that the additional 1” 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 compared to R-1.55 without. This limits heat output and requires higher water temperatures. Before choosing this system, do a careful heat loss analysis to see if this method will produce enough heat. If it won't, choose another method, or make provisions for back-up heat. We recommend, but don't require, a hydronic control strategy with a reset curve that gradually adjusts water temperature going to Ecowarm Radiant Board™.



**Clip style floating strip flooring systems** must be installed directly over Ecowarm Radiant Board™ 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, and often have 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. Ecowarm Radiant Board™ should be installed such that the hardwood runs perpendicular to the majority of the tubing runs.

**Glue and nail down and glue down wood flooring systems require care and CORRECT GLUE:**

When using glue down and glue and nail down methods, the wood floor should be attached to the Ecowarm Radiant Board™ according to the flooring and glue manufacturers' recommendations for installation over radiant heat. Please see the next page for details.

## GLUE AND NAIL / GLUE DOWN – WOOD FLOORING SYSTEMS

There has been a recent increase in the use of glue with wood flooring of all types, as well as an increase in wide plank engineered wood flooring that recommends installation with glue and nails, as well as flooring that recommends or allows for installation by glue down methods. This text addresses these changes and recommends several glues to use when wood flooring is installed over Ecowarm™ with glue, and highlights concerns and limitations that should be considered.

### ***General Considerations***

Great efforts have been made to make Ecowarm as green as possible, and this applies to our glues as well. We use low VOC (Volatile Organic Compound) glues to bond the aluminum to our plywood, and our aluminum is additionally a positive barrier to outgassing from the glue and the plywood. Since wood flooring glues used to bond flooring to Ecowarm are applied on top of our aluminum, they have the potential to significantly affect the indoor air quality of a room. There is a new generation of more environmentally benign adhesives which substantially reduce these possible emissions, and we recommend their use when gluing down a floor. But consumers should be made aware that traditional nail down methods, edge glued floating engineered wood flooring and floating edge lock flooring, have, in general, less likelihood of affecting indoor air quality and can be a great choice. Traditionally, in all homes and those with radiant heated floors, wide boards have presented more problems in contraction and expansion than narrow boards; narrow boards allow more small spaces for expansion and contraction from changes in humidity and temperature. Use of wide plank engineered wood floors, or stabilized reclaimed wide plank wood, requires a sophisticated manufacturing of a well stabilized product and should be carefully researched before use over radiant heat. Wide plank boards are best glued and nailed and wide plank flooring of species known to expand and contract significantly with changes in humidity should be avoided. Wood flooring installers are advised to discuss these issues with their clients.

### ***Additional Considerations***

Wood flooring glue used needs to be compatible with PEX pipe. Due the aluminum layer on top of our board, glues dry significantly slower than when applied on a wood subfloor, which should be accounted for in installation.

#### **INSTALLER'S NOTE : USE ONLY THESE APPROVED GLUES**

Sikabond T-35

Mapei Ultrabond Eco-980

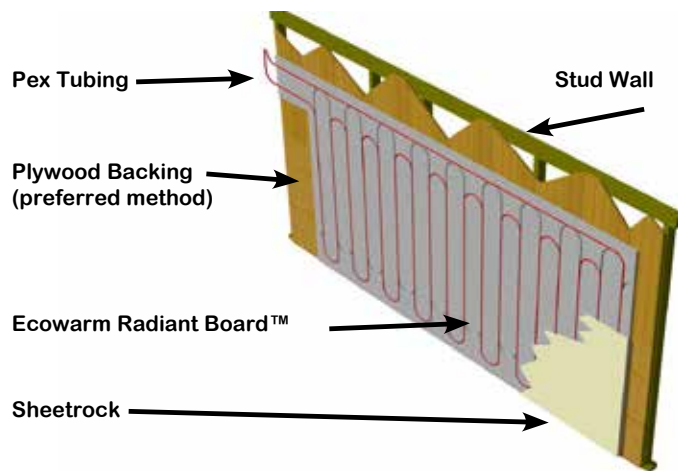
Bostik Greenforce

See Appendix: Recommended Glues, page SP-4

## WALL OR CEILING

### APPLICATION OF ECOWARM RADIANT BOARD™

Ecowarm Radiant Board™ may be installed on walls or ceilings to provide extra heat output when floors cannot provide all the necessary heat. Radiant walls and ceilings may also be used to provide all the heat of a room under certain circumstances when properly designed. The heat output of radiant walls and ceilings is different from that 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 relatively low R-value 1/2" sheetrock, 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 14% for walls and 22% for ceilings. This is because the convective component of the heat output is lower in wall and ceiling radiant heating systems.



#### ***Ecowarm Radiant Board™ wall and ceiling systems shall be installed as follows:***

As with flooring, pre-plan your layout. Ecowarm Radiant Board™ shall be installed square to framing, attached per p.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. Ecowarm Radiant Board™ 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 grooves and routed to a manifold per your plan. A 1" minimum tubing clearance shall be maintained for all nailing. Add steel plate protectors over tubing where tubing crosses studs. Supply water temperatures shall not exceed 120F° when Ecowarm Radiant Board™ is installed under plaster or sheetrock.

## ECOWARM RADIANT BOARD™ INSTALLED OVER CONCRETE

*The successful installation of Ecowarm Radiant Board™ over concrete requires special care due to moisture issues, difficulties in sealing concrete, and in attaching boards 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 Ecowarm Radiant Board™. Ecowarm Radiant Board™ may be installed over concrete using the following 3 methods, *only when the installing parties are willing to assume full responsibility for any installation issues regarding moisture and attachment of Ecowarm Radiant Board™ to concrete.*



**MOISTURE:** When installing Ecowarm Radiant Board™ 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 seasonally as environmental conditions change. Below is a procedure for testing the moisture of slabs, including slabs between floors, as in commercial construction. It is the co-responsibility of the contractor and the installer to test all concrete substrates, both new and old, for moisture content to assure a slab is sufficiently dry to install Ecowarm Radiant Board™. Moisture in 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 hrs/ 1,000 sq.ft. New concrete slabs and basements must be cured for a minimum of 60 days prior to installation. Before you proceed with any Ecowarm Radiant Board™ installation, determine whether the existing or new slab is sufficiently dry, and do any sealing of the slab.

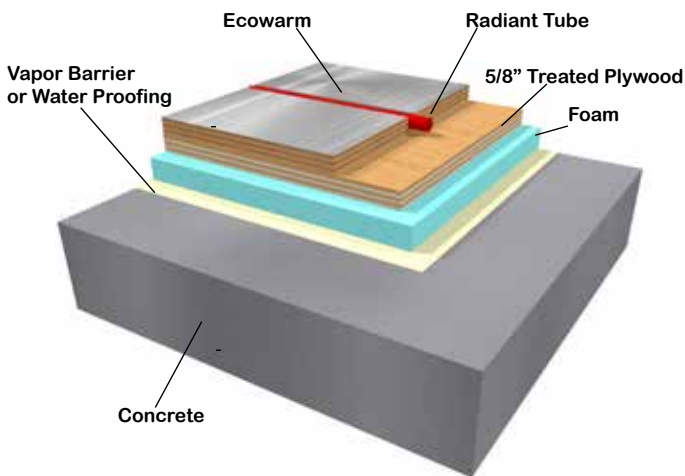
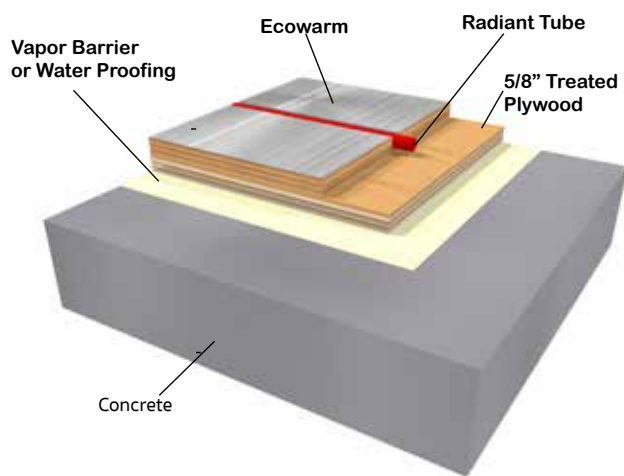
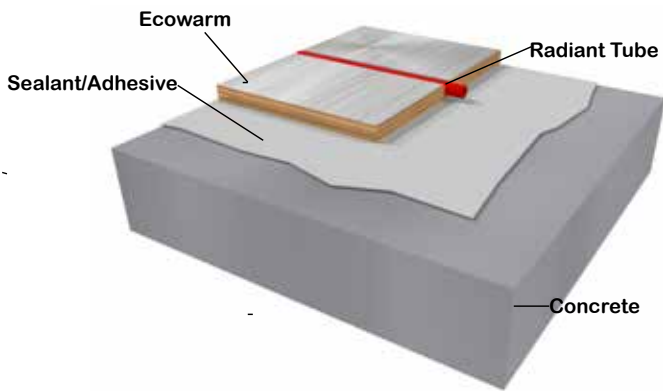
**SEALING:** Before installing Ecowarm Radiant Board™, it is strongly recommended that all slabs below grade and slabs on grade be sealed against moisture penetration by means of vapor barriers or products such as Sika T-35, which is both a sealant and adhesive. It is also important that all installations of Ecowarm Radiant Board™ over concrete slabs, below grade and on grade, be insulated against downward heat loss, either as shown in the detail on p.32, or under the slab, or downward at the perimeter, per recommendations of the Radiant Professional's Alliance. In seismic areas, the increasing use of engineered "Seismic Slabs" means that fewer radiant floor heating systems will be installed with tubing in the slab itself; there will be more need for the 3 details that follow.

### **FLOOR COVERINGS installed over Ecowarm Radiant Board™ installed over concrete:**

For general details and additional information and requirements for installing various flooring materials above the Ecowarm Radiant Board™ layer, refer to the illustrated guidelines on previous pages. However, please refer to the following page for details on how to install Ecowarm Radiant Board™ itself over concrete. For example, on pages 23-24, you'll see that tile would be installed over Ecowarm Radiant Board™ with a backerboard layer, crack isolation membrane, mortar, etc. However...

*Ecowarm Radiant Board™ itself should be installed over concrete according to one of the 3 methods shown on the next page.*

## APPLICATION DETAILS OF ECOWARM RADIANT BOARD™ OVER CONCRETE



### ***Ecowarm Radiant Board™ bonded to concrete using sealant and adhesive***

Ecowarm Radiant Board™ 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 Sika-T35 or the sealant and adhesive may be two separate but compatible products.

### ***Ecowarm Radiant Board™ over plywood and vapor barrier or waterproofing***

Ecowarm Radiant Board™ 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.

### ***Ecowarm Radiant Board™ over plywood, with foam insulation and vapor barrier or waterproofing***

Ecowarm Radiant Board™ 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.

### **INSTALLER'S CAUTION + NOTES ON GLUE**

When installing traditional strip wood flooring directly to Ecowarm Radiant Board™ installed over concrete, you must use one of the methods utilizing 5/8" T&G plywood under the Ecowarm Radiant Board™ to provide adequate nailing. **GLUES APPROVED** by Ecowarm Radiant Board™ for gluing boards directly to concrete. See Appendix: Recommended Glues on page SP-4.



## APPLICATION DETAILS OF ECOWARM RADIANT BOARD™ OVER CONCRETE

### WHEN INSTALLING ALL REGULAR FLOORING GOODS\*

\*EXCEPT STRIP WOOD FLOORING

#### ***INSTALLATION OVER CONCRETE***

Installation shall comply with one of the 3 details on Page 32, and installing parties must accept responsibility for, and understand, all cautions on page 31 regarding moisture, sealing, and the attachment of Ecowarm Radiant Board™ to concrete. They should also refer to this complete Installation Manual for further instructions on the installation of an Ecowarm Radiant Board™ system. Do not install Ecowarm Radiant Board™ without an accurate room-by-room heat loss analysis for the structure to be heated, as well as a design/layout for Ecowarm Radiant Board™ that takes into account the resistance and heat transfer of the actual floor coverings. If Ecowarm Radiant Board™ cannot provide all the necessary heat, make provisions for additional backup heat.

1. Thoroughly clean and level all surfaces where Ecowarm Radiant Board™ will be applied.
2. Prevent moisture penetration through the 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 an above-slab vapor barrier as shown on page 32.
3. Follow one of the three details on page 32, chalking lines on the floor as reference points, and lay out boards according to your plan.
4. If you're gluing Ecowarm Radiant Board™ to concrete sealed with a membrane, be sure to use adequate adhesive compatible with the vapor membrane to glue down Ecowarm Radiant Board™ to the membrane. Approved glues, p.29, 32.
5. When attaching Ecowarm Radiant Board™ to plywood, lay out boards according to your plan, and glue and screw or glue and cross staple Ecowarm Radiant Board™ to the 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, lapping 3" into each of two adjacent boards, 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 the designated grooves and route to the manifold, per plan.
10. Install backerboard when applying tile or vinyl flooring over Ecowarm™.
11. Maintain a 2" minimum tubing clearance from carpet tack strips or any nailing.
12. Refer to drawings on previous pages for additional details and requirement of installing various flooring goods over Ecowarm Radiant Board™.

## APPLYING ECOWARM RADIANT BOARD™ over CONCRETE with STRIP WOOD FLOORING

Installation shall comply with one of 2 details on Page 32 involving the use of 5/8" treated T&G plywood. Installing parties must accept responsibility for, and understand, all precautions on page 31 regarding moisture and attachment of Ecowarm Radiant Board™ to concrete, and should refer to this complete Installation Manual for further instructions on the installation of Ecowarm Radiant Board™ systems. Do not install Ecowarm Radiant Board™ without an accurate room-by-room heat loss analysis for the structure to be heated, as well as a design/layout for Ecowarm Radiant Board™ that takes into account the resistance and heat transfer of the actual floor coverings. If Ecowarm Radiant Board™ cannot provide all the necessary heat, make provisions for additional backup heat.

1. Thoroughly clean and level all surfaces where Ecowarm Radiant Board™ will be applied.
2. Prevent moisture penetration through the slab, either by sealing concrete with a vapor membrane such as Hydroment Ultraseal, per the manufacturer's guidelines, or with a continuous unperforated under-slab or above-slab vapor barrier, as shown on page 32.
3. Follow one of the 2 details on page 31 that use 5/8" T&G treated plywood under the Ecowarm Radiant Board™.
4. Chalk lines of a square reference point, as construction of walls may be inconsistent.
5. Lay out the boards according to your plan.
6. To allow for proper alignment, start your layout of all pieces by securing a corner.
7. To help align the grooves of adjacent boards, use 6" lengths of tubing as a guide, lapping 3" of the tubing into each board, as illustrated on p.13.
8. Glue and screw or glue and staple Ecowarm Radiant Board™ to plywood. Be sure to use adequate adhesive.
9. Once all boards are installed, clean grooves with a vacuum just prior to tubing installation.
10. Snap tubing into the designated grooves to route it to the manifold, per your plan.
11. Install strip flooring with mallet driven nails that penetrate the Ecowarm Radiant Board™, with care not to puncture tubing.
12. Insulfoam under plywood may be used instead of plywood alone, as shown on page 32.
13. Hardwood floors installed directly over Ecowarm Radiant Board™ shall employ indoor or outdoor reset controls that gradually adjust the 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. Ecowarm Radiant Board™.
15. Structure humidity shall be kept within the range specified by the flooring manufacturer.
16. Use narrower 2"-3 1/2" hardwood strips over radiant floors, not wider plank flooring.
17. The lessons of local practices and climate shall be referenced.
18. 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 the enclosed structure's temperature and humidity have stabilized to predicted future levels.
19. The flooring product shall be allowed to acclimatize before installation, per p. 26-27.

## CAUTIONS AND LIMITATIONS OF USE

### **GENERAL CAUTION**

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

### **INSTALLER 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 Installation Manual. This guide does not purport to address all relevant issues; it assumes a knowledge of good practices in both hydronics and construction methods. Installers should always consult all relevant local, regional and national codes, and adhere to good construction practices. Ecowarm Radiant Board™ should only be installed by knowledgeable, qualified installers. Ecowarm Radiant Board™ 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 practices may cause an unsatisfactory result. See also "limitations of use" elsewhere in this manual. 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**

Ecowarm Radiant Board™ 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. Ecowarm Radiant Board™ is not intended as, or rated as, a replacement or substitution for a structural subfloor. The BTU output of Ecowarm Radiant Board™ is limited by the R-values of the finish flooring goods applied over it, and by the recommended and available water temperatures. Ecowarm Radiant Board™ is not intended for use with finish goods that are incompatible with the temperatures and conditions present in a radiant heating system. Ecowarm Radiant Board™ is not intended as a finish floor, and should be left uncovered and unprotected only during installation.

***ECOWARM RADIANT BOARD™** is a patented product sold under license from Warm Brothers Inc.*

## ENERGY CALCULATIONS / TUBING AND MECHANICAL LAYOUTS

***Ecowarm has partnered with The Monterey Energy Group for project layouts:***



Monterey Energy Group (MEG)  
26465 Carmel Rancho Blvd. #8  
Carmel, CA 93923  
Phone: (831) 372-8328 Fax: (831) 359-4173

The optimum performance of an Ecowarm Radiant Board™ system goes hand in hand with knowledgeable system design: accurate heat loss calculations on a room-by-room basis, the selection of a system based on factors that affect system output such as insulation values, floor coverings, multilevel interaction, floor temperature limitations, heat source type and more – all of which go into the design process. A MEG Ecowarm Radiant Board™ system design weighs all these conditions with the aid of computer simulation to maximize the system's efficiency and cost effectiveness. Most radiant heating systems are integral to the structure and become a permanent part of the building. Therefore, it is imperative, in terms of both accuracy and clarity, that a proper design be established prior to installation.

### ***The MEG Design Advantage***

With more than 20 years of experience in the radiant industry, and having designed more than 3,000 systems across the US and in many parts of the world, MEG has the experience and knowledge to design the optimum operating system per your type of construction. A national leader and independent source of design and consultation, MEG works with homeowners, architects, installation contractors, and manufacturers to design custom or production heating systems for both residential and commercial buildings.

### ***Enduring Benefits of a system designed by MEG***

- Personal consultation on advantages/disadvantages of various systems
- A system design matched to construction type, with strategic zone control
- Experience integrating all system types – solar, geothermal, pool, etc.
- Ensured compatibility of 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 compatible with construction type
- A precise, detailed system record for the owner and future owners
- Allows “apples to apples” bids from prospective installation contractors.

## SYSTEM DESIGN SERVICES – CONTINUED

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

An engineered radiant heating system can save money, time and headaches. Professionally designed Ecowarm Radiant Board™ systems offer peace of mind, ensuring optional function for new or retrofit installation of the most comfortable heating system for your budget. Properly designed and installed, radiant heating systems add value to any home or building, and plans provide a permanent record of your system for resale or for future renovation.

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

Professional system plans may double as complete mechanical systems than can be incorporated into the submittal plan to building departments. A “complete heating system design” is an attractive selling feature to a client. A professional plan designer can offer expert advice on integrating mechanical systems into the design, which type of system is best suited for a specific construction type, information on integrating the system with building controls, if applicable, and is prepared to discuss system performance per various floor coverings, ceiling heights, window configurations, and in multilevel, multi-zoned homes and buildings.

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

With a professionally designed plan, installation contractors can quickly get material take-offs for bids. All components, including 1/2” PEX distribution tubing, are pre-sized, including exact circuit lengths. A plan also offers balancing data for all circuits in a clear, concise table. Installers spend less time on design, focusing instead on Ecowarm™ system installation. A plan “engineered to ensure proper operation” is a good selling feature to prospective clients: an exact design prior to work, and a clear, permanent record of the system.

### ***Standard layout design***

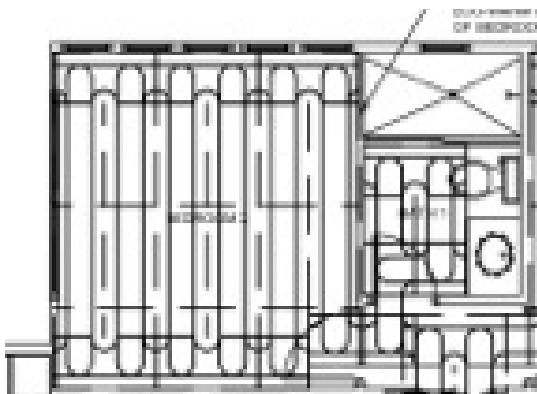
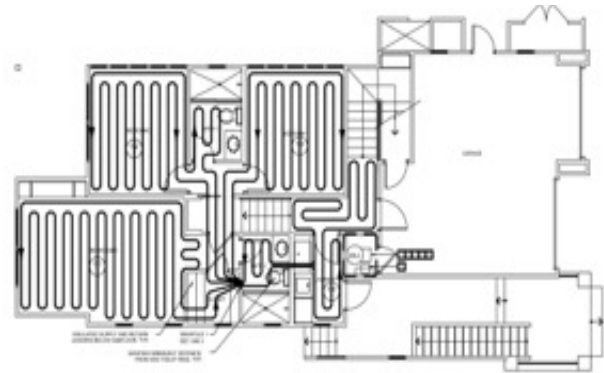
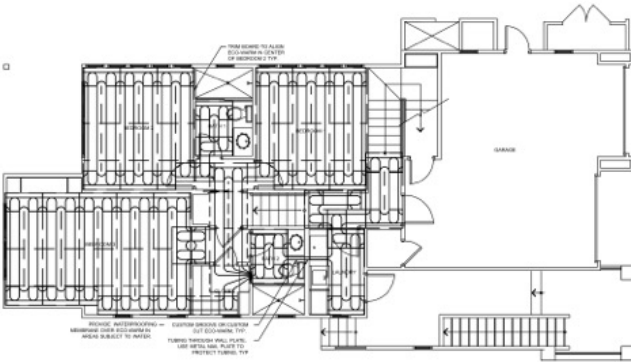
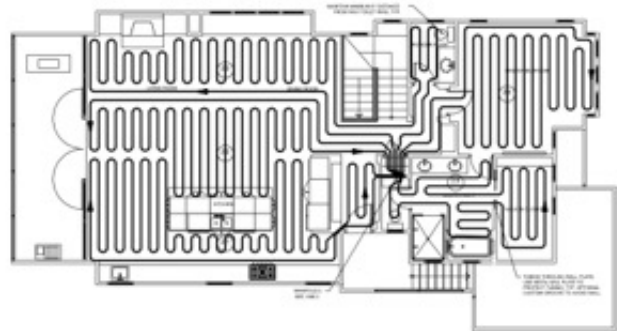
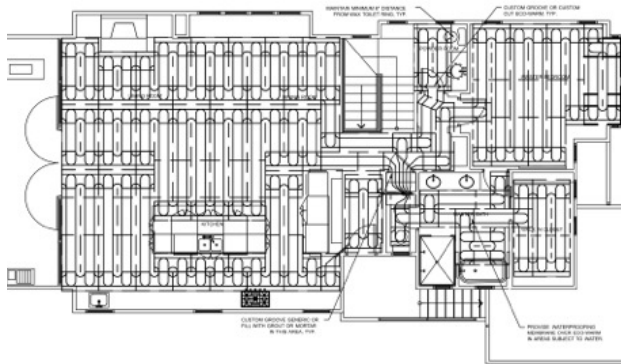
- Full size system plan of board and tubing layout, including manifold location(s)
- Separate tubing loop layout, including lengths of all loops
- Board count of required Ecowarm Radiant Board™ Straights and Supercombos

### ***A complete mechanical design can include :***

1. System balancing data – a computer simulation report that summarizes zones, flows, water temperatures, and tube lengths, which allows the installer to properly bid, install and balance the system for optimal performance.
2. Complete component schematic, including specifications on heat sources, pumps, valves, manifolds, expansion tank, etc., as well as sizing (length) of distribution tubing.
3. Installation notes and details
4. A system controls page providing controls schemes

# SYSTEM DESIGN - LAYOUT EXAMPLE

A system design includes:  
detailed board and loop layout, board count and loop lengths.



ESTIMATED PANEL SCHEDULE	
TYPE	QUANTITY
STRAIGHT	244
COMBO	82

LOOP SCHEDULE		
MANIFOLD	LOOP #	LENGTH
1	1	269
	2	277
	3	273
	4	279
	5	280
	6	279
	7	279
	8	280
	9	277

DESIGN SERVICES

# SYSTEM DESIGN - MECHANICAL EXAMPLE

A complete mechanical design (higher cost) can include: electrical specs, mechanical specs, wiring & mechanical schematics, heat loss calcs and system flow rates. Below is a partial example. Call us for more information or a more complete example.



## WATER HEATING DEVICES

MAKE	TYPE	WATER HEAT. CAP.	WATER HEAT. TYPE	WATER HEAT. MODEL	WATER HEAT. PRICE
BOE	RA 102	102	RF	RA 102	102

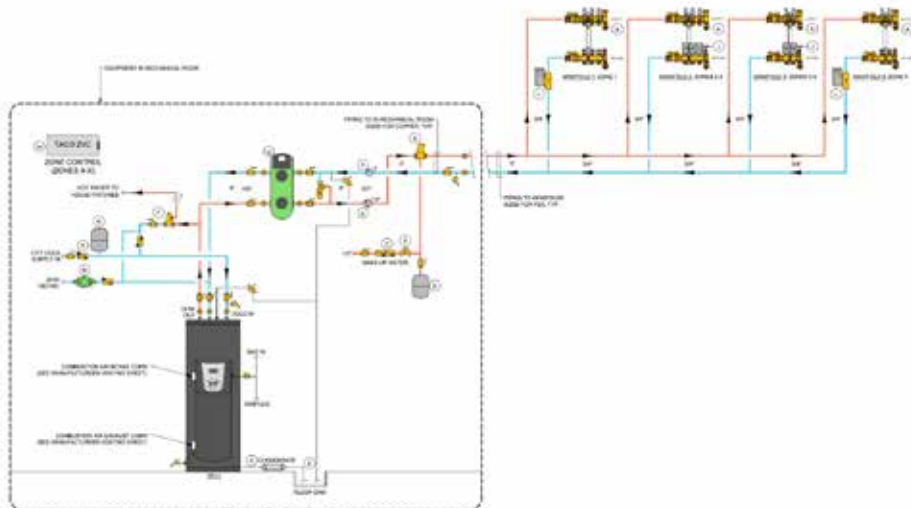
NOTES:  
1. All devices are shown in their factory condition and are not to be modified.  
2. All devices are shown in their factory condition and are not to be modified.

## SYSTEM COMPONENTS

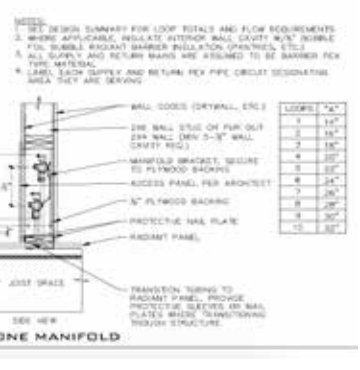
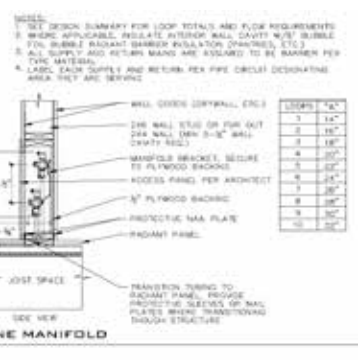
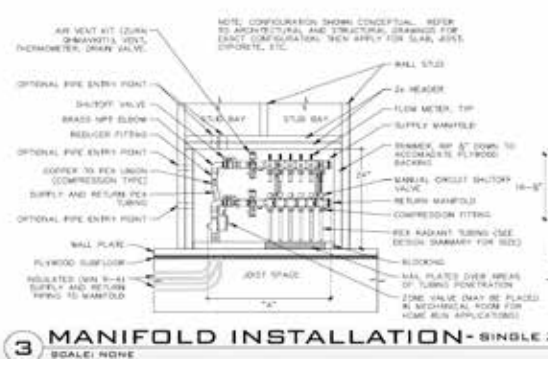
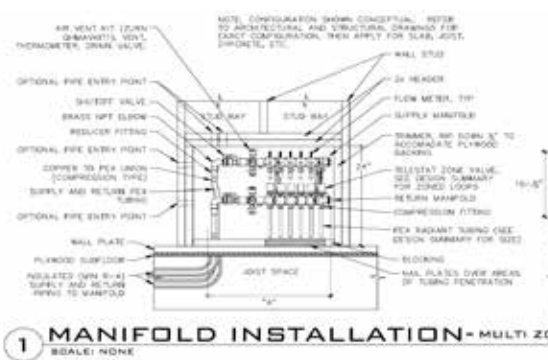
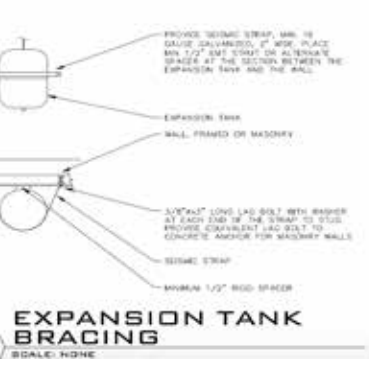
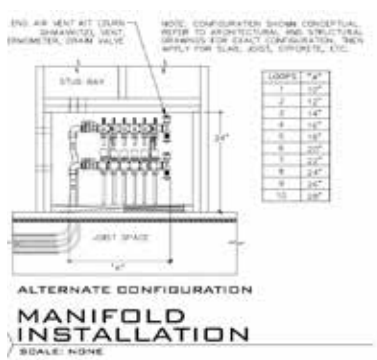
NO.	COMPONENT	MAKE	MODEL	PRICE
1	WATER HEATING DEVICE	BOE	RA 102	102
2	WATER HEATING DEVICE	BOE	RA 102	102
3	WATER HEATING DEVICE	BOE	RA 102	102
4	WATER HEATING DEVICE	BOE	RA 102	102
5	WATER HEATING DEVICE	BOE	RA 102	102
6	WATER HEATING DEVICE	BOE	RA 102	102
7	WATER HEATING DEVICE	BOE	RA 102	102
8	WATER HEATING DEVICE	BOE	RA 102	102
9	WATER HEATING DEVICE	BOE	RA 102	102
10	WATER HEATING DEVICE	BOE	RA 102	102
11	WATER HEATING DEVICE	BOE	RA 102	102
12	WATER HEATING DEVICE	BOE	RA 102	102
13	WATER HEATING DEVICE	BOE	RA 102	102
14	WATER HEATING DEVICE	BOE	RA 102	102
15	WATER HEATING DEVICE	BOE	RA 102	102

## NOTES

- 1. All devices are shown in their factory condition and are not to be modified.
- 2. All devices are shown in their factory condition and are not to be modified.
- 3. All devices are shown in their factory condition and are not to be modified.
- 4. All devices are shown in their factory condition and are not to be modified.
- 5. All devices are shown in their factory condition and are not to be modified.
- 6. All devices are shown in their factory condition and are not to be modified.
- 7. All devices are shown in their factory condition and are not to be modified.
- 8. All devices are shown in their factory condition and are not to be modified.
- 9. All devices are shown in their factory condition and are not to be modified.
- 10. All devices are shown in their factory condition and are not to be modified.
- 11. All devices are shown in their factory condition and are not to be modified.
- 12. All devices are shown in their factory condition and are not to be modified.
- 13. All devices are shown in their factory condition and are not to be modified.
- 14. All devices are shown in their factory condition and are not to be modified.
- 15. All devices are shown in their factory condition and are not to be modified.



1 HEATING SYSTEM PIPING SCHEMATIC- PHOENIX LO - HEATING AND DHW  
SCALE: NONE



DESIGN SERVICES

# SPECIFICATIONS

## ECOWARM RADIANT BOARD™ MODULAR NON-STRUCTURAL RADIANT BOARD SYSTEM

### ***Part 1 – General***

#### ***1.01 General***

- A. Provide all labor, materials, transportation, equipment and services to install Ecowarm Radiant Board™ 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 Ecowarm Radiant Board™ non-structural system. Provide all work as described and required and support and accommodation of related work.

#### ***1.02 References***

- A. Radiant Professionals Alliance Guidelines for the Design and Installation of Radiant Heating Systems, applicable portions of sections 16.2 and 19.3
- B. SFI (Sustainable Forestry Initiative Inc.) certification (substrata board supplier used in manufacture of Ecowarm)
- 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 Ecowarm Radiant Board™
- 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 modular board and 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 Ecowarm modular boards are received in good condition and installed without damage and installed in accordance with construction documents, the then current Ecowarm Installation Manual and applicable code.
- B. The Ecowarm board shall be stored indoors in a temperate (40°F-90°F), dry location. 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 in the Ecowarm™ Installation Manual on 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.

#### **1.05 Site Conditions Required For Installation Of Ecowarm Radiant Board™**

- A. Ecowarm 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 Ecowarm Radiant Board™ 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 Ecowarm Radiant Board™. 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**

Ecowarm warrants that its non-structural modular board products are free from defects in material and workmanship in the manufacturing process when shipped from the factory. For a period of 1 year after shipment from the factory, any boards that are defective when they left the factory will be replaced by a like number of boards as the exclusive remedy. To qualify for warranty, goods must be inspected upon receipt by customer for defects and stored and installed according to the most current Ecowarm Installation Manual, and used in conformity with the written specifications in the Manual. Assertions of defect must be presented to Ecowarm in the form of return of goods or other documentation acceptable to Ecowarm. If Ecowarm agrees that the defect is covered by the Ecowarm warranty then Ecowarm shall at its expense ship replacement boards as the sole remedy. Ecowarm specifically disclaims any incidental, consequential or other claims of damage beyond the replacement of defective product. In no event shall damages exceed the cost of the goods provided. Any product that has been removed and reinstalled is excluded from warranty coverage. Ecowarm is a construction board product and many aspects of its storage, transport and installation are beyond the control of Ecowarm.

## **Part 2 - Originating Manufacturer and Related Products**

### **2.01 Approved Board Manufacturer**

- A. Ecowarm Radiant Board™ shall be manufactured solely by Ecowarm™ or by Ecowarm's approved manufacturer. No other modular radiant boards may be substituted.

### **2.02 Tubing**

- A. Tubing Installed in Ecowarm Radiant Board™ non structural modular boards shall be third party certified to and manufactured to ASTM F-876 and F-877.
- 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 F-877, and shall never have loops longer than 350'.

### **2.02 Glues**

See website for current recommended products: [www.ecowarmradiantheat.com](http://www.ecowarmradiantheat.com)

## **Part 3 – Job Execution And Sequencing**

### **3.01 Preparation**

- A. Ecowarm™ non structural modular board shall be installed according to the contract documents and to the current Ecowarm Installation Manual.

### **3.02 Modular Board Installation**

- A. Using a layout plan, install the Ecowarm boards to the subfloor as required by the contract documents and the then current Ecowarm Installation Manual. Follow recommended floor assemblies, gluing and attachment patterns contained in Ecowarm Installation Manual.
- B. Reference planned direction of any wood flooring before installation and align straight boards at 90° from direction of wood flooring. If this is a change from the submitted and approved plan, the plan should be re-done.
- C. Perform custom routing and drilling before installation of the 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 an 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 60PSI, and maintained through completion of any and 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 sills, door jams or radius into walls for manifolds. Inform the other trades of the 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.

## RECOMMENDED ASSOCIATED PRODUCTS AT A GLANCE

REGULARLY UPDATED - CHECK WEBSITE FOR MOST CURRENT RECOMMENDATION

### *Tubing and Glues as of 8/26/18*

#### **1.0 Recommended Tubing for use with Ecowarm Radiant Board™**

- 1.1 Tubing Installed in Ecowarm Radiant Board™ non structural modular boards shall be third party certified to and manufactured to ASTM F-876 and F-877.
- 1.2 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
- 1.3 The PEX tubing shall be nominal 1/2" ID in accordance with ASTM F-876 and F-877, and shall never have loops longer than 350' and shorter loops shall be used in circumstances as recommended in this Manual.
- 1.4 **Do not Use PEXALPEX** (Pex Aluminum Pex). Ecowarm Radiant Board™ has a slightly undercut groove. Regular PEX will oval then rebound into the undercut, and be retained, whereas PEX-ALPEX will oval and will not expand into the slight undercut. The result is that it will not be as well retained in the groove as regular PEX, and may stand tall of the board.
- 1.5 We recommend these brands of regular 1/2" PEX: **Uponor, Zurn, Watts, Mr. PEX, Rehau.**
- 1.6 Use of Barrier Pex is recommended in most systems to reduce any potential corrosion of metallic components.

#### **2.0 Recommended Glues for use with Ecowarm Radiant Board™**

- 2.1 We recommend using one of the 3 glues listed below when adhering any wood flooring, backer-board or underlayment wood material to Ecowarm Radiant Board™. All 3 may also be used to glue Ecowarm Radiant Board to clean dry concrete. Sika T-35 and Bostik Greenforce also provide a degree of protection from vapor intrusion from a slab. Be sure to reference instructions of both the glue manufacturer and any products being adhered.

##### **Sikabond T-35**

*Product Data Sheet Link*

<https://ecowarmradiantheat.com/wp-content/uploads/2017/02/pds-cpd-SikaBondT35-us.pdf>

*Sell Sheet Link*

<https://ecowarmradiantheat.com/wp-content/uploads/2017/02/Sell-Sheet-SikaBond-T35.pdf>

##### **Mapei Ultrabond Eco-980**

*Brochure*

[https://ecowarmradiantheat.com/wp-content/uploads/2017/02/Ultrabond\\_ECO\\_980-EN\\_lr.pdf](https://ecowarmradiantheat.com/wp-content/uploads/2017/02/Ultrabond_ECO_980-EN_lr.pdf)

##### **Bostik Greenforce**

*Product Data Sheet Link*

[https://www.bostik.com/globalassets/tdsdocuments/greenforce\\_united\\_states\\_en/technical-data-sheet/greenforce\\_tds\\_101016.pdf](https://www.bostik.com/globalassets/tdsdocuments/greenforce_united_states_en/technical-data-sheet/greenforce_tds_101016.pdf)

#### **3.0 Avoid Tubing When Screwing Backboard or Underlayment plywood to Ecowarm™**

- 3.1 Take a photograph as reference and snap chalklines where the tubing runs are and avoid screwing to those areas. Remember tubing runs are 11.75" apart. Take a thick clear sheet of plastic, cut it to size and lay it out over the Ecowarm once tubing has been installed and mark with a permanent marking pen where all the tubing is. This may be rolled up and later unrolled and used as a reference to avoid tubing when screwing products to Ecowarm.