Hydronic Alternatives™

RADIANTBOARD

MODULAR HYDRONIC RADIANT TUBING RETENTION PANELS

4 New Park Rd, East Windsor, CT 06088 phone 413.543.8733 fax 413.543.8737
www.hydronicalternatives.com E-mail : info@hydronicalternatives.com

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4 New Park Rd, East Windsor, CT 06088 phone 413.543.8733 fax 413.543.8737
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Installer Caution:

This manual is deemed current at the time of publication. It is the installer's responsibility to install according to the most current Application Guide.

This guide does not purport to address all relevant issues; it assumes knowledge of good practice both in hydronics and construction methods. Installers should always consult all relevant local, regional and national codes, and adhere to good construction practice.

Only knowledgeable, qualified installers should install RadiantBoard. RadiantBoard installations frequently require the coordination of trades. These are, most typically, mechanical and flooring trades.

Any issues regarding this coordination should be worked out in advance. Failure to follow the instructions of this guide, failure to adhere to relevant local, regional and national codes, failure to coordinate trades and failure to follow good construction practice may cause an unsatisfactory result.

See also "Limitations of Use" elsewhere in this publication. The limitations of use and instructions for PE-RT pipe and other hydronic components provided by the manufacturers shall also be referenced and followed during installation; this manual does not address many aspects of a hydronic installation.

INTRODUCTION

Outstanding for both new construction and retrofit, RadiantBoard allows for the fast and effective installation of PE-RT tubing in virtually every application.

No longer does one have to deal with expensive or impractical lightweight concrete pours or time-consuming staple up floor joist installations.

- 16" × 48" dimensions allows for straightforward material calculations: $\frac{\text{SqFt /}}{5.33}$ = # of RADIANTBOARD
- Adds only ⅝" to existing/planned floor height.
- Open channel design leaves tubing fully visible and accessible during installation.
- Lightweight-5 times lighter than concrete.
- The floor heating system is closer to the finish floor allowing better heat transfer and lower delivery water temperatures providing

WHY IT WORKS SO WELL

Non-structural RadiantBoard is designed specifically for subfloor applications.
RadiantBoard is constructed of a dense composite board covered with aluminum that spreads the heat evenly and quickly from the hydronic tubing. RadiantBoard heats rapidly and is easy to control with the proper weather responsive control for maximum energy efficiency. It contains just enough thermal mass to be effective, but not so much that it is difficult to control. No other produ ct offers this combination of performance, ease of installation and cost-effectiveness.

Quick Response

- ***Low profile, light weight for easy installation***
- ***Avoid the moisture, weight and mess of gypsum cement or concrete***
- ***Radiant installations, big or small, can be easily scheduled with no lost time for concrete curing***

RadiantBoard is typically glued and screwed, or stapled to a wood subfloor. Then PE-RT pipe, which will carry warm water, is snapped into the groove. Heat is transferred from the pipe to the aluminum and the board. RadiantBoard is manufactured from MDF (medium density fiberboard), which is a good heat conductive wood product weighing

44-50 lbs. per cubic foot. The board is grooved and then laminated with a top layer of conductive aluminum to efficiently disperse and transfer heat away from the groove to th e surface area of the whole board

ACCELERATION

Acceleration is a measure of how fast a radiant heating system responds.

Aluminum is approximately 1,000 times more conductive than wood. The layer of aluminum on RadiantBoard significantly enhances both the transfer of heat and the evenness of heat distribution to the space to be conditioned. See Illustration 1 to see how the heat transfers through RadiantBoard.

Illustration 1

The thin profile and relatively high density contributes to the superior acceleration and deceleration of RadiantBoard. In the industry, this is what we refer to as loading and unloading the floor with BTU's. Efficient loading and unloading takes the flywheel effect out of the equation, which does not lead to over or under heating.

Traditional radiant heating systems in concrete work well, but they must first load a large thermal mass before heat will begin to radiate from the floor. They accelerate and decelerate very slowly due to the large thermal mass, and they can be hard to control. This is the classic description of flywheel effect. RadiantBoard, being thin, but relatively dense and aided by its conductive aluminum layer, responds very rapidly. This results in improved response time, with almost no overheating since there is almost no "thermal lag" to overcome. RadiantBoard as any radiant heat system should be managed with a weather responsive control for the best economy of operation and highest degree of heating comfort.

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The aluminum top layer provides multiple benefits. It is highly conductive and moisture resistant. When the edges are sealed using moisture resistant caulking, it provides significant moisture protection for the board and provides a barrier to diminish the transmission of any out-gassing from the board. RadiantBoard is manufactured to meet the Federal Housing Authority (FHA) out gassing standard of less than 0.3 PPM of formaldehyde. Independent laboratory tests with 144F° water indicate that due to the aluminum top layer, has virtually no detectable levels of out gassing.

ADVANTAGES OF RADIANTBOARD

Hydronic radiant heating is the most comfortable and efficient way to heat your home or building. For many years, typical applications for radiant systems involved embedding tubing in concrete slabs or pouring “lightweight concrete” over tubing stapled to subfloors.

The lack of good alternatives for these types of systems permitted designers to overlook the limitations and disadvantages of concrete systems. RadiantBoard provides that alternative. It is designed for the application of hydronic radiant tubing over a variety of construction types.

RadiantBoard is suitable for new construction or retrofit projects. While only adding 5/8” to the existing floor height, and provides a superior performing radiant heat system. In addition, installation of the system is made easy with only three types of floor panels

CONSTRUCTION-FRIENDLY

RadiantBoard avoids structural engineering, tighter joist spacing, furring up carrying beams or the installation of hardwood nailing strips associated with gypsum-based concrete radiant heating systems. In addition, RadiantBoard eliminates substantial drying costs required by moisture-laden concrete and gypsum-based cement. RadiantBoard eliminates scheduling and curing delays.

COST-FRIENDLY

RadiantBoard is installed using conventional construction practices and commonly used tools. With the proper layout only three RadiantBoard panels are required to systematically arrange an efficient floor heating system on the subfloor. The boards are not only lightweight ¬ they are also easy to handle, cut and attach.

FLOORING-FRIENDLY

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

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

PLANET-FRIENDLY/GREEN PRODUCT

RadiantBoard is made with Green Cross Certified Medium Density Fiberboard (MDF), which is manufactured with recycled wood products. The glue is a zero VOC, and the aluminum layer may be recycled.

The MDF used in RadiantBoard has less than HUD minimum Formaldehyde content and the aluminum layer is a positive barrier to prevent the out-gassing of formaldehyde. A report by Environmental Analysis, Inc. has provided independent testing of this in real-life heating conditions.

RADIANT DESIGN

THE FOLLOWING STEPS ARE PROVIDED AS A GUIDE IN DESIGNING A RADIANT FLOOR HEATING SYSTEM

DETERMINING YOUR HEATING REQUIREMENTS

The room or area heating requirements must be determined using an ASHRAE or Manual J heat loss method utilizing the proper R or U values and air changes per hour. IBR and rule of thumb heat loss methods should not be used. Once the proper heat loss calculation is done, the correct BTU per square foot performance criteria is determined. Using the charts provided you can now confirm the correct performance of your RadiantBoard radiant floor heating system.

In addition to Hydronic Alternatives, your local product representatives or wholesale distributor can assist you in the proper design of your radiant floor heating system

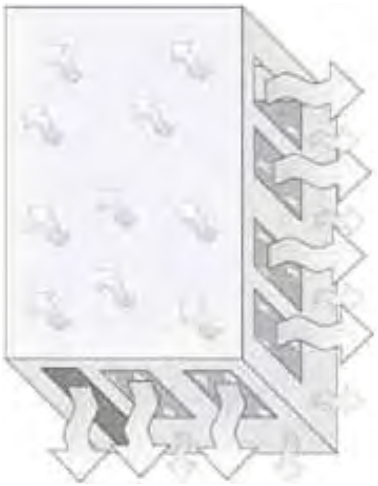

Illustration 2 - Account for all heat losses of the building.

REQUIRED HEAT OUTPUT

The heat loss of any given area must be replaced with the heat output provided by the radiant source (floor). It is important that only “open” floor area (Net Area) be utilized in determining the Required Heat Output. The Net Area is established by subtracting from the total square footage all cabinets, fixtures and other non-heat producing areas.

$$\text{Required Heat Output BTU/h} = \frac{\text{Heat Loss}}{\text{Net Area}}$$

R-VALUE OF FLOOR ASSEMBLIES

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

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, RadiantBoard is designed with a 10F° temperature drop. This means the supply water temperature would typically be 5F° higher than the average water temperature.

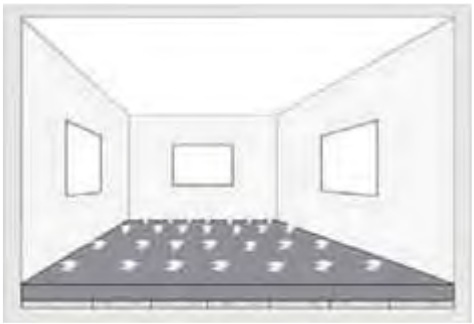

Illustration 3 - Always account for the resistance of the floor coverings.

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TYPICAL R-VALUES OF FLOORING GOODS AND MATERIALS

Thickness	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
Building Board								
Gypsum or Plaster Board	0.11	0.23	0.32	0.45	0.56	0.68	0.79	0.90
Plywood	0.16	0.31	0.47	0.62	0.77	0.93	1.09	1.24
Particleboard, low density	0.18	0.35	0.53	0.71	0.88	1.06	1.23	1.41
Particleboard, medium density	0.13	0.27	0.40	0.53	0.66	0.80	0.93	1.06
Particleboard, high density	0.11	0.21	0.32	0.43	0.53	0.64	0.74	0.85
Waferboard	0.20	0.40	0.60	0.80	0.99	1.19	1.39	1.59
Wood subfloor	0.16	0.31	0.47	0.62	0.78	0.93	1.09	1.24
Cement board	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24
Tile								
Ceramic Tile	0.02	0.03	0.05	0.07	0.08	0.10	0.12	0.13
Marble	0.01	0.01	0.02	0.03	0.03	0.04	0.04	0.05
Granite	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08
Slate	0.01	0.03	0.04	0.05	0.06	0.08	0.09	0.10
Linoleum or Vinyl	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40
Rubber, hard	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96
Cork Tile	0.28	0.56	0.84	1.12	1.40	1.68	1.96	2.24
Carpet Pad								
Waffled Sponge Rubber	0.20	0.41	0.61	0.81	1.01	1.22	1.42	1.62
Synthetic Jute	0.43	0.86	1.28	1.71	2.14	2.57	2.99	3.42
Bonded Urethane, 4 lb Density	0.52	1.05	1.57	2.09	2.61	3.14	3.66	4.18
Bonded Urethane, 8 lb Density	0.55	1.10	1.65	2.20	2.75	3.30	3.85	4.40
Prime Urethane, 2.2 lb Density	0.54	1.08	1.61	2.15	2.69	3.23	3.76	4.30
Carpet								
Acrylic Level Loop	0.52	1.04	1.56	2.08	2.60	3.12	3.64	4.16
Acrylic Level Loop with Foam Back	0.51	1.02	1.53	2.04	2.55	3.06	3.57	4.08
Acrylic Plush	0.43	0.86	1.29	1.72	2.15	2.58	3.01	3.44
Polyester Plush	0.48	0.96	1.44	1.92	2.40	2.88	3.36	3.84
Nylon Level Loop	0.68	1.36	2.04	2.72	3.40	4.08	4.76	5.44
Nylon Plush	0.26	0.52	0.78	1.04	1.30	1.56	1.82	2.08
Nylon Shag	0.27	0.54	0.81	1.08	1.35	1.62	1.89	2.16
Nylon Saxony	0.44	0.88	1.32	1.76	2.20	2.64	3.08	3.52
Wool Plush	0.55	1.10	1.65	2.20	2.75	3.30	3.85	4.40
Hardwood								
Ash	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Beech	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96
Cherry	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Elm	0.14	0.28	0.42	0.56	0.70	0.84	0.98	1.12
Maple	0.13	0.26	0.39	0.52	0.65	0.78	0.91	1.04
Oak	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Cedar	0.23	0.46	0.69	0.92	1.15	1.38	1.61	1.84
Fir	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Hemlock	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44
Pine	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60
Redwood	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60
Spruce	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60
Engineered Flooring								
Laminated Parquet Flooring	0.11	0.23	0.34	0.45	0.57	0.68	0.79	0.91

Table 1 - R-Values of Flooring Goods

SUPPLY WATER & SURFACE TEMPERATURE

Using the Floor Output Chart, the system Supply Water Temperature and Surface Temperature can be determined. Find the Required Output on the left side of the chart and read across to the right to determine the Surface Temperature.

Calculate the Total R-Value of the floor covering material and extend a line up from this point to where it intersects the Required Output. The Supply Water Temperature can be read at the point of intersection.

Delivery water temperature to the system should not go above 150°F or the Surface Temperature above 85°F.

Required BTU / sq ft	Required Average Water Temperature Based on 68°F Room Temperature				Surface Temp.
35	140				85
30	130	144			83
25	121	133			81
20	112	122	140		78
15	102	111	126	141	76
10	90	100	110	130	73
5	86	90	93	100	70
	0.5	1.0	2.0	3.0	
	R-Value of Floor Covering				

Table 2 – Floor Output Chart

IF YOUR DESIGN FALLS INTO ONE OF THE DARK RED AREAS:

Check the heat loss for accuracy. Has it been selected for radiant heat?

Choose a floor covering with a lower R-Value. Reduce the heat loss of the area (i.e. increased insulation, new windows) Last resort is to include supplemental heating for the area.

CAD LAYOUT AND DESIGN SERVICES

Third party services can provide complete system design and CAD layouts for RadiantBoard installations.

Contact your RadiantBoard distributor for details.

All RadiantBoard systems should be installed by qualified installers.

Illustration 4 – CAD Layouts are particularly useful for first time installers.

RADIANTBOARD REQUIREMENTS

To estimate the number of panels needed, divide the square footage of the area by 5.33 (each panel is 5.33 square feet in area). Example: A 30ft. x 10ft. room = 300sq.ft, dividing 300 by 5.33 = 56 panels. For standard room configurations, (square, rectangle) include 5% additional panels to allow for waste. For rooms with angled walls, multiple corners, or bump outs, include 10% additional panels.

For Utility or Combo pieces; perform a complete layout noting tubing orientation and where the Utility/Combo piece will be required. For estimation purposes, factor in 10% of the square footage for a mix of Utility and Combo pieces. Once the values of Combo Ends are realized, refinement of this estimation technique will become clear.

⅜" PE-RT TUBING REQUIREMENTS

RadiantBoard is designed to secure ~" ASTM F2623 PE-RT tubing. Based upon the RadiantBoard 8" on center tube-spacing, a factor of 1.6 should be used to calculate a close approximation of your job tubing requirements. To determine the amount of tubing that will physically fit into the panels, multiply the square footage of the area by 1.5. The factor of 1.6 is a comfortable number to compensate for supply/return leader lengths. **If manifold locations are a great distance from the floor heating area, attention to the length of the supply and returns must be made**. The greater the distance to the manifold the more tubing required. **This is why the factor of 1.6 is for budget purposes only.**

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NUMBER OF CIRCUITS

Maximum circuit length is 300 linear feet including supply and return tails.

To determine the number of individual circuits of tubing required, take the square footage of RadiantBoard and multiply by 1.5 to determine tubing length. This is the physical amount of tubing in the floor. **Add in the supply and return tails, not to exceed 300 linear feet.** This will determine the amount of circuits required.

Note: shorter circuit lengths will narrow your Delta T and reduce head pressure on your pump. This decision is a balance between manifold size, room area and job requirements. If you are unsure about your circuit requirements contact your distributor, representative or Hydronic Alternatives

Example:

For 275 square foot of floor area: 275 x 1.5 (amount of tubing in floor) = 412.5 feet of tubing. This exceeds the 300' maximum run requirement; this area should be split into two 200' + circuits including your supply and return tails.

Notice Loop Lengths:

- Notice that loop lengths should never be over 300'.
- Tubing is 8" on center; a 300' loop will cover a maximum of 200 sq. ft. A 200' loop will cover 133 sq. ft.
- Remember to allow for the supply and return tails to the manifold location.

PRESSURE DROP CHART FOR PEOC-PLUS PIPE

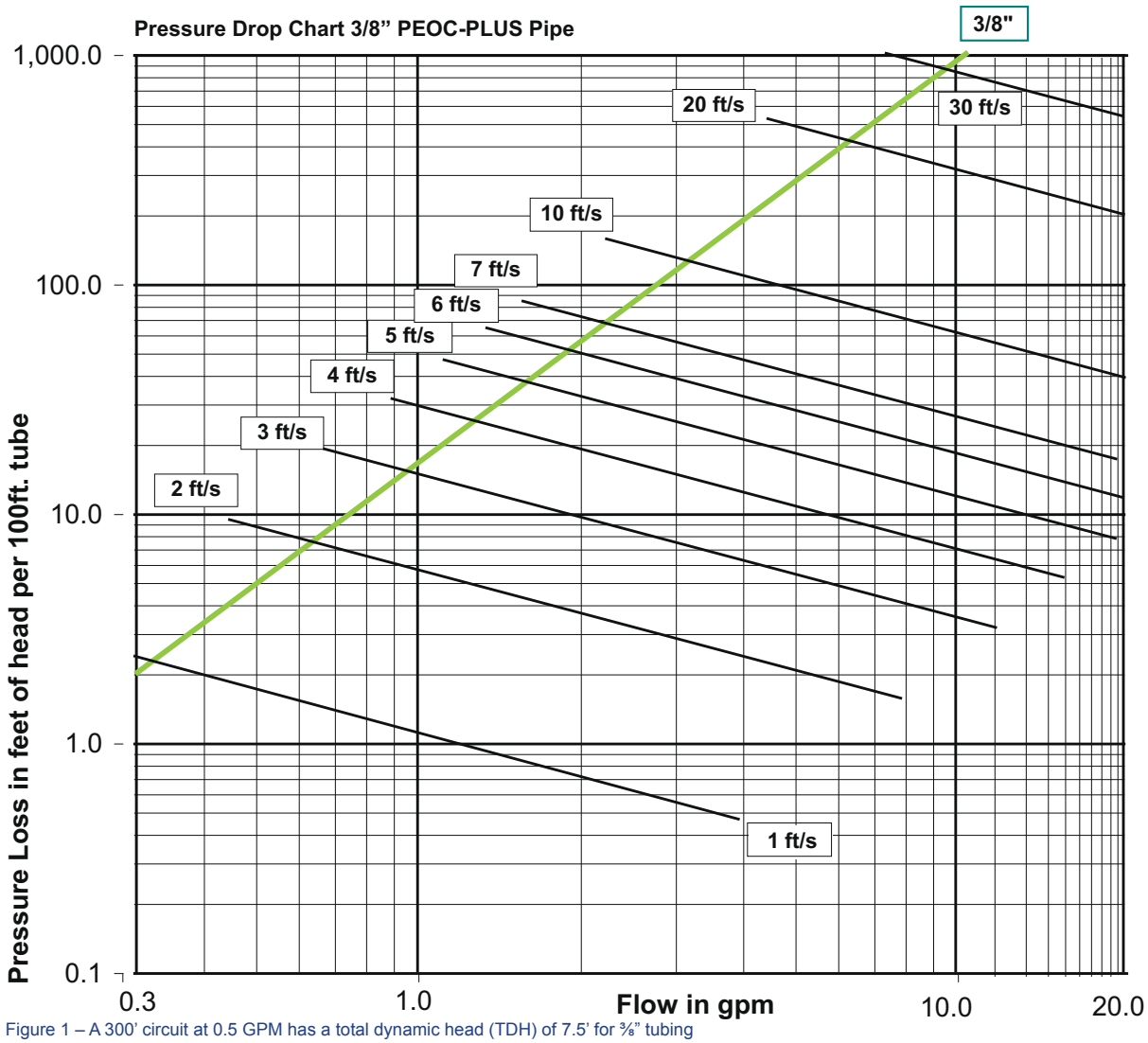


Figure 1 – A 300' circuit at 0.5 GPM has a total dynamic head (TDH) of 7.5' for ⅜" tubing

INSTALLATION

UNDERSTAND THE PRODUCT

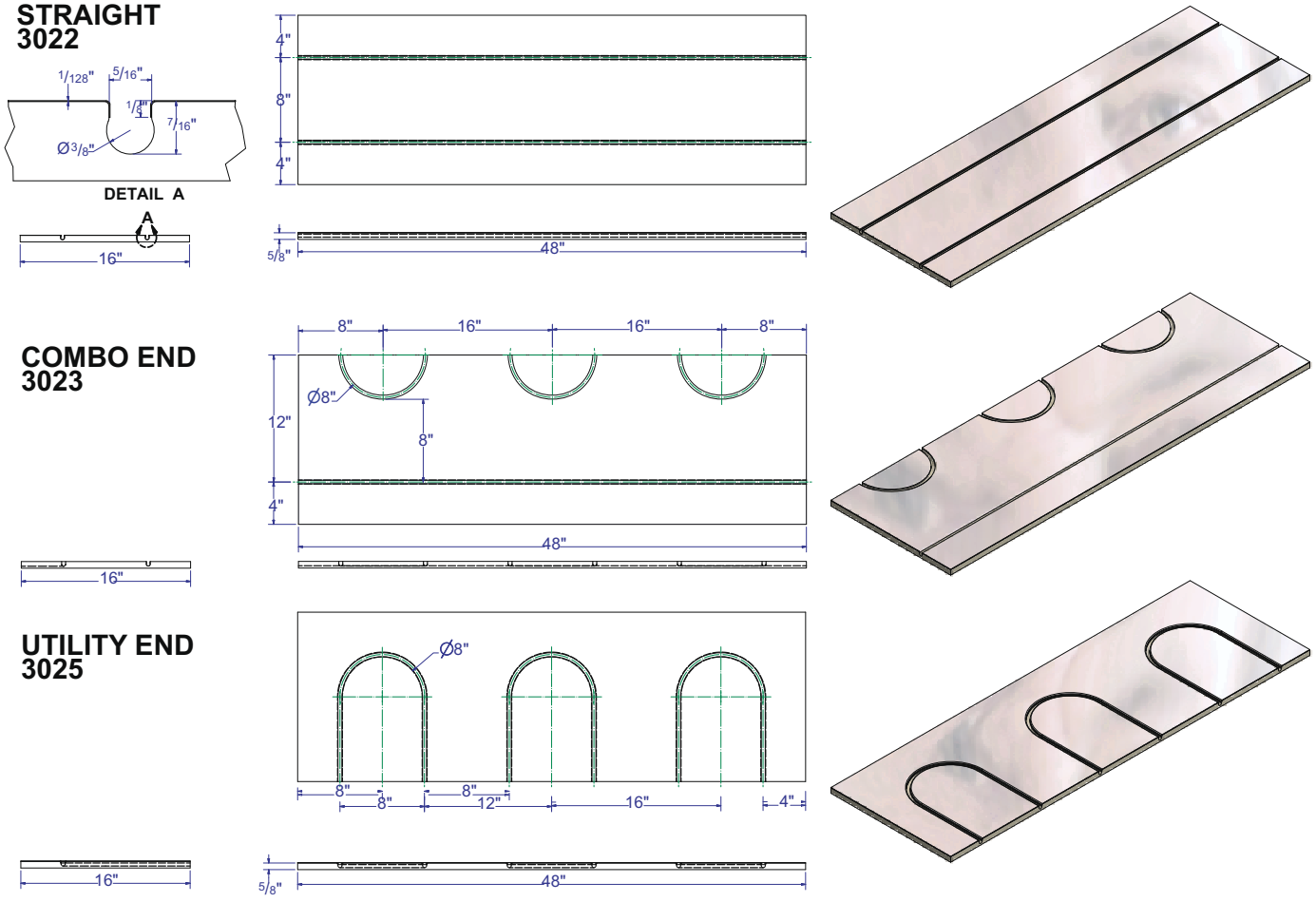
RadiantBoard comes in 3 different board configurations.
- Straight
- Combo End
- Utility

They are assembled to make a channel for the pipe. Each piece measures 16” x 48”. The grooves are centered 8” apart. RadiantBoard cuts easily with a circular saw.

Always Plan Ahead:

- Carefully read and follow the installation instructions.
- Familiarize yourself with the materials and installation methods before you start.
- Rely on your designer or distributor, particularly if you are a first-time installer.

STRAIGHT 3022



COMBO END 3023

UTILITY END 3025

Illustration 5 – RadiantBoard configurations

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PRODUCT SHIPPING INFORMATION

Nominal dimensions	Each board is 16” x 48” x 5/8” thick, or 5.333 square feet
Weight	Approximately 2.16 lbs. per square foot, 11.5 lbs. per board 4’ x 4’ x 36” tall (Three RadiantBoard
Pallet Size	to a row, 33 rows high) Approximate Pallet Weight: 1,330 lbs.
Approximate Truckload Quantities	17,941 square feet, or 34 pallets, 45,288 lbs.
Pallet Appearance	Shrink wrapped, corner protected, labeled on exterior of pallet
Recommended Product Mix	Straight 80%, combo end 10%, utility 10%.

INSTRUCTIONS FOR PROPER STORAGE AND MOISTURE CONTACT

RadiantBoard should always be stored in a temperate, dry place (35F° - 90F°). Avoid prolonged exposure to sunlight and moisture. 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, damage to the product will occur.

UNDERSTAND HOW TO SPACE THE BOARDS

The actual width of each board is 15 7/8”, which provides for installing the boards with a very slight gap in-between boards which allows for expansion at different temperatures and for normal variances in humidity in a finished home. When aligning straights with the combo ends or utility ends using a piece of tubing, as shown in the following section, a slight gap of approximately 1/16” will naturally occur between the straight boards. This is normal. Try to allow a similar 1/16” gap between the ends of all boards, but always make sure all grooves align, as described in the following section.

INSTALLER’S NOTE

Since RadiantBoard is a modular system; the boards are manufactured to tight toler¬ances in groove spacing and squareness of the sides and ends. When cutting RadiantBoard make sure to cut them squarely and align them carefully so that subsequent pieces will fit correctly. This is not difficult, but attention to detail will result in an easier installation.

SUBFLOOR PREPARATION

All subfloors must be structurally sound, level, and free of voids or defects. High and/or low spots must be addressed prior to panel installation. Sags and/or creaking may be signs of a larger problem. These and all structural deficiencies will need to be repaired in order to assure satisfactory panel installation. The entire floor area should be swept and vacuumed prior to installation.

MOISTURE CONTENT-SUBFLOORS

The moisture resistant properties of RadiantBoard (MDF) are minimal. Excessive or continual moisture will cause adverse effects on the wood subfloor material.

The necessary precautions must be taken in the storage and construction installation of RadiantBoard to minimize contact with moisture and water. If a specific project is required for a high-moisture area or if the construction environment does not have weather tight conditions, a moisture-resistant MDF is available. Please contact Hydronic Alternatives for pricing.

Wood subfloors should have stable moisture content with no more than a 20% difference between RadiantBoard and the subfloor. Since RadiantBoard is a heating product the 20% difference is a good rule to follow. If the difference is greater than 20% between the subfloor and RadiantBoard then an acclimation period should take place. Optimal acclimation time should be a minimum of two weeks. If these guidelines are not followed the expansion and contraction rate of the two product s (subfloor and RadiantBoard) will differ and could cause problems. If wood floors are the desired finish, follow the National Wood Flooring Association guidelines for installing wood floors over radiant heat. For further information, you can visit their website: http://www.woodfloors.org/consumer/

CONCRETE SLABS

All concrete slabs will release moisture regardless of their location (below, above, or on grade). In most cases, for new slabs, it will take 60 days or more before the slab is dry enough (cured) to proceed. If RadiantBoard is to be installed over a new or existing concrete floor you will have to install good quality vapor barrier paint. Follow the manufacturer's recommendations for proper curing , once that occurs, RadiantBoard can be glued to the floor and radiant heat installed. If the concrete floor is not level and tile is the desired finish flooring material, the appropriate measures should be taken to level the floor. RadiantBoard should be level to receive a cover sheet or crack isolation membrane (Schluter-DITRA), and then the tile installer can recommend the best installation method. The application of thin set or adhesive to bond the tiles should follow the manufacturer's recommendations. If wood flooring is the desired floor finish, floating laminate or prefinished wood floors would be the easiest to install. If nail-down wood floors are desired, then a wood subfloor is necessary to fasten the finishing flooring to.

If wood floors are to be installed over a concrete subfloor then the adherence of the subfloor to the existing slab should be discussed with the installing contactor. Once the subfloor is installed, follow the wood floor installation guidelines listed in this manual.

RADIANTBOARD LAYOUT

It is best to utilize a floor plan to determine the optimum panel layout. Using a carpenter's square, determine if the room itself is square. If necessary, snap a chalk line to follow. In general, the first Utility/Combo end panel should be placed in a far exterior corner of the room so that the straight runs of tubing will be parallel to the exterior wall of highest heat

Illustration 6 – Gluing the Panels

SECURING PANELS

Apply a ⅛" bead of construction adhesive around the perimeter of the panel, approximately 1" from the edge. Complete the adhesive coverage by applying a zigzag pattern from top to bottom (see image).

Each panel should be secured with a construction type screws or rosin coated staples; 10 screws/staples per panel (5 per side). Construction adhesive will be applied to each board.

FLOATING PANEL INSTALLATION

RadiantBoard may also be installed without physically attaching it to the subfloor. This application is typically used for installation over a concrete slab or where subfloor penetrations are not desired. **A floating panel installation is not recommended for tile or stone finish floors.**

Note: It is important in a floating panel installation to stagger the seams between rows of panels. This will provide for a more stable floor.

At the start of the second row, cut 24" off of the first panel. Continue to cut the first panel on every other row making sure that the surface grooves line up with previous rows.

There are two methods for installing "floating" panels. First, panels may be edge-glued, similar to laminate flooring installation. Use a quality construction adhesive and follow the manufacturer's instructions. Wipe all excess adhesive from the grooves and joints taking care to ensure that adhesive will harden in the tubing grooves and cause the tubing to protrude above theRadiant Board causing chafing and nuisance noise problems. The second method is to apply a plywood cover sheet over the top of a "dry" fit (not edge glued) RadiantBoard installation. After the PE-RT tubing has been installed (see Install PE-RT Tubing), the cover sheet should be glued and screwed to the panels. Apply construction adhesive to the panels maintaining at least a 2" clearance from all surface grooves. After gluing, screw the cover sheet to the RadiantBoard using 12" on center screw spacing.

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FINAL ALIGNMENT

Illustration 7 – Use a short piece of tubing toinsure proper alignment

Short (6") lengths of ⅜" PE-RT tubing can be useful in aligning adjoining panels. Simply place the tubing into the grooves between two panels to assure groove alignment. Slight variations in either subfloor or panels may result in panel edges not always being perfectly aligned.

* **Do not assume that panel edge alignment will guarantee groove alignment.** In almost all installations, it will be necessary to cut a small number of panels to finish out a room. In addition, if the final panel in a row will place the PE-RT tubing within 2" of the finished wall, make an adjustment by cutting off an inch or two from the first panel in the row. Always make sure that the surface grooves line up with all previous rows. Panels can also be cut in order to change direction of the tubing. This may be necessary if there is limited access where tubing may enter or exit an area. This is a situation where by the Combo end panels will become valuable in the installation process. Panels can be cut with a table or skill saw with a high quality carbide tip blade

*** Cutting should be done with adequate ventilation and while wearing protective eyewear**. Cuts should be made so that the edges continue to match up. Cut panels may also be used as filler boards, with no tubing installed, to create a uniform floor height in an area. During panel layout, it will also be necessary to determine the location where the PE-RT tubing will enter the first panel and exit the last panel in a circuit. This tubing is called the supply and return leaders and will run from the panels to a manifold or main piping location. Holes (typically 1") should be drilled in the floor, or at the base of the wall, to accommodate the leaders. PE-RT bend supports are available to provide a tight 90º turn into the floor or up a wall. In areas that require several circuits of tubing (see RadiantBoard & PE-RT Tubing Requirements) it will be necessary to drill holes for each supply and return leader.

Leaders may also be run along the subfloor to a common entry/exit location without being installed into panels. If necessary, a leveling compound, or ~" sleepers (filler boards), may be installed between or along the tubing to provide a sound base for floor coverings.

EQUIPMENT REQUIRED FOR INSTALLATION OF RADIANTBOARD

- Table or circular saw. A carbide blade is recommended.
- Electric or cordless screw gun with ⅝" drill bit for supply and return bury points.
- #2 Phillips bit (if boards will be screwed down).
- Sheathing type pneumatic stapler (if boards will be cross stabled).
- Caulking Gun
- Rubber or hard hide mallet.
- Chalk line, marking pencil and square.
- Vacuum cleaner to clean grooves prior to installation.
- 6" pieces of ⅜" PE-RT tubing for alignment of grooves.
- Tubing uncoiler is recommended for installing tubing.

INSTALLER'S NOTE

RadiantBoard cuts easily with a quality carbide tip blade. A table saw is best but a circular will work. Pieces must frequently be cut to provide an accurate fit for each room. It is important to cut them squarely to keep the alignment of grooves accurate in the installation. If you are cutting a large number of boards for a complex layout, number them and make a map so you can remember where they go.

Illustration 8 – Installation Tools

INSTALLING THE PE-RT TUBING

Vacuum the surface and grooves of all panels to ensure that there is nothing present that may damage the PE-RT tubing and to provide a satisfactory fit into the grooves. Starting with the first panel (supply leader hole location), leave sufficient excess tubing to reach the manifold location. . Next, begin rolling the tubing out from the coil and "snap" it into the grooves. A rubber or other soft mallet is recommended to assist with this step. The grooves are designed to provide a tight fit for the PE-RT tubing in order to hold it firmly in place. Please note, due to tolerances in both the tubing and the panels, it is normal for varying degrees of force to be required to fully seat the tubing into the grooves. Check the length of tubing remaining in the coil to ensure sufficient length for the return leader to reach the manifold location; couplings can be used but whenever possible a continuous circuit is better. After completing the installation of each circuit of tubing, confirm that the entire length is fully seated into the grooves.

Illustration 9 – Preparing Panels for Tubing

INSTALLER'S NOTE

RadiantBoard has a thin aluminum layer that is slit for the grooves. It is designed to be folded down into the grooves and pressed to the side as the tubing is pushed into the grooves.

The tubing **MUST** sit below the surface of the panels in order to provide a sound base for the finish floor. The easiest way to identify "camel humps" in the tubing is to lie down on the floor and look across the installation. You can then easily identify areas where the tubing is protruding above RadiantBoard. Where the tubing is protruding, simply go back and set the tubing fully into the grooves with a rubber mallet

Illustration 10 – Tubing Installation

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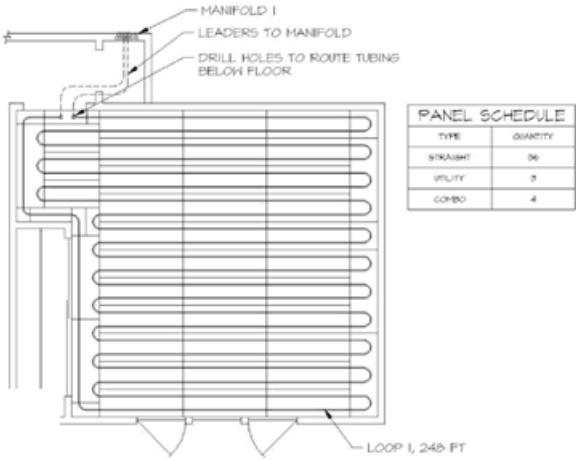
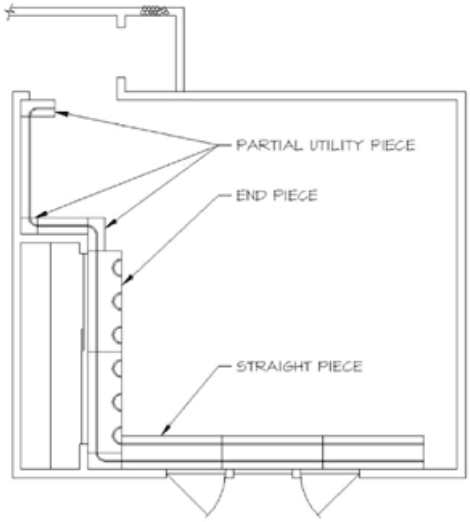
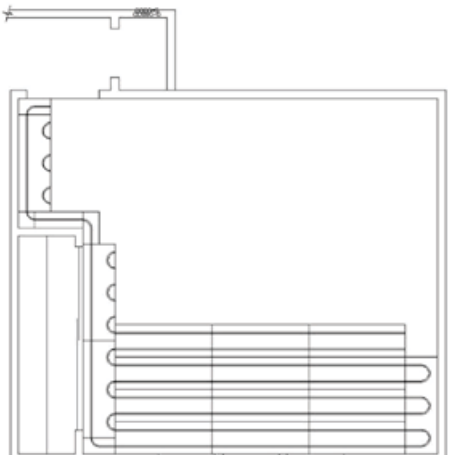
SAMPLE LAYOUT AND INSTALLATION

Installation Step 1:
Determine number and type of panels needed and tubing lengths required. Be sure to always use good judgment in allowing enough tubing at ends for leaders to manifolds. Straight panels will need to be cut in half to start the initial run of boards.

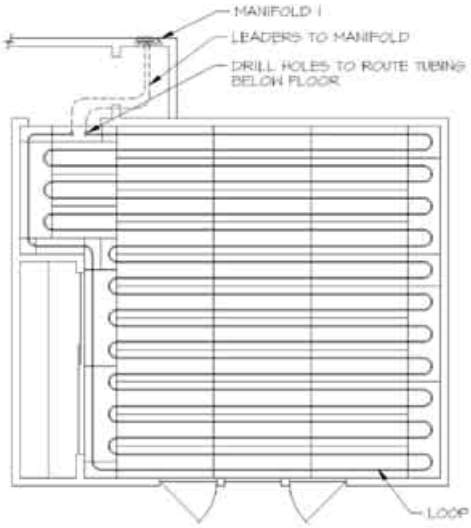




Installation Step 2:
Begin the RadiantBoard layout by starting at the beginning of the supply run into the space and running board along the perimeter of the heated space toward the area of highest heat loss. Drill 1” holes where tubing enters and exits the circuit. Utilize bend supports or sleeves where tubing enters and exits the system.



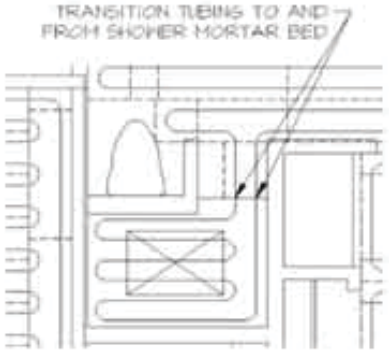
Installation Step 3:
Add end pieces and straight pieces, working your way back away from the area of greatest heat loss. Once all boards are in place, drill 1” holes (subfloor with access application) to route S & R leaders back to manifold.



Installation Step 4:
Feed enough supply tubing to route to manifold through 1” drilled supply hole below the floor or before the start of groove. Tubing may then be “popped” into grooves after all grooves have been thoroughly cleaned with a vacuum cleaner. Tubing deployment to and from the manifold location is a matter of logic and work patterns. The end goal is to curtail the waste of tubing.

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 Thermalboardrm in order to accommodate desired coverage.

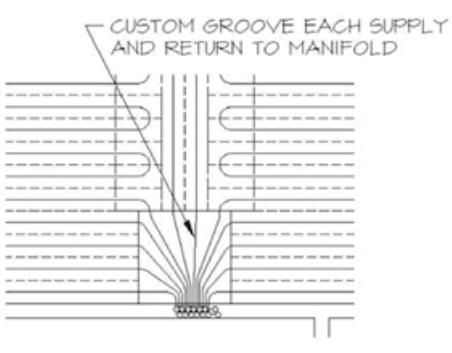


CONNECTIONS AT MANIFOLD

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

1. Insert tubing directly into the grooves, which is recommended when working with a few loops, ending adjacent to the manifold location.
2. Drill holes, dive the tubing under the floor and bring it up again at the manifold location if it is on the same floor as the system.
3. If working strictly above the floor utilize Combi and Utilities to get to and from the manifold location. This is usually the case when installing a system over an existing concrete slab

The end result is to deploy your supply and returns in an efficient pattern without a lot of custom work unless you have acute angles. If that is the case make sure your geometry is good. Now you will be able to appreciate your teacher in high school.



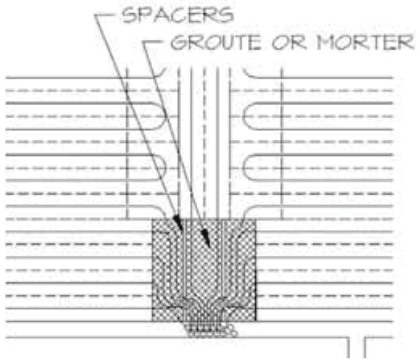


Illustration 11 – Sample Manifold Connections

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GENERAL INSTALLATION REQUIREMENTS FOR ALL FLOORING OVER WOOD SUBFLOOR

1. RadiantBoard requires an accurate room-by-room heat loss analysis of the structure to be conditioned. The design has to take into account the thermal resistance of the finish floor coverings. Performance of the system is then analyzed. If RadiantBoard cannot provide all the necessary heat, supplemental heat may be required.
2. Thoroughly clean all surfaces that RadiantBoard will be applied to. The surface to which RadiantBoard will be attached must be flat and dry prior to installation. See requirements for flatness and moisture. The maximum acceptable difference in level is 3/16 of an inch in a 10-ft. radius. Wood subfloors must have stable moisture content below 20%. 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 below the 20% range. Check for excessive moisture in the crawl space or basement and look for other signs of potential water problems. High areas should be sanded or planed, low areas patched or filled with an appropriate leveling compound, or covered with rigid underlayment properties. 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 can be used for a square reference point, as walls may be out of square.
4. Lay out boards according to predetermined design.
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. It could be useful for 6" lengths of tubing be snapped into the grooves, lapping 3" into each board to help align the grooves of the boards.
8. A 1/16" width space is desired between panels.
9. After gluing the panels in place, drill and screw or cross-staple RadiantBoard to the sub-floor, according to the recommended pattern.
10. Once all boards are installed, clean out all grooves with a vacuum cleaner.
11. Snap tubing into groove and route to manifold according to the design.
12. Follow specific, additional recommendations for each floor covering; refer to the complete installation manual for further instructions on the installation of the RadiantBoard system.

CARPET OVER RADIANTBOARD

Radiant Board is installed over a wooden subfloor, complying with "General RadiantBoard Installation Requirements for All Flooring over Wood Subfloor". In addition, the following specific cautions and instructions shall be followed:

Carpet and pad may be installed over RadiantBoard. When installing the pad, care should be taken to avoid puncturing tubing. It is advised that a thin layer of underlayment plywood (1/4") be applied over RadiantBoard prior to carpet and pad installation to protect the carpet from wear patterns. As with all radiant heating installations, a thin slab foam rubber pad and short, high-density carpet should be used. If carpet pad is glued, a high temperature latex adhesive or bonded urethane glue should be applied. Glue carpet pad to underlayment plywood: do not glue to RadiantBoard or to tubing! Maintain 2" minimum tubing clearance from carpet tack strips

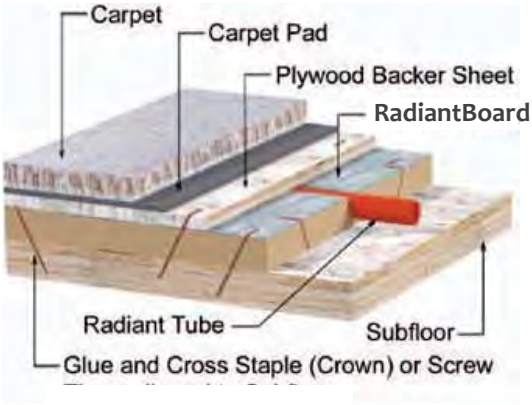

Illustration 12 – Carpet Over RadiantBoard

VINYL OVER RADIANTBOARD

RadiantBoard may be installed over a wooden subfloor, complying with "General installation requirements for "All Flooring over Wood Subfloor". In addition, the following specific cautions and instructions should be followed: When installing vinyl flooring, it is required that a thin layer of underlayment plywood be applied over RadiantBoard. In wet locations, a sealant layer should be added. Underlayment plywood that has a grid printed on it helps locate tubing runs and prevent puncturing the tubing when the plywood is being screwed through the RadiantBoard into the underlayment. When installing the 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.

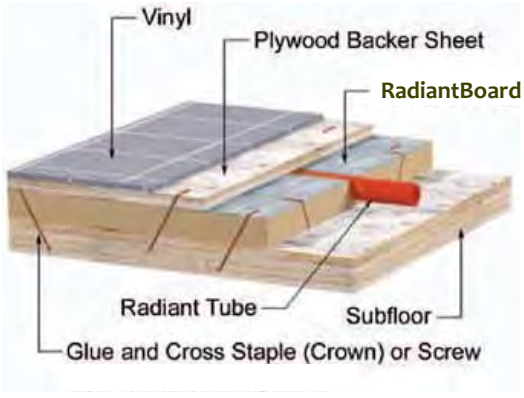

Illustration 13 – Vinyl Over RadiantBoard

THINSET TILE OR STONE OVER RADIANTBOARD

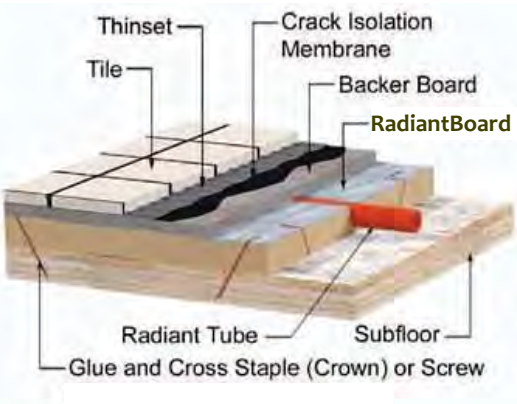

Illustration 14 – Thin set tile or stone for areas unlikely to be subject to moisture.

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

When installing masonry, tile or stone, a concrete backer board is recommended over RadiantBoard With the backer board a thin set installation can be used. In kitchens, baths, laundry or any other area where water may be present, water sealant layer (i.e. Schluter-DITRA) can be used. Where tile or stone is going to be thin-set, anti-fracture membrane, (Schluter-DITRA) or equivalent, is recommended to be installed on the backer board and over the RadiantBoard. When nailing the backer, maintain a 2" minimum tubing clearance when screwing down. Refer to the complete installation manual for further instructions on the installation of the RadiantBoard system.

INSTALLER'S TIPS

When using a slip-sheet or approved crack isolation membrane (Schluter-DITRA) and proper reinforcement mesh, hard pack mortar may be applied over RadiantBoard.

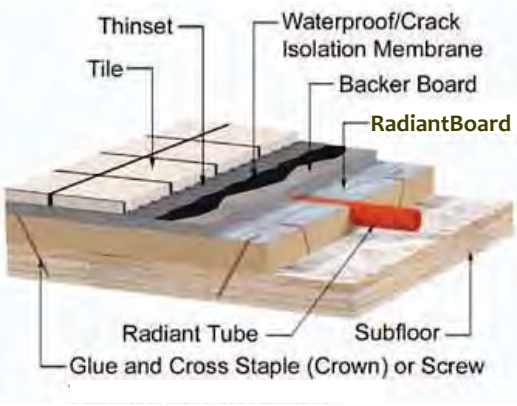

Illustration 15 – Thinset tile or stone for areas likely to be subject to moisture.

Notes on Sealing:

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

MORTAR BED SETTING OF TILE OR STONE OVER RADIANTBOARD

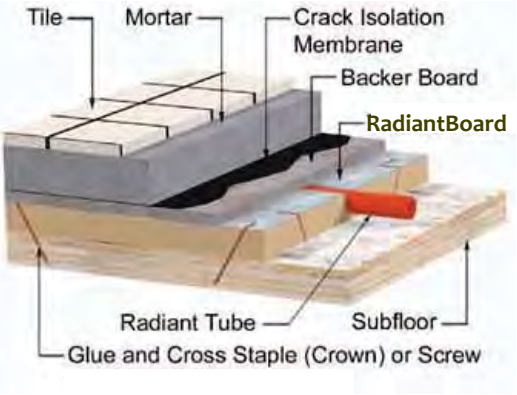

Illustration 16 – Traditional mortar set tile or stone for areas unlikely to be subject to moisture.

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

When installing masonry, tile or stone, backer board shall be used over RadiantBoard. A conventional mortar bed shall then be used. In kitchens, baths, laundry or any other area where water may be present, a water sealant (Schluter-DITRA) should 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 RadiantBoard system

INSTALLER'S TIPS

When nailing any cover sheet over RadiantBoard remember the return bends. Many contractors will outline the returns so they do not think they are nailing over straight runs. The consequences can be disappointing if you forget about the return bends as you will most likely penetrate all the heating pipes in that run. An ounce of caution can go a long way for a successful installation.

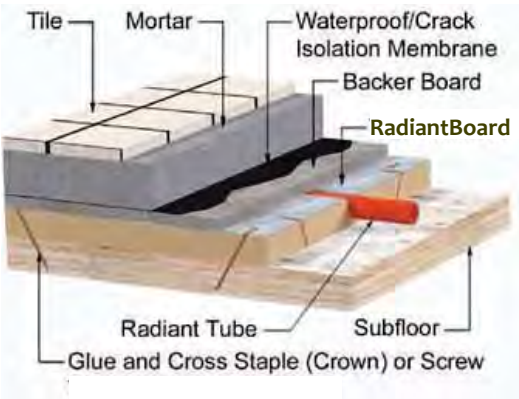

Illustration 17 – Traditional mortar set tile or stone for areas likely to be subject to moisture.

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LAMINATE OVER RADIANTBOARD

RadiantBoard can be installed over a wooden subfloor, complying with “General RadiantBoard Installation Requirements for All Flooring over Wood Subfloor”. In addition, the following specific cautions and instructions shall be followed:

When installing laminate flooring, it is advised that a thin layer of underlayment plywood should be applied over RadiantBoard. In wet locations, a moisture barrier sealant should be painted over the underlayment layer of plywood. Many, but not all, laminate-flooring products are suitable and recommended by

the manufacturer for use with radiant floor heat. Check before installing. Many laminate flooring products have floor temperature limits that need to be observed. Install laminate flooring crosswise to RadiantBoard whenever possible. It is recommended that laminate flooring installed over RadiantBoard be used with a weather responsive control strategy. This strategy utilizes the proper reset curve to gradually adjust the temperature of the water flowing through the tubing in the RadiantBoard, and under the laminate flooring.

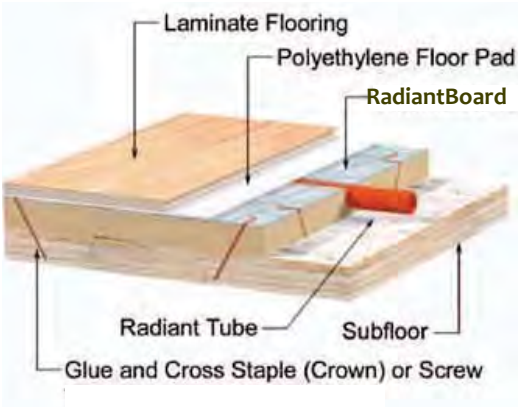

Illustration 18 – Laminate Flooring Over RadiantBoard

ENGINEERED WOOD OVER RADIANTBOARD

RadiantBoard can be installed over a wooden subfloor, complying with “General RadiantBoard Installation Requirements for All Flooring over Wood Subfloor”. In addition, the following specific cautions 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. Install engineered wood flooring crosswise to RadiantBoard whenever possible. It is recommended that engineered flooring installed over RadiantBoard as with all radiant floor installations; a weather responsive control strategy be used with the proper reset curve which will gradually adjust water temperature going to the RadiantBoard and under the engineered wood. This approach will limit excessive surface temperature which could damage the surface of the product

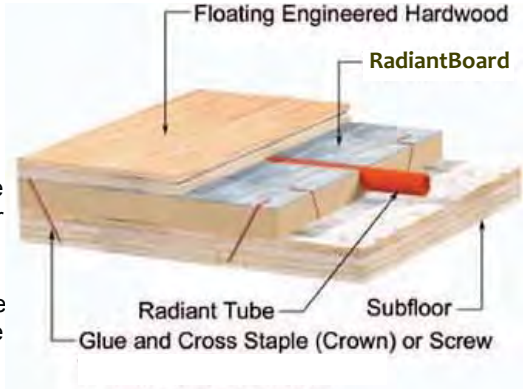

Illustration 19 – Engineered Wood Over RadiantBoard

TRADITIONAL HARDWOOD INSTALLED DIRECTLY OVER RADIANTBOARD

A conventional nailed hardwood type system can be used directly over RadiantBoard, with nails long enough to penetrate through the RadiantBoard and secure into the subfloor. See also sections on general considerations with the use of traditional wood flooring.

RadiantBoard should be installed over a wooden subfloor complying with “General RadiantBoard installation requirements for all flooring over wood subfloors”. One should always follow the National Wood Flooring Association guidlines for installing wood floors over radiant heat. For more information, you can visit their website at http//:www.woodfloors.org/consumer/

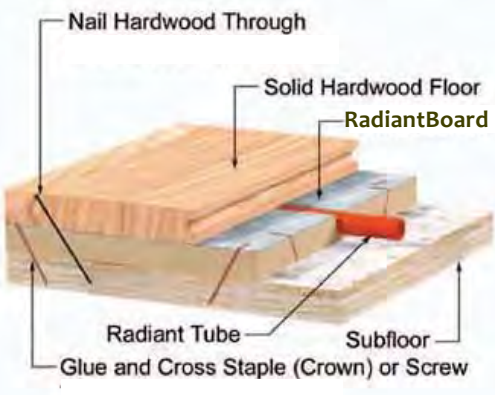

Illustration 20 – Traditional Hardwood Over RadiantBoard

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

1. In the selection of your floor, use woods known to be dimensionally stable. Rift sawn and quarter sawn are most desirable, plain or flat sawn are the least expensive and also the least stable, stay away from this type of wood flooring system with radiant floor heat. Use narrow (2") strips of wood flooring over radiant floors for the most stable floor. The adage in the wood floor industry is "the wider the board, the wider the gap."
2. When delivered your floor should be kiln dried and have moisture content between 6¬ 9% or whatever the manufacturer states is stable and correct.
3. The wood flooring shall be installed at the relative humidity recommended by the manufacturer for the climate involved. Acclimation is critical to the stability of the wood floor system, contact floor manufacturer for desired acclimation period. Not paying attention to this detail could cause cupping and checking no matter what heating system you select.
4. If installing your wood floors during the heating season, make sure the system has been running and the space has been conditioned long enough that temperature and humidity levels have stabilized before your floor is nailed and sealed.
5. Structure humidity shall be kept within the range specified by the flooring manufacturer.
6. Remember wood is hygroscopic and will act like a sponge accepting and rejecting moisture as the relative humidity changes, the more stable the humidity environment, ultimately the more stable your wood floor system will be.
7. It is extremely important that the installer of the wood floor knows which direction the strip flooring will be aligned to the tubing layout of the Thermalboard™ system so there are no conflicts. The Thermalboard™ should always run perpendicular to the direction of the strip flooring otherwise conflicts will definitely occur.
8. Hardwood floor joints should not be installed directly at the RadiantBoard joint.
9. Hardwood floor nails shall be long enough to penetrate both RadiantBoard and the subfloor.
10. Install strip flooring with mallet-driven nails and nails penetrating the RadiantBoard 1/2" into the subfloor. Use 15 gauge nails (21/2" with 3/4" floors) to penetrate the subfloor. A nailer such as the Senco # SFM40, with a tongue-and-groove attachment, such as #SFM40 TG, should be used.
11. Caution should be taken to avoid nailing tubing; a pressure test is good insurance.
12. Most installers forget about the turnarounds; it is different tubing direction than the straight boards. If you nail one tube, chances are you will get all of them. Note of caution, pay attention when your tubing changes direction before nailing.
13. Hardwood floors installed directly over RadiantBoard as with all radiant floor installations; a weather responsive control strategy should be used with the proper reset curve which will gradually adjust water temperature going to the RadiantBoard and under your wood floor. This will reduce the likelihood of warping, gapping or checking problems. It also prevents excessive surface temperature which will cause damage to your floor.
14. Precaution for expansion noise should be taken. Defer to your installer for his recommendation.
15. Lastly follow the National Wood Flooring Association guidelines for installing wood floors over radiant heat. For further information you can visit their website at http://www.woodfloors.org/consumer/

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OTHER APPLICATION OPTIONS FOR WOOD FLOORS OVER RADIANTBOARD

RadiantBoard may be used under traditional strip wood flooring in several ways. A conventional nailed and hardwood-type system may be used directly over RadiantBoard, with nailing long enough to penetrate sub-floor and with controls as described in the previ¬ous section. There are many advantages to this method; they include quick response, lower cost of installation, higher heat output due to lower resistance of flooring, and a quality con¬trol that brings the flooring through temperature changes gradually and accurately, which increases comfort.

Optional floating methods for use with traditional strip wood flooring

Two layers of ‘/2” plywood may be floated on top of the RadiantBoard and strip flooring nailed to it, as shown below, in a method recommended by the National Wood Flooring Association. Thismethod has the advantage of allowing the wood flooring system to float independentlyfrom the RadiantBoard, but has significant disadvantages in that the 1” extra thickness of wood limits the output of the system. For example, two layers of ‘/2” plywood with 3/4” of oak flooring have an R-value of about R-2.14 (see our R-value chart on page 8). This limits the output of the floor at 140°F water temperature to less than 20 BTU/square foot (see our chart on page 9). A careful heat loss analysis must be done to determine whether this method will produce enough heat. If not, another method should be chosen or provisions made for backup heat. A hydronic control strategy with a reset curve that gradually adjusts water temperature going to the RadiantBoard is recommended.

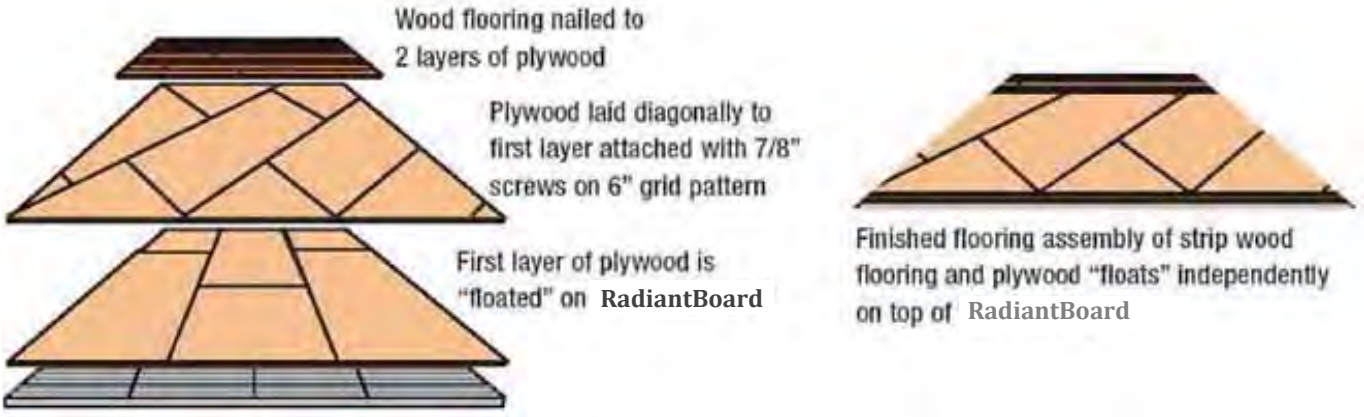

Illustration 21 – NWFA Double Plywood Floating Method

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

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

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

APPLICATION OF RADIANTBOARD TO WALLS OR CEILING

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

RadiantBoard wall and ceiling systems shall be installed as follows:

RadiantBoard shall be installed square to framing, screwed to studs, rafters and/or blocking with as many joints as possible screwed securely to the framing. RadiantBoard shall be secured to 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. Short lengths of tubing (6") shall be temporarily placed in the grooves lapping 3" into each board to help align the grooves of the boards during installation. Once all boards are installed, all grooves shall be cleaned out with a vacuum just prior to tubing installation. Tubing shall be snapped into the groove and routed to manifold according to the plan. A 1" minimum clearance from tubing shall be maintained for all nailing. Add steel plate protectors over tubing where tubing crosses studs. Water temperatures shall not exceed 120F° supply water temperatures when RadiantBoard is installed under plaster or sheetrock.

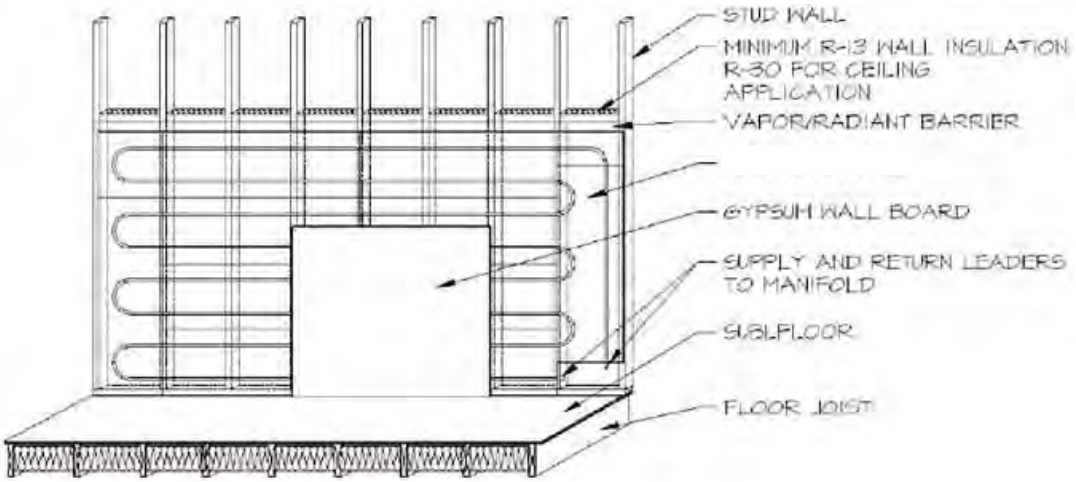

Illustration 22 – RadiantBoard Wall Installation

Required BTU / h / ft2	Supply Temperature °F	Surface Temperature
60	186	98
55	177	95
50	168	93
45	158	91
40	149	88
35	140	85
30	130	83
25	121	81
20	112	78
15	102	76
10	90	73
5	86	70

Table 3 - RadiantBoard In-Wall BTU Output

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INSTALLING RADIANTBOARD OVER CONCRETE

In the past, RadiantBoard was promoted for application over raised floors.

RadiantBoard is also a great slab-topping product for use over new structural slabs or existing slabs encountered in remodel projects. For concrete slab application apply ⅝" RadiantBoard over new or existing concrete slab with either a floating system or direct adhesion. **A primary consideration is determination of the current and estimated future moisture conditions of the slab.**

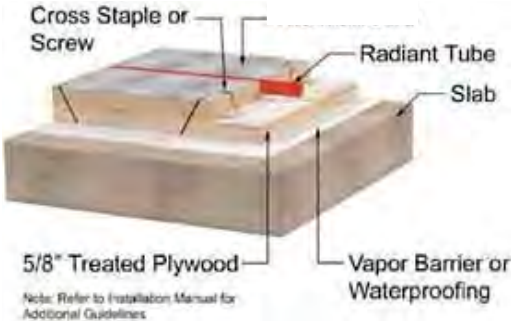

Illustration 23 – Concrete Floating Installation

RadiantBoard and any sub-floor **must remain dry.** Thus, the ideal installation detail includes a vapor barrier, vapor barrier paint or water proofing membrane, plywood and RadiantBoard. This floating system avoids penetration of the vapor barrier or water proofing membrane (Schluter-DITRA). Direct adhesion to the slab with construction adhesive may be used when no water vapor or moisture is present and nailed hardwood will not be employed as finished flooring good. If moisture is present or anticipated, water proofing must be employed with a membrane such as (Schluter-DITRA) or adhesive mastic (www.bostik.com).

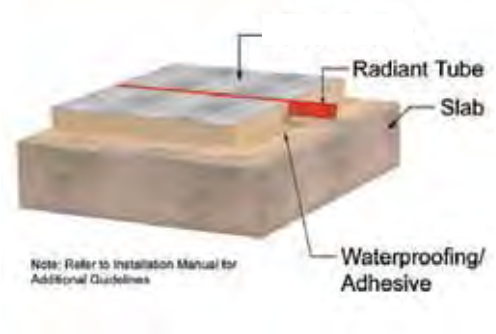

Illustration 24 – Concrete Direct Adhesion

If vapor or moisture are present use Bostik UltraSeal for direct adhesion and waterproofing.

Assembly Profile: ¾"

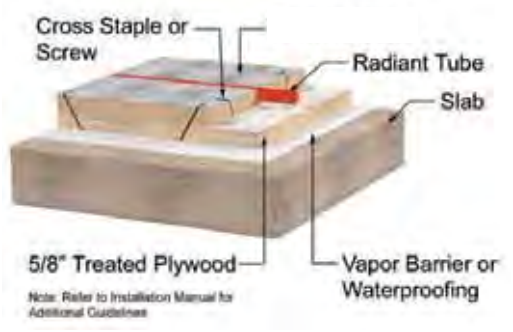

Illustration 25 – Concrete Floating with Insulation

Adhere ⅜" Barrier insulation (R2) or 1" Ultraboard (R5) foam insulation to slab prior to applying plywood.

Assembly Profile: 1⅝"-2¼"

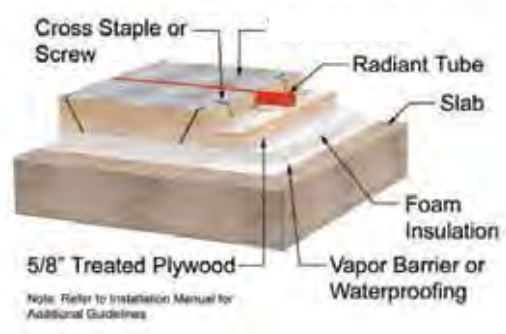

Illustration 26 – Concrete Floating

Float exterior grade ⅝" plywood or OSB over vapor or waterproofing membrane.

Assembly Profile: 1¼"

CAUTIONS AND LIMITATIONS OF USE

General Caution

As with any radiant heating system, do not install RadiantBoard without an accurate room-by-room heat loss analysis for the structure to be heated that takes into account the resistance and heat transfer of the actual floor coverings. If RadiantBoard 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 Application Guide. This guide does not purport to address all relevant issues; it assumes knowledge of good practice both in hydronics and construction methods. Installers should always consult all relevant local, regional and national codes, and adhere to good construction practice. RadiantBoard should only be installed by knowledgeable, qualified installers. RadiantBoard installations frequently require the coordination of trades. These are, most typically, mechanical and flooring trades. Any issues regarding this coordination should be worked out in advance. Failure to follow the instructions of this guide, failure to adhere to relevant local, regional and national codes, failure to coordinate trades, and failure to follow good construction practice may cause an unsatisfactory result. See also "Limitations of Use". The limita¬tions and instructions of use for PE-RT 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

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

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Hydronic Alternatives™

PEOC Plus pipe Specifications

Applications:

Pipes for hot and cold water non-potable systems, e.g.:

- radiator connections
- heating / cooling applications

Pipe Dimensions and Tolerances

Outside Diameter (O.D.), Inside Diameter (I.D.) and Wall Thickness (W.T.)
SDR according to ASTM Standard F876-04

Tube	O.D	W.T	I.D.	Weight	Water Content
	Nominal dimension				
	in inch			in lb/ft	in gal/ft
5/16”	0.430	0.064	0.302	0.030	0.0037
3/8”	0.500	0.070	0.360	0.039	0.0053
1/2”	0.625	0.070	0.485	0.050	0.0096
5/8”	0.750	0.083	0.584	0.071	0.0139
3/4”	0.875	0.097	0.681	0.097	0.0189
1”	1.125	0.125	0.875	0.160	0.0312
	in mm			kg/m	in l/m
5/16”	10.92	1.63	7.66	0.045	0.0461
3/8”	12.70	1.78	9.14	0.057	0.0656
1/2”	15.88	1.78	12.32	0.074	0.1192
5/8”	19.05	2.11	14.83	0.106	0.1727
3/4”	22.23	2.46	17.31	0.144	0.2353
1”	28.58	3.18	22.22	0.239	0.3878

Material

PE-RT Polyethylene Resin is an ethylene / octene-1 copolymer produced in a proprietary solution process. It has a unique molecular structure with a controlled side chain distribution, which provides excellent stress crack resistance properties combined with outstanding Long Term Hydrostatic Strength.
PE RT conforms to ASTM F-2623

Maximum Operating Temperature and Pressure:

200°F at 80 psi
180°F at 100 psi
86°F at 160 psi

Oxygen Diffusion Standard: DIN 4726

Chemical Tubing Resistance Chart:

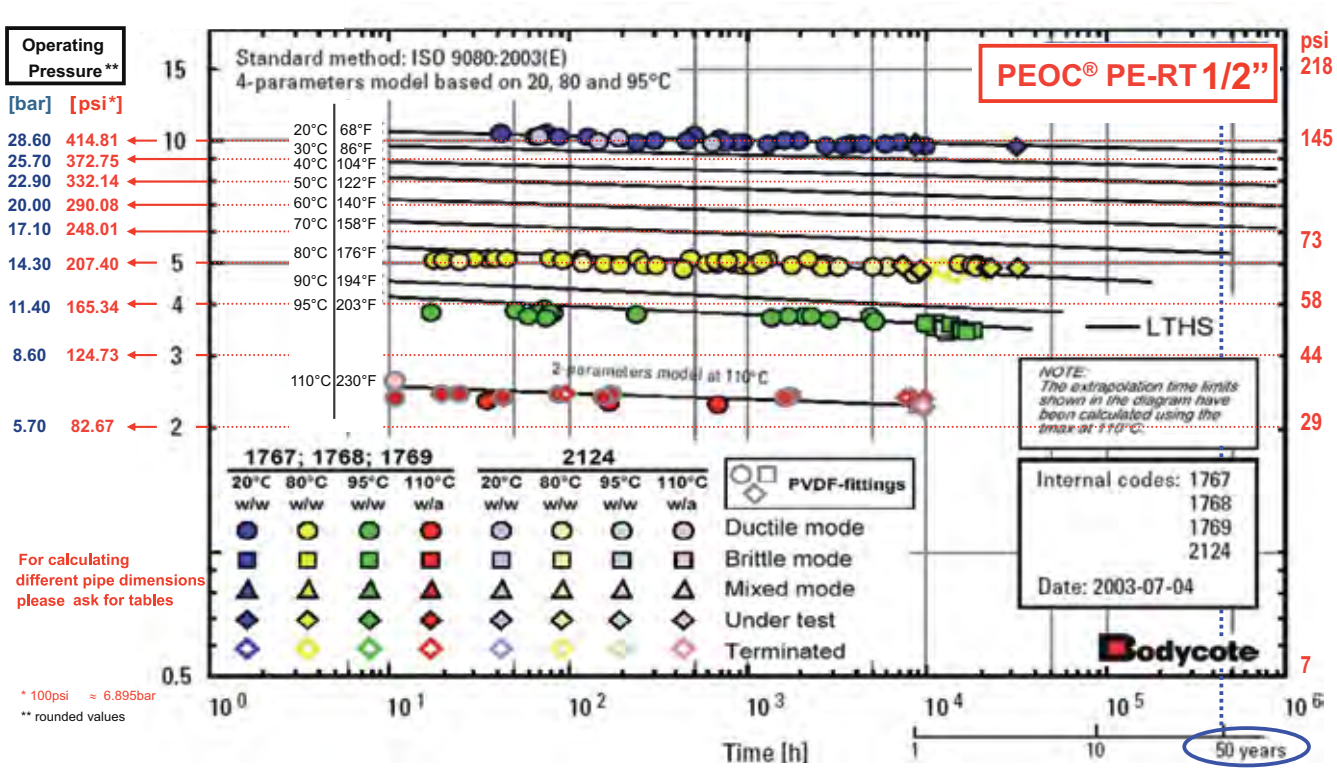
DIN 8075 Standard

Warranty:

30 year replacement warranty covering manufacturer related tubing defect. 10 year pre-paid liability insurance policy covering $ 5,000,000.00 of repair due to consequential damage, single occurrence, related to manufacturers defect.

Continuous Pipe Dimension Production Testing

By laser sensors and ultra sound.
Regular manual testing during the pipe extrusion and coiling procedure.



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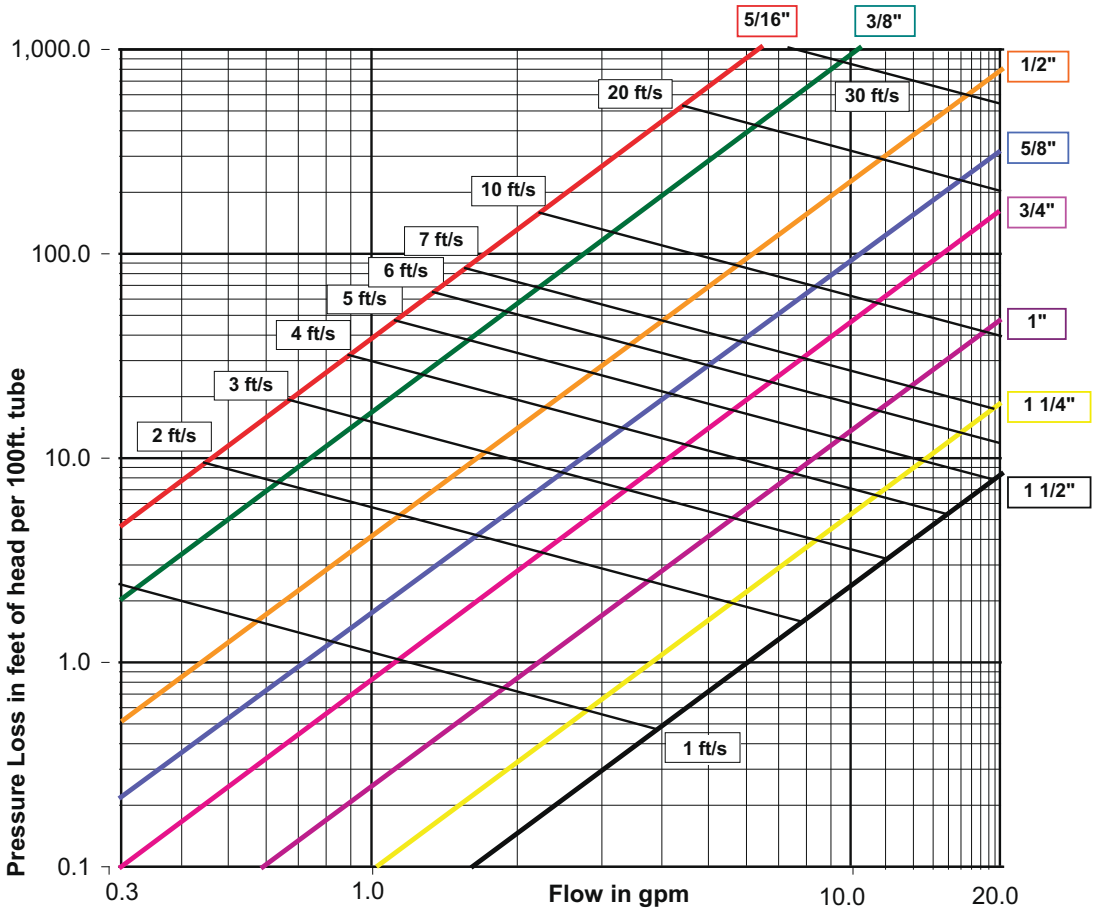
Technical Specifications

Physical Properties	Unit	Test Method	Values
Density	lb/ft³	ASTM D-792	58.745
Thermal Conductivity at 140°F	Btu/(h.ft².°F/in	DIN 52612-1	2.7734
Thermal Expansion Coefficient °F (68°F to 158°F)		DIN 5375	0.0000394
Oxygen Diffusion Rate with O2 Barrier at 100°F	mg/in² ×24h	DIN 4726	better than 0.0002
Oxygen Diffusion Rate with O2 Barrier at 180°F	mg/in² ×24h	DIN 4726	better than 0.00004
Mechanical Properties	**Unit**	**Test Method**	**Values**
Tensile Yield	psi	ISO 527-2	2,988
Ultimate Tensile	psi	ISO 527-2	5,221
Percentage of Elongation	%	ISO 527-2	760
Modulus of Elasticity	psi	ISO 178	138,511
PE RT conforms to ASTM F-2623			

Pressure Drop Chart PEOC-PLUS Pipes



Combustibility

Polyethylene resins will burn when supplied with adequate amounts of heat and oxygen.
They should be handled and stored away from contact with direct flames and/or other ignition sources. In burning, polyethylene resins contribute high heat and may generate a dense black smoke. Fires can be extinguished by conventional means with water fog preferred. In enclosed areas, fire fighters should be provided with self-contained breathing apparatus.

Recycling

Polyethylene resins can be recycled. Production rejects and/or conversion waste should preferably be recycled instead of being disposed of.

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