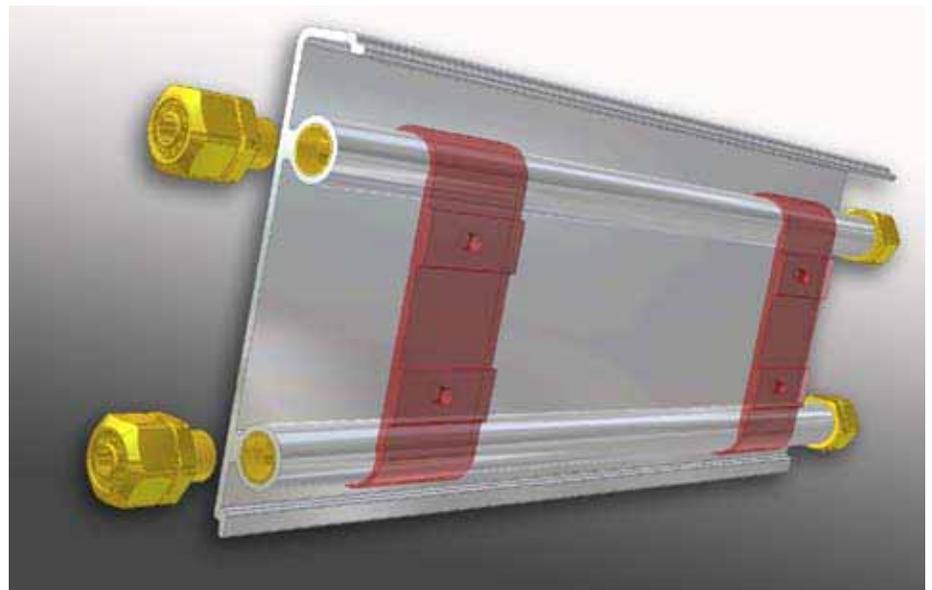


RadiantPanel Baseboard Installation Guide

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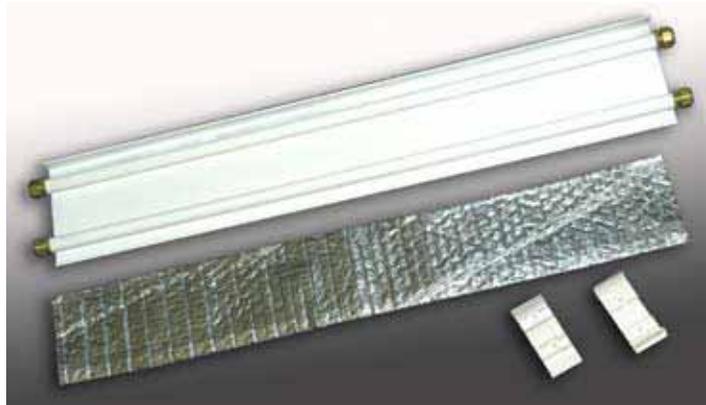


Introduction

RadiantPanel Baseboard is one of the most advanced concepts in perimeter hot water heating. Extending only one inch from the wall, **RadiantPanel** gives the appearance of typical mop board style wood molding.

Traditional heating systems have always limited one's freedom of choice in creating the home environment, requiring a sacrifice in comfort, efficiency, and design. With superior comfort, energy efficiency and complete freedom of interior design, the **RadiantPanel Baseboard™** system opens up a world of new possibilities.

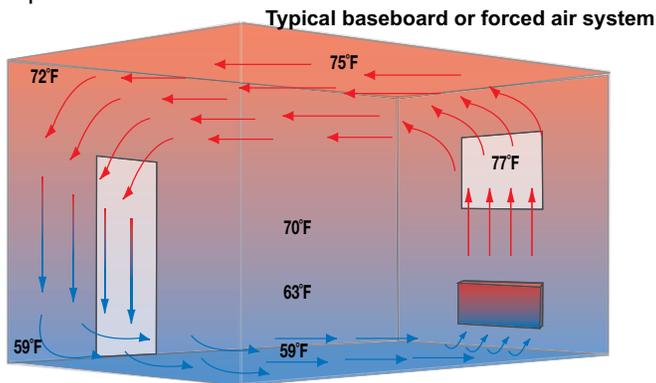
RadiantPanel Baseboard eliminates the localized heating provided from conventional baseboard, radiator, and forced air systems by using what is called the "Heat Enclosure Principle".



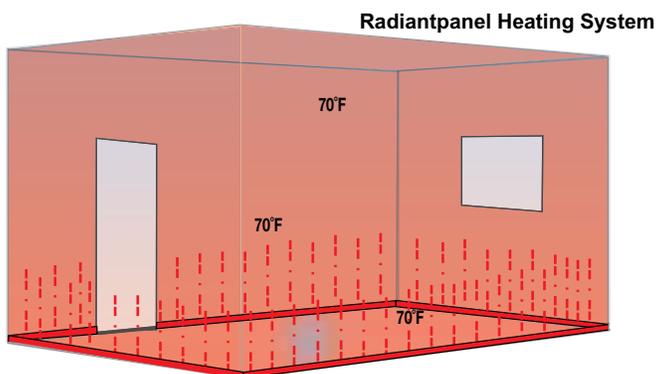
RadiantPanel is a copper lined aluminum radiant heating panel.

Lengths are available from 1 1/2' through 8 1/2' in 6" increments. Each panel comes complete with brass fittings designed to receive 3/8" PERT tubing only, mounting brackets and reflective insulation foil.

RadiantPanel is available in a standard white (RAL 9010) powdered-coated finish



Warming a room from its perimeter, **RadiantPanel Baseboard** maintains a consistent room temperature throughout, minimizing air turbulence (drafts) and dust circulation, while protecting the air humidity. In addition, radiant heat by nature is energy efficient because it delivers higher levels of comfort at lower thermostat settings.



With these advantages the expensive and wasted "Heat Blanket" that accumulates at the ceiling and the "Dried Out" stuffy air associated with traditional heating systems are greatly reduced allowing for an altogether higher comfort level, improved energy conservation and a healthier living environment. Optional manifold and control packages offer room by room zoning, weather responsive operation and the ability to customize a heating system to fit everyone's unique needs

Technical Data

Material:	Copper lined aluminum
Fittings:	Brass
Max operating temp:	180°F
Max. operating pressure:	50 PSI
Weight per foot:	1.34 lbs
Water content per foot:	.018 gal
Height:	5.14"
Depth (front to back):	0.925"

Design Guidelines

Step 1: Determining you're Heating Requirements

The initial step in your heating system design is to determine the individual area heating requirements. Our in-house sales engineers and local representatives can assist you with your entire system design. This will assure you that the maximum comfort levels and energy savings potential of your specific system are achieved. Conventional heat loss calculations (e.g. I=B=R) **should not be utilized** for a radiant heating design. If they are used then the result will be an oversized system. An ASHRAE or Manual J heat loss calculation or equivalent is the only proper way to design a modern heating system. Appropriate U or R values and the closest air exchange rate should be selected. After these calculations have been performed, then the system can be laid out. A system should always be designed for the lowest possible water temperature necessary to offset the heat loss. The more baseboards you install, the lower the water temperature your system will require. This will provide maximum energy savings and comfort levels. As a rule you save 1% of fuel for every 3 degrees you lower the delivery water temperature to your heating system

Step 2: Required Amount of Baseboard

The heat loss of any given area must be replaced with the heat output from the baseboard radiation. Table A shows the BTU/hour output for **RadiantPanel Baseboard** at various average water temperatures.

Table B shows the correct **RadiantPanel** sizes for walls from

Average Water Temperature F	BTU / hr @ .07 GPM Flow Rate
200	245
190	225
180	205
170	176
160	151
150	115
140	104
130	92
120	72

2'6" through 18' in length. As a rule of thumb, leave at least 5" from the ends, corners and 2" between joining panels for the tubing connections. These spaces will be covered using our 12" or 60" snap on cover plates.

(E.g. a 12' wall would require 10' 6" of **RadiantPanel Baseboard** 1 - 5' panel, 1 - 5' 6" panel, 2 - end caps, and 3 - 12" snap-on covers.)

$$\frac{\text{Room Heat Loss}}{\text{BTU Output (@ } ^\circ\text{F)}} = \text{Necessary Footage}$$

After the total numbers of panels have been established, the following components can be determined:

- Manifold Size:

Dependent upon zoning requirements, larger rooms may require more than one manifold loop.

***Note** - In general, no more than 60 feet of baseboard, with 60 feet of supply and 60 feet of return PERT tubing should be run for any single loop.

- 3/8" PERT Tubing:

3/8" PE RT is the only material for all supply and return lines. We recommend using only 3/8 PE RT, Pex-A or Pex-C type tubing. These specially formulated Polyethylene heating pipes perform best for high temperature systems with the longest service life. The size of the tube must conform to dimensional tolerances outlined in ASTM F-876. Tubing manufactured to a different standard will not work properly with the fitting included in the RadiantPanel Baseboard and the probability of leaks is definite. We will not honor claims for tubing made outside of this standard.

- Cover Plates:

You will need a cover plate at every end cap, both sides of a corner piece, and at every joint between 2 panels. We offer 12" snap-on cover plates as a standard, and we also have a 60" cover plate which can be used as a blank baseboard run, or custom cut for spaces longer than 12". When using the 60" cover plates the # 2021 will be required to fasten the cover plate to the wall. It is suggested that two # 2021 wall fasteners per 60" cover plate be utilized for proper attachment to the wall.

- End Caps and Corners:

We have left and right hand end caps as well as inside and outside 90 degree corner trims. Some contractor will opt to use 12" cover plates and the # 2021 wall fasteners in lieu of end caps. This approach is called the wall end application. This provides a continuous metal finish to the installation.

For other angles or corners, one can custom field assemble the angled joint using either the 12" or 60" snap-on covers.

The amount of end caps and corner trims will depend on your room layout.

- Zone valves:

If desired individual room control, can be equaled to the amount of manifold outlets. Typically zone valve control boxes are available in 5 or 10 zone modules. You will need a thermostat for each zone you plan to have. (Note: A thermostat can generally control up to 3 powerheads as 1 zone)

- Circulator Pumps:

Generally you only need 1 circulator for your **RadiantPanel** system. It should be sized based on the required flow rate and pressure drop of your system. (See Step 4). There are many ways of piping a hydronic heating system, including using separate circulator for each zone.

Though we feel you only need 1 circulator, there is no right or wrong in this area. Please consult your local heating professional for his opinion.

Table B

Length of Wall	Panel Size
32" - 37"	1 1/2'
38" - 43"	2'
44" - 49"	2 1/2'
50" - 55"	3'
56" - 61"	3 1/2'
62" - 67"	4'
68" - 73"	4 1/2'
74" - 79"	5'
80" - 85"	5 1/2'
86" - 91"	6'
92" - 97"	6 1/2'
98" - 103"	7'
104" - 109"	7 1/2'
110" - 115"	8'
116" - 125"	8 1/2'
126" - 132"	4 1/2' & 4 1/2'
133" - 137"	4 1/2' & 5'
138" - 145"	5' & 5'
146" - 151"	5' & 5 1/2'
152" - 157"	5 1/2' & 5 1/2'
158" - 163"	5 1/2' & 6'
164" - 169"	6' & 6'
170" - 175"	6' & 6 1/2'
176" - 181"	6 1/2' & 6 1/2'
182" - 187"	6 1/2' & 7'
188" - 193"	7' & 7'
194" - 199"	7' & 7 1/2'
200" - 205"	7 1/2' & 7 1/2'
206" - 211"	7 1/2' & 8'
212" - 217"	8' & 8'

Table C

Flow (GPM)	3/8" PERT (per foot)	RadiantPanel (per foot)	Connections (per panel)
.1	.0024	.0022	.0142
.2	.0076	.0067	.0429
.3	.0159	.0128	.0822
.4	.0272	.0203	.1303
.5	.0394	.0290	.1862
.6	.0550	.0388	.2492
.7	.0734	.0496	.3189
.8	.0917	.0614	.3949
.9	.1138	.0742	.4768
1.0	.1387	.0878	.5644

$$FR (GPM) = \frac{BTU / HR Output}{5000}$$

Next, using the largest single zone the pressure drop resistance must be calculated. This consists of the internal resistance of the **RadiantPanel Baseboard** and PERT tubing, along with the connection resistance of the **RadiantPanel** fittings. Utilizing the flow rate formula above, calculate the necessary GPM for this zone.

Table C shows the pressure drops in feet of head (FOH) for flow rates of 0.1 - 2.0 GPM. Reading across from the calculated required GPM will give the pressure drop for 3/8" PERT tubing (per ft.), **RadiantPanel Baseboard** (per ft.), and connection resistance of **RadiantPanel** fittings (per panel). The total pressure drop can now be calculated.

Step 4: Flow Rates and Pressure Drop

Typically, the maximum **RadiantPanel** zone (consisting of 60 feet of baseboard and 120 feet of 3/8" PERT pipe) requires 0.7 GPM of flow at 15.3 feet of head. A Grundfos UP15-42F circulator or equivalent will handle most normal requirements. You may also calculate the required flow and pressure drop (feet of head) for your system as follows:

First, calculate the system's flow rate by dividing the total BTU/hr output of your baseboard system by 512.50. A design delta T of 10°F is considered optimum.

$$PDR = (length\ 3/8" \text{ PERT} \times PD) + (length\ \text{RadiantPanel} \times PD) + (\# \text{ of panels} \times PD) \text{ FOH}$$

In order to properly size the circulator, choose one that can produce the total system flow that is needed while maintaining the highest single loop's head pressure or PDR. It's ok to size the circulator slightly above your highest PDR, but over-sizing can lead to problems in your system including noise, metal fatigue, and the unnecessary consumption of electricity.

System Control

Distribution Manifold

A distribution manifold provides the flexibility necessary to design and tailor the optimum heating system for any given project. Manifolds incorporate individual zones, shut offs, balancing valves, air vents, and purge valve into solid brass supply and return headers. Optional zone valves and room thermostats allow for individual zone control (often on a room by room basis) and are easily installed or removed at any time without disassembly of the system.

Mixing Valves and Reset Controls

We strongly recommend using a mixing valve reset control with constant circulation for maximum comfort and the best economy of operation. A mixing valve is the only way to accurately deliver the precise water temperature to the **RadiantPanel Baseboard** system. This minimizes the expansion and contraction that occurs with a conventional demand circulation hot water system.

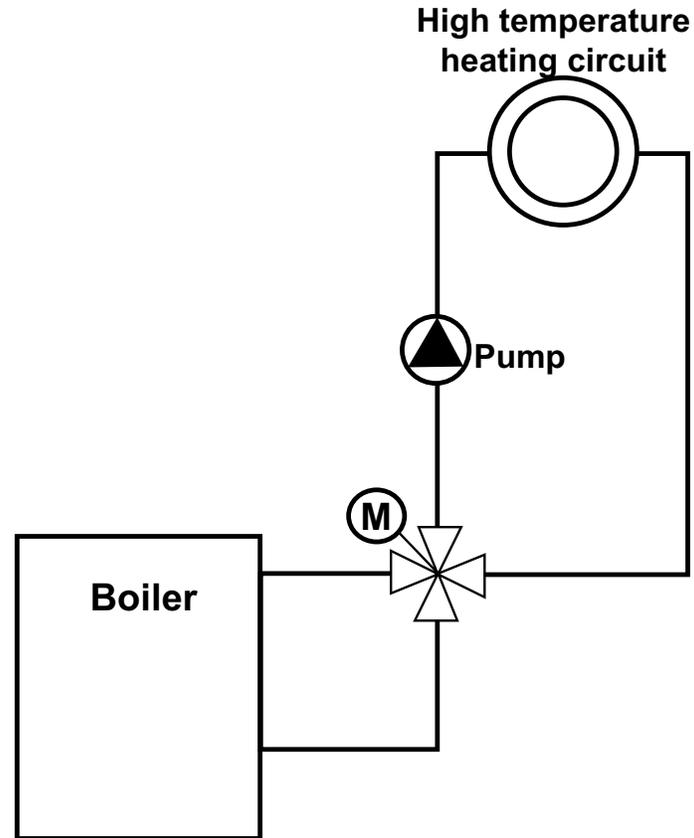
There are two different kinds of mixing valve reset controls available, indoor and outdoor. With an indoor reset control only (in most cases this is a non-electric device), you will set the desired room temperature, and the control will adjust the delivery water temperature at the mixing valve, so the system maintains the proper room temperature. This type of control is limited to small areas.

A mixing valve reset control can be either electronic or non-electric. An electronic outdoor reset control has a sensor that mounts on the exterior of the house to record outdoor air temperature. The electronics then regulate the temperature of the water delivered to the **RadiantPanel Baseboard** by adjusting the mixing valve. The introduction of an interior room sensor in the worst case room completes this type of system. It is by far the best way to manage a heating system of any fashion. No peaks and valleys in your room temperature set points. Consistent temperatures day after day, with a reduced energy bills to boot.

This control strategy will suit our **RadiantPanels** as well as all other forms of high temperature radiation. So mixing and matching our products with others is not out of the question.

We do not recommend demand circulation type systems for RadiantPanel Baseboard! Expansion problems and associated noise problems can be a nuisance.

We highly recommend the above mentioned and below detailed control strategy.



4-way mixing valve layout for use with mixing valve reset controls.

Hydronic Facts

To calculate the required flow rate in gpm:

- Multiply these three things together
 - 8.33 (weight of 1 gal. water)
 - 60 (minutes per hour)
 - The temperature drop across the system (usually 20°)
- Divide the BTU/hr. load of the system (heatloss) by that.

Example: $\frac{100,000 \text{ BTU/hr}}{8.33 \times 60 \times 20} = 10 \text{ gpm}$

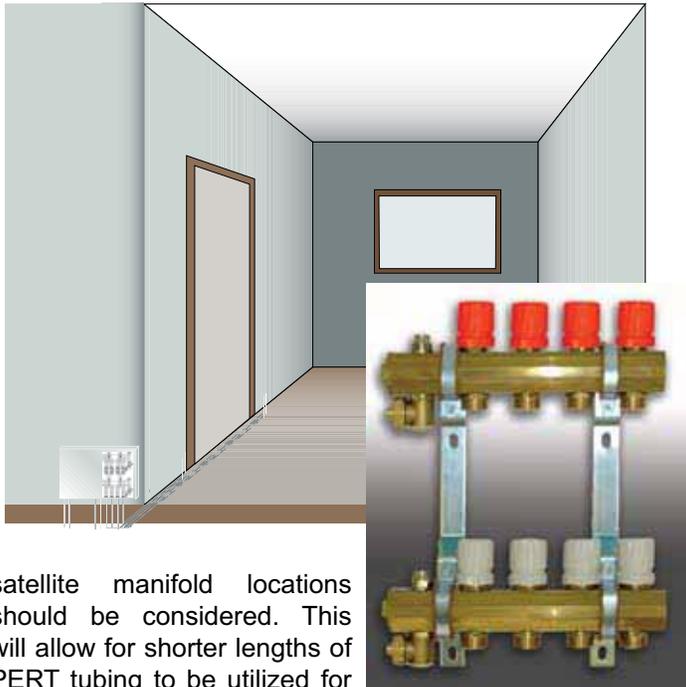
Maximum Trouble Free, design flow rates for hot water heating

Copper tube		Steel pipe	
Ø	gpm	Ø	gpm
1/2"	1.5	1/2"	2
3/4"	4	3/4"	4
1"	8	1"	8
1 1/4"	14	1 1/4"	16
1 1/2"	22	1 1/2"	25
2"	45	2"	50
2 1/2"	85	2 1/2"	80
3"	130	3"	140

Installation Guidelines

Step 1: Manifold Location

The distribution manifold should be located and installed first. Ideally this should be installed in the boiler or mechanical room. However, for larger installations, central and remote

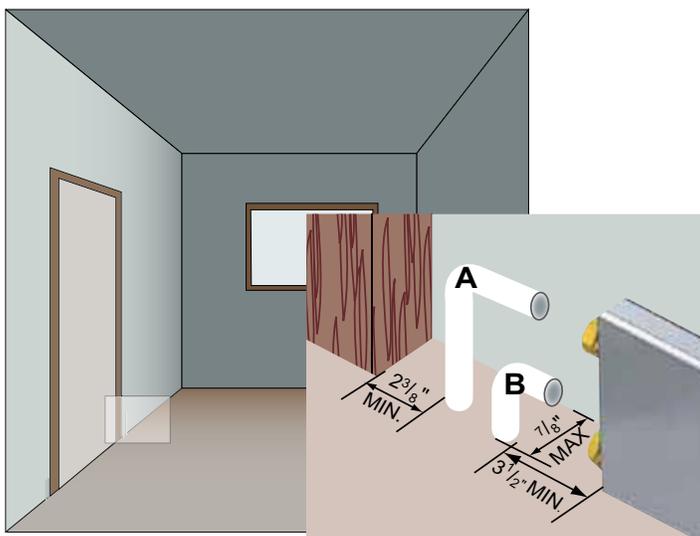


satellite manifold locations should be considered. This will allow for shorter lengths of PERT tubing to be utilized for the supply and return runs to each zone. This reduces the pressure drop of the circulator, and increases the overall integrity of the system.

Step 2: Rough in of PERT Tubing

A. Identify the supply and return points, as well as jumps at doorways or openings. In almost every case the top pipe "A" will be the supply and the bottom pipe "B" will be the return.

B. With a 9/16" bit, drill holes for the PERT tubing centered in the 1" opening of the product where the **RadiantPanel** will be mounted. Where the tubing exits the floor or wall, plastic pipe insulators/clips should be installed to prevent expansion noise at the exiting point. When connecting the PERT tubing to the **RadiantPanel** make sure to use bend



supports when changing direction of 90 degrees. (Note the measurements in picture "B" showing proper clearances to make an easy connection).

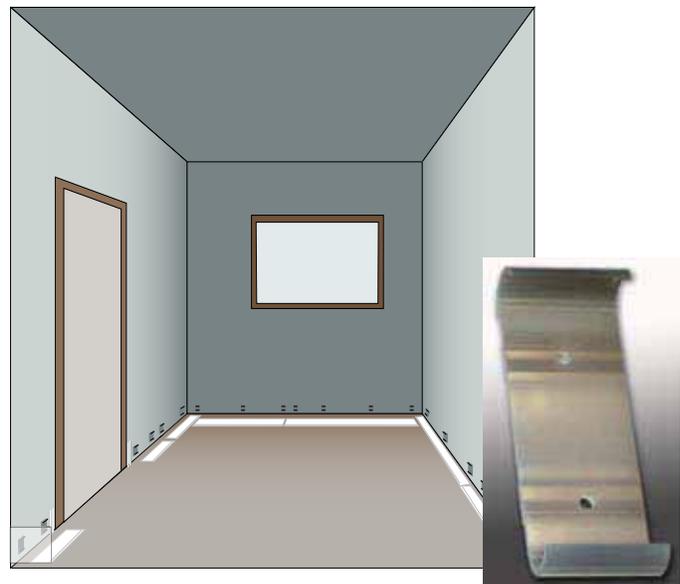
***Important- as PERT is roughed through the floor, sleeve or make allowances so the tubing does not rub against the wood. This will prevent expansion noise at the exiting point. Also Note-bend supports must be used at the supply and return connections when changing direction of 90 degrees.**

C. Run all pipe leaving approximately 12" coming up from the floor for connection to the **RadiantPanel**.

Step 3: Laying out and attaching the panels

Lay the **RadiantPanel Baseboard** out on the floor according to the plan. A pre-cut piece of reflective insulation is included with each panel and should be stapled in place on the wall where the **RadiantPanel Baseboard** is to be installed; some contractors will use the panel brackets as the fastening medium for the insulation.

Two mounting brackets minimum per panel are required and should be securely fastened into a stud near the end of each panel. For the proper mounting height, rest the panel

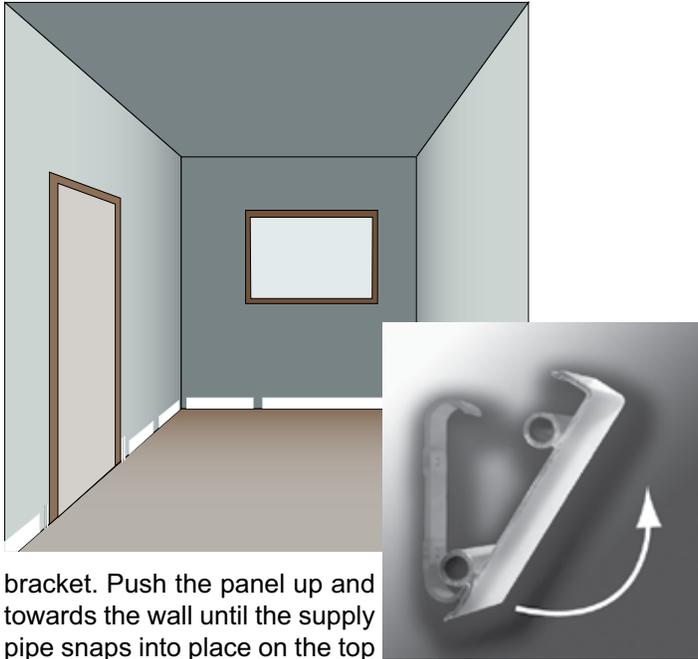


bracket on a 3/4" spacer or a separate panel bracket laid flat on the floor. If a panel is installed on a wall which is not plumb, it may be necessary to shim out the bracket so that the panel can move freely during the natural expansion and contraction of the heating system.

If the RadiantPanel rubs against sheetrock/gypsum wall board, plaster, or floor, expansion noise will occur.

Make the necessary precautions to shim the panel brackets for a plumb installation. If there is too much space between the wall and the **RadiantPanel**, one might consider installing a wood molding over the top of the product to hide these spaces. If this method is employed, a small bead of silicone should be introduced between the **RadiantPanel** and the wood molding to allow both products to move at their own rate.

Snap the **RadiantPanels** onto the panel brackets as shown. The return pipe will be placed into the bottom cradle of the

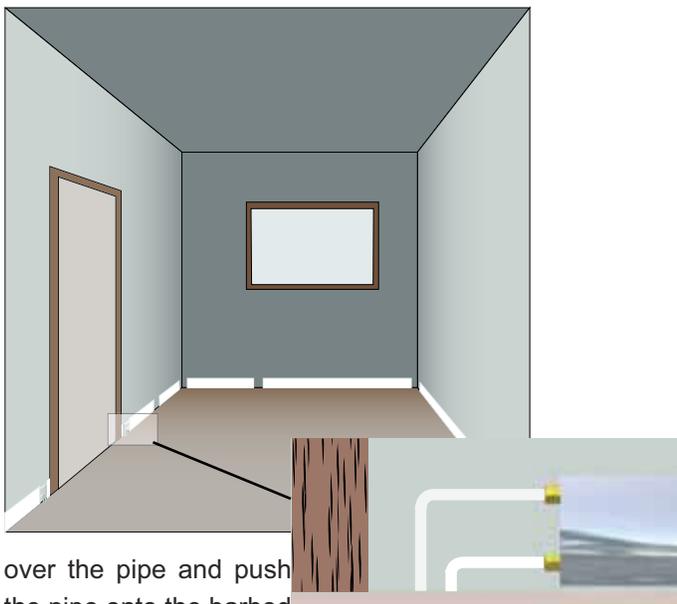


bracket. Push the panel up and towards the wall until the supply pipe snaps into place on the top portion of the bracket.

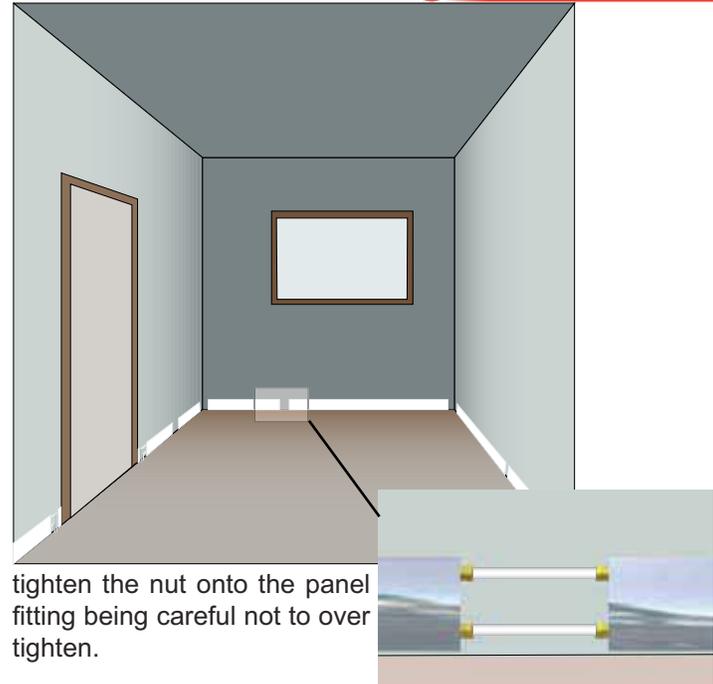
When properly installed the RadiantPanel Baseboard should not be in contact with the floor or rubbing against the wall at any point.

Step 4: Connecting the PERT

A. The PERT piping can be installed before the panels are mounted on the wall. It is much easier to make up the PERT connections on the floor, than in place. Remember that PERT is flexible, and though it may not look correct, once the panels are snapped in place, the PERT pipe will correct itself. To connect the PERT slide the nut and ferrule



over the pipe and push the pipe onto the barbed post of the panel fitting. Make sure that the pipe is properly seated on the post prior to tightening. Using two wrenches



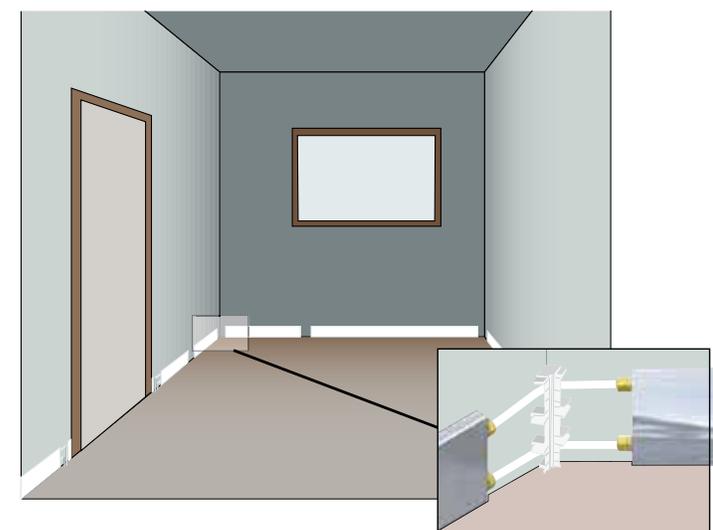
tighten the nut onto the panel fitting being careful not to over tighten.

B. When joining two or more panels on a single wall, measure and cut both lengths of pipe together to assure equal length and correct fit between panels. There should be a minimum of 2" - 5" of tubing between panels. Install the bottom tube first.

C. For inside and outside corners use the following procedures:

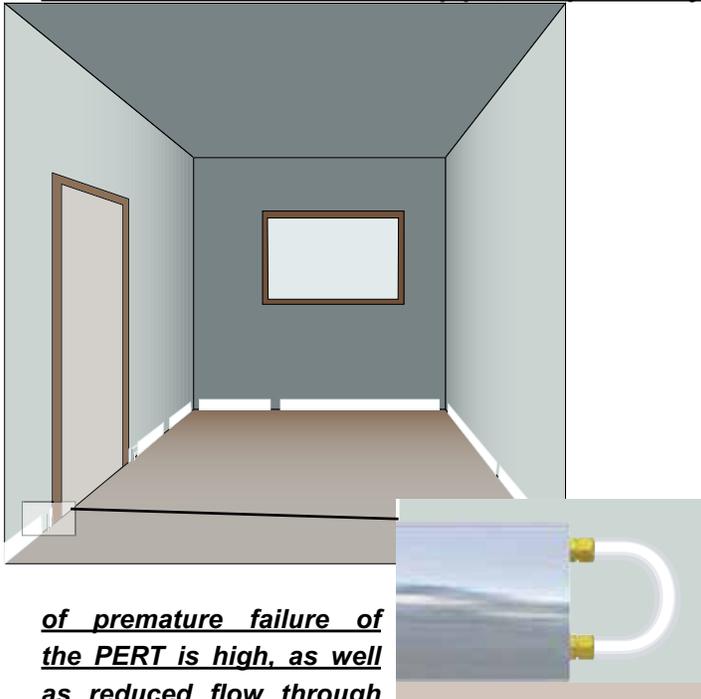
1. Cut an oversize piece of pipe and install the external tube bend support.
2. Hold pipe over the panel, mark and cut the ends, leaving a minimum of 4" between the panel and corner.
3. Cut a second piece of pipe the same size
4. Install the bottom piece first

D. At the end of each heating loop, form a "U" bend with



15" of PERT tubing. If you use less than 15" of PERT, the possibility of kinking the pipe is great.

If installed with a kink in the pipe, the probability



of premature failure of the PERT is high, as well as reduced flow through the product. When there is a crease on the inside curvature of the PERT, this is what the PERT pipe manufacturers call "The hinging effect". Over time, the product will expand and contract, and the point of the hinge is where the pipe will fail.

Taking the necessary precautions, connect one end to the supply and one end to the return. Form the "U" bend in your hands before installing.

***Note:** Once the system is operational, all fittings should be checked and re-tightened before any trim pieces are installed

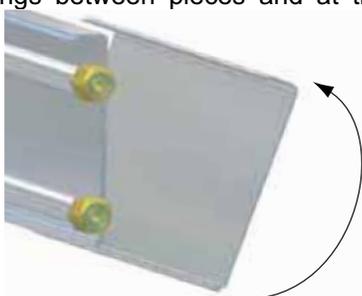
Step 5: Filling the System

Fill each zone/loop one at a time and bleed accordingly to make sure that all the air is removed. Re-check all fittings. Once you have thoroughly inspected the system and have determined that no leaks exist you can proceed to Step 6.

Step 6: Installing Trim Pieces

All end caps and corners can be installed at this time by fastening them to the wall. Cover plates will be used to conceal the pipe and fittings between pieces and at the ends of each panel. The cover plate will attach to a corner or end cap on one side and overlap the panel on the other side.

It will also act as a splice between two pieces of



panel on a wall. Before installing the cover plate, remove the protective layer on the double face adhesive tape that you will find on the end caps and corners. To mount the cover plates attach the bottom first by hooking it under the panel, end cap, and corners then swing the top upwards over the panel, snapping it into place. Press firmly against the adhesive tape to lock into place

Step 7: Enjoy

Congratulations of the installation of your new **RadiantPanel Baseboard** heating system. If you like you may now add any wood trim that may be needed to match the remaining baseboard / mop board in the room. (i.e.- cove / crown molding, 1/4 round, etc.)

You can now place your furniture around the room as you normally would. There is no need to leave a space in front of the panels as you would with a conventional convective type finned baseboard as we are not concerned with air movement. Maintenance of the panels should only involve cleaning the exterior of the panel with a mild solution as needed. (Do not use an abrasive type cleaner.)

We thank you for your purchase and are sure that you will enjoy the comfort and efficiency of your **RadiantPanel Baseboard** system for years to come. If you have any questions on the installation or operation of your system, please contact your local contractor, supplier or our office.

WARRANTY

RadiantPanel copper-lined hydronic baseboard carries a ten (10) years warranty against manufacturing defects in material or workmanship to the original consumer at the original installation address. During this warranty period Hydronic Alternatives, Inc. will repair or replace any panels shown to be defective at no cost to the owner for the new or repaired panel. All charges and costs for labor and freight are the obligation of the owner. Consequential damages arising out of, or in connection with, the use or performance of the product, or other indirect damages with respect to the loss of property, revenue, profits of the cost of removal, installation, or reinstallation are not covered under this warranty