Warmboard-R
installation guide

warmboard

Table of Contents

Setup and preparation

Hardwood and tile installation

Carpet, other flooring, temperature guide and R–values

10 important installation highlights

Read these highlights before proceeding. They will save you time and hassle in the long run.

1. We recommend the existing subfloor to be reasonably smooth and flat prior to the installation of Warmboard–R. Inspect for squeaks and refasten to joists if necessary.

2. The existing subfloor needs to be dry prior to the Warmboard–R installation. The Warmboard–R panels cannot be exposed to rain before or after installation.

3. Use the provided alignment pins when fastening the Warmboard–R panel.

4. ONLY use tubing approved by Warmboard, Inc. Use electrical nail plates to hold down tubing and remove them before the installation of finish floors. Silicone or other types of adhesives should not be used on tubing.

5. Tubing layouts for Warmboard–R can be quite flexible. Make field revisions as needed. Do not exceed 300 linear feet per loop.

6. Custom routes require a $1\frac{1}{2}$ horsepower router minimum. A Porter Cable router will interface with the template guides provided by Warmboard, Inc. Do not attempt a custom route without the proper template guide attached to the router (see page **6**).

7. The Warmboard–R heating system (and the entire radiant industry) requires the surface temperature of the finished floors not to exceed 85ºF.

8. When Warmboard–R is being installed over a crawlspace or existing subfloor, a minimum of R-19 insulation is required underneath the panels to prevent downward heat loss.

9. Review the installation manual before installing finish floors

10. Call us if you have any questions: **1.877.338.5493**

CAUTION!
Warmboard–R panels must **NOT** be exposed to water or excess moisture.

Approved tubing list

These are the tubing types/brands approved for use with Warmboard products.

Select ONLY from the tubing listed below. This will ensure a silent interface between the pex tubing and the aluminum groove. Installing other types of tubing may create a ticking noise as the tubing expands during operation. This noise is created by the outer layer of the EVOH barrier rubbing against the aluminum.

Warmboard Inc. can also supply tubing and manifolds for your project. Ask your Project Manager for details.

Pex Aluminum Pex tubing, 1/2" ID

- AIM: Pex AL Pex
- Allied Pipe Systems: Pex AL Pex
- Aqua Therm: Pex AL Pex
- ComfortPro: Pex AL Pex
- EHT (Efficient Heating Technology): Pex AL Pex
- Everhot: Pex AL Pex
- Excel: Pex AL Pex
- Henco: Pex AL Pex
- Hydro-flex: Pex AL Pex
- HYDRONX: Pex AL Pex
- Inferno: Pex AL Pex
- Infloor Heating Systems: Pex AL Pex
- Mr. Pex: Pex AL Pex
- RHT: Pex AL Pex
- Rifeng: Pex AL Pex
- Roth: Pex AL Pex
- Uponor: Multi-Layer composite tubing (MLC) Pex AL Pex
- Watts: Pex AL Pex
- Weil-McLain: Pex AL Pex
- WSD (Willow Springs Distributing) Pex AL Pex
- Zurn Alumicor: Pex AL Pex

Standard Barrier Pex tubing, 1/2" ID

- Mr. Pex
- Rehau Raupex Oxygen barrier manufactured after 3/8/11-date printed on tubing
- ThermaPEX (LK PEX)
- Uponor Wirsbo hePEX
- ViegaPEX Barrier
- Watts RadiantPEX+

PERT tubing, 1/2" ID

- Oil Creek Plastics: HEATFLEX pipe
- Roth: X-PERT S5, 5 layer
- Watts: RadiantPERT

NOTE:
Use nail plates to secure tubing in the channels. Remove plates before installation of finish floors.

CAUTION!
Viega Fostapex is not approved, the diameter is too large for the Warmboard groove.

DO NOT USE silicone or other adhesives in the tubing channels.

Necessary tools

Installation kit includes
(supplied with each order)

- 3 Custom routing templates/guides (wood)
- 1 Router bit, 5/8"
- 2 Alignment pins
- 1 Porter Cable template guide
- 1 Porter Cable guide lock nut

Additional materials and tools
(for on-site use)

- Porter Cable router, 1½ horsepower minimum required
- Electrician nailing plates
- Heavy roller (typically a linoleum roller)
- Warmboard approved tubing
- Shop vacuum
- Drill motor with a 1¼" drill bit
- Pex tubing cutter
- Felt tip marking pen
- Warmboard panel and tubing plans
- Tubing un-coiler
- 4" grinder or dremel

Warmboard, Inc. can supply tubing, manifolds and nail plates at very competitive prices. Ask your Project Manager for details.

Choosing the correct router

FIRST AND ALWAYS

Know that not all Porter Cable sub-bases will interface properly with the Warmboard supplied Porter Cable metal template guides.

- The Porter Cable router photo on the left has the correct sub-base for our supplied metal template guides.
- The center photo is an example of a Porter Cable router with the correct sub-base and the supplied metal template guide installed.

CAUTION!

The image below shows an example of a Porter Cable router that has a sub-base which **DOES NOT** interface with the our supplied template guide. This can be corrected by purchasing a Porter Cable sub-base as shown in the packaging below. This accessory only fits on some Porter Cable routers.

A minimum 1½ horsepower router is required. The size of the metal template guide is 1" OD, designed for Porter Cable routers and accessories only.

Porter Cable item number 42186
Router Sub-base
Standard center hole
1⅛" router #100, #690, #691 & #693

Custom routing

Check list

- Review all the tubing layout plans. Using a felt tip marker and the provided wood templates, mark all areas on the Warmboard–R panel that will require custom routing.
- Prepare router with router bit, template guide and template guide lock nut.

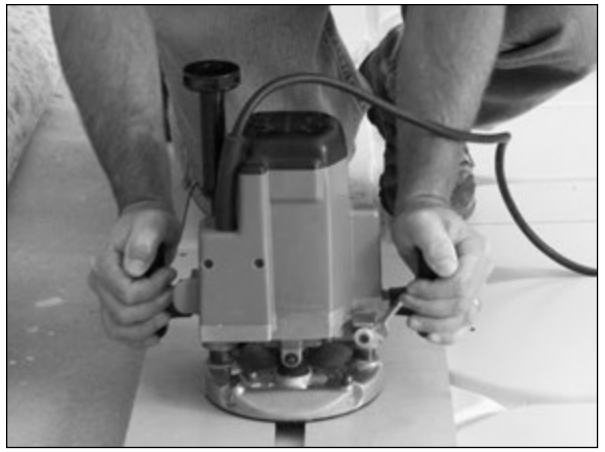
The Porter Cable router is not provided. A minimum 1½ horsepower is required.

Procedure

- Place the appropriate custom routing template over the area to be routed
- Fasten with 3 screws to secure the wooden template in position
- Ensure that the router bit and metal template guide are properly installed, then proceed with the router
- When the route is complete, remove the template guide and use 4" grinder or deburring tool to remove aluminum burrs to ensure that entire area is smooth in preparation for tubing installation

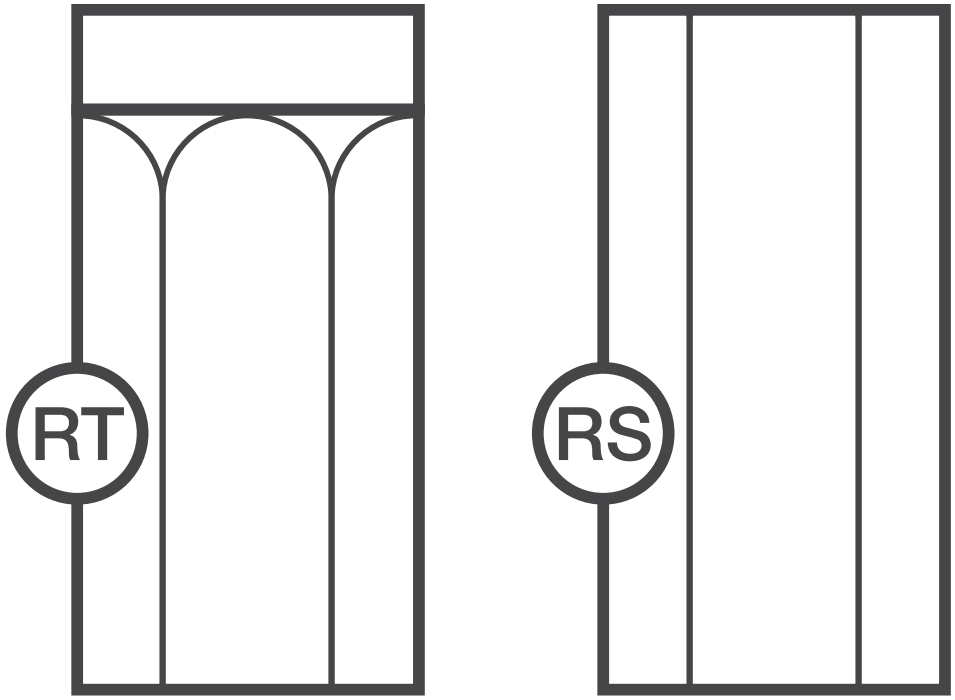
Visit warmboard.com/videos for further instructions.

⅝" Router Bit Template Guide GuideLock Nut



Panel types

There 2 panel types of Warmboard–R panels. Each panel measures $23\frac{7}{8}$"W x $47\frac{7}{8}$"L x $\frac{13}{16}$"H.
Panels are made from OSB and are square-edged. Filler panels are also available.



Turn Panel *Straight Panel*

NOTE Read all instructions before beginning the installation process.

Review supplied working drawings including floor plan dimensions, before installation.

Example of panel and tubing design

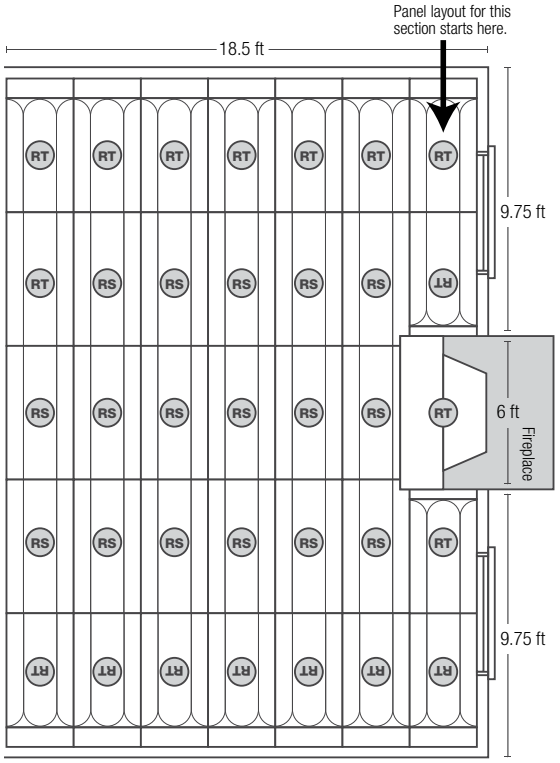
Warmboard does encourage confident contractors and homeowners to draw their own panel and tubing shop drawings. We recommend loop lengths of 300 foot maximum, from supply to return manifold.

The modular design of the Warmboard–R panel allows opportunity for little or no custom routing.

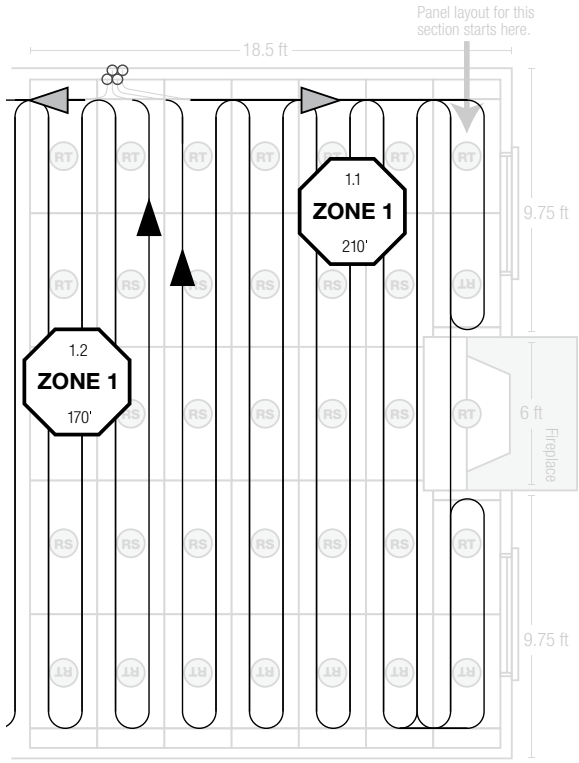
If the finish floor is a nail down hardwood, Warmboard–R panel should install perpendicular to the hardwood planks.

If this is not an endeavor you want to take on, Warmboard, Inc. can provide the shop drawings.

Panel layout example



Tubing layout example



Installing over existing subfloor

It is essential that the existing subfloor is both flat and smooth before the installation of Warmboard–R. Inspect the subfloor for evenness along the joists and flatness between the joists.

If necessary, sand the subfloor, install extra blocking below the subfloor, and refasten the subfloor to even areas. Also, inspect for squeaks and refasten with decking screws as necessary.

The subfloor and Warmboard–R need to be dry. The Warmboard–R cannot be exposed to any rain before or after installation.

Cutting and installing Warmboard–R is very straightforward. The panels can be trimmed with a standard skill or table saw and will rip just like ordinary OSB. It is best to cut the panels with the aluminum side down. We recommend two different options for attaching the panels to the subfloor.

It is crucial to use the provided alignment pins to line up the channels from panel to panel.

Screw fasteners method

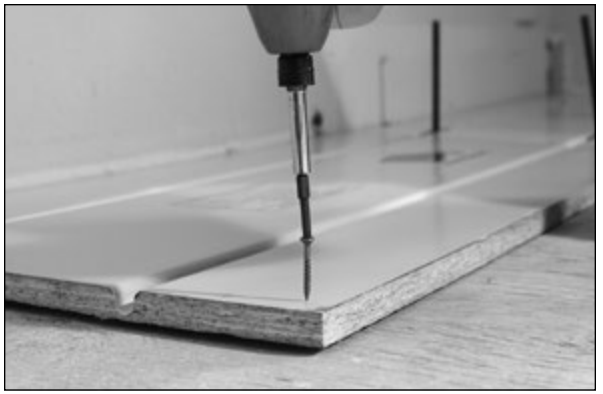
Use a 9 x 1 3/4" "GRK Uber Grade" multi-purpose screw with a top 3/4" smooth shank. The use of an equal product is acceptable. Fasten with a screw pattern of 3 rows of 4.

- No pre-drilling required
- Self counter sinking
- No adhesive needed

Nail and glue method

Using a construction adhesive designed for bonding OSB and plywood, such as "Loctite PL Wood" is an excellent choice. The use of an equal product is also acceptable. Follow all directions as specified by the adhesive manufacture.

For nailing, use a ring shank or a screw nail.
To determine the appropriate length of the nail to use, evaluate existing thickness of subfloor and add 13/16". This will be the minimum length required. Fasten nails with a pattern of 3 rows of 4.



Installing over concrete slab

Benefits

Installing Warmboard–R over an existing concrete slab can retrofit a basement or home remodel with a state of the art radiant floor heating system. Finish floor options include the broad range available with a Warmboard system such as hardwood, tile, carpet, vinyl and linoleum.

Concrete slab requirements

The existing slab must be level and flat. A newly poured slab needs to be well cured which requires a minimum of 30 days. A moisture test should be conducted prior to installation to ensure the slab is properly cured. The slab must have sufficient drainage from rain and snow on a year round basis. If the Warmboard–R panels are exposed to any standing water or any moisture intrusion, the wood will rot. Do not use Warmboard–R if these environmental conditions are possible.

When Warmboard–R is being installed over an existing slab, it is crucial for the panels never to be exposed to weather. After installation, if the Warmboard panels are exposed to rain or snow, the moisture will be trapped in the panel and wood rot will take place.

Testing for moisture

There are several possible methods by which to test the moisture content of a newly poured slab, the simplest being "The Plastic Sheet Method" (ASTM D 4263-83). For this method, seal an 18" x 18" square of clear plastic sheet to the slab with tape on all 4 sides. If, after 16 hours, any condensation is found on the underside of the plastic or if the surface of the concrete is darkened, the concrete is considered too wet for coating application. Do not allow the sheet to come in contact with direct sunlight or excessive heat.

It is possible for this particular method to yield a false result, giving the impression that the slab is fully cured, when in fact it still contains moisture. For example, in cooler conditions, the concrete may retain its moisture and fail to condense on the plastic. However, an obvious appearance of moisture in this method almost always indicates excessive moisture.

With the Plastic Sheet Method, the best way to ensure a reliable result is to make sure that the surface temperatures and ambient conditions during the test are very similar to those present after the Warmboard panels are installed.

If no moisture test is conducted, we recommend giving a newly poured slab 90 days to cure fully.

Installation method 1

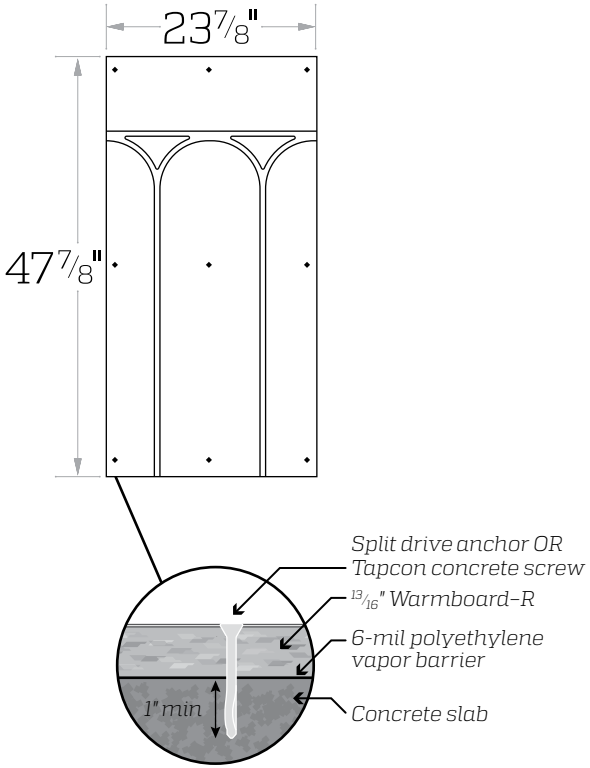
Install a vapor retarder directly to the slab. We recommend either a 6 or 10-mil polyethylene overlapped two feet (2') at the seams. Continue with Warmboard–R panel installation with the use of Tapcon concrete fasteners or Split Drive Anchors. We recommend a maximum of 9 fasteners for each panel.

Installation method 2

Install a 6- or 10-mil polyethylene vapor retarder directly to the slab, overlapping two feet (2') at the seams. Next, install the $^{1}/_{2}$" Homasote Comfort Base or Homasote 440 Soundbarrier over the entire slab (adding a R-value of 1.2). Gap all Homasote panels $^{3}/_{16}$" from all adjoining panels and $^{3}/_{8}$" from walls. Use fasteners to attach the entire assemble to slab. We recommend 9 fasteners per panel. Review the installation instructions of the Homasote Comfort Base or the 440 Soundbarrier at **homasote.com**

Before installation of a Tapcon fastener, drill a pilot hole $^{1}/_{2}$" deeper than the Tapcon will reach. Draw the bit in and out of the pilot hole repeatedly to loosen excess material. Then remove the excess using a shop vacuum.

Fastening pattern for Warmboard–R over concrete



We highly recommend flat head split drive anchors. They will save many hours, or days, of labor by comparison.

Concrete drilling should be done with panels in place. Predrilling the panels prior to installation is not recommended.

Concrete drilling should be done with a heavy duty roto hammer drill and a high quality 1/4" masonry drill bit. Use a 3 lb. sledge hammer to drive the split drive anchor through the predrilled panel and into the concrete.

Use a 1/4" x 2 1/2" flat head split drive anchor.

Split drive anchors can be difficult to find in common retail stores. We suggest visiting confast.com or calling 888-498-5747.

Before installation of a Tapcon fastener, drill a pilot hole 1/2" deeper than the Tapcon will reach. Draw the bit in and out of the pilot hole repeatedly to loosen excess material. Remove the excess using a shop vacuum.

Predrill with Warmboard–R in place using a high-quality masonry bit. Drilling depth should be 1/2" deeper than the required specification without drilling through the slab. All concrete drilling should be done with a heavy duty rotary hammer drill.

Preferred method

2 1/2" x 1/4" Flat Head Split Drive Anchor
Use 1/4" high-quality masonry bit

2 1/4" x 1/4" Flat Head Tapcon Concrete Screw
Use 3/16" high-quality masonry bit

Tubing installation

1. Clean channels and entire panel

This simple, but important step of the process will ensure the tubing sits flush and level.

- Use a shop vac and leaf blower if available
- Make sure channels are free of all debris

2. Lay tubing loops over panels

- Layout the tubing path and clearly mark each loop to avoid any future confusion
- Mark manifold locations as well as supply and return lines
- Mark the areas that require a custom route

The router base does require room to operate. It may not work well directly next to an existing wall.

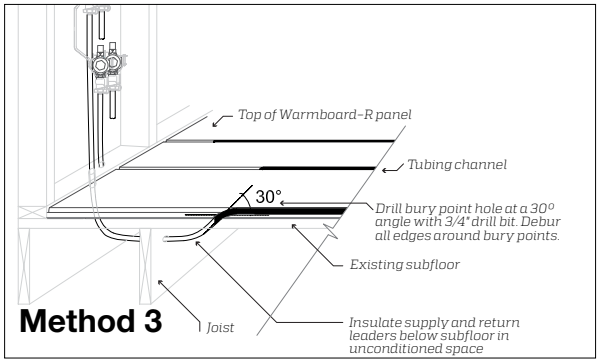
3. Return lines back to manifolds
(4 available methods)

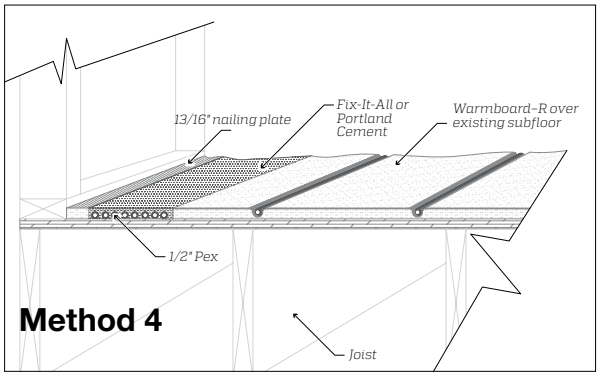
Method 1
Use the pre-grooved channels in the panels to return the tubing to the manifold location.

Method 2
Use the custom routes on the surface of the panel to return the tubing back to the manifold location.

Method 3
Use a bury point, so that the tubing drops below the subfloor to return the tubing back to the manifold (see example to the right).

Method 4
Use the "panel cut back" to create a tubing channel above the subfloor for the tubing to return back to the manifold (see example to the right).





4. Perform the custom route

- Use the templates supplied by Warmboard, Inc. to complete process (see p.5)
- Do not attempt a custom route without the proper metal template guide attached to the router (see p.6)

5. Install tubing

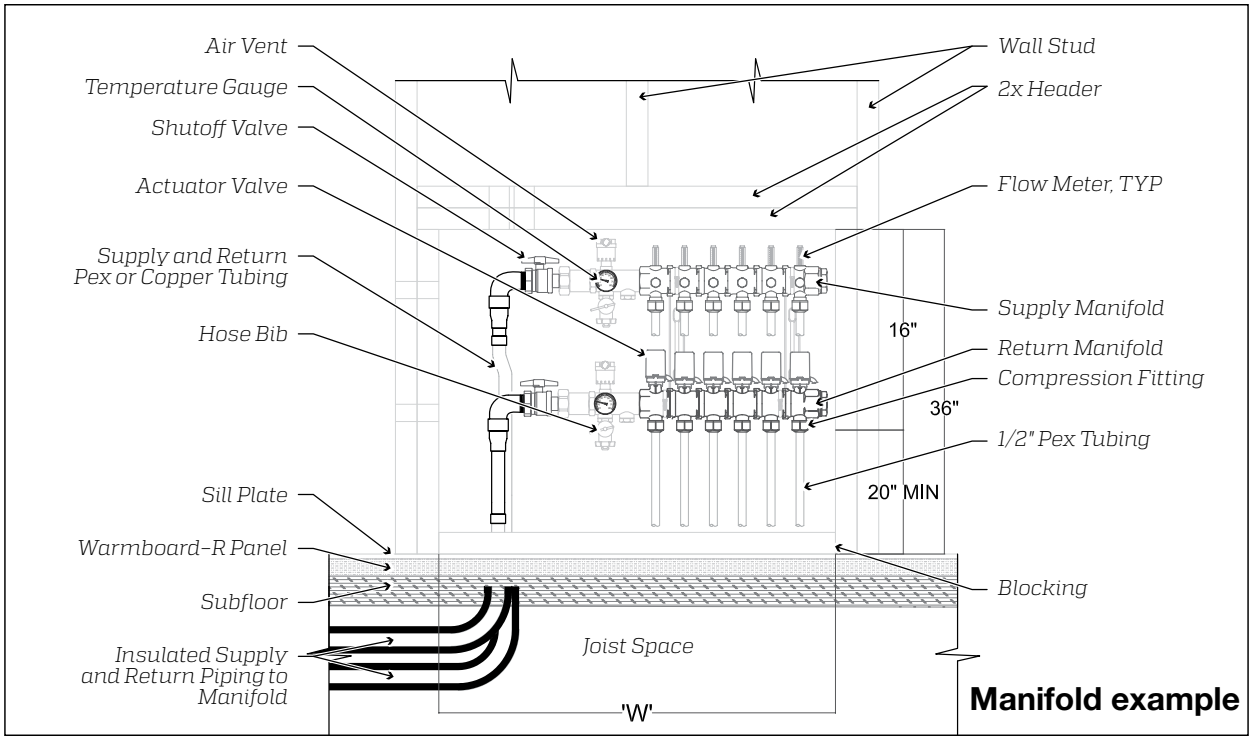
- Only use a tubing brand from our “Approved tubing list” (see p.4)
- Use a heavy roller or wooden block and hammer to secure the tubing firmly in the channel
- Use nail plates as necessary to hold down tubing at the 180 degree turns. Remove plates before finish floors are installed
- Do not use silicone or adhesive in the channels as this will cause the tubing to sit too high
- Tape the ends of the tubing to prevent any debris from clogging the lines
- For large jobs a tubing uncoiler can be an excellent investment

Tubing installation (cont'd)

6. Install manifold

- Follow all installation details and specifications documented by the manufacturer. Manifolds are usually placed in closets or between interior wall stud bays with an access door
- Pressure test all loops with air, at a minimum of 60 PSI
- Clearly mark all supply and return loops, documenting rooms and zones on manifolds to avoid future confusion

Framing Dimensions for Manifold Box	
Loops	Width x Height
2	14" x 36" Clear
3	16" x 36" Clear
4	18" x 36" Clear
5	20" x 36" Clear
6	22" x 36" Clear
7	24" x 36" Clear
8	26" x 36" Clear
9	28" x 36" Clear
10	30" x 36" Clear



Manifold example

7. Tubing repair

If tubing damage does occur it is an easy fix. Every tubing manufacturer makes repair couplers to repair a punctured section of tubing. Simply pop out the tube, cut out the damaged area and insert a coupling. Because the couplings are larger in diameter than the PEX tube, the installer will have to chisel the groove slightly to accommodate the coupler. Average time to fix a punctured tube is typically 10–15 minutes.

Installing solid wood flooring

FIRST AND ALWAYS

Follow specifications and recommendations of the floor manufacturer. Also follow all installation guidelines documented by the National Wood Flooring Association.

- Wood is a hygroscopic material; meaning it absorbs moisture from the air
- The changing atmosphere of humidity will cause the hardwood to expand and contract
- These changes that finish hardwood floors can experience from humidity swings are referred to as “gapping” and “cupping”

The application of solid hardwood floors installed over a radiant heated floor is approved by many hardwood manufacturers and trade organizations. Warmboard–R installed with hardwood floors is a proven successful technology.

Avoid gapping/cupping of hardwood

Use a wood species that is dimensionally stable. There are three types of cuts from the tree: Quartersawn, Riftsawn, and Plainsawn. Quartersawn is nearly all vertical grain lumber which is a better quality cut and dimensionally stable. Riftsawn is the next best choice. Anything wider than 3 1/4" is referred to as plank flooring. Anything narrower than this is called strip flooring. In general, strip flooring is more dimensionally stable. However, plank flooring has been installed over Warmboard–R successfully in many projects with widths of up to 12" on occasion.

Acclimate wood

Low moisture content of the wood flooring is an important condition for stability. It is crucial to acclimate the wood. Bring the wood strips to the job site and sticker them. This means pull them out of their boxes and set them up so air can circulate around them. Acclimation time can vary, but two weeks is recommended. The wood flooring should not be delivered on the job site until the interior plastering is completed and dry.

The radiant floor heating should be in good operation also before the hardwood arrives. It is best to operate the radiant floor system for a few weeks to help bring down the moisture content of Warmboard–R. This procedure should take place no matter what time of year the hardwood is being installed.

Humidity control on the job site is crucial in some areas of the country. It may be required to operate the air conditioner to control the indoor humidity a few days before the wood is delivered. Keeping the indoor humidity between 30%-50% will keep the wood stable.

The hardwood should not experience any large swings in humidity or temperature once it arrives on the job site. It is best to keep the ambient temperature in the house between 60°F and 80°F and keep the indoor humidity between 30-50% range. To meet these specifications, it will be required to operate the radiant floor heating or the air conditioner during wood acclimation and after hardwood installation.

Hardwood floor installers will often test the moisture content of the subfloor and the wood finish floor prior to an installation. The moisture content of Warmboard–S should be at 12% or less. The moisture content of the finish hardwood should read within 4% of the Warmboard reading. The ideal reading of the hardwood would be between 6-9%, however, this reading can vary in your climate zone.

It is difficult to get a proper moisture content reading from the Warmboard–S subfloor due to the aluminum skin. For an accurate moisture reading from the top side of the Warmboard panel, use a moisture meter with insulated contract pins that have hammer probes. An example of this meter is model J4 or J2000, available at **delmhorst.com**.

Be aware of any moisture or humidity intrusion that may take place on a project. For example, a crawl space under Warmboard–S that is dry in the summer and experiences water intrusion in the winter months could cause large humidity swings and movement of the finished hardwood floor (gapping and cupping).

Hardwood manufacturers

A list of hardwood manufacturers who endorse their products for use with Warmboard. Other brands of hardwood can also be installed.

	Engineered	Solid Wood
Anderson Wood Floors 864.833.6250 andersonfloors.com	some	no
Armstrong, Bruce, Robbins 800.2233.2823 armstrong.com	some	no
Arrigoni Woods 888.423.6668 arrigoniwood.com	yes	yes
Authentic Pine Floors 800.283.6038 authenticpinefloors.com	yes	yes, less than 6"
Award Hardwood Floors 715.849.8080 awardfloors.com	yes	yes
Bellawood Hardwood Floors 800.HARDWOOD bellawood.com	some, floating only	no
Boen Hardwood Floors 888.897.0800 boen.com	yes	n/a
BR-111 Exotic Hardwood Floors 800.525.2711 br111.com	yes	no
Broad-Axe Flooring Company 802.257.0064 broadaxeflooring.com	n/a	yes
Carlisle Wide Plank 800.595.9663 wideplankflooring.com	n/a	yes
Columbia Forest Products 800.654.8796 columbiaflooring.com	yes	no
Dinesen +45 7455 2140 dinesen.com	n/a	yes
Goodwin Heart Pine Company 800.336.3118 heartpine.com	n/a	yes
Hallmark Hardwood Floors 888.551.0888 hallmarkhardwoods.com	yes	yes

	Engineered	Solid Wood
Heritage Wide Plank Flooring 877.777.4200 heritageplankflooring.com	n/a	yes
Homerwood Hardwood Flooring 814.827.3855 homerwood.com	yes	no
Junckers Hardwood Floors 800.878.9663 junckershardwood.com	most	yes
Karelia Hardwood Floors 888.840.3435 kareliafloors.com	n/a	yes
Launstein Floors 888.339.4639 launstein.com	yes	yes
Lauzon Hardwood Flooring 877.427.5144 lauzonltd.com	yes	no
LM Flooring 972.417.9900 lmflooring.com	some, floating only	n/a
Mannington Wood Floors 856.935.3000 mannington.com	yes	yes
Max Windsor Hardwood Floors 909.477.6698 maxwindsor.com	most	n/a
Mirage Floors 800.463.1303 miragefloors.com	most	no
Mountain Lumber 800.445.2671 mountainlumber.com	yes	yes
Muskoka Hardwood Flooring 800.461.5386 muskokaflooring.com	yes	no
Mohawk Hardwood Flooring 800.266.4295 mohawk-flooring.com	yes	no
Nordstar Hardwood Flooring 207.799.0010 nordstar.net	some	n/a

	Engineered	Solid Wood
Plyboo 866.835.9859 plyboo.com	yes	n/a
Schotten & Hansen schotten-hansen.com	yes	yes
Satin Finish Hardwood Flooring 800.60.SATIN satinfinish.com	yes	no
Shannon & Waterman 844.315.2520 shannonwaterman.com	yes	yes
Shaw Hardwood Floors 800.441.7429 shawfloors.com	some	no
Southern Wood Floors 888.488.7463 southernwoodfloors.com	yes	no
Swedish Flooring 360.752.0350 swedishflooring.com	yes	n/a
Tarkett Wood Floors 800.842.7816 tarkett-floors.com	some	no
The Woods Company 888.548.7609 thewoodscompany.com	n/a	yes
Thermory Flooring and Decking 585.591.2333 thermoryusa.com	yes	yes
Torlys 800.461.2573 torlys.com	yes	n/a
What It's Worth 512.328.8837 wiwpine.com	n/a	yes
Zickgraf Hardwood Company 800.243.1277 zickgraf.com	n/a	yes, less than 5"

Installing traditional strip and plank hardwood

FIRST AND ALWAYS

Follow specification and installation guidelines as provided by the hardwood manufacturer and the National Wood Flooring Association. Also follow instructions provided by the adhesive manufacturer.

Because Warmboard–R has a vapor retarder built into the panel, no additional vapor retarder is required. Wood can be installed directly over Warmboard–R.

We recommend 3 installation options (all common methods)

- Nail hardwood directly to Warmboard–R
- Nail and glue hardwood directly to Warmboard–R
- Glue the hardwood directly to Warmboard–R (no fasteners)

Warmboard approved adhesives

- Mapei Ultrabond Eco 975 and 980
- Sikabond T-35 and T-55
- Bostik's Best, BST, EFA and Vapor Lock
- Wakol MS 260, PU 225
- Stauf Adhesives PUM-950 Power Mastic
- Titebond 811, 821 and 771

Warranty letters from these companies are available upon request.

Nail directly to Warmboard–R

Should you choose to nail plank flooring directly, know that the aluminum coating on Warmboard–R acts as the required vapor retarder. You do not need to install additional material between the Warmboard–R panel and the hardwood.

Installing the hardwood perpendicular to the tubing pattern is the easiest method. It is important to see the tubing as the hardwood is nailed to avoid tubing damage. It is recommended to tongue nail at a 45 degree angle at 6" on centers and use 2" flooring nails. Occasionally, plank flooring may need to run the same direction as the tubing, and nailing the plank could cause tubing damage. Should this occur, DO NOT NAIL – either glue with an approved adhesive or face nail the plank. While the planks can be successfully nailed down parallel to the tubing pattern, this method may require extra labor. Strategic planning with the layout can avoid face nailing and gluing in many locations.

Nail and glue directly to Warmboard–R

Should you choose to nail and glue the hardwood directly, know that the aluminum coating on the Warmboard–R panel acts as the required vapor retarder. Aside from the glue itself, you do not need to install additional material between the Warmboard–R panel and the hardwood.

Installing the hardwood perpendicular to the tubing pattern is the easiest method. It is important to see the tubing as the planks are nailed to avoid tubing damage. It is recommended to tongue nail at a 45 degree angle at 6" on centers and use 2" flooring nails. Occasionally, plank flooring may need to run the same direction as the tubing, and nailing the plank could cause tubing damage. Should this occur, DO NOT NAIL – the troweled on glue will successfully bond the plank to the Warmboard–R panel. Be sure to use only an adhesive approved by Warmboard, Inc.

Glue directly to Warmboard–R

Should you choose to glue the hardwood directly, know that the aluminum coating on the Warmboard–R panel acts as the required vapor retarder. Be sure to use one of the approved adhesives listed on **page 19** or **21**.

Operating the radiant heating system

We recommend circulating low water temperatures for the first few days of operation under newly installed wood floors. Then, gradually bring the water temperature up to the designed set point. For example, start with 90°F water and after a few days, bring it up to 100°F. Then, finalize a set point of 110°F.

It is ideal for the heating system to be designed with a control strategy referred to as Outdoor Reset. This technology sets up a heating curve that will gradually change the delivered water temperature based on the current heat loss of the house. This is an excellent strategy for gradually heating hardwood floors.

Surface temperatures of the installed hardwood should not exceed 85°F.

Installing engineered, laminate and bamboo flooring

FIRST AND ALWAYS

Follow specification and installation guidelines as provided by the hardwood/bamboo manufacturer as well as the National Wood Flooring Association. Also follow instructions provided by the adhesive manufacturer.

Because Warmboard–R has a vapor retarder built into the panel, an additional one is not required. Wood can be installed directly over Warmboard–R.

To review an excellent line of bamboo products to install over Warmboard–S, check out plyboo.com. For information on their full warranty with Warmboard, products visit warmboard.com. Be sure to review their installation instructions.

We recommend 4 installation options (all common methods)

- Floating floor method
- Glue only
- Nail the planks directly to Warmboard–R
- Nail and glue planks directly to Warmboard–R

Warmboard approved adhesives

- Mapei Ultrabond Eco 975 and 980
- Sikabond T-35 and T-55
- Bostik's Best, BST, EFA and Vapor Lock
- Wakol MS 260, PU 225
- Stauf Adhesives PUM-950 Power Mastic
- Titebond 811, 821 and 771

Warranty letters from these companies are available upon request.

Floating floor method

This is a great option because the floorboards are locked together at the joints of each board and not nailed or adhered to the subfloor. This allows the whole floor to move as a single unit if a dimensional change within the floor takes place. There is an acoustic padding available that is placed between the Warmboard–R and the planks. This padding is an excellent upgrade for the system.

Glue directly to Warmboard–R

Should you choose to glue the directly, know that the aluminum coating on the Warmboard–R panel acts as the required vapor retarder. Be sure to use one of the approved adhesives listed on pages **19** and **21**.

Nail directly to Warmboard–R

Should you choose to nail the flooring directly, know that the aluminum coating on Warmboard–R acts as the required vapor retarder. You do not need to install additional material between the Warmboard–R panel and the hardwood.

Installing the planks perpendicular to the tubing pattern is the easiest method. It is important to see the tubing as the planks are nailed to avoid tubing damage. It is recommended to tongue nail at a 45 degree angle at 6" on centers and use 2" flooring nails. Occasionally, plank flooring may need to run the same direction as the tubing, and nailing the plank could cause tubing damage. Should this occur, DO NOT NAIL – either glue with an approved adhesive or face nail the plank. While the planks can be successfully nailed down parallel to the tubing pattern, this method may require extra labor. Strategic planning with the layout can avoid face nailing and gluing in many locations.

Nail and glue directly to Warmboard–R

Should you choose to nail and glue the flooring directly, know that the aluminum coating on Warmboard–R acts as the required vapor retarder. Aside from the glue itself, you do not need to install additional material between the Warmboard–R panel and the hardwood.

Installing the planks perpendicular to the tubing pattern is the easiest method. It is important to see the tubing as the planks are nailed to avoid tubing damage. It is recommended to tongue nail at a 45 degree angle at 6" on centers and use 2" flooring nails. Occasionally, plank flooring may need to run the same direction as the tubing, and nailing the plank could cause tubing damage. Should this occur, DO NOT NAIL – the troweled on glue will successfully bond the plank to the Warmboard–R panel. Be sure to use only an adhesive approved by Warmboard, Inc.

Acclimate wood

See **page 17**.

Surface temperatures of the installed hardwood should not exceed 85°F.

Installing tile

Warmboard–R is a $^{13}/_{16}$" thick, 2' x 4' panel of OSB (Oriented Strand Board) with a .025" thick aluminum skin. Tile or stone set to Warmboard–R is subject to all of the tile setting requirements of any ordinary unheated wooden subfloor.

We recommend that the installation of all tile and stone meet the standards set forth by the TCNA (Tile Council of America). All materials and installation practices should be referenced in the American National Standards Institute (ANSI) as well.

There are currently no TCNA testing results for Warmboard–R. We do however have test results for our Warmboard–S structural subfloor panel. Due to the nearly identical properties of these two products, we are strongly convinced that Warmboard–R would perform equally to Warmboard–S under the established TCNA testing conditions.

TCNA testing

The TCNA has successfully tested six different tile methods over Warmboard–S. The purpose of this testing was for an expert third party to endorse best practices for installing tile and stone over Warmboard. The testing method used was ASTM C627 (The Robinson Floor Test: check out **warmboard.com/reports** for more info)

TCNA performance ratings and description

Residential - Suitable for homes (tile survived 3 cycles of testing with no evidence of damage)

Light Commercial - Suitable for office spaces, etc. (Tile survived 6 cycles of testing with no evidence of damage)

Moderate - Suitable for hospitals, etc. (Tile survived 10 cycles of testing with no evidence of damage)

Heavy - Suitable for shopping malls, etc. (Tile survived 12 cycles of testing with no evidence of damage)

Extra Heavy - Suitable for airports, etc. (Tile survived 14 cycles of testing with no evidence of damage)

Warmboard recommended assembly methods and test results

To review the TCNA testing assembly results, visit **warmboard.com/reports**

Method 1: Backer Board
Performance Rating: Extra Heavy
Page **24**

Method 2: $^{3}/_{4}$" Mapei Mud Bed
Performance Rating: Extra Heavy
Page **26**

Method 3: $^{3}/_{8}$" Mapei Self-leveling Underlayment
Performance Rating: Extra Heavy
Page **27**

Method 4: Uncoupling Membrane Custom SpiderWeb
Performance Rating: Light Commercial
Page **28**

Method 5: Uncoupling Membrane Blanke • Permat
Performance Rating: Light Commercial
Page **29**

Method 6: Uncoupling Membrane Schluter Ditra
Performance Rating: Light Commercial
Page **30**

Method 1 Backer Board

There are a variety of Cementitious Backer Units, or CBU's available. Backer boards have the advantage that they have low mass and are relatively inexpensive to install. Also the available thicknesses of 1/4" and 1/2" provide a base for tiled areas to match up well with adjacent finish floors.

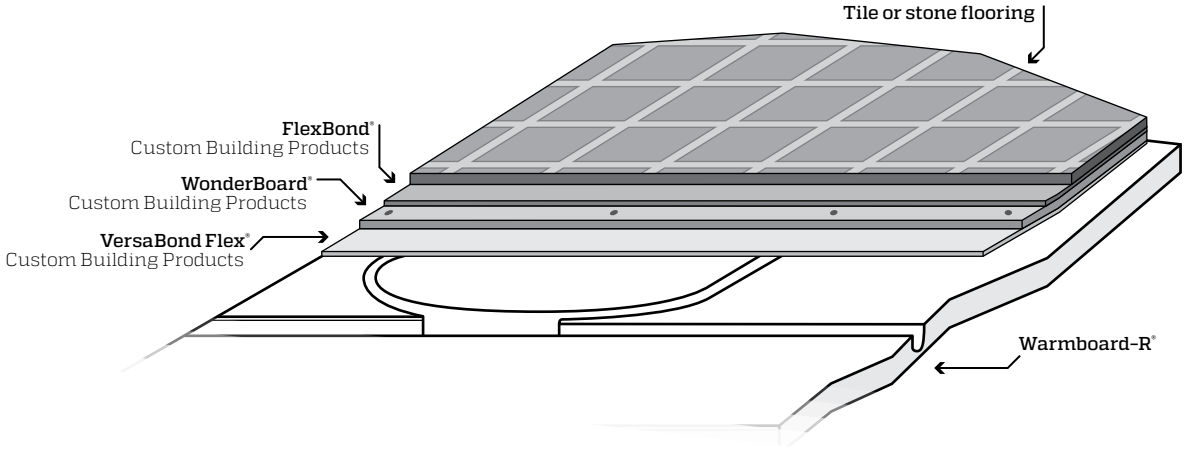
Prior to each panel installation, apply thin-set to the top surface of the Warmboard–R using a 1/4" square-notched trowel. The purpose of this butter coating of thin-set is to function as a leveling compound. Immediately fasten the backer board before the thin-set dries using "backer board screws." See details on next page for a tip on avoiding tubing damage. Tape all seams with backer board tape. Finish with tile or stone.

A warranty letter from Custom Building Products for the use of WonderBoard® over Warmboard–R is available upon request.

Backer board must run perpendicular to the Warmboard–R panels. Seams should also be staggered. Take special care while fastening to note, and avoid, tubing damage.

Substituting with other comparable brands that meet ANSI standards is acceptable.

The surface temperatures of tile or stone must not exceed 85°F.

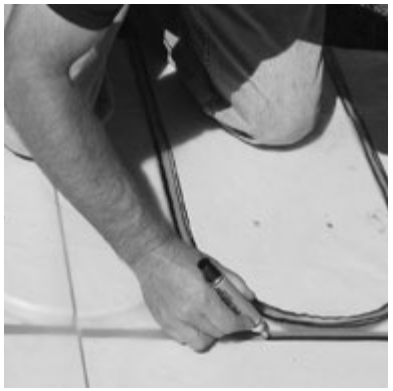


Installation tip Use a stencil to avoid tubing damage with Backer Board

With the use of a clear thin polyethylene plastic sheeting (3 or 4-mil) and a permanent marker, you can quickly create a stencil of the actual tubing pattern. By placing this custom stencil over the backer board you can safely install all of your fasteners and avoid tubing damage.

1.

Cut the polyethylene plastic to the size of backer board. Save time by cutting all of your full size 3' x 5' plastic stencils at once. **Caution:** Do not cut directly over the Warmboard or the tubing.



2.

Place the precut plastic over the Warmboard–R panel and tape down the corners. With a permanent marker, trace the tubing pattern onto the plastic. Be sure to clearly mark the top and bottom on the stencil. Carefully remove plastic and lay flat next to work area.

3.

Trowel a coat of Thin-Set over the Warmboard–R panel and place the backer board over the appropriate Warmboard location (review any information on previous page as needed).

4.

Align the stencil over the backer board and tape down the corners. Mark all safe fastening locations with a drill bit, then remove plastic stencil and fasten as normal.

Method 2 Mortar Bed ¾" thick with "4 To 1™ Mud Bed Mix" by Mapei®

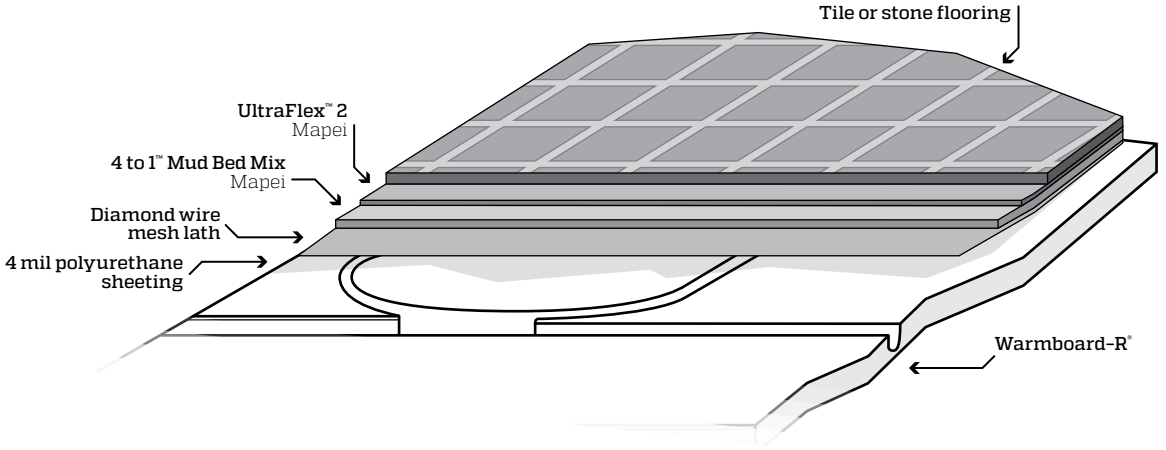
Mortar beds have been the traditional method of addressing the expansion, contraction and deflection properties of wooden subfloors. They have the advantage that by their very nature they provide a thick, continuous, stable surface to which tile readily adheres. They have the disadvantage that they tend to be expensive, add significant mass to a system, and due to their thickness, often cause the elevation of tile areas to not match up well with adjacent carpeted or hardwood areas.

When applying mortar beds, install a 4 or 6-mil polyethylene to serve as a cleavage membrane. Fasten down a diamond wire mesh lath over the membrane using crown staples and finish with a minimum ¾" mortar bed (Mapei® 4 to 1™ Mud Bed Mix or equal). After the mortar bed has cured, thin-set and tile or stone may then be applied.

Take care to avoid tubing damage.

Substituting with other comparable brands that meet ANSI standards is acceptable.

The surface temperatures of tile or stone must not exceed 85°F.



Method 3 Ultraplan® Easy, 3/8" self-leveling underlayment by Mapei®

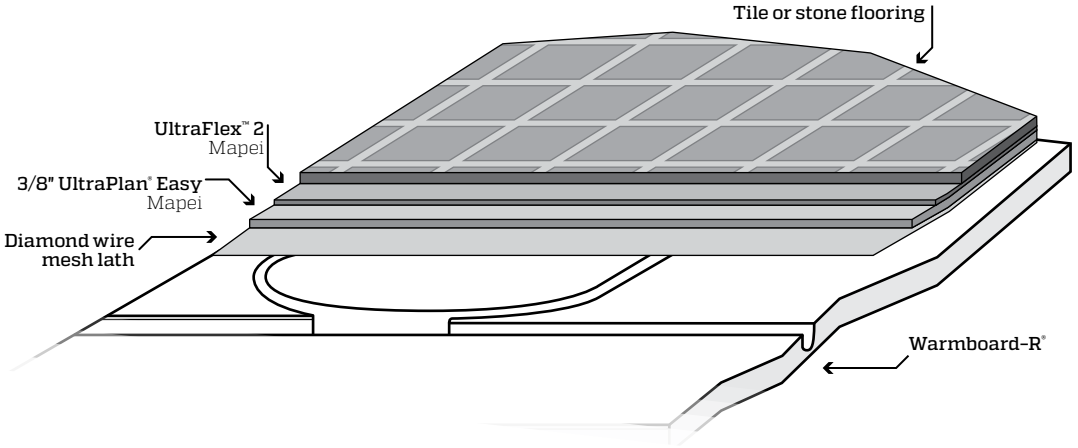
The main advantage of this product is the thin profile with the great strength of a mortar bed.

To proceed with this underlayment, clean panels, apply "Mapei Primer T" (per Mapei instructions) then follow with diamond wire mesh lath and attach with crown staples. Mix and apply (per Mapei instructions) "Ultraplan® Easy" to a thickness of 3/8" or more. Finish with thin set and tile or stone.

Take care to avoid tubing damage.

Substituting with other brands in this assembly is **NOT** recommended.

The surface temperatures of tile or stone must not exceed 85°F.



Method 4 Spiderweb™ Uncoupling Mat by Custom Building Products

SpiderWeb™ Uncoupling Mat is a water– and vapor-proof uncoupling membrane that can be used for crack-suppression in tile, porcelain or natural stone installations. SpiderWeb is designed differently than bonded membranes, with a sacrificial layer of fabric that shears away, or "uncouples," when exposed to excessive substrate movement, absorbing stress and preserving the surface and integrity of the tile. SpiderWeb's mesh layer has reinforced strands which lock mortar into the mat, ensuring strong, reliable installations.

To proceed with this installation, clean panels, trowel on "Mapei Granirapid® Thin-Set mortar" (mix per Mapei's instructions) using a ¼" x 3/16" V-notched trowel. Immediately install SpiderWeb Mat. Follow next day with thin-set using ¼" x ¼" square notch trowel. Finish with tile or stone.

A warranty letter from Custom Building Products for the use of SpiderWeb over Warmboard–R is available upon request.

Take care to avoid tubing damage.

Substituting with other brands in this assembly is **NOT** recommended.

The surface temperatures of tile or stone must not exceed 85°F.

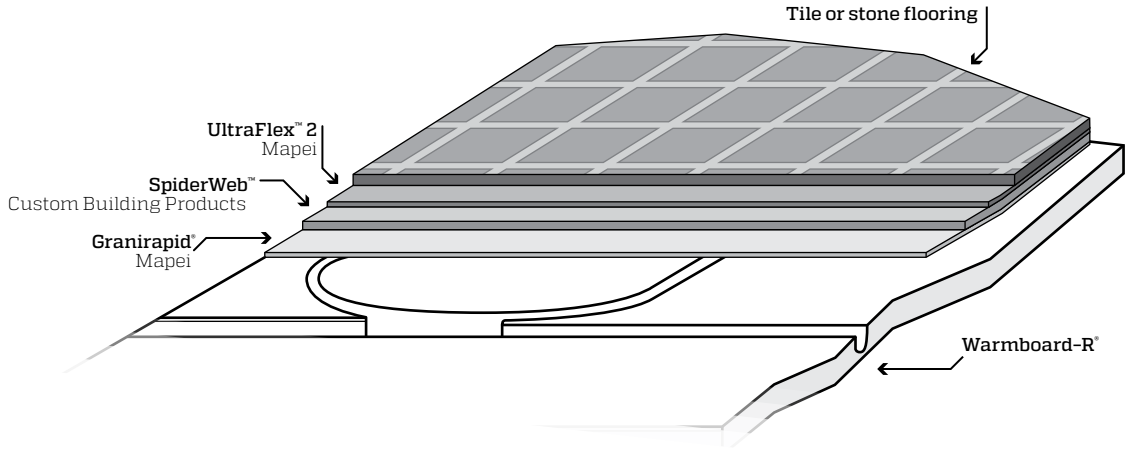
A TCNA "Bond Strength Test" was performed with Warmboard and Mapei Granirapid. Summary of these test results are below:

Warmboard–S with Granirapid averaged 217 PSI.

Plywood with Granirapid averaged 240 PSI.

Minimum requirement is 50 PSI.

The TCNA "Bond Strength Test" assembly results, can be made available upon request.



Method 5 Uncoupling membrane "Permat" by Blanke

For stone and tile installations, Blanke • PERMAT offers amazing crack isolation protection and superior compression and tensile strength. The Blanke • PERMAT reinforced mesh panel adds major support to wood subfloors, greatly reducing vertical subfloor movement (deflection).

To proceed with this installation, clean panels, trowel on the Mapei "Granirapid Thin-Set mortar" (mix per Mapei's instructions) using a $^{1}/_{4}$" x $^{3}/_{16}$" V-notched trowel. Immediately install the Permat. Follow next day with thin-set using $^{1}/_{4}$" x $^{1}/_{4}$" square notch trowel. Finish with tile or stone.

A warranty letter from Blanke, Inc. for the use of Permat over Warmboard–R is available upon request.

Take care to avoid tubing damage.

Substituting with other brands in this assembly is **NOT** recommended.

The surface temperatures of tile or stone must not exceed 85°F.

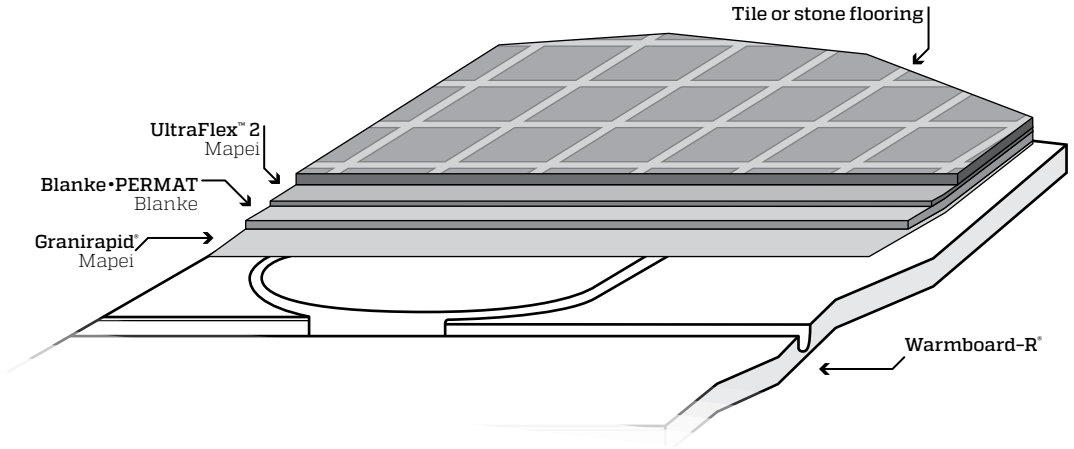
A TCNA "Bond Strength Test" was performed with Warmboard and Mapei Granirapid. Summary of these test results are below:

Warmboard–S with Granirapid averaged 217 PSI.

Plywood with Granirapid averaged 240 PSI.

Minimum requirement is 50 PSI.

The TCNA "Bond Strength Test" assembly results, can be made available upon request.



Method 6 Uncoupling membrane “Ditra” by Schluter

DITRA® is a polyethylene membrane with a grid structure of square cut cavities and an anchoring fleece laminated to its underside. Apply a layer of Mapei’s “Granirapid Thin-Set mortar” (a premium rapid-setting and flexible polymer-modified mortar) directly to the Warmboard, using a $^{5}/_{16}$" or $^{1}/_{4}$" V-notched trowel, and then install the DITRA grid. Wait until the mortar is completely dry below the DITRA, then trowel on an unmodified thin set mortar that meets or exceeds ANSI A118.1 on the topside of the DITRA, and immediately install tile or stone. There have been hundreds of successful tile installations installed by this method with no reports of problems or failure.

Schluter does not warranty the interface described above (Warmboard–S and DITRA).

Substituting with other brands in this assembly is **NOT** recommended.

The surface temperatures of tile or stone must not exceed 85°F.

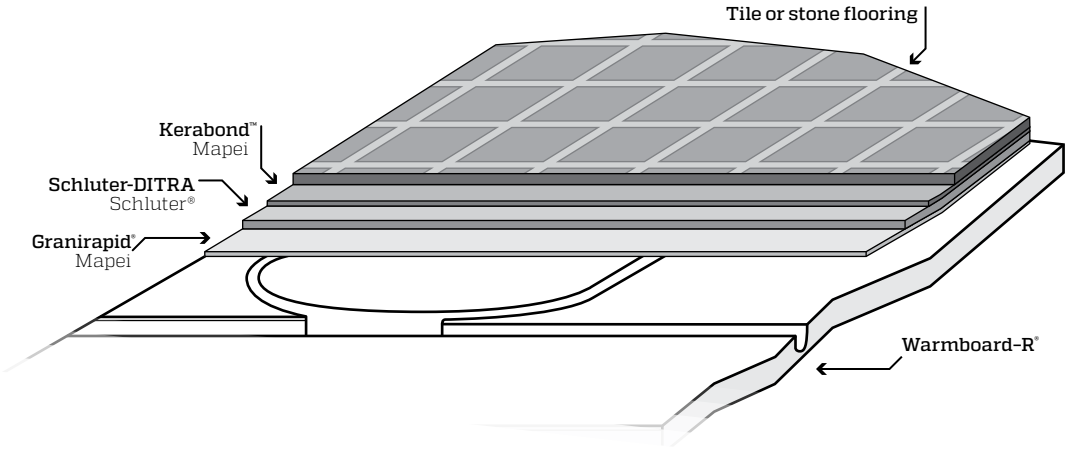
A TCNA “Bond Strength Test” was performed with Warmboard and Mapei Granirapid. Summary of these test results are below:

Warmboard–S with Granirapid averaged 217 PSI.

Plywood with Granirapid averaged 240 PSI.

Minimum requirement is 50 PSI.

The TCNA “Bond Strength Test” assembly results, can be made available upon request.



Tile information resources

The surface temperatures of tile or stone must not exceed 85°F.

Warmboard, Inc. is not an agent for the manufacturers listed here, and gives no actual or implied warranty of fitness for any of these products or manufacturers.

CAUTION!
Whatever method you use, make sure that the product meets the standards set forth and accepted by the TCNA, ANSI, and the ICC (formerly ICBO). Be sure to follow each manufacturer's specific recommendations when using these products.

Ceramic tile backer board resources

USG Durock and Fiberock

Georgia-Pacific

JamesHardie

Wonderboard

Uncoupling membrane resources

Blanke

Custom Building Products

Schluter

Additional resources

American National Standards Institute (ANSI)
ansi.org

Tile Council of North America (TCNA)
tileusa.com

Mapei
mapei.us

Installing carpet

Padding and carpet is a very common finish floor to use over Warmboard–R. The carpet cushion (padding) can be installed directly over Warmboard–R. Before installing the carpet cushion it is necessary to fill all of the empty grooves to provide an even surface for installation. Empty grooves can be filled with scrap pex tubing. Another option is to use a floor leveling compound or Portland cement to fill the empty grooves making them flush and level with the panel surface. Do not install padding and carpet until all the loops have been properly pressure tested.

Sponge Cushion, Inc.
1.800.435.4062
commercial-carpetcushion.com

Product	R-Values
Luxury Step	.80
Full House	.68
Berber Supreme	.59
Berber Master	.35
Silent Walk	.46
SP 380	.66
Tred-MOR 1562	.27
Tred-MOR 2568	.46
Tred-MOR 2580	.48
Tred-MOR 2500	.34
Deci-BLOK	.10

When choosing a carpet cushion/carpet assembly we recommend a product that has a low R-value rating. The advantage of using a product with a low R-value is to keep the radiant floor system very simple. Meaning the system can use the same water temperatures for the tile, hardwood, and carpet in a home. This type of system is referred to as a one temperature system. To achieve a simple one temperature system, it is best to purchase a carpet and carpet cushion assembly that does not exceed an R-value of 2. If the R-value assembly exceeds R-2, a two temperature system may be required.

Leggett & Platt
1.800.866.9446
lpcarpetcushion.com

Product	R-values
Arcadia	.80
STAINMASTER® Plus	.70
Laguna	.70
Valencia	.70
Aurora	.70
Coronado	.70
Solano	.60

The Radiant Professionals Alliance (RPA) and International Association of Plumbing and Mechanical Officials (IAPMO) recommends that the surface temperature of carpet does not exceed 85ºF. Warmboard Inc. supports the recommendations of the RPA and IAPMO.

For other carpet cushion options review Group Two on on the following page.

Carpet and padding R-values

Carpet Thickness	R-Value
1/8"	R-0.6
1/4"	R-1.0
1/2"	R-1.4
3/4"	R-1.8
1"	R-2.2

R-values are approximate. Check with product manufacturer for actual R-values.

GROUP 1	Density	Thickness	R-Value	
Prime Urethane	2.2 lb/cu ft	1/4" 3/8" 1/2"	R-1.08 R-1.62 R-2.15	Not Recommended
Bonded Urethane	4-8 lb/cu ft	5/32" 1/4" 3/8" 7/16" 1/2"	R-0.66 R-1.05 R-1.57 R-1.84 R-2.09	Not Recommended
Sunburst Family	10 lb/cu ft SunBerber Sunburst BerberGuard SunGuard	 3/8" 15/32" 3/8" 15/32"	 R-1.16 R-1.43 R-1.25 R-1.50	Not Recommended

GROUP 2	Density	Thickness	R-Value	
Fiber/Hair/Jute	6-8 lb/cu ft 3/8"	1/4" R-1.46 1/2"	R-0.97 R-1.94	3rd Choice
Waffle Rubber	25 lb/cu ft	1/4" 3/8" 1/2"	R-0.62 R-1.00 R-1.33	2nd Choice
Slab Foam Rubber	33 lb/cu ft	1/4" 3/8" 1/2"	R-0.31 R-0.47 R-0.62	Best Choice

Installing cork flooring

FIRST AND ALWAYS

Follow all installation specifications provided by the cork manufacturer.

Cork flooring has a naturally high insulation value so it is important to choose one that is ⅜" to ½" in thickness when working with radiant heat. This will keep the R-value to 1.5 or less giving better heating and response times, while simplifying the mechanical design at the same time. A more simple mechanical design means your cork floor will operate in the same water temperature range as tile, hardwood or carpet.

Established brands include Expanko Cork (**expanko.com**), American Cork (**amcork.com**), and Natural Cork (**naturalcork.com**).

Installation of standard cork flooring

The installation of an underlayment is required over the Warmboard surface before standard cork flooring is installed. Care should be taken when fastening the underlayment to Warmboard–R because the tubing is obscured during this step. We recommend installing a ¼" APA listed plywood underlayment with a sanded face. For complete installation details, refer to the "Engineered Wood Construction Guide" at **apawood.org**. Complete the installation of the cork by following all the manufacturer guidelines and specifications.

Once the underlayment is installed, the cork is adhered using a urethane adhesive made for cork applications. A good product to use is Dri Tac 7500 (**dritac.com**, 1.800.726.7845).

Installation of cork laminate products

Cork laminate products also work well with Warmboard–R. These products are manufactured with cork on the top and bottom and an MDF layer sandwiched in between. It is not necessary to put any barrier between the cork flooring and the Warmboard surface prior to installation. The advantage of this type of cork floor is that it installs as a floating floor and requires no adhesive or nailing for proper installation. This allows the homeowner more flexibility if they ever decide to change the floor covering.

The surface temperature of cork flooring must not exceed 85°F.

When using a plywood or OSB (or equivalent) underlayment it is crucial to fully acclimate panels before installation. If underlayment panels are too high in moisture content, the panels will shrink from the floor heating and create an installation failure.

Installing vinyl

FIRST AND ALWAYS

Follow all installation specifications provided by the vinyl manufacturer.

There are many different types of vinyl flooring available and each can be used with Warmboard–S. The inlaid vinyl type or vinyl inner layer is the most durable. Vinyl floors are manufactured with a sandwich of layers. It starts with a felt or vinyl backing, then the vinyl granules are put directly on the backing all the way up to the wear surface.

The installation of underlayment is required over Warmboard–R before the vinyl is installed. Care should be taken when fastening the underlayment to Warmboard–R because the tubing is obscured during this step. We recommend installing a ¼" or ½" APA listed plywood underlayment with a sanded face. For complete installation details, refer to the "Engineered Wood Construction Guide" at **apawood.org**. Complete the installation of vinyl by following all the manufacturers guidelines and specifications.

The surface temperature of vinyl flooring must not exceed 85°F.

When using a plywood or OSB (or equivalent) underlayment it is crucial to fully acclimate panels before installation. If the underlayment panels are too high in moisture content, the panels will shrink from the floor heating and create an installation failure.

Installing linoleum

FIRST AND ALWAYS

Follow all installation specifications provided by the linoleum manufacturer.

Linoleum is a floor covering made from solidified linseed oil in combination with flour or cork dust over a burlap or canvas backing. As an all natural product, linoleum offers many advantages and interfaces well with Warmboard–R.

The installation of underlayment is required over Warmboard–R before the linoleum is installed. Care should be taken when fastening the underlayment to Warmboard because the tubing is obscured during this step. We recommend installing a 1/4" or 1/2" APA listed plywood underlayment with a sanded face. For complete installation details refer to "Engineered Wood Construction Guide" at **apawood.org**. Complete with installation of linoleum, following manufacturer guidelines and specifications.

The surface temperature of linoleum flooring must not exceed 85°F.

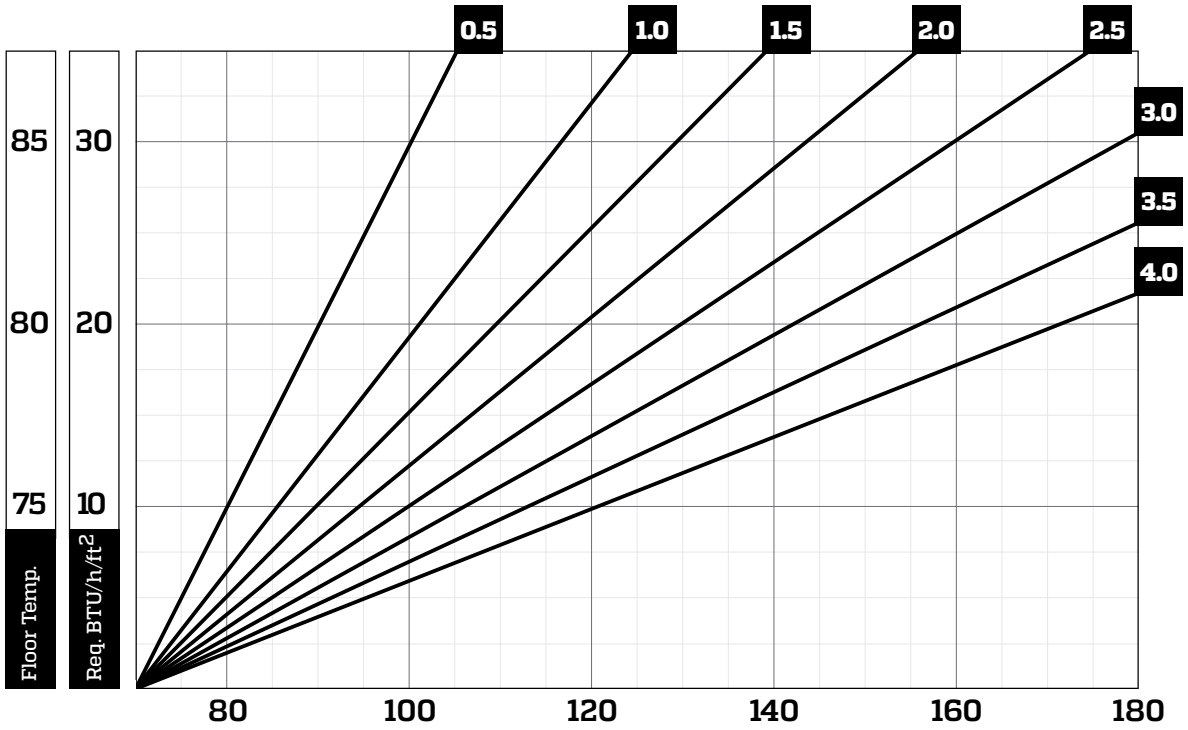
When using a plywood or OSB (or equivalent) underlayment it is crucial to fully acclimate panels before installation. If the underlayment panels are too high in moisture content, the panels will shrink from the floor heating and create an installation failure.

Finish floor R-values

Material	Typical R-value	R-value per inch	Typical thickness
Plywood	0.825	1.10	0.750
OSB	1.050	1.40	0.750
Softwood	0.825	1.10	0.750
Ash	0.750	1.00	0.750
Maple	0.750	1.00	0.750
Oak	0.638	0.85	0.750
Pine	0.975	1.30	0.750
Fir	0.900	1.20	0.750
Engineered Bamboo	0.720	0.96	0.750
Engineered Wood	0.250 0.375 0.625 0.750	1.00 1.00 1.00 1.00	0.250 0.375 0.625 0.750
Engineered Wood Flooring Pad	0.200	1.60	0.125
Carpet Pad/Slab Rubber 33 lb	0.320 0.480 0.640	1.28 1.28 1.28	0.250 0.375 0.500
Carpet Pad/Waffle Rubber 25 lb	0.620 1.240	2.48 2.48	0.250 0.500
Hair Jute	1.940 1.250	3.88 3.88	0.500 0.325
Prime Urethane	1.400 2.150	4.30 4.30	0.325 0.500
Bonded Urethane	1.350 2.100	4.20 4.20	0.325 0.500

Material	Typical R-value	R-value per inch	Typical thickness
Carpet	0.700 1.050 1.400 1.750 2.100	2.80 2.80 2.80 2.80 2.80	0.250 0.375 0.500 0.625 0.750
Wool Carpet	1.575 2.100	4.20 4.20	0.375 0.500
Sheet Vinyl	0.200	1.60	0.125
Vinyl Composition Tile (VCT)	0.200	1.60	0.125
Linoleum	0.400 0.200	1.60 1.60	0.250 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
Thin-set 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

Required water temperature chart



Ave. of Supply/Return Water Temperature at Manifold for Good Dynamic Performance

Assumes a Designed Ambient Air Temperature of 70º Fahrenheit

■ = R-Value (thermal resistance)

Steady State Performance will require 10% lower supply temperature.

R-value = Resistance value of floor covering

Warmboard, Inc. recommends a maximum floor temperature of 85°F in accordance with industry standard practices.

Assumes minimum R-19 insulation below the floor.

Warmboard–R is one component of a complete radiant system.

Complete system design shall be performed in accordance with Radiant Professionals Alliance (RPA) guidelines, manufacturers' recommendations for ancillary components, and is the responsibility of the system designer.

warmboard®

warmboard.com
877.338.5493
8035 Soquel Dr., Ste. 41A
Aptos, CA. 95003