1122

WARMBOARD-S PANEL

Installation Guide

warmboard

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Review this guide and our supplied plan set (and floor plan dimensions) before work begins.

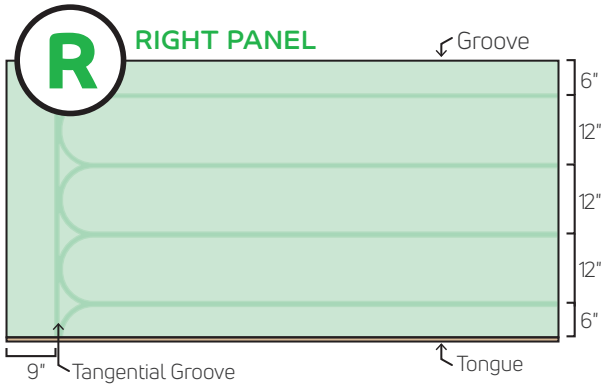
PANEL DESCRIPTION

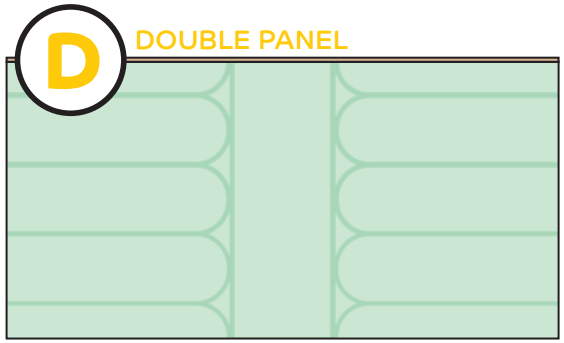
Warmboard-S is a structural, tongue and groove hydronic radiant subfloor panel made from 7-ply plywood with a conductive .025" thick 1070 aluminum alloy skin bonded to the entire top surface. Each panel type is stamped with a series of aluminum channels on the top surface to accommodate the installation of 1/2" PEX or PEX-AL-PEX tubing.

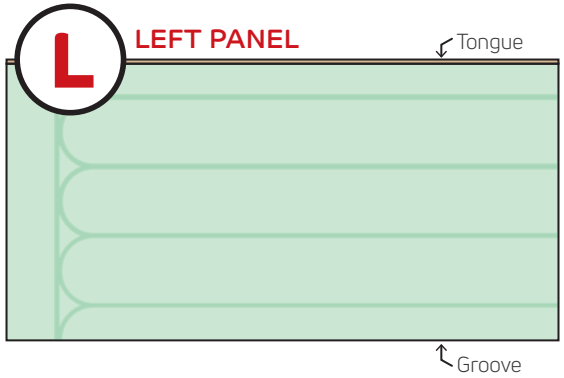
Warmboard-S consists of four, modular panel types, each measuring 4' x 8' x 1 1/8" thick and weighing approximately 100 lbs. In a completed assembly, Warmboard-S weighs 3.2 lbs per square foot, which includes the panel, tubing and water.

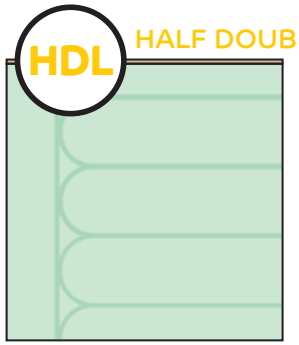
Warmboard-S is typically installed over joist (24" OC maximum), though also over concrete or subfloor.

Non-aluminum filler panels are also available.

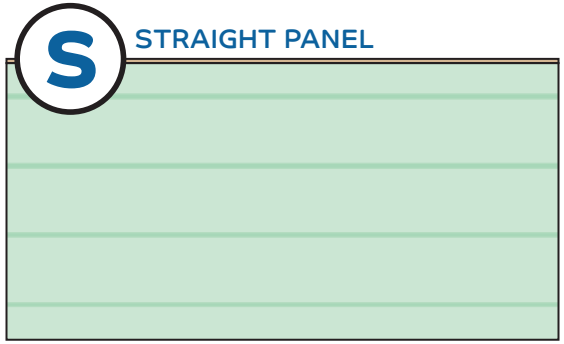


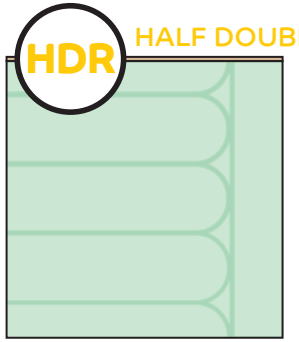






Cut a **Double Panel** in half to create the **HDL** and **HDR** panels.





APA Report: T2002Q-37
ICC Report: ESR-1421

Warmboard-S panels are but one component in a complete radiant system. System design should be done in accordance with manufacturers' recommendations for ancillary components, and is the responsibility of the system designer.

INSTALLATION HIGHLIGHTS

1 Count your panels when they arrive on site and confirm the shipment is correct. Use the color code painted on the end of each panel to compare numbers against your plan set, which will be found inside of your Installation Kit. If there are any questions or inconsistencies with your delivery, call us immediately.

2 Review the Shop Drawings: Check floor plan dimensions and joist layout. Verify that the joist direction and location of the pull are correct. Note that some tubing loops may need to be installed before the walls are framed, and some after (If you are not familiar with the time line of this process, give us a call).

3 Gap 1/8" between panels on the 4' butt side (no need on the 8' side). Use the alignment pins when fastening to ensure the tubing paths between panels line up.

4 **ONLY** use tubing approved by Warmboard, Inc. (pg. 5). **DO NOT** use silicone or other types of adhesives in the tubing channel.

5 **DO NOT** exceed a 275 linear loop length when making field revisions.

6 After tubing is installed, we recommend a Masonite or Lauan in high traffic areas to help protect the tubing. Remove before installing the finish floors.

7 Custom routes require a router with a minimum 1.75 horsepower (2.25hp is recommended). **DO NOT** attempt a custom route without the proper wood and metal template guides (pg. 7).

8 When installing over floor joists, it is mandatory that the crawl space or basement have substantial ventilation, per IBC guidelines to outside ambient air (Exposure to Weather, pg. 8). After installation, R-19 (or greater) insulation is required beneath the panels to prevent downward heat loss.

9 Review this manual before installing finish floors.

10 The surface temperature of finished floors is not to exceed 85ºF. This rule applies to the entire radiant industry.

By reading these highlights before proceeding, you will save you time, money and hassle.

Warmboard products are required to be installed and managed by experienced and licensed trade professionals pursuant to current local laws. Failure to use proper installers will void any product warranty.

Should installed panels be exposed to rain, **DO NOT** install subfloor insulation until the panels have returned to an acceptable level of moisture content.

APPROVED TUBING LIST

PEX Aluminum PEX tubing, 1/2" ID

- **Warmboard PEX: PEX-AL-PEX**
- Bluefin: PEX-AL-PEX
- Mr. Pex: PEX-AL-PEX
- Watts: PEX-AL-PEX

PEX tubing, 1/2" ID

- HeatLink FL PEX-a
- Mr. Pex
- Rehau Raupex Oxygen Barrier
- Uponor helioPEX X2
- Uponor/Wirsbo hePEX
- ViegaPEX Barrier

Warmboard Comfort System

Although Warmboard approves these tubing products for panel projects, they are **NOT** supported for use with the Warmboard Comfort System. **ONLY** use the supplied Warmboard PEX-AL-PEX, which has been specified and tested by Warmboard for use with the WCS.

If equipment failure does occur on a WCS project without the specified tubing, Warmboard has the option to deny any warranty claim related to the system hydronics.

ONLY use tubing listed here. Other products may create ticking noises during operation as the EVOH barrier rubs against the channel.

Warmboard tubing and manifolds are included with the Warmboard Comfort System and do not need to be purchased separately.

If only using Warmboard panels, tubing and manifolds can also be purchased from us separately at very competitive prices.

NECESSARY TOOLS

Installation Kit Content

(supplied with each order)

- Warmboard panel/tubing plans
- 3 Custom routing templates (wood)
- 5/8" Router bit
- 2 Alignment pins
- Router template guide
- Router guide lock nut

Other Tools and Materials

- Circular saw, carbide blade
- Router, minimum 1.75 horsepower, 2.25hp recommended (pg. 7)
- Electrician nailing plates
- 16oz Rubber mallet
- Warmboard approved tubing
- Shop vacuum
- Drill motor with a 3/4" drill bit
- PEX tubing cutter
- Wax pencil or permanent marker
- Tubing un-coiler
- 4" Grinder or Dremel tool

SELECTING A ROUTER

Provided Equipment

The items shown below are shipped with your installation kit and should be used when routing. **DO NOT** attempt a route without them.

Template guide
25/32" I.D., 1" O.D.

Guide lock nut

5/8" Core Box router bit

This is the correct sub-base with the supplied metal template guides installed.

This sub-base does **NOT** work with our template guide and will not create custom routes.

The provided items can be used with some Makita and Dewalt brand routers. Consider the Makita RF1101, Dewalt DW616 or Dewalt DW618PKB.

While we recommend a router with a minimum 1.75 horsepower, 2.25 is preferred.

Not all sub-bases interface properly with the supplied items. **DO NOT** attempt a route without the correct template guide.

INSTALLING OVER JOIST

For traditional joist application, fasten with panel adhesive and 2 3/4" screws or ring shank nails as specified by your design professional or listed in our ICC-ES report. Apply common sense when sizing fasteners for Truss and I-Joist systems, and select a fastener to grab as much flange as possible. **DO NOT** size a nail or screw that will penetrate the bottom side of the flange.

If the nailing pattern is not listed in the architectural specification, the APA (American Panel Association) recommends a 12" inside, 6" edges pattern.

As panels are placed, tap alignment pins into place on the two outer most channels, across the seam between the adjacent panels, to ensure proper channel alignment. Pay close attention to the Panel Layout plans as the work proceeds. Per APA guidelines all subfloor panels, including Warmboard-S, should be gapped 1/8" on the 4' side.

It is **ESSENTIAL** to check your plan set (inside the installation kit) to see where the first panel is to be installed.

Warmboard-S panels install over joist just like regular subfloor.

Cut panels with the aluminum side down and save your offcuts as they may be used elsewhere in the project.

Exposure to Weather

Warmboard-S panels are rated "Exposure 1" by the APA. They can be exposed to occasional and intermittent rain, snow and ice for a building season and still serve as structural subfloor. Warmboard-S panels will still respond to moisture like any plywood product, which means minor edge swelling can occur from water intrusion.

If the panels experience water intrusion, create a constantly dry and well-ventilated environment beneath to release this moisture from the bottom side of the panels. This is necessary due to the aluminum bonded to the top of the plywood.

DO NOT insulate below the panels until the structure is completely dried-in and all excessive moisture has been released from the panels.

Here are a few installation tips that are crucial to understand and follow.

- Keep the panels completely dry and covered until the time of installation
- If installing over a crawl space or basement, this space **MUST** be well-ventilated (per IBC guidelines) and completely dry at all times during the construction process
- If installing over slab, ensure the slab is completely cured and dried, then apply a moisture barrier. Warmboard-S panels **MUST** be completely dry before, during and after installation
- To accelerate the removal of moisture, fire up the boiler and circulate hot water through the system. Using portable fans and/or heaters is also effective
- If edge swelling occurs, the panels will return close to their original shape once the moisture exits the panels

If the panels are exposed to rain or snow, create a constantly dry and well-ventilated environment so the moisture can be released from the bottom of the panel.

INSTALLING OVER SLAB

Benefits

Installing Warmboard-S over a concrete slab can retrofit a basement, home remodel or new home with a state of the art radiant floor heating system. A broad range of finish floor options are available, including 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 for a minimum of 30 days, and a moisture test should be conducted to ensure the slab is properly cured prior to installation of Warmboard-S.

Like any wood product, if Warmboard-S panels are exposed to standing water or moisture intrusion, the wood will swell and rot. **DO NOT** use Warmboard-S if these environmental conditions are possible during or after construction.

Testing for Moisture

There are several methods by which to test the moisture content of a newly poured slab, the simplest being the "Plastic Sheet Method" (ASTM D 4263-83). To do this, place an 18"x 18" clear plastic sheet on the slab and tape down on all sides. **DO NOT** allow the sheet to come in contact with direct sunlight or excessive heat. After 16 hours, if any condensation is found on the underside of the plastic, or if the slab surface is darkened, the concrete is too wet for a coating application.

NOTE: It is possible for this method to yield a false result in cooler conditions when the concrete may retain moisture and fail to condense on the plastic.

To ensure a reliable result, 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 not performing a moisture test, we recommend giving a newly poured slab 90 days to cure fully. Once certain of the moisture level of the slab, we recommend one of three installation methods.

The slab **MUST** have sufficient drainage from rain and snow at all times. Failure to provide sufficient drainage will void any product warranty.

Warmboard-S **MUST** be mechanically fastened, not just floated or glued. Failure to mechanically fasten the product will void any product warranty.

Method 1: Fasten Directly

Apply either a liquid vapor barrier or a 6- or 10-mil polyethylene vapor retarder overlapping two feet (2') at the seams. Continue with Warmboard-S panel installation using split drive anchors, Tapcon concrete fasteners or powder-actuated fasteners. We recommend a maximum of 21 fasteners for each panel.

Method 2: Using Insulation

Install a 6- or 10-mil polyethylene vapor retarder directly to the slab, overlapping two feet (2') at the seams. Next, install a 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 (21 per panel) to attach the entire assembly to the slab. Find the instructions for these products at homasote.com

Method 3: Sleepers

Install a 6- or 10-mil polyethylene vapor retarder directly to the slab, overlapping two feet (2') at the seams. Continue by installing 2"x 4" pressure treated sleepers attached to the slab (flat framed) on 24" centers with fasteners. Insulate the cavity between the sleepers with rigid foam insulation. To complete the procedure, install Warmboard-S and fasten to the sleepers with screws or ring shank nails and construction adhesive.

Fastening to Concrete

Drilling should be done with the Warmboard panels in place (pre-drilling the concrete is not recommended). Use a heavy duty roto hammer drill and a high-quality 1/4" masonry drill bit. The hole should be 1/2" deeper than the required specification. Once drilled, draw the drill bit in and out a few times to loosen excess material. Use a shop vacuum to remove the debris.

Choose one of the following methods to fasten the Warmboard panels to the concrete. Use a pattern of 3 rows of 7.

- **Method 1: Split Drive Anchors (Recommended)**
  Use a 3lb. sledge hammer to force the Split Drive Anchor through the pre-drilled panel and into the concrete

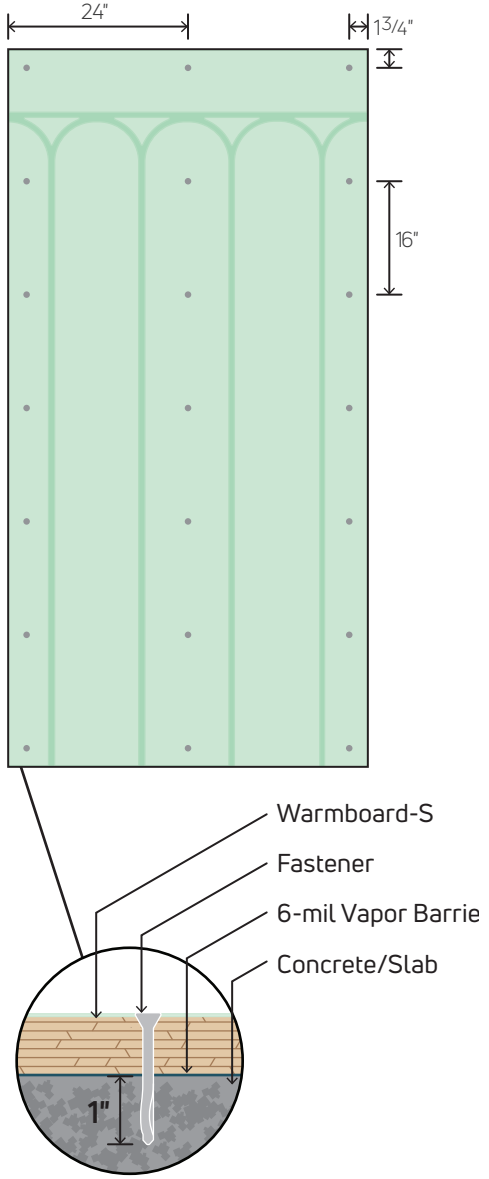
2 1/2" x 1/4" flat head Split Drive Anchor:
Use 1/4" high-quality masonry bit

- **Method 2: Tapcons**
  Simply install the Tapcon through the pre-drilled hole and into the concrete

2 1/2" x 1/4" flat head Tapcon concrete screw:
Use 3/16" high-quality masonry bit

- **Method 3: Powder-actuated fasteners**
  Select an actuated tool, and charge, designed for fastening 1 1/8" plywood to concrete. Choose a fastener that will grab a minimum of 1" of concrete

0.138" Hilti X-C P8 Powder-actuated fastener:
Use Hilti DX 2 semi-automatic, powder-actuated tool or approved equivalant



Flat head Split Drive Anchors will save you many hours of labor, but may be difficult to find in retail locations. Call 888.498.5747 or visit confast.com.

Fasteners **MUST** exceed a length of 2 1/4" if using Homasote between the slab and Warmboard-S

INSTALLING OVER SUBFLOOR

Preparation

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

If necessary, sand the subfloor and install extra blocking below. Inspect for squeaks and refasten with decking screws as necessary.

Cutting and installing Warmboard-S is very straightforward. The panels can be trimmed with a standard skill or table saw and will rip just like ordinary subfloor. We recommend cutting with the aluminum side down to help avoid burrs.

Method 1: Screw Only

Use a #8 x 2" GRK R4 Multi-Purpose screw (or equivalent) with a top 1/2" smooth shank.

- Fasten with a grid pattern of 6" on the edges and 12" on the inside
- No pre-drilling required
- Self-counter sinking
- No adhesive needed

Method 2: Nail and Glue

Use a construction adhesive designed for bonding to plywood (Loctite PL Wood Adhesive or equivalent). Follow all directions specified by the manufacturer.

For nailing, use a ring shank or a screw nail.
To determine the length of the nail, evaluate the thickness of the existing subfloor and add 1 1/8".

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

The subfloor and Warmboard-S **MUST** be completely dry, with a moisture reading between 8-12% before, during and after installation.

Cut panels with the aluminum side down.

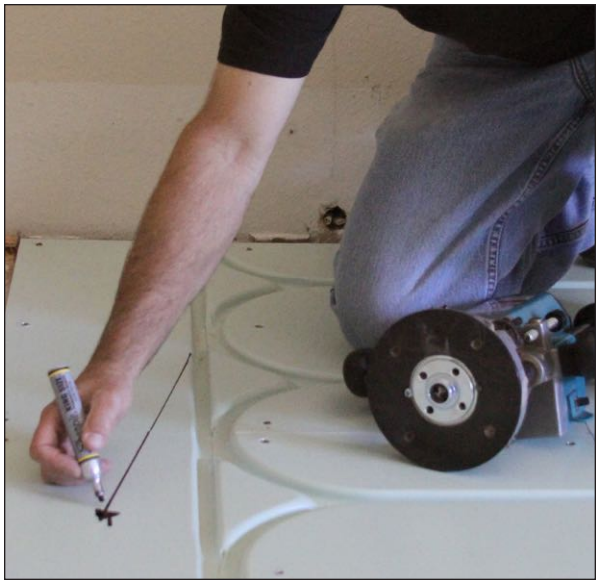
CUSTOM ROUTING

Check List

- Review all the tubing layout plans
- Use a permanent marker and the provided wood templates to mark all areas on the Warmboard panel that will require custom routing
- Prepare router with router bit, template guide and template guide lock nut

Procedure

- Place the routing template over the appropriate area and fasten into position with 3 screws. Be sure the screws do not interfere with the path of the router
- Ensure that the router bit and template guide are properly installed, then proceed with the route
- When complete, remove the template guide and use a 4" grinder or deburring tool to smooth the area for the tubing installation
- Use a shop vac to clear debris from the channel
- Place a piece of tubing into the new groove to confirm it sits level and flush with the top of the Warmboard panel



The router base needs room to operate and may be difficult to use near a wall - plan accordingly.

Visit **warmboard.com/videos** for instruction.

TUBING INSTALLATION

Step 1: Clean the Panels

Clearing the panels and tubing channels of debris will ensure the tubing sits flush and level. This is essential to a well functioning radiant system.

- Use a broom, shop vacuum or leaf blower to clear the debris from the panel and tubing channels
- Use a 1/2" conduit to break loose stuck-on material

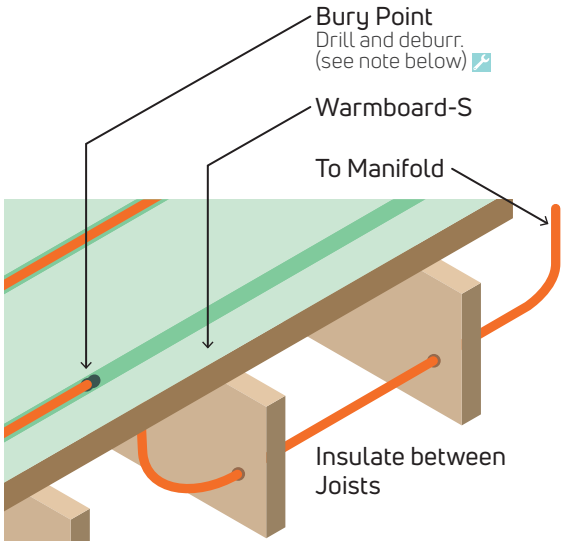
Step 2: Mark the Tubing Paths

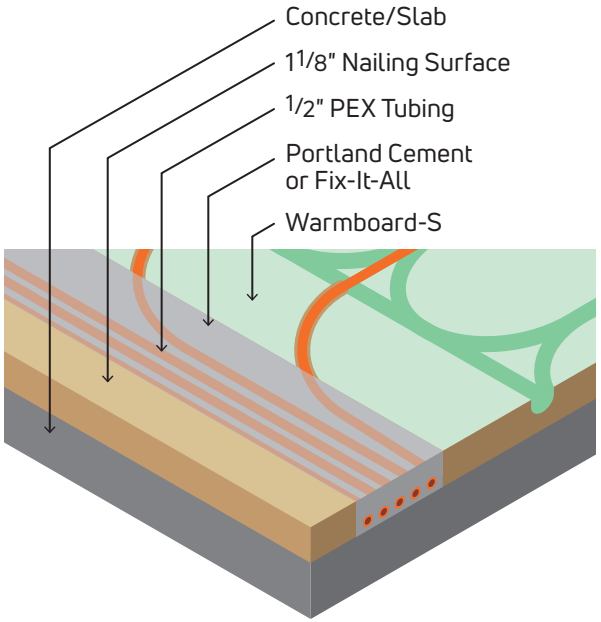
- Follow the Tubing Layout plan set and mark the tubing paths on your panels with a permanent marker
- Clearly mark turns, bury points, custom routes, and manifold locations
- Mark locations of all plumbing waste lines
- Mark each loop to avoid any future confusion

Step 3: Return Lines to Manifolds

To return the PEX tubing back to the manifolds, there are a few different options which will work.

- **Method 1**
  Use the existing channels in the panels to return the tubing to the manifold
- **Method 2**
  Create custom routes in the panel and return the tubing back to the manifold
- **Method 3**
  Create a bury point and feed the tubing back to the manifold by going through the subfloor (illustration)
- **Method 4**
  Use the "panel cut back" to create a tubing channel above the slab for the tubing to return to the manifold. Fill with Portland cement to create a level surface (illustration)





Use a Sharpie or wax pencil to mark panels.

Use a 3/4" drill bit to create a 3/4" x 11/2" bury point which will help prevent the tube from kinking.

Visit **warmboard.com/videos** for instruction.

Step 4: Custom Routes

Follow the instructions on page 12.

Step 5: Install Tubing

- Avoid installing tubing at temperatures below 50˚F as the tubing becomes rigid and difficult to bend
- **ONLY** use tubing from our Approved Tubing List (pg. 5)
- Use a 16oz. rubber mallet to secure the tubing in the channel (be sure the tubing sits level and flush with the top of the panel)
- **DO NOT** use silicone/adhesive in the channels
- Tape over the ends of the tubing to prevent debris from clogging the lines
- A tubing uncoiler will help avoid twists and kinks when installing the tubing. It is an excellent investment and highly recommended for large jobs
- Use nail plates to secure tubing as needed and remove before finish floors are installed

The tubing **MUST** be level and flush with the surface of Warmboard.

Consider Ram Board (or equivalent) to help protect the tubing in high traffic areas.

Step 6: Install Manifold(s)

- 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
- Clearly mark all supply and return loops. Document rooms and zones on the manifolds to avoid future confusion
- Pressure test all loops to the mechanical code requirement of 100 PSI for 15 minutes. After this, the PSI will drop 5-10% (this is normal)
- After the 15 minutes, lower the air pressure to 60 PSI and maintain during the construction process. After this, the PSI will drop 5-10% (this is normal)

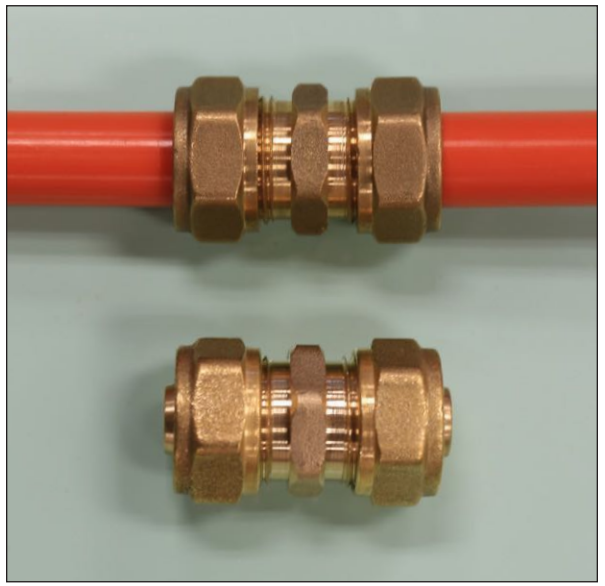
Minimum Framing Dimensions

Loops	Width x Height
2 Loop Manifold	14" x 36" clear
3 Loop Manifold	16" x 36" clear
4 Loop Manifold	17" x 36" clear
5 Loop Manifold	20" x 36" clear
6 Loop Manifold	22" x 36" clear
7 Loop Manifold	24" x 36" clear
8 Loop Manifold	26" x 36" clear

Step 7: Tubing Repair

Every tubing manufacturer makes a repair coupler to repair a punctured section of tubing. Repairing tubing damage is an easy fix and should require less than 30 minutes to complete.

- Pop the tube out of the tubing channel
- Cut out the damaged area and insert the coupler
- Chisel/Cut a groove into the panel to accommodate the size of the coupler



HARDWOOD FLOORING

Hardwood Recommendations

Solid, sawn, hardwood planks have been an integral part of residential architecture for over 400 years. Since 1998, over 40 million square feet has been successfully installed over Warmboard. The long documented history of hardwood combined with our decades of experience tells us that traditional 3/4" solid plank flooring is the gold standard and accordingly, that is our strong recommendation.

All wood products expand and contract with changes in humidity. Solid plank wood is naturally monolithic and expands and contracts most evenly. When these dimensional changes do occur, cupping, crowning and gapping at the edges may result. These changes are inherent to all wood flooring, regardless of the heating method. To minimize such dimensional changes, especially as humidity varies throughout the seasons, we also recommend quartersawn and/or rift cut planks due to their stability.

To further limit dimensional movement, ensure the hardwood has the proper moisture content at the time of installation (pg. 16). A good hardwood installer will know the ideal range for your geographic region (moisture content should be at the low end of this range). A moisture meter is required to determine when that moisture percentage is achieved.

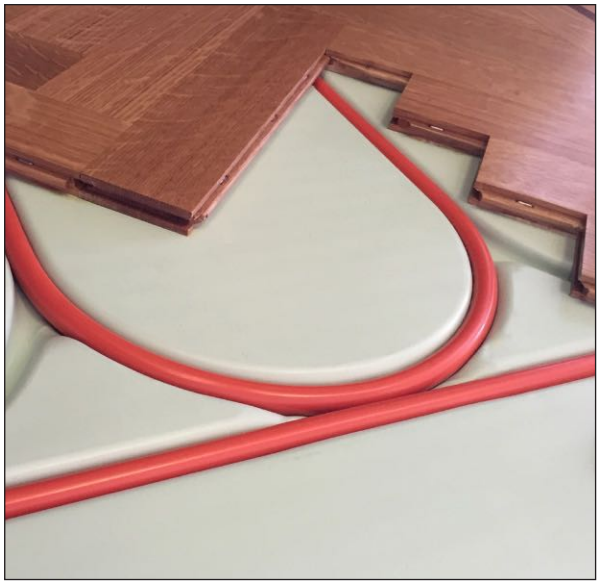
Whether using plank, engineered or laminate wood flooring, there have been thousands of successful installations over Warmboard.

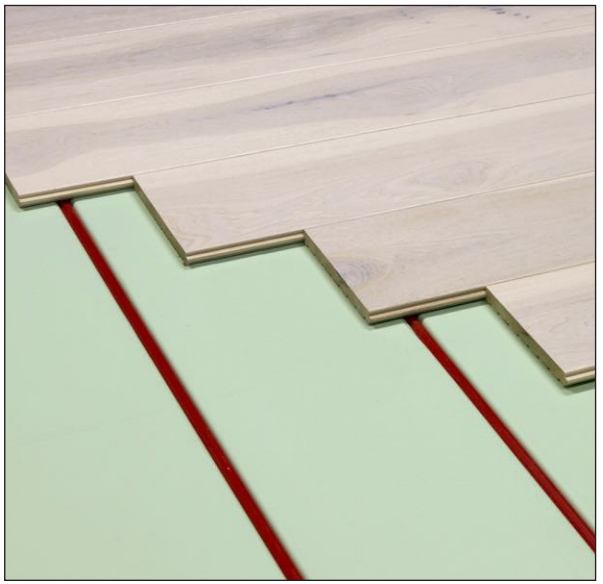
A Word about Engineered Flooring

Numerous engineered flooring products have been developed in recent years. With each product comes variations in material, assembly method, dimensional stability and overall quality. Warmboard is unable to test every iteration of these products and therefore cannot express an informed opinion on how variations in humidity may impact their dimensional stability. We leave it to the consumer to do their own due diligence to determine any particular engineered product's suitability for their project.

A Word about Flooring Thickness

Many mistakenly believe that a radiant floor cannot have 3/4" thick floor coverings. This thinking is based on a theory that the resulting higher R-value prevents the system from adequately heating the space. This may be true for low conductivity radiant panels, but not Warmboard. Apart from the fact that thicker hardwood, all things being equal, is better quality, its increased R-value causes more even heat across your floor with the result that your feet will not be able to tell where tubing is and isn't. With thinner material, the temperature variation across the tubing is increased causing what is known in the radiant industry as "striping" which makes your floor less comfortable. And comfort is the primary reason for Warmboard's existence, which is why we recommend using 3/4" hardwood over our panels.





HARDWOOD ACCLIMATION

Hardwood Flooring Acclimation

Before the hardwood is on site, ensure the interior plastering is complete (and dry), and that the radiant system has been operating for a couple weeks in order to reduce any excess moisture from the Warmboard panels. In some locales, you may need to operate the air conditioner simultaneously with Warmboard to lower the indoor humidity. The hardwood should experience consistent, low humidity once on site.

Consider any moisture or humidity intrusion that may take place in the future, such as a crawl space beneath the Warmboard panels which could be dry in the summer and experience water intrusion in the winter. This could cause large humidity swings and excess movement of the hardwood flooring.

Once the interior space is properly conditioned to the desired relative humidity, bring in the wood planks and sticker them - pulling the planks out of their boxes and setting them up so air can circulate around them (photo).

Prior to flooring installation, **the moisture content of Warmboard-S should be 12% or less. The moisture content of the finish hardwood should be between 6-9%**, though this will vary by climate zone. Be sure to discuss this with your flooring installer.

It will be difficult to get a moisture reading from Warmboard due to its aluminum surface, so we a moisture meter with insulated contact pins and hammer probe. The Delmhorst J4 and J2000 models (delmhorst.com) are good options, and can be upgraded with pins and hammer probe.

Operating the System

Circulate warm water under the newly installed floor for a few days before gradually bringing the water temperature up to the designed set point. For example, start with 100ºF, then increase to 120ºF. Finalize the set point according to the needs of the structure.

Ideally, the heating system should use “Indoor Reset” or another type of reset control strategy. “Reset” is a system for automatically resetting boiler temperatures (up or down), to better meet changing heatloads. This is an excellent strategy for hardwood floors.

It is **ESSENTIAL** to acclimate wood flooring prior to installation. Acclimation time can vary by season, but two weeks is recommended.

Keep low moisture levels in the hardwood to ensure long term stability. Maintain an indoor ambient temperature between 60-80˚F (15-26˚C), and keep the humidity between 30-50%.

INSTALLING SOLID PLANK

3 Installation Methods

- Method 1
  Nail hardwood directly
- Method 2
  Nail and glue hardwood directly
- Method 3
  Glue hardwood directly (no fasteners)

Approved Adhesives

- Bona R850T, R851, R859
- Bostik's BEST, BST, Climb, EFA+, GreenForce, HDAC, ProCure, Pro-MSP, Ultra-Set SingleStep 2, Vapor-Lock
- Mapei Ultrabond Eco 975, 980
- Sikabond T-35 and T-55
- Stauf Adhesives PUK-455 Wide Plank Adhesive, PUM-950 Power Mastic
- Titebond 771, 811, 821
- Wakol MS 230, MS 232, MS 260, MS 262, MS 290, MS 292, MS 245/246, PU 224, PU 385

Warranty letters from these companies are available upon request.

Method 1: Nail Directly

Installing hardwood perpendicular to the tubing pattern is the best method as it allows you to see the tubing and avoid damaging it. Tongue nail at a 45º angle at 6" on centers and use 2" flooring nails.

Warmboard's thick aluminum surface acts as the moisture barrier, no other product is needed.

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.

It is essential to lower the moisture content of your hardwood prior to installation (pg. 16)

Warmboard's aluminum surface acts as a vapor barrier - no additional vapor retarder is required. Wood flooring can be installed directly over the Warmboard panels.

Visit **warmboard.com/videos** to watch our hardwood installation video.

When installing hardwood parallel to the tubing, rip the first plank at an appropriate width to create a nailing pattern which will avoid the tubing at all T&G locations.

Method 2: Nail & Glue Directly

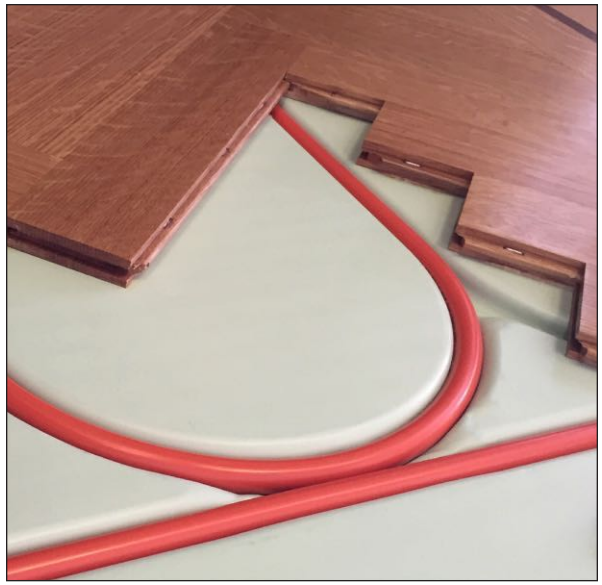
Aside from the glue itself, you do not need to install additional material between the Warmboard panel and the hardwood.

Installing hardwood perpendicular to the tubing pattern is the best method as it allows you to see the tubing and avoid damaging it. Tongue nail at a 45º angle using 2" flooring nails at 6" on center.

Occasionally, plank flooring may run the same direction as the tubing, and nailing the plank could cause tubing damage. Should this occur, DO NOT nail - the glue will successfully bond the plank to the Warmboard panel.

Method 3: Glue Directly

Aside from the glue itself, you do not need to install additional material between the Warmboard panel and the hardwood.



ONLY use approved adhesives listed in the guide (pg. 17, 19). Failure to use approved adhesives will void any product warranty.

ENGINEERED, LAMINATE AND BAMBOO

4 Installation Methods

- **Method 1**
  Floating Floor
- **Method 2**
  Nail planks directly
- **Method 3**
  Nail and glue planks directly
- **Method 4**
  Glue the planks directly (no fasteners)

Approved Adhesives

- Bona R850T, R851, R859
- Bostik's BEST, BST, Climb, EFA+, GreenForce, HDAC, ProCure, Pro-MSP, Ultra-Set SingleStep 2, Vapor-Lock
- Mapei Ultrabond Eco 975, 980
- Sikabond T-35 and T-55
- Stauf Adhesives PUK-455 Wide Plank Adhesive, PUM-950 Power Mastic
- Titebond 771, 811, 821
- Wakol MS 230, MS 232, MS 260, MS 262, MS 290, MS 292, MS 245/246, PU 224, PU 385

Warranty letters from these companies are available upon request.

Method 1: Floating Floor

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 approach allows the whole floor to move as a single unit if a dimensional change within the floor takes place.

We highly recommend installing acoustic padding between Warmboard and the planks. A good option is the Roberts' AirGuard Premium 3-in-1 Underlayment with Microban (homedepot.com)

It is essential to lower the moisture content of your hardwood prior to installation (pg. 16)

Warmboard's aluminum surface acts as a vapor barrier - no additional vapor retarder is required. Wood flooring can be installed directly over the Warmboard panels.

If considering bamboo, visit plyboo.com.
They offer a full warranty with Warmboard.

Method 2: Nail Directly

You do not need to install additional material between the Warmboard panel and the hardwood.

Installing hardwood perpendicular to the tubing pattern is the best method as it allows you to see the tubing and avoid damaging it. Tongue nail at a 45º angle using 2" flooring nails at 6" on center.

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.

Method 3: Nail and Glue Directly

Aside from the glue itself, you do not need to install additional material between the Warmboard panel and the hardwood.

Installing hardwood perpendicular to the tubing pattern is the best method as it allows you to see the tubing and avoid damaging it. Tongue nail at a 45º angle using 2" flooring nails at 6" on center.

Occasionally, plank flooring may run the same direction as the tubing, and nailing the plank could cause tubing damage. Should this occur, **DO NOT** nail - the glue will successfully bond the plank to the Warmboard panel.

Method 4: Glue Directly

Aside from the glue itself, you do not need any additional material between the Warmboard panel and the hardwood.

When installing hardwood parallel to the tubing, rip the first plank at an appropriate width to create a nailing pattern which will avoid the tubing at all T&G locations.

ONLY use approved adhesives listed in the guide (pg. 17, 19). Failure to use approved adhesives will void any product warranty.

INSTALLING TILE

Tile or stone set to Warmboard-S is subject to all of the tile setting requirements of any ordinary unheated wooden subfloor.

Testing and Approvals

We recommend using one of seven tile assemblies when installing tile or stone over Warmboard. Three of these methods have been warrantied and approved by product manufacturers, and five have been rigorously tested by the Tile Council of America (TCNA). These tests provide an expert third party endorsement for best practices when installing tile and stone over Warmboard radiant panels.

Robinson Floor Test (ASTM C627) results are available upon request.

TCNA Ratings & Description

- **TCNA rating: Residential (homes)**
  Tile survived 3 cycles of testing with no damage
- **TCNA rating: Light Commercial (offices, etc.)**
  Tile survived 6 cycles of testing with no damage
- **TCNA rating: Moderate (hospitals, etc.)**
  Tile survived 10 cycles of testing with no damage
- **TCNA rating: Heavy (shopping malls, etc.)**
  Tile survived 12 cycles of testing with no damage
- **TCNA rating: Extra Heavy (airports, etc.)**
  Tile survived 14 cycles of testing with no damage

Ensure your chosen products and methods meet the standards set by the TCNA, ANSI and ICC. Follow the manufacturer's recommendations when using their products.

Warmboard Inc. is not an agent for manufacturers listed herein, and gives no implied warranty for any of these products or manufacturers on these assemblies.

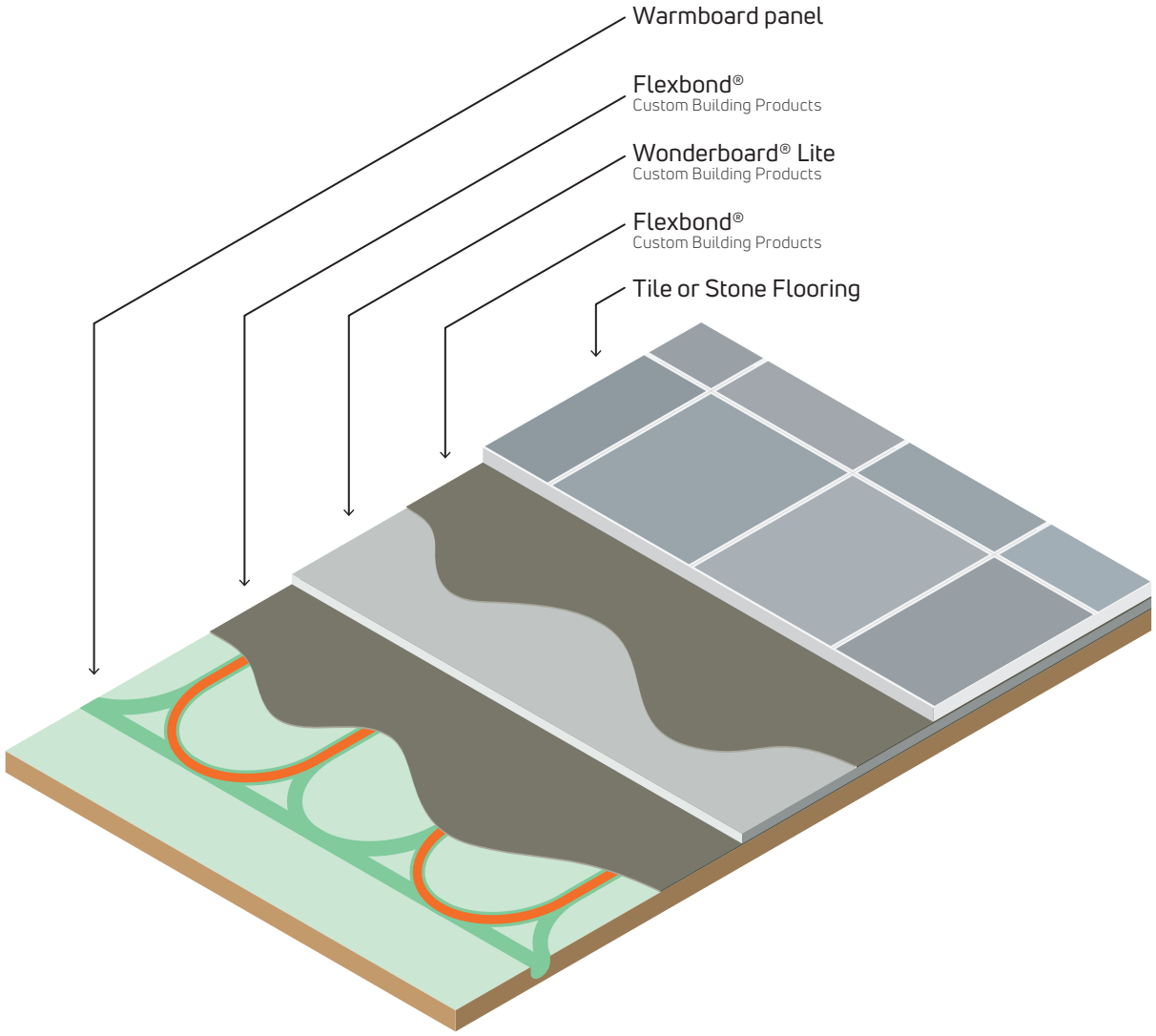
Recommended Assemblies

BACKER BOARD

Backer boards have a low mass and are relatively inexpensive to install. They can be 1/4" or 1/2" thick and provide a base for tiled areas which will match up well with adjacent finish flooring. There are a variety of Cementitious Backer Units (CBUs) available.

- Apply thinset to the surface of Warmboard using a square-notched trowel (this layer will function as a butter coating)
- Immediately, before the thinset dries, fasten the Backer board using Backer board screws (pg. 23)
- Use Backer board tape on all seams then apply the thinset
- Finish with tile or stone

A warranty letter from Custom Building Products for this applications is available upon request.



Surface temperatures of the finish flooring should not exceed 85˚F.

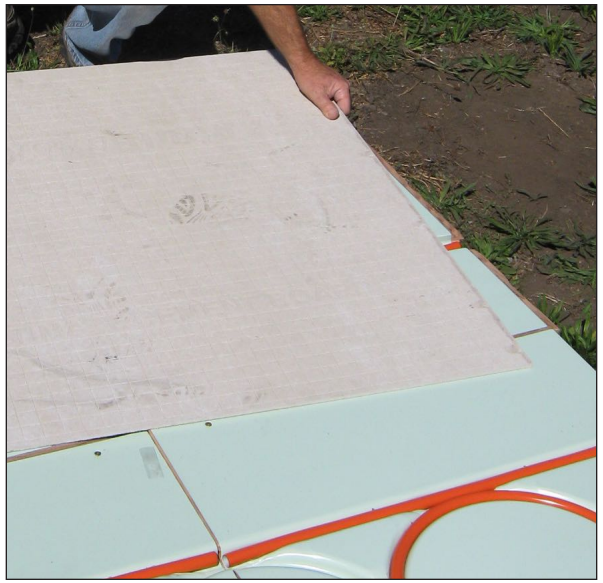
This specific assembly was TCNA tested. Substituting comparable brands is acceptable.

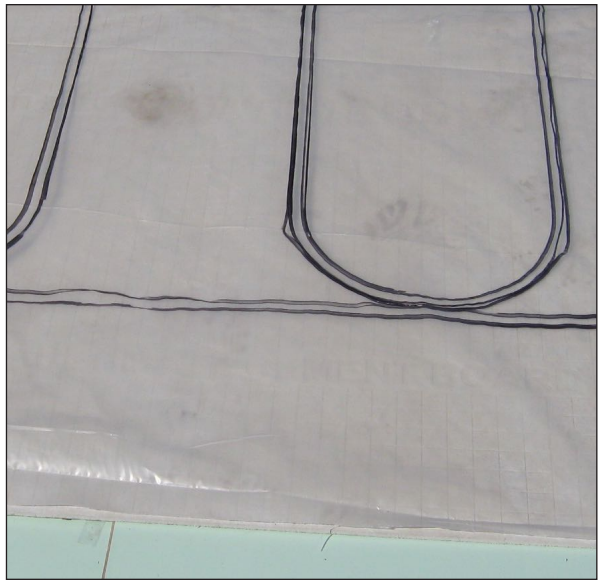
Backer board **MUST** run perpendicular to the Warmboard panels. Be sure to stagger the seams and take special care when fastening to avoid tubing damage.

BACKER BOARD STENCIL

Using a clear polyethylene sheet (3- or 4-mil), take a permanent marker to quickly create a stencil of the tubing pattern. Now, use this stencil as a guide over the Backer board to install the fasteners and avoid tubing damage.

- Cut the polyethylene to the size of Backer board (cut all 3' x 5' stencils at once to save time). **DO NOT** cut directly over the Warmboard or the tubing
- Place the cut sheets over the Warmboard panel and tape down the corners. With a permanent marker, clearly mark the top and bottom of the stencil, then trace the tubing pattern. Remove the stencil and lay flat next to your work areas
- Trowel a coat of Thin-set over the Warmboard panel and set the Backer board
- Align the stencil and tape down over the Backer board. Pre-drill all safe fastening locations, then remove stencil and fasten as normal





Take care to avoid tubing damage.

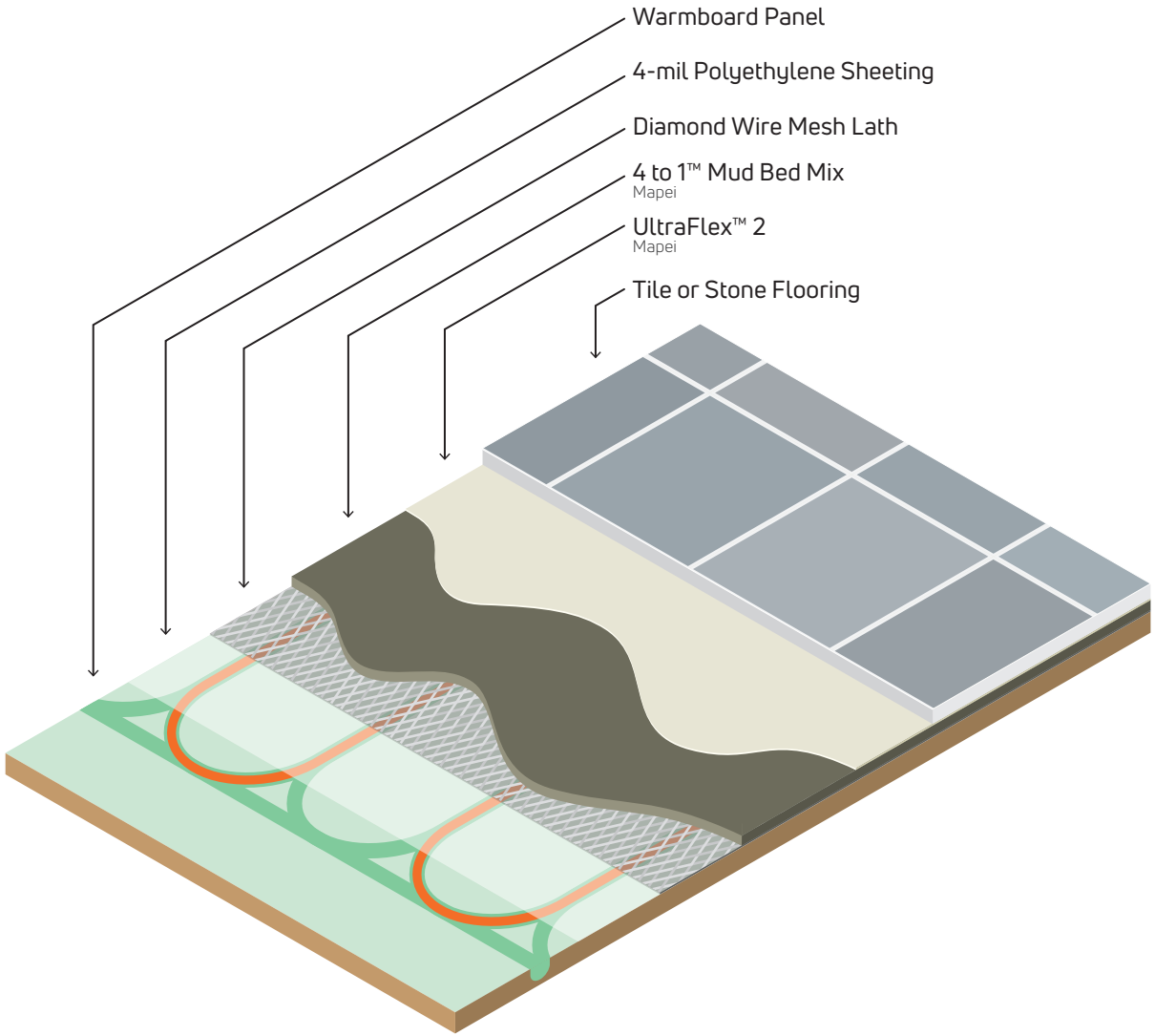
MUD BED, MAPEI

A mortar bed is the traditional method of addressing the expansion, contraction and deflection properties of wooden subfloors while providing a thick, continuous and stable surface for tile adhesion. However, they are expensive and add significant mass to a system. The thickness often causes the elevation of tile areas to misalign with adjacent carpeted or hardwood areas.

- Install a layer of 4- or 6-mil polyethylene to serve as a cleavage membrane
- Fasten down a diamond wire mesh lath over the membrane using crown staples
- Finish with a minimum 3/4" mortar bed (Mapei® 4-to-1 Mud Bed Mix or equal).
- After the mortar bed has cured, apply thinset
- Finish with tile or stone

TCNA testing results are available upon request.

A warranty letter from Mapei for this application is available upon request.



Surface temperatures of the finish flooring should not exceed 85˚F.

This specific assembly was TCNA tested. Substituting brands is acceptable.

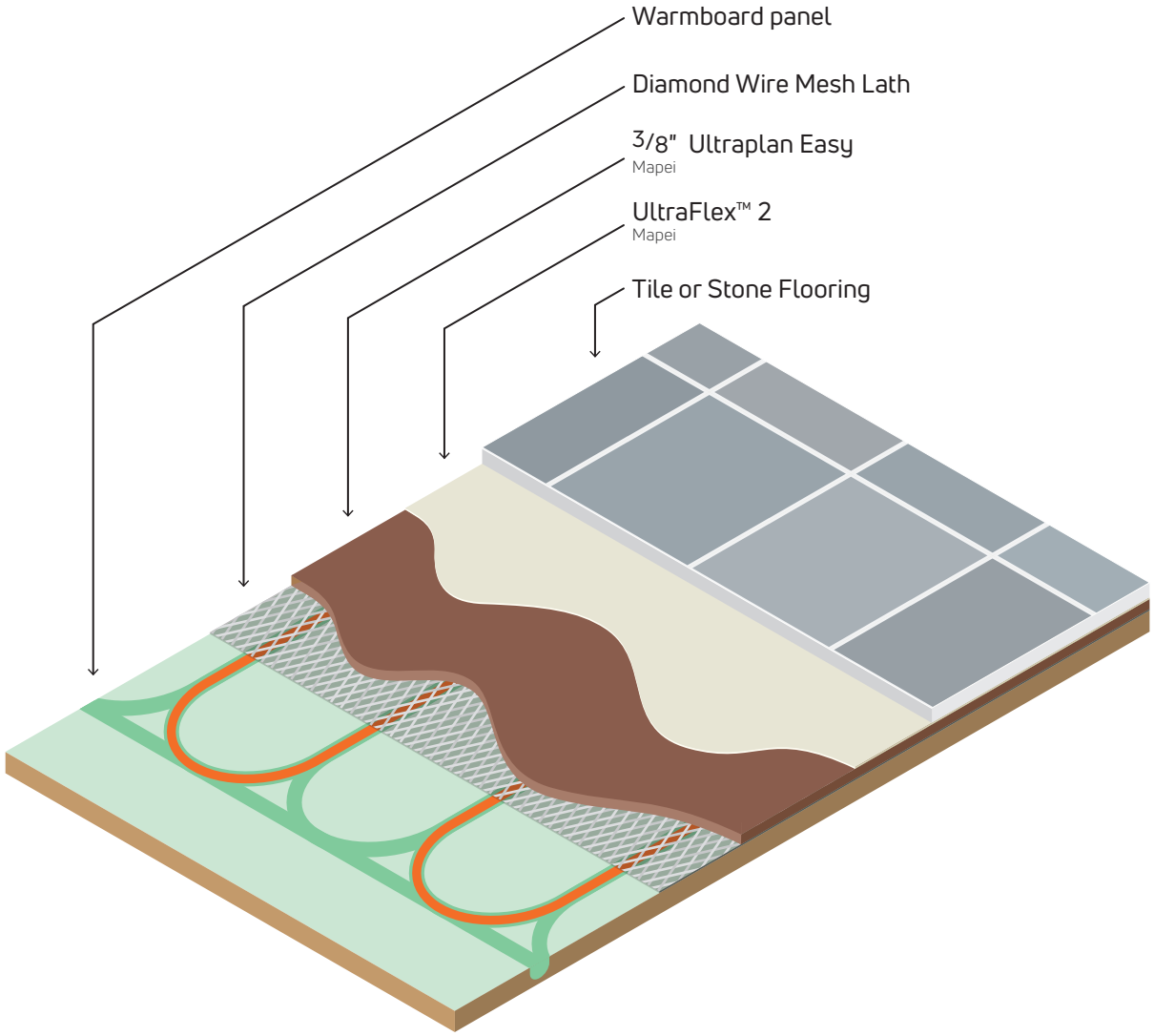
SELF-LEVELING UNDERLAYMENT, MAPEI

This product has a thin profile with the great strength of a mortar bed.

- Clean the panels and apply "Mapei Primer T" (per Mapei instructions)
- Follow with the diamond wire mesh lath and attach with crown staples
- Mix and apply "Ultraplan® Easy" at a thickness of 3/8" or more
- Apply thinset
- Finish with tile or stone

TCNA testing results are available upon request.

A warranty letter from Mapei for this application is available upon request.



Surface temperatures of the finish flooring should not exceed 85˚F.

This assembly was TCNA tested.
Substituting brands is **NOT** recommended.

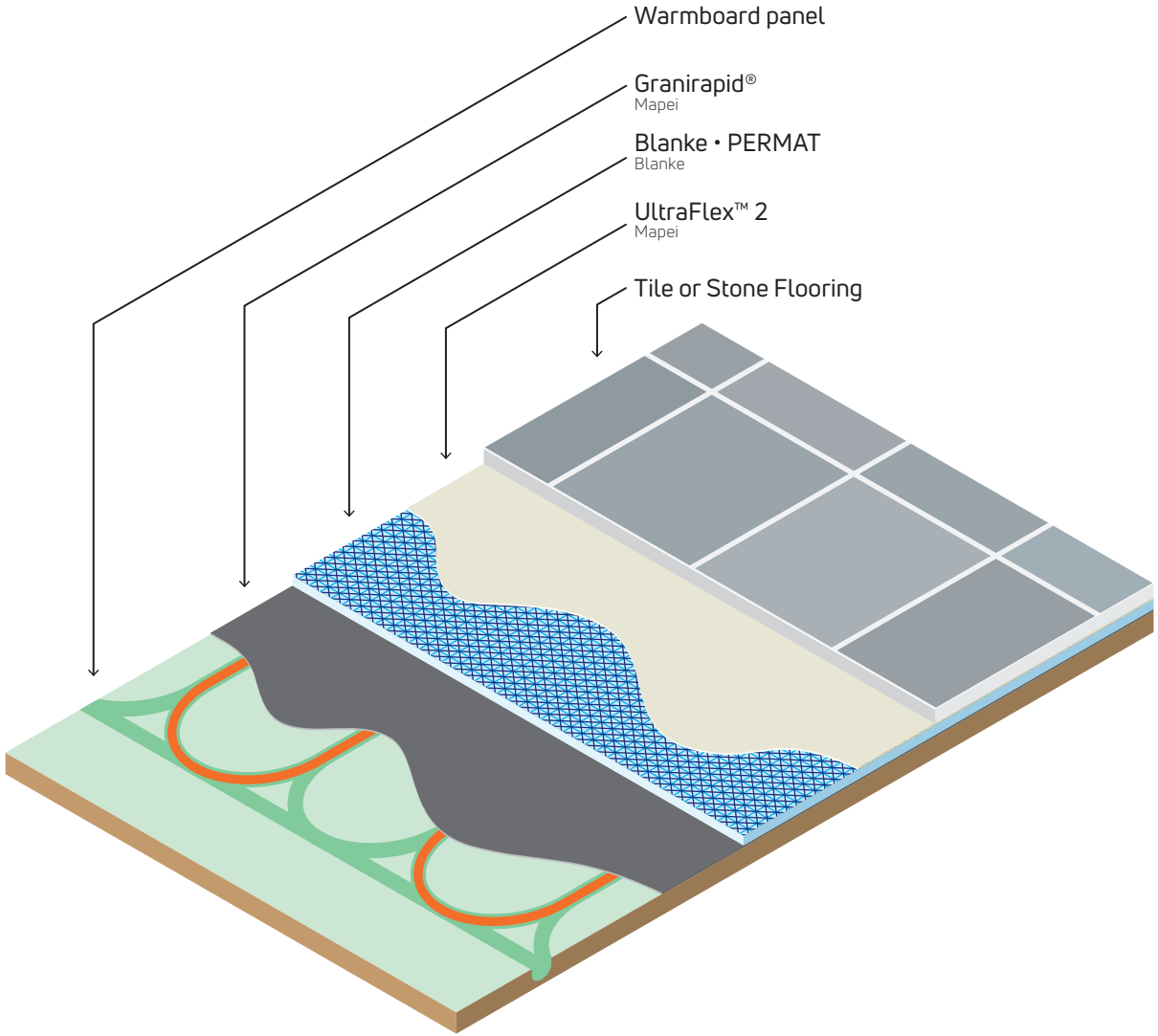
UNCOUPLING MEMBRANE, BLANKE

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

- Clean the panels
- Trowel on the Mapei Granirapid thinset mortar using a V-notched trowel
- Immediately install the Permat
- The next day, follow with thinset using a square-notched trowel
- Finish with tile or stone

TCNA testing results are availbale upon request.

A warranty letter from Blanke, Inc. for this application is available upon request.



Surface temperatures of the finish flooring should not exceed 85˚F.

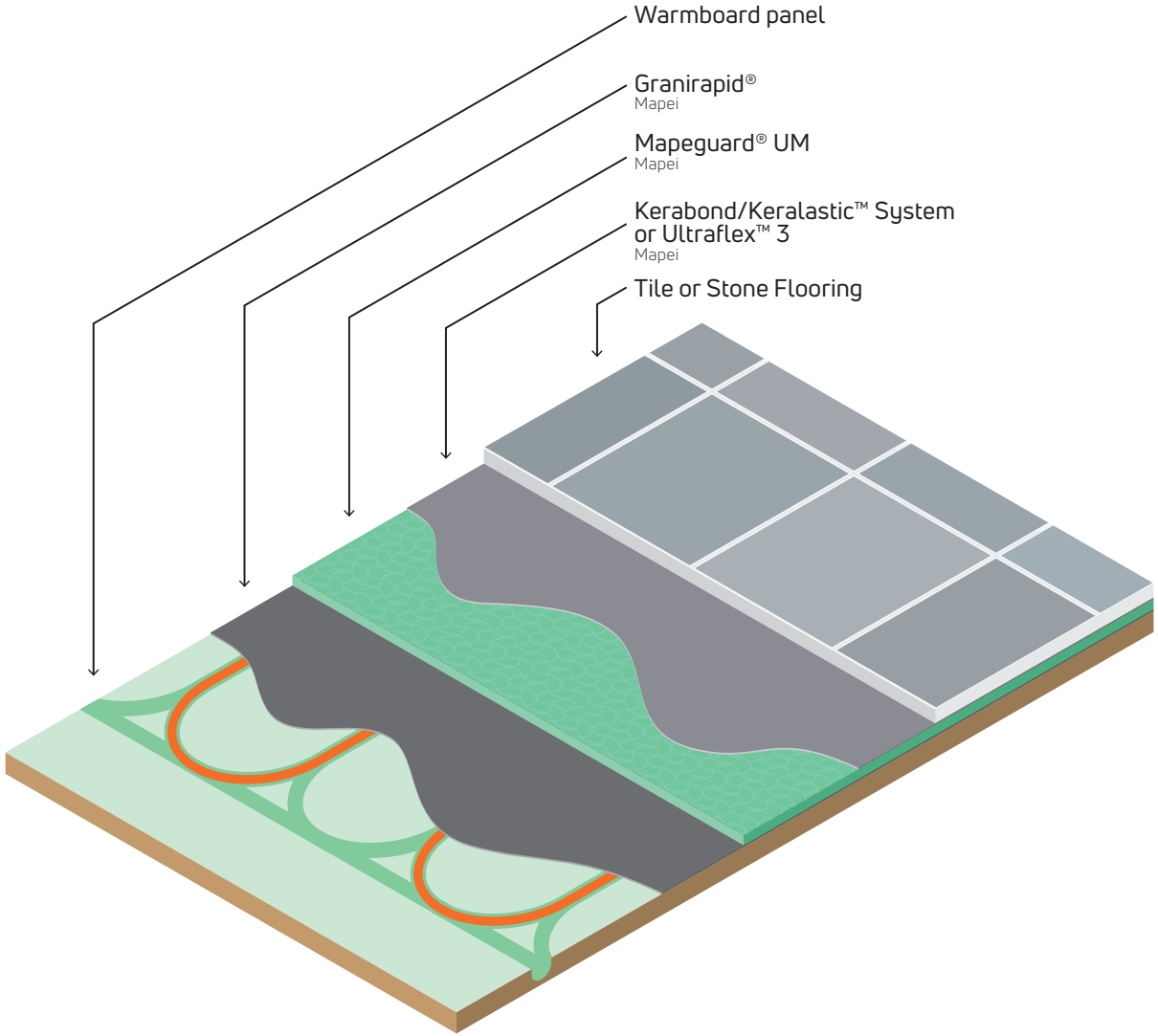
This assembly was TCNA tested.
Substituting brands is **NOT** recommended.

UNCOUPLING MEMBRANE, MAPEI

Mapeguard UM is a premium-performance, lightweight, waterproofing and vapor-pressure equalizing membrane that provides crack suppression for ceramic tile and stone installations.

- Apply the Mapei Granirapid® thinset mortar using a v-notched trowel
- Install the Mapeguard UM
- Wait for the mortar below the Mapeguard UM to be completely dry
- Trowel on the Kerabond/Keralastic System (or Ultraflex 3)
- Immediately finish with tile or stone

TCNA testing results are available upon request.



Surface temperatures of the finish flooring should not exceed 85˚F.

This assembly was TCNA tested.
Substituting brands is **NOT** recommended.

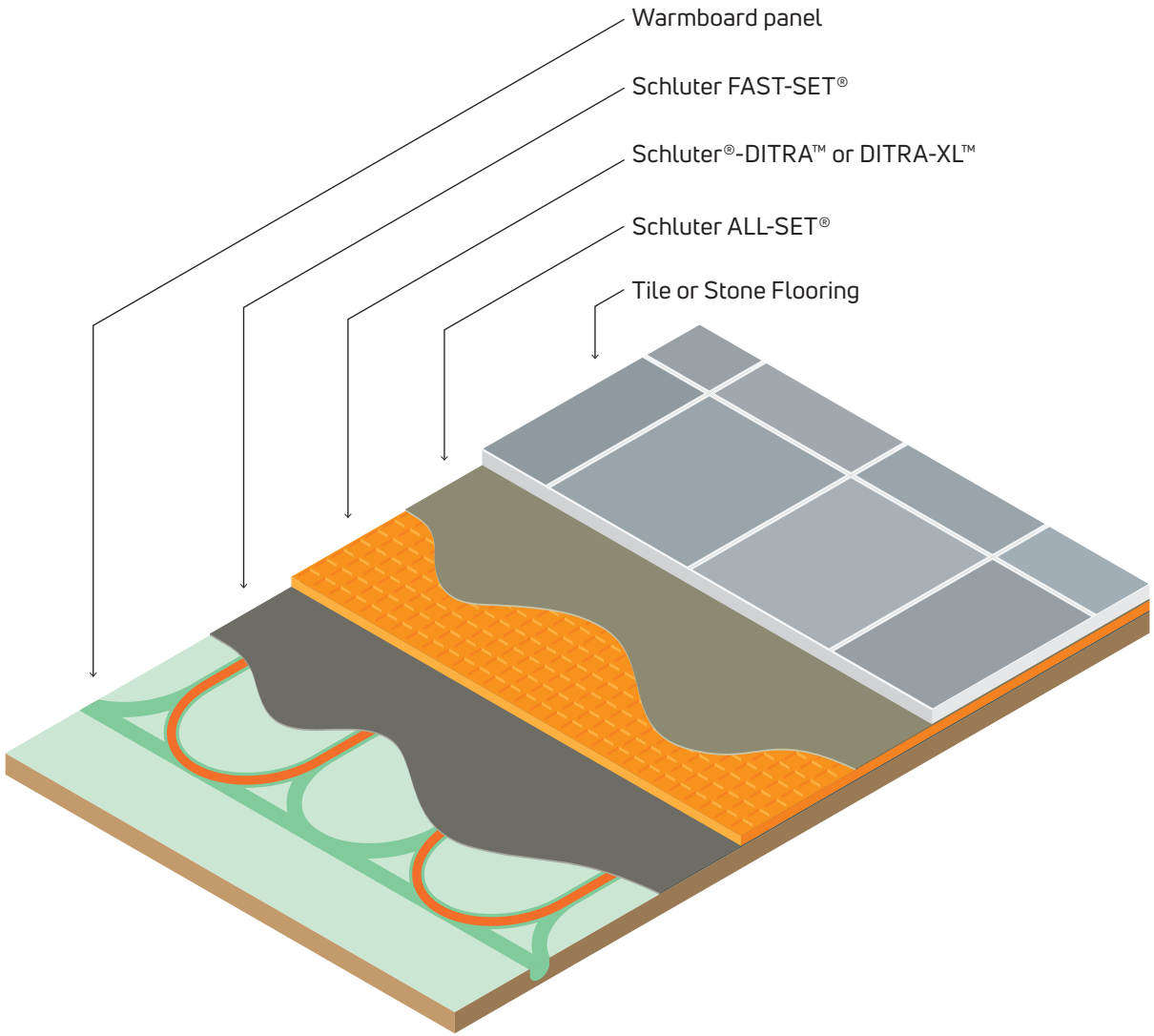
UNCOUPLING MEMBRANE, SCHLUTER®

Schluter®-DITRA® and DITRA-XL™ uncoupling membranes are designed to help prevent cracking in ceramic and stone tile installations. Made of waterproof polyethylene, these product installations can be waterproofed with minimal effort.

- Trowel a layer of Schluter FAST-SET® directly over the Warmboard and PEX tubing, filling all empty tubing channels with the thinset
- Before the thinset is cured, install the uncoupling membrane
- Once the Schulter FAST-SET® is completely dry, trowel Schluter ALL-SET® modified thinset mortar directly on to the membrane
- Finish with stone or tile before the Schluter ALL-SET® has cured

Follow all Schluter installation instructions for these products.

An approval letter from Schluter is available upon request.



For stone applications over DITRA, structural joist (TJI) **MUST** be on 16" centers.

Surface temperatures of the finish flooring should not exceed 85˚F.

Substituting brands is **NOT** recommended.

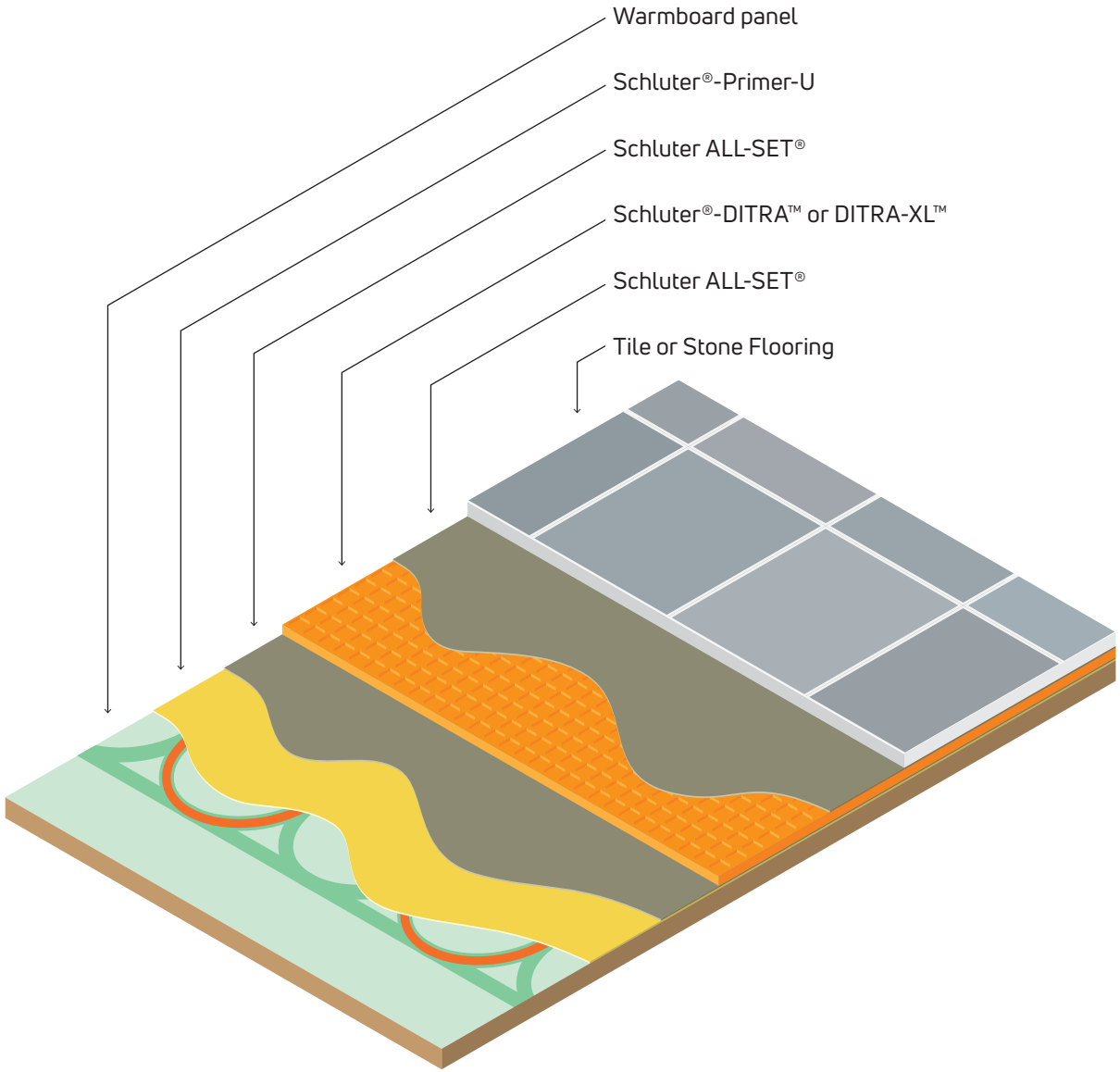
UNCOUPLING MEMBRANE, SCHLUTER®

Schluter®-DITRA® and DITRA-XL™ uncoupling membranes are designed to help prevent cracking in ceramic and stone tile installations. Made of waterproof polyethylene, these product installations can be waterproofed with minimal effort.

- ROll a layer of Schluter® PRIMER-U directly over the Warmboard and PEX tubing
- Apply a layer of Schluter® ALl-SET®. Before the thinset is cured, install the uncoupling membrane
- Once the Schulter® ALL-SET® is completely dry, trowel Schluter® ALL-SET® modified thinset mortar directly on top of the uncoupling membrane
- Finish with stone or tile before the Schluter® ALL-SET® has cured

Follow all Schluter installation instructions for these products.

An approval letter from Schluter is available upon request.



For stone applications over DITRA, structural joist (TJI) **MUST** be on 16" centers.

Surface temperatures of the finish flooring should not exceed 85˚F.

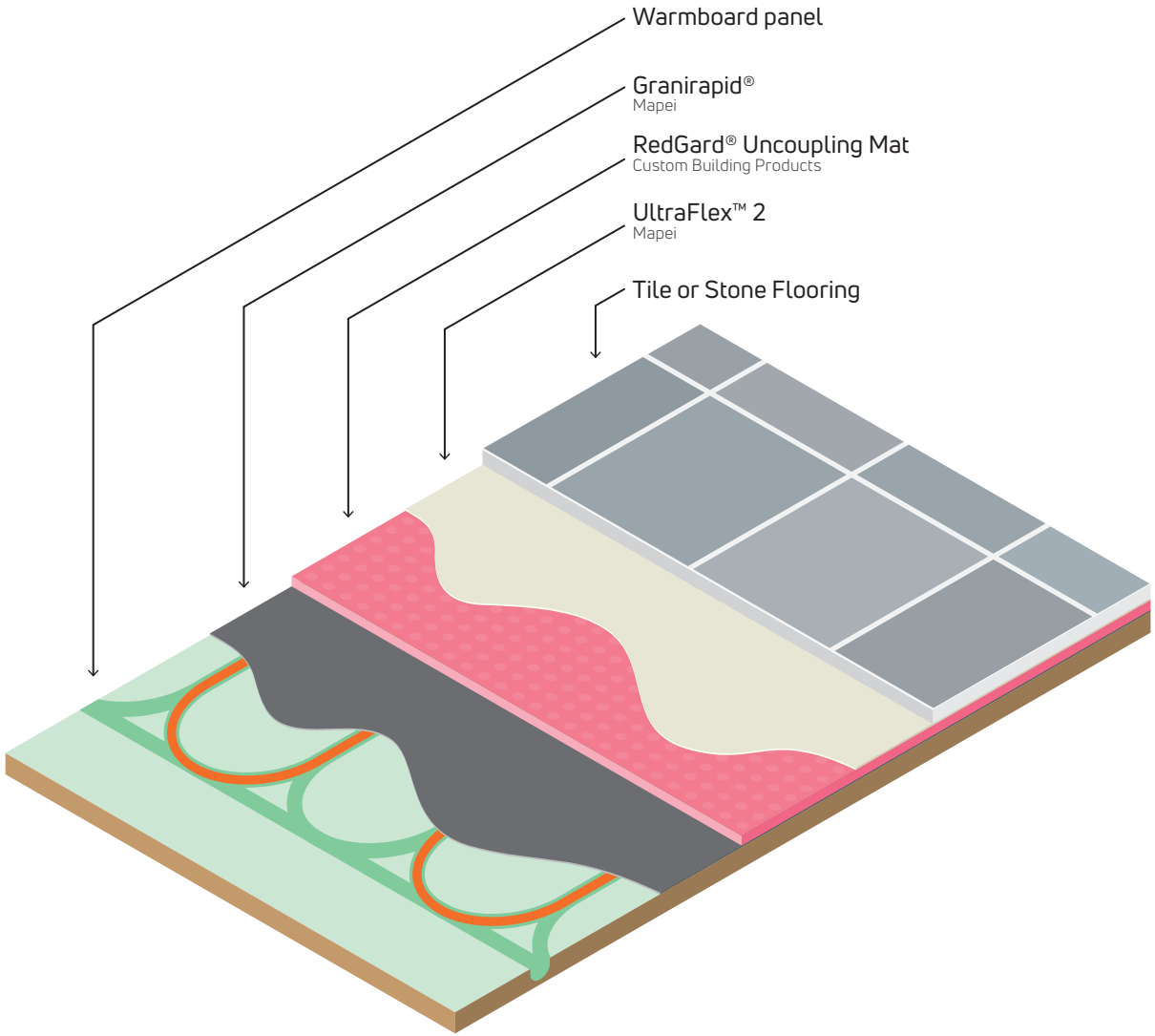
Substituting brands is **NOT** recommended.

UNCOUPLING MAT, REDGARD

The RedGard® Uncoupling Mat is a water and vapor-proof uncoupling membrane that can be used for crack-isolation in most tile, porcelain or natural stone installations. This product absorbs stress and preserves the surface and integrity of the tile. RedGard Uncoupling Mat's bonding layers have reinforced fleece which locks mortar into the mat, ensuring strong, reliable installations.

- Clean the panels
- Apply the Mapei Granirapid® thinset mortar using a v-notched trowel
- Immediately install the RedGard Uncoupling Mat
- The next day, follow with thinset using a square-notched trowel
- Finish with tile or stone.

An approval letter from Custom Building Products is available upon request.



Surface temperatures of the finish flooring should not exceed 85˚F.

Substituting brands is **NOT** recommended.

CARPET

Carpet and padding (cushion) is a very common finish floor that can be installed directly over Warmboard. We recommend a carpet assembly with a low R-value (2.0-2.5) so the system can use the same water temperatures beneath all finish flooring types. Higher values may require creating a two temperature system.

The R-values listed below are approximate based on carpet thickness. Check with the manufacturer to obtain accurate values.

Carpet thickness	Approximate R-value
1/8"	+/- 0.6
1/4"	+/- 1.0
1/2"	+/- 1.4
3/4"	+/- 1.8
1"	+/- 2.2

- Before installing the padding, fill all of the empty tubing grooves with a floor leveling compound (Portland cement) to make the grooves flush and level with the panel surface. Scrap pieces of PEX is also a good solution, though they should be fastened into place to prevent movement
- **DO NOT** install padding and carpet until all the loops have been properly pressure tested

Recommended Padding

Company	R-value	Product
Leggett & Platt 1.800.866.9446 lpcarpetcushion.com	0.80	Arcadia
	0.70	Aurora, Laguna, Coronado,
	0.60	Solano
Sponge Cushion 1.800.435.4062 commercial-carpetcushion.com	0.71-0.80	Luxury Step
	0.61-0.70	Full House, Tred-MOR 3700, Opulence, Horizon 100, Cloud 9, Luxury Walk
	0.51-0.60	Berber Supreme, Horizon 80, Royal Flex, Pinnacle
	0.41-0.50	Luxury Walk, Granite IV, Tred-MOR 2568, Tred-MOR 2580
	0.31-0.40	Eclipse, Tred-MOR 2500, Contract Master, Onyx Super
	0.21-0.30	Tred-MOR 1562, Onyx, Badger

Other Product Options

Product	Thickness	R-value
Slab Foam Rubber	1/4" 3/8" 1/2"	R-0.31 R-0.47 R-0.62
Waffle Rubber	1/4" 3/8" 1/2"	R-0.62 R-1.00 R-1.33
Fiber/Hair/Jute	1/4" 3/8" 1/2"	R-0.97 R-1.62 R-2.15

While many brands of carpet padding are available in the marketplace, we **DO NOT** recommend Prime Urethane, Bonded Urethane or Sunburst products due to their high R-values.

Surface temperatures of the finish flooring should not exceed 85˚F.

CORK FLOORING

Cork flooring naturally has a high insulation value. By choosing a product that is 1/4" to 1/2" thick, the R-value will remain low (1.5 or less) causing heat output and response times to improve. It will also simplify your mechanical design, allowing your cork floor to operate at the same water temperatures as tile, hardwood or carpet.

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

Standard Cork

The installation of an underlayment is required over the Warmboard surface before standard cork flooring is installed. We encourage a 3/4" thick finish floor assembly, but priority should be given to matching floor heights throughout the house. Take care when fastening the underlayment to Warmboard because the tubing is obscured during this step. We recommend installing a 1/4" 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. Consider Dri Tac 7500 (dritac.com).

Cork Laminate

Cork laminate products contain an MDF layer sandwiched between two layers of cork. It is not necessary to put any barrier between the cork flooring and the Warmboard prior to installation. This flooring installs the same as a floating floor and requires no adhesive or nailing for proper installation, providing flexibility for the homeowner if they ever decide to change the floor covering.

When using a plywood or OSB (or equivalent) underlayment, you **MUST** fully acclimate the panels before installation. If the moisture content of the underlayment is too high, it will shrink from the floor heating and cause an installation failure.

DO NOT use adhesive with plywood or OSB, only staples or screws.

Surface temperatures of the finish flooring should not exceed 85˚F.

Failure to follow these guidelines will void any product warranty.

Follow all installation instructions provided by your finish flooring manufacturer.

VINYL

There are several different types of vinyl flooring, and all can be used with Warmboard.

Increasing in popularity is the use of Luxury Vinyl Flooring (LVF) over Warmboard. This product emulates the look of natural materials like wood or stone, is a very durable and could be a great option for areas expecting a lot of wear and tear.

We recommend installing a substrate underlayment between the Warmboard and the vinyl finish floor.

Suggested Underlayments

- 1/4" or 1/2" interior plywood or OSB
- 1/4" or 1/2" tile backerboard (bathrooms, kitchens)

We encourage a 3/4" thick finish floor assembly, but priority should be given to matching floor heights throughout the house.

We recommend the Stencil Method (pg. 23) to avoid tubing damage. For tile Backer board installation, see page 22.

When using a plywood or OSB (or equivalent) underlayment, you **MUST** fully acclimate the panels before installation. If the moisture content of the underlayment is too high, it will shrink from the floor heating and cause an installation failure.

DO NOT use adhesive with plywood or OSB, just staples or screws.

Surface temperatures of the finish flooring should not exceed 85˚F.

Failure to follow these guidelines will void any product warranty.

Follow all installation instructions provided by your finish flooring manufacturer.

LINOLEUM

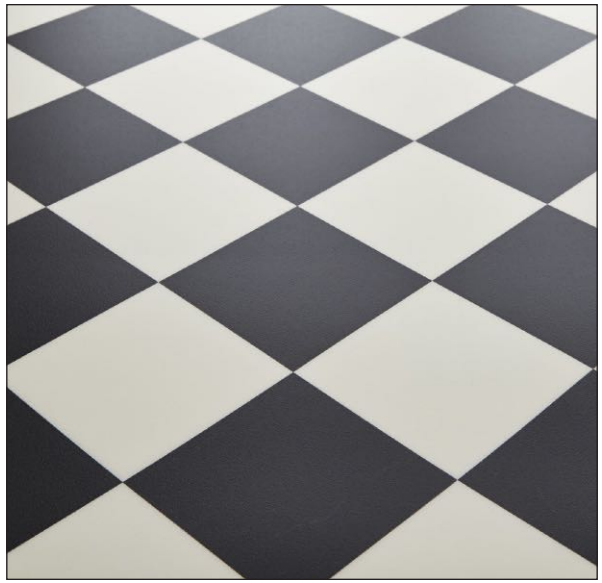
Always install a substrate underlayment between the Warmboard and the finish linoleum.

Suggested Underlayments

- 1/4" or 1/2" interior plywood or OSB
- 1/4" or 1/2" tile backerboard (bathrooms, kitchens)

We encourage a 3/4" thick finish floor assembly, but priority should be given to ensure matching floor heights throughout the house.

We recommend the Stencil Method (pg. 23) to avoid tubing damage. For tile Backer board installation, see page 22.



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DO NOT use adhesive with plywood or OSB, just staples or screws.

Surface temperatures of the finish flooring should not exceed 85˚F.

Failure to follow these guidelines will void any product warranty.

Follow all installation instructions provided by your finish flooring manufacturer.

FLOORING R-VALUES

Flooring	Thickness	Typical R-value	R-value per inch
Softwood	3/4"	0.825	1.10
Ash	3/4"	0.75	1.00
Fir	3/4"	0.90	1.20
Maple	3/4"	0.75	0.75
Oak	3/4"	0.638	0.85
Pine	3/4"	0.975	1.30
Engineered Bamboo	3/4"	0.72	0.96
Engineered Wood	1/4" 3/8" 5/8" 3/4"	0.25 0.375 0.625 0.750	1.0
Carpet	1/4" 3/8" 1/2" 5/8" 3/4"	0.70 1.05 1.40 1.75 2.10	2.80
Wool Carpet	3/8" 1/2"	1.575 2.10	4.20
Vinyl (sheet)	1/8"	0.20	1.60
Vinyl, (composite tile)	1/8"	0.20	1.60
Linoleum	1/8" 1/4"	0.20 0.40	1.60
Cork	3/8"	1.125	3.00
Cork/MDF/Laminate	1/2"	1.175	2.35
Brick	1 1/2"	3.375	2.25
Marble	1/2"	0.40	0.80
Ceramic Tile	1/4"	0.25	1.00

Underlayment	Thickness	Typical R-value	R-value per inch
Plyboo	3/4"	0.825	1.10
OSB	3/4"	1.05	1.40
Engineered Wood Flooring Pad	1/8"	0.20	1.60
Carpet Pad/Slab (rubber) 33 lb.	1/4" 3/8" 1/2"	0.32 0.48 0.64	1.28
Carpet Pad/Waffle (rubber) 25 lb.	1/4" 1/2"	0.62 1.24	2.48
Hair Jute	5/16" 1/2"	1.25 1.94	3.88
Prime Urethane	5/16" 1/2"	1.40 2.15	4.30
Bonded Urethane	5/16" 1/2"	1.35 2.1	4.20
Dense Rubber Flooring	5/16"	0.25	1.30
Recycled Rubber Flooring	1/2"	1.10	2.20
Thin-set Mortar	1/8"	0.05	1.00
MDF/Plastic Laminate	1/2"	0.50	1.00
Laminate Floor Pad	4/25"	0.30	1.92

HARDWOOD MANUFACTURERS

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

Arrigoni Woods
arrigoniwood.com // 888.423.6668

Mill & Woods
millandwoods.com // 800.283.6038

Boen Hardwood Floors
boen.com // 888.897.0800

BR-111 Exotic Hardwood
br111.com // 800.525.2711

Carlisle Wide Plank Floors
wideplankflooring.com // 800.595.9663

Craft Artisan Hardwood
craftfloor.com // 877.828.1888

Dinesen
dinesen.com // +45.7455.2140

The Heartpine Company
heartpinecompany.com // 434.234.8199

Homerwood Hardwood
homerwood.com // 814.827.3855

Junckers Hardwood Floors
junckershardwood.com // 800.878.9663

Launstein Floors
launstein.com // 888.339.4639

Lauzon Hardwood Flooring
lauzonflooring.com // 800.665.6765

mafi
mafi.com // 647.409.5984

Mirage Floors
miragefloors.com // 800.463.1303

Mountain Lumber
mountainlumber.com // 800.445.2671

Monarch Plank Hardwood
monarchplank.com

Plyboo
plyboo.com // 866.835.9859

Schotten & Hansen
schotten-hansen.com

Signature Hardwoods
signaturehardwoods.com // 866.554.4252

Southern Wood Floors
southernwoodfloors.com // 888.488.7463

Vermont Plank Flooring
vermontplankflooring.com // 866.804.9587

Vintage Flooring
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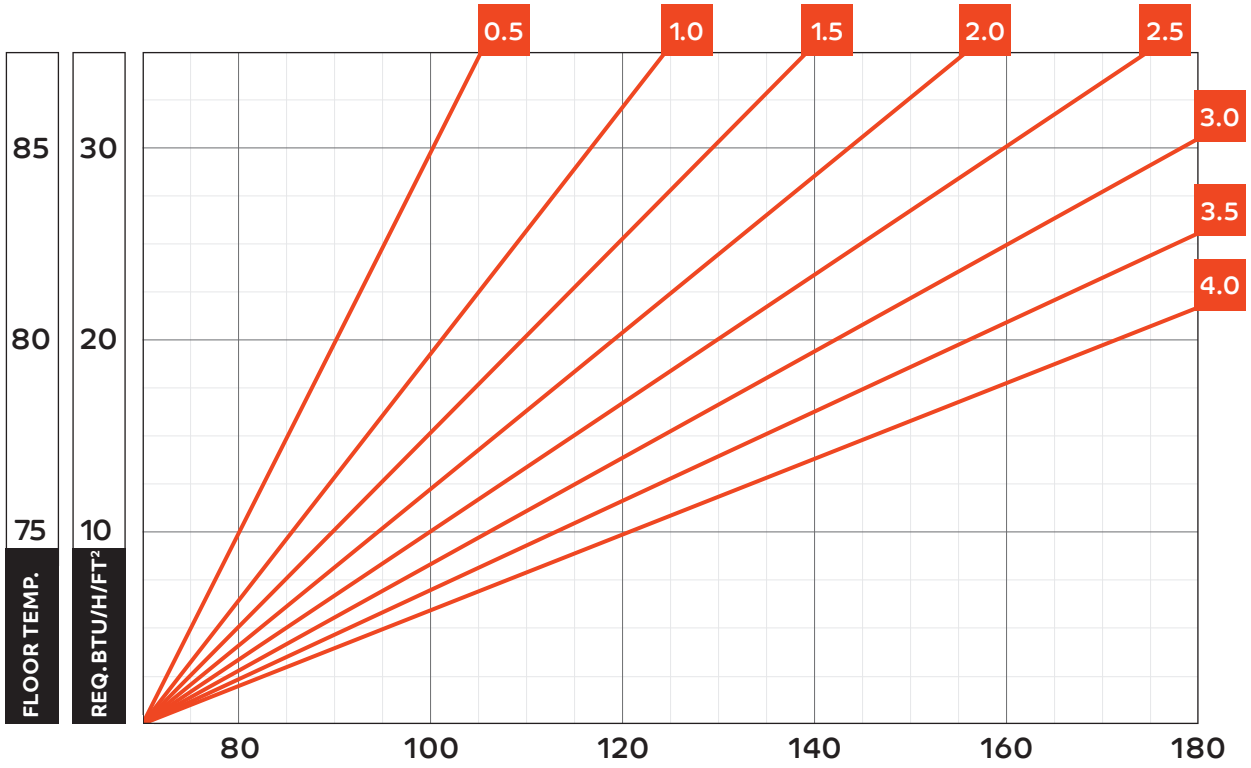
WATER TEMPERATURE CHART



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

This chart assumes an ambient air temperature of 70°F

= R-value (thermal resistance)

Steady State Performance requires 10% lower supply temperature.

Assumes minimum R-19 insulation below the floor.

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