



Warmboard-S

Installation Guide



warmboard

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IF IN DOUBT CALL : 1300 137 407

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Review this manual and the supplied working drawings (including floor plan dimensions) before work begins.



Panel Description

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Warmboard-S is a structural, tongue and groove hydronic radiant subfloor panel made from 7-ply plywood with a conductive .025" thick 1060 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. Panels weigh approximately 95lbs. In a completed assembly, Warmboard-S weighs 3.1lbs per square foot, which includes the panel, tubing and water.

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

Non-aluminum filler panels are also available.

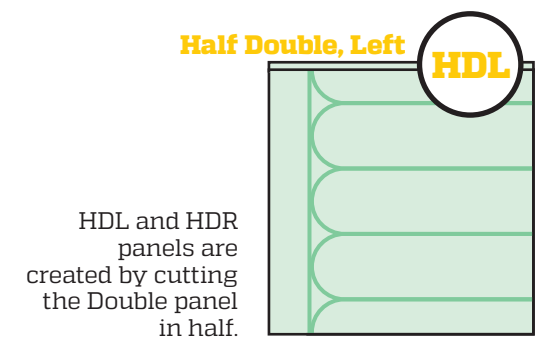
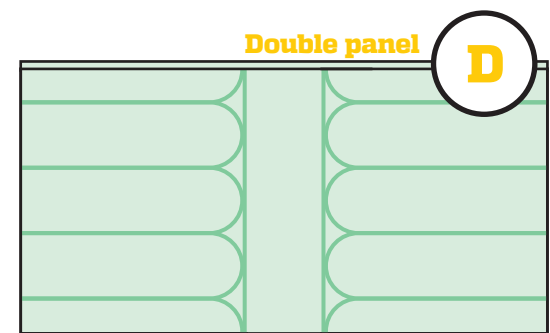
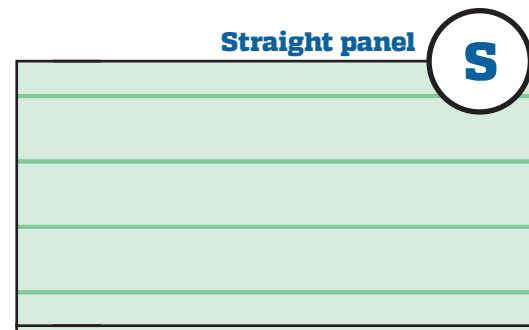
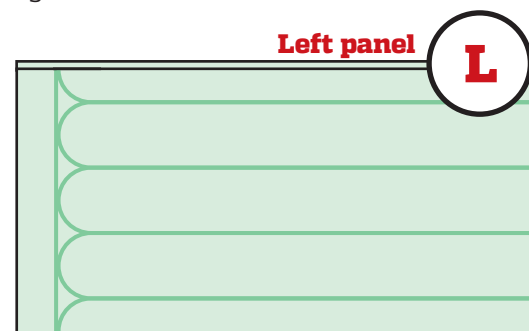
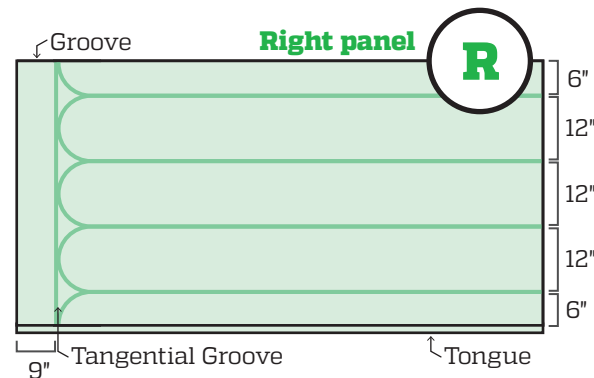
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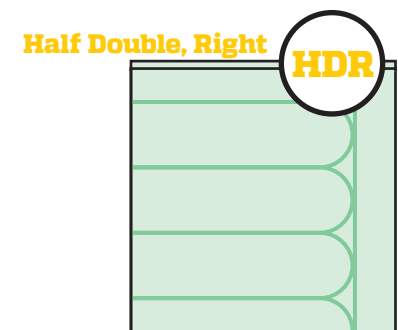


Warmboard panels are but one component in a complete radiant system.

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



HDL and HDR panels are created by cutting the Double panel in half.



10 Installation Highlights

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Read these highlights before proceeding.
They will save you time, money and hassle.



- 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/TJI layout. Verify that the joist/TJI 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. Silicone or other types of adhesives should not be used on tubing.
- 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 minimum 1.75hp router, though 3hp is recommended. A Porter Cable router will interface with the template guides provided. **DO NOT** attempt a custom route without the proper template guide (page 7).
- 8 When installing over floor joists/TJI's, it is mandatory that the crawl space or basement have substantial ventilation to outside ambient air (see "Exposure to Weather" on page 8). After installation, 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 The surface temperature of finished floors is not to exceed 85°F. This rule applies to the entire radiant industry, and is endorsed by the Radiant Professionals Alliance (RPA) and International Association of Plumbing and Mechanical Officials (IAPMO).

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



Warmboard products should be installed and managed by experienced and licensed trade professionals.



Approved Tubing List

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Warmboard - PEX-AL-PEX

PEX ALUMINUM PEX TUBING

Tubing Supplied with Warmboard

12.7mm ID - 16mm OD

ONLY use tubing found on this tubing list.
Using other products may create ticking
noises during operation as the EVOH
barrier rubs against the channel.



Warmboard, Inc. provides tubing and
manifolds at very competitive prices.
Ask for details.



Necessary Tools

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INSTALLATION KIT INCLUDES

(supplied with each order)

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

ADDITIONAL MATERIALS AND TOOLS

- ▶ Circular saw, carbide blade
- ▶ Porter Cable router, minimum 1.75 horsepower (3hp recommended)
- ▶ 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



Choosing the Correct Router

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We recommend Makita Router or Porter Cable router with a minimum 1.75 horsepower, 3hp is preferred. Router not provided.



IMPORTANT

Suitable router guide bush to interface properly with the supplied template guides. DO NOT attempt a route without the correct template guide.

If you cannot source the suitable 25mm guide bush contact
Warmboard 1300 137 407

These are correct template guides to use with the router and are shipped to you with your Warmboard Installation Kit. They are 1" OD.



Correct Makita sub-base with 25mm OD metal template guide bush installed.



Makita 25mm OD Guide

Supplied 5/8" Core Box Router Bit



Installing over Joist

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For traditional joist application, fasten with panel adhesive and 2 3/4" screws, ring shank nails, or 10D common nails. Apply common sense when sizing fasteners for Truss systems (TJI's), 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.

We Recommend

Sikaflex 11FC (Fast Curing Construction Adhesive)

Check your plan set (found in the Installation Kit) to see where the first panel is to be installed. This is essential.



Warmboard-S installs over joist just like regular subfloor.



Cut your panels with the aluminum side down. Be sure to save your offcuts as they are often used elsewhere in the project.



EXPOSURE TO WEATHER INSTRUCTIONS IMPORTANT

EXPOSURE TO WEATHER

Warmboard-S panels are rated "Exposure 1" by the APA, which means they can be exposed to 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.

However, if the panels are exposed to water intrusion, a constantly dry and well-ventilated environment must be created below the panels in order to release the 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.

- 1 Keep the panels completely dry and covered until you are ready to install
- 2 If installing over a crawl space or basement, it is essential that this space is completely dry and well-ventilated at all times during the construction process
- 3 If installing over slab, ensure the slab is completely cured and dried. Warmboard-S panels must be completely dry before, during and after installation
- 4 To accelerate the removal of moisture, fire up the boiler and circulate hot water through the radiant system
- 5 If edge swelling occurs, the panels will return close to their original shape when the moisture leaves the panels
- 6 Warmboard can supply Warmboard surface protection film to keep the Warmboard surface clean during construction.

If 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

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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.

The slab must have sufficient drainage from rain and snow year round.



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). For this method, 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.

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

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 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.

Warmboard panels must be mechanically fastened, not just floated or glued.



METHOD 1 FASTEN DIRECTLY

Install a 6- or 10-mil polyethylene vapor retarder directly to the slab, 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 WITH 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 to attach the entire assemble to slab. We recommend 21 fasteners per panel. Review the installation instructions of the Homasote Comfort Base and 440 Soundbarrier at homasote.com

METHOD 3 WITH 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"x4" 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

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, then choose one of the following methods to fasten the Warmboard panels to the concrete:

We highly recommend using a Flat Head Split Drive Anchors. They will save you many hours of labor.

Split Drive Anchors may be difficult to find in retail locations. We suggest confast.com or calling 888.498.5747



► Method 1 Split Drive Anchors

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

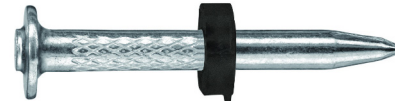
Simply install the Tapcon through the pre-drilled hole and into the concrete



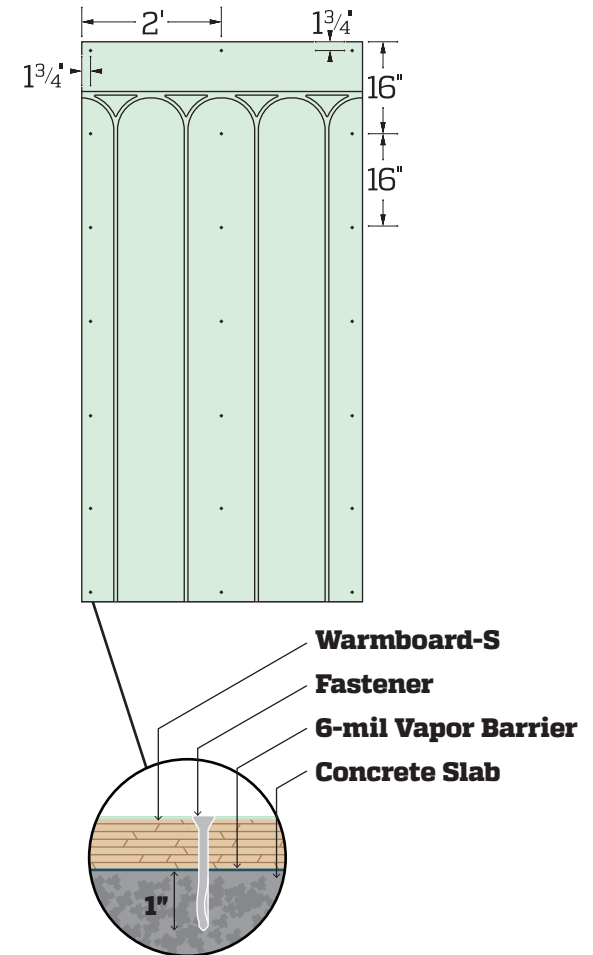
2 1/2" x 1/4" Flat Head Tapcon Concrete Screw
Use 3/16" high-quality masonry bit

► Method 3 Powder Actuated Fasteners

Choose an actuated tool, and charge, that is designed for fastening 1 1/8" plywood to concrete. For sizing, choose a fastener that will grab a minimum of 1" of concrete



0.138" X-C P8 Powder-Actuated Fastener from Hilti. Use Hilti DX 2 Semi-Automatic Powder-Actuated tool



If using Homasote between the slab and Warmboard panel, the fastener will need to be longer than 2 1/4".



Installing over Subfloor

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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.

The existing subfloor and Warmboard-S must be completely dry and have a moisture content reading between 8-12% before, during and after installation.



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.

Cut panels with the aluminum side down.



METHOD 1 SCREW ONLY

Use a #9 x 2" "GRK Uber Grade" multi-purpose R4 screw (or equivalent) with a top 1/2" smooth shank (available at homedepot.com).

- ▶ 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

Using a construction adhesive designed for bonding OSB or plywood, such as "Loctite PL Wood" (or equivalent) is an excellent choice. Follow all directions specified by the adhesive manufacturer.

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

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



Custom Routing

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CHECK LIST

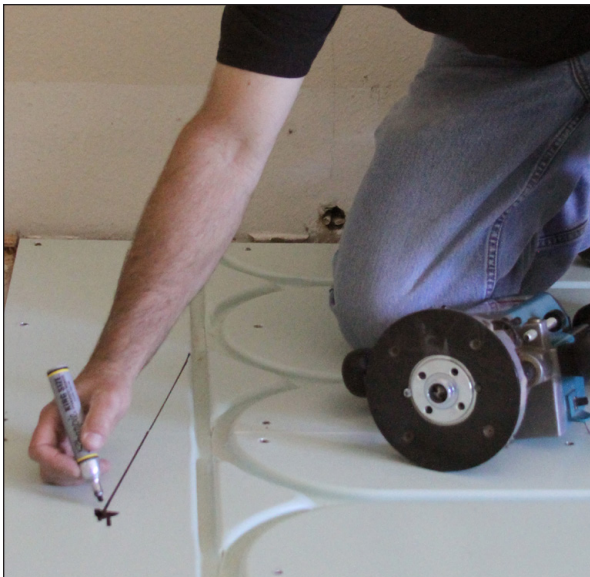
- ▶ Review all the tubing layout plans
- ▶ Use a permanent marker and the provided wood templates to mark all areas on the Warmboard panel that will require custom routing
- ▶ Prepare router with router bit, template guide and template guide lock nut

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, dremel 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 requires room to operate and may be difficult to use near an existing wall – plan accordingly.

Visit warmboard.com/videos for further instruction and information.



Tubing Installation

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1. CLEAN TUBING CHANNELS, PANEL

This simple, but important step of the process will ensure the tubing sits flush and level – which 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
- ▶ A 1/2" conduit is useful for breaking loose stuck-on material

2. MARK TUBING LOOPS ON PANELS

- ▶ 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

Use a Sharpie or wax pencil to mark the panels.



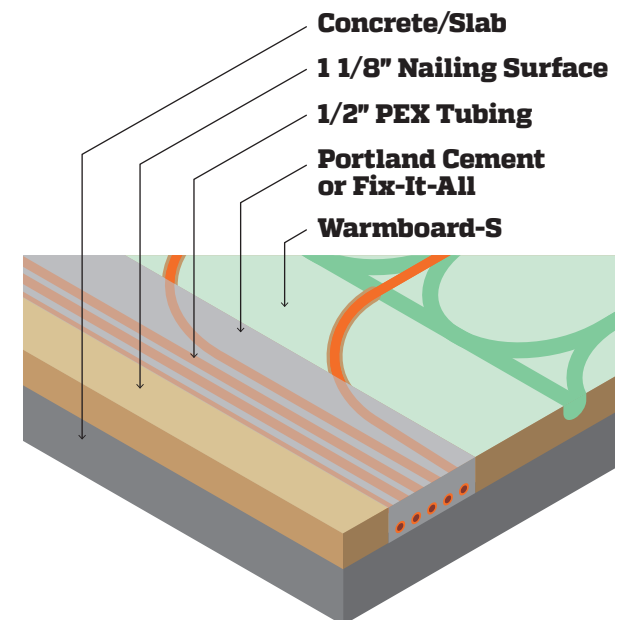
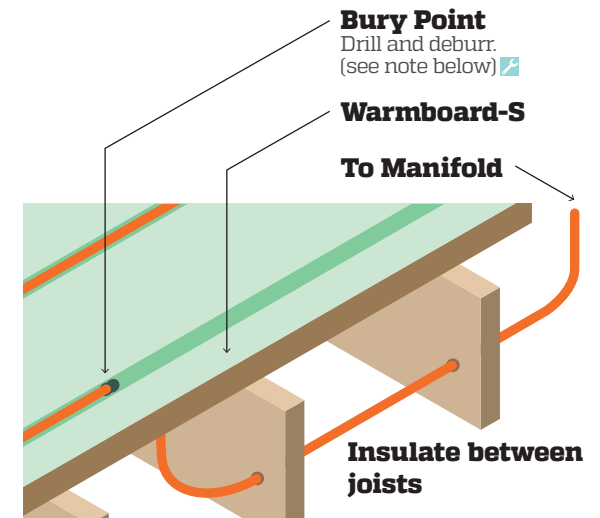
3. RETURN LINES TO MANIFOLDS

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. (see example to right)
- ▶ **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. (see example to right)

To create a bury point, use a 3/4" drill bit and create a 3/4" x 1 1/2" hole. This will help prevent the tubing from kinking.

Visit warmboard.com/videos for further instruction and information.



4. CREATE CUSTOM ROUTE

- ▶ Follow the instructions outlined on page 12

5. INSTALL TUBING

- ▶ Installing tubing at temperatures below 50°F is not advised as the tubing becomes more rigid and difficult to bend
- ▶ **ONLY** use tubing from our “Approved Tubing List” (page 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 the ends of the tubing to prevent debris from clogging the lines
- ▶ A tubing uncoiler is an excellent investment and 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.



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
- ▶ Clearly mark all supply and return loops, documenting rooms and zones on manifolds to avoid future confusion
- ▶ Pressure test all loops to the mechanical code requirement of 100 PSI for 15 minutes.
Note: 5-10% of the air will settle and cause the PSI to drop
- ▶ After the 15 minutes, lower the air pressure to 60 PSI and maintain during the construction process. **Note:** 5-10% of the air will settle and cause the PSI to drop

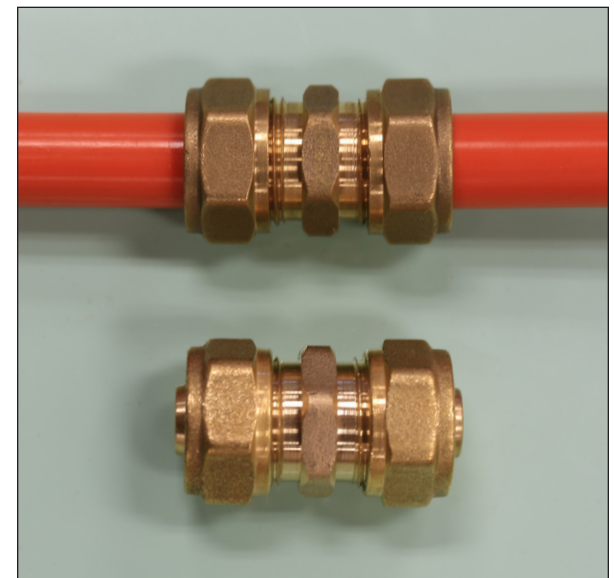
Framing Dimensions for Manifold Box

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

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 30 minutes.

Consider using Ram Board or equivalent to help protect tubing in high traffic areas.



Hardwood Flooring Overview

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

There are many misconceptions about hardwood flooring and radiant floor heating, much of which comes from the wood flooring industry itself. But here are some facts:

- ▶ All wood products, from flooring to guitars, naturally expand and contract with changes in ambient humidity levels. This occurs regardless if the heat is coming from the floor, a forced air system or the sun
- ▶ The minor movement (gapping) in wood floors has been a characteristic of wood planked floors throughout their long history, regardless of the heating system used, but the movements are small, and most homeowners never notice
- ▶ The **only** effect radiant floor heating has on wood flooring is to slightly lower its moisture content. The difference in movement of radiant heated floors compared to floors with other heating means is negligible
- ▶ If wood flooring is installed with a **high** moisture content (over 9%), gapping or cupping may occur. If wood flooring with a **low** moisture content (6-9%) is installed over Warmboard, there will be minimal gapping or cupping of the floor. For this reason, it is essential to acclimate the wood properly prior to installation

WOOD RECOMMENDATIONS

- ▶ **3/4" Solid Plank T&G, Rift and Quarter Sawn (Highly Recommended)**
Using a stable species of wood is encouraged. Narrow widths (2 1/4" – 5 1/2") are more stable, but wide plank is also an excellent option. While hardwood suppliers often recommend engineered products with radiant, we are confident that solid plank is the better choice.
- ▶ **3/4" Engineered (Recommended)**
Narrow widths (2 1/4" – 5 1/2") are more stable, but wide plank is also an excellent option. When floating planks, use thick acoustic padding directly over Warmboard.
- ▶ **1/2" Engineered**
Often chosen in the mistaken belief that thinner is better with radiant, these planks have a lower R-value which can cause an increase in thermal striping. Cupping and crowning are also more likely, with the top layers expanding and contracting differently than the bottom.
- ▶ **Laminate**
The use of laminate over Warmboard works very well. When floating planks, use thick acoustic padding directly over Warmboard.

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



OPERATING THE RADIANT SYSTEM

Circulate low water temperatures under the newly installed floor for the first few days. Then, gradually bring the water temperature up to the designed set point. For example, start with 100°F water and after a few days, bring it up to 120°F. Finalize the set point according to the needs of structure.

It is ideal for the heating system to be designed with the “Indoor Reset” or other types of reset control strategies. “Reset” refers to a system for automatically resetting the boiler temperature (up or down), to better match water temperature to changing heatloads. This is an excellent strategy for hardwood flooring.



Hardwood Flooring Acclimation

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WOOD FLOOR ACCLIMATION

Before 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 in the Warmboard panels. In some locales, you may need to operate the air conditioner simultaneously with the Warmboard system to lower the indoor humidity. The hardwood should experience consistent, low humidity once on site.

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

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 (see 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 **within 4% of Warmboard-S, ideally 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 recommend using a moisture meter with insulated contact pins and hammer probe. The Delmhorst J4 and J2000 models from delmhorst.com are good options, and can be upgraded with the necessary pins and hammer probe.



Keep the moisture level of the hardwood low before installation to ensure long term stability. Maintain an indoor ambient temperature between 60–80°F (15–26°C), and keep the humidity between 30–50%.



It is standard practice (and crucial) to acclimate wood flooring prior to installation. Acclimation time can vary by season, but 2 weeks is recommended.



Installing Solid Plank Hardwood

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Warmboard's aluminum surface is a vapor barrier; no additional retarder is required. Wood flooring should be installed directly over the Warmboard panels.

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

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



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 R851, R859, R850T
- ▶ Bostik's BEST, BST, ProCure, EFA+, Vapor-Lock, Ultra-Set SingleStep 2, GreenForce, Pro-MSP, HDAC, Climb
- ▶ Mapei Ultrabond Eco 975, 980
- ▶ Sikabond T-35 and T-55
- ▶ Stauf Adhesives PUM-950 Power Mastic, PUK-455 Wide Plank Adhesive
- ▶ Titebond 811, 821, 771
- ▶ Wakol MS 260, PU 225

Warranty letters from these companies are available upon request.

METHOD 1 NAIL DIRECTLY

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.

When installing hardwood parallel to the tubing pattern, 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 AND GLUE DIRECTLY

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

Installing 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 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.

Use the approved adhesives listed on pages 17 and 19.



Surface temperatures of the installed hardwood should not exceed 85°F (29°C).



Installing Engineered, Laminate and Bamboo Flooring

19

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



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.



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



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 R851, R859, R850T
- ▶ Bostik's BEST, BST, ProCure, EFA+, Vapor-Lock, Ultra-Set SingleStep 2, GreenForce, Pro-MSP, HDAC, Climb
- ▶ Mapei Ultrabond Eco 975 and 980
- ▶ Sikabond T-35, T-55
- ▶ Stauf Adhesives PUM-950 Power Mastic, PUK-455 Wide Plank Adhesive
- ▶ Titebond 811, 821, 771
- ▶ Wakol MS 260, PU 225

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 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 the Warmboard and the planks. A good option is the “Roberts’ AirGuard Premium 3-in-1 Underlayment with Microban” which can be found at Home Depot.

METHOD 2 NAIL DIRECTLY

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

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

Use the approved adhesives listed on pages 17 and 19.



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



Installing Tile

21

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

TCNA TESTING

The TCNA (Tile Council of America) has successfully tested six different tile methods over the Warmboard-S panel. 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 results of the Robinson Floor Test can be made available upon request).

Make sure any products and methods chosen meet the standards established by the TCNA, ANSI and ICC. Follow the manufacturer's specific recommendations when using these products.



TCNA RATINGS AND DESCRIPTION

Residential Rating

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

Light Commercial Rating

Suitable for office spaces, etc. (tile survived 6 cycles of testing with no evidence of damage)

Moderate Rating

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

Heavy Rating

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

Extra Heavy Rating

Suitable for airports, etc. (tile survived 14 cycles of testing with no evidence of damage)

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



RECOMMENDED ASSEMBLIES

- **Method 1** Page 22
Backer board
TCNA Rating: Extra Heavy
- **Method 2** Page 24
Mud Bed, Mapei
TCNA Rating: Extra Heavy
- **Method 3** Page 25
Self-leveling Underlayment, Mapei
TCNA Rating: Extra Heavy
- **Method 4** Page 26
Uncoupling Mat, RedGard
TCNA Rating: Extra Heavy
- **Method 5** Page 27
Uncoupling Membrane, Blanke
TCNA Rating: Light Commercial
- **Method 6** Page 28
Uncoupling Membrane, Mapei
Mapei Approved: Light Commercial
- **Method 7** Page 29
Uncoupling Membrane, Schluter
Schluter Approved: Light Commercial

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

Always take care to avoid tubing damage.



Method 1 **Backer Board**

22

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

Apply Thin-Set to the surface of Warmboard using a square-notched trowel – this layer will function as a butter coating. Immediately fasten the Backer board using “Backer board screws” before the Thin-Set dries (see page 23 for avoiding tubing damage). Use Backer board tape on all seams then apply Thin-Set. Finish with tile or stone.

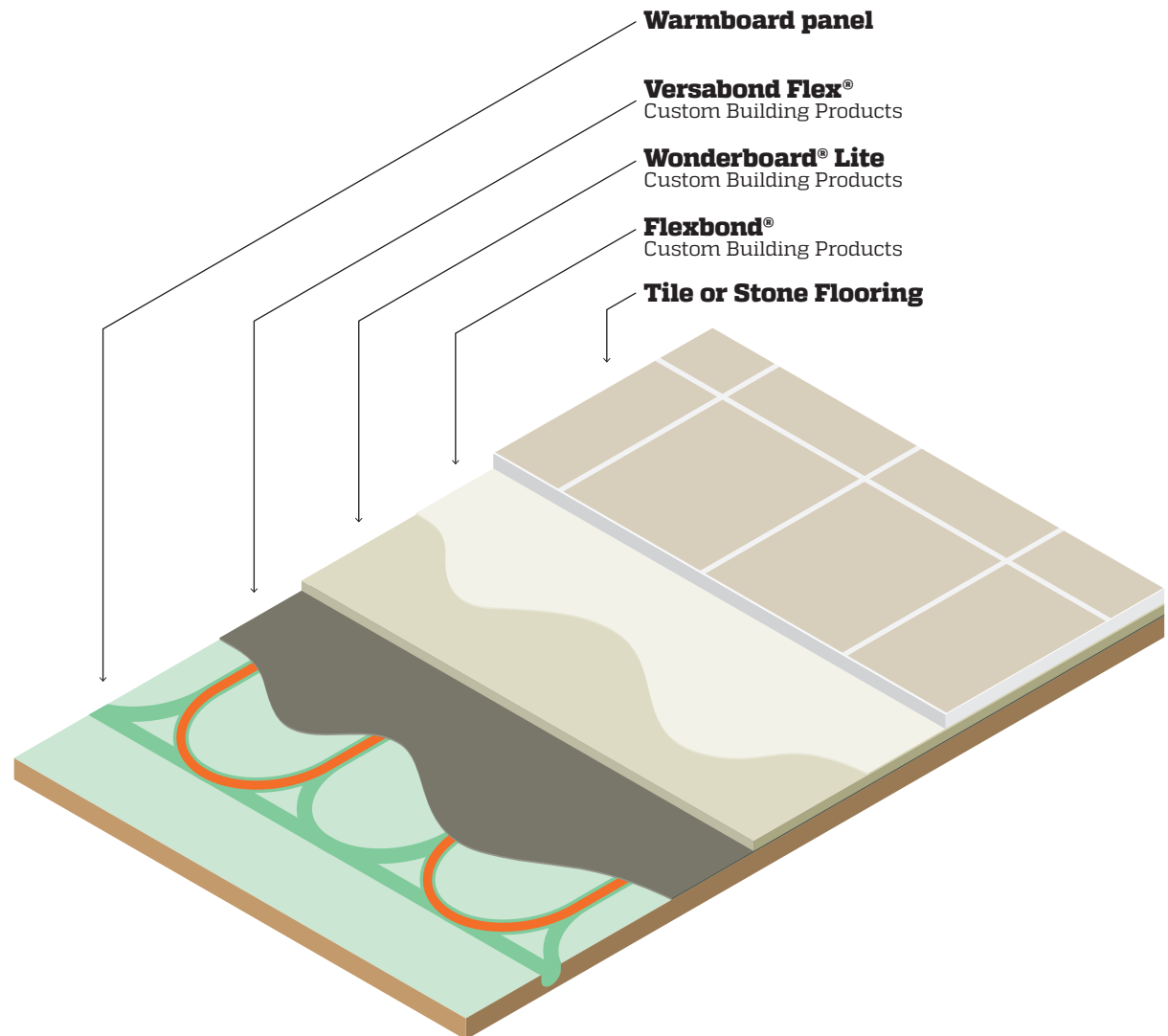
Backer board must run perpendicular to the Warmboard panels. Be sure to stagger the seams and take special care when fastening to avoid tubing damage.



This specific assembly was TCNA tested. Substituting with other comparable brands that meet ANSI standards is acceptable.



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



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



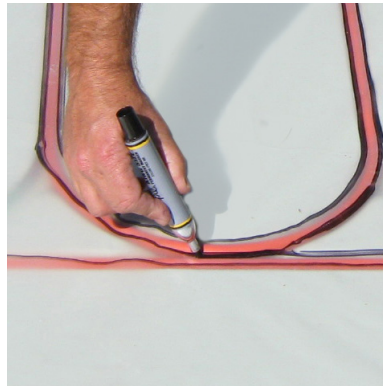
Backer Board, Pro Tip

23

Use a clear polyethylene plastic sheet (3 or 4-mil) and a permanent marker to quickly create a stencil of the tubing pattern. Place this stencil over the Backer board to safely install fasteners and avoid tubing damage.



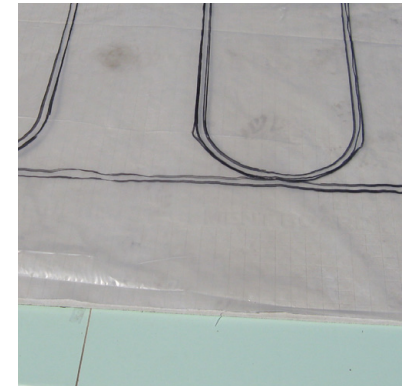
- 1 Cut the polyethylene to the size of Backer board. Save time by cutting all of your full size 3' x 5' plastic stencils at once. **DO NOT** cut directly over the Warmboard or the tubing.



- 2 Place the cut sheets over the Warmboard panel and tape down the corners. With a permanent marker, trace the tubing pattern, and clearly mark the top and bottom on the stencil. Remove plastic and lay flat next to work area.



- 3 Trowel a coat of Thin-Set over the Warmboard panel and place the Backer board over to the appropriate location.



- 4 Align and tape the stencil down over the Backer board. Pre-drill all safe fastening locations, then remove stencil and fasten as normal.

Take care to avoid tubing damage.



Method 2 **3/4" Mud Bed**

24

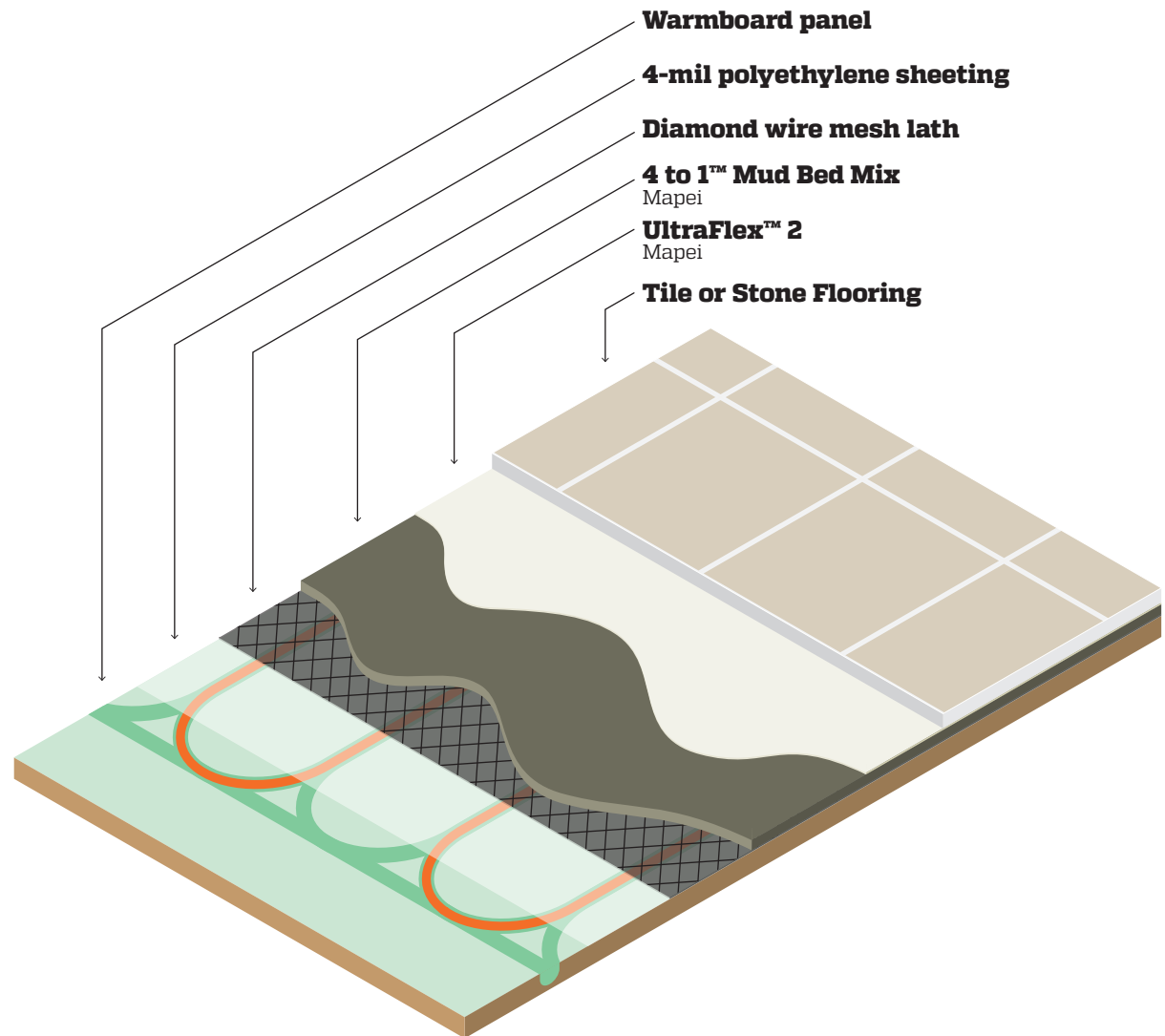
Mortar beds have been the traditional method of addressing the expansion, contraction and deflection properties of wooden subfloors while providing a thick, continuous and stable surface to which tile readily adheres. The disadvantage is that they tend to be expensive, add significant mass to a system,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

When applying the mortar, 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 and finish with a minimum 3/4" mortar bed (Mapei® 4-to-1 Mud Bed Mix or equal). After the mortar bed has cured, Thin-Set. Tile or stone may then be applied.

TCNA testing results are available upon request.

A warranty letter from Mapei for the use of "4-to-1 Mud Bed Mix" over Warmboard-S is available upon request.

This specific assembly was TCNA tested. Substituting with other comparable brands that meet ANSI standards is acceptable.



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



Method 3 **3/8" Self-Leveling Underlayment**

25

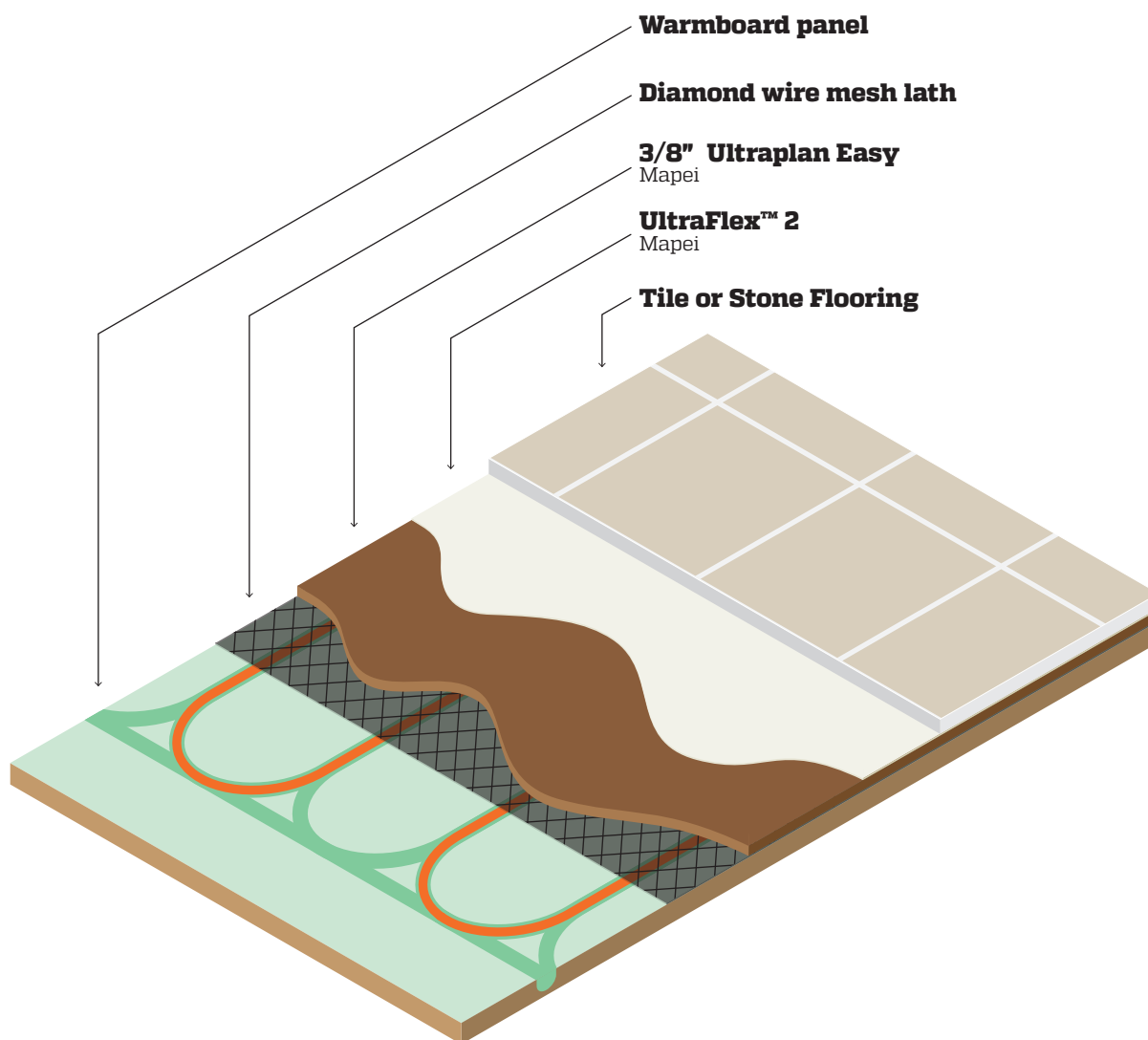
The main advantage of this product is the thin profile with the great strength of a mortar bed.

To proceed, 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. Finish with Thin-Set, the tile or stone can be applied.

TCNA testing results are available upon request.

A warranty letter from Mapei for the use of "Ultraplan Easy" over Warmboard-S is available upon request.

This specific assembly was TCNA tested.
Substituting with other comparable brands
NOT recommended.



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



Method 4 **Uncoupling Mat,** **RedGard**

26

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.

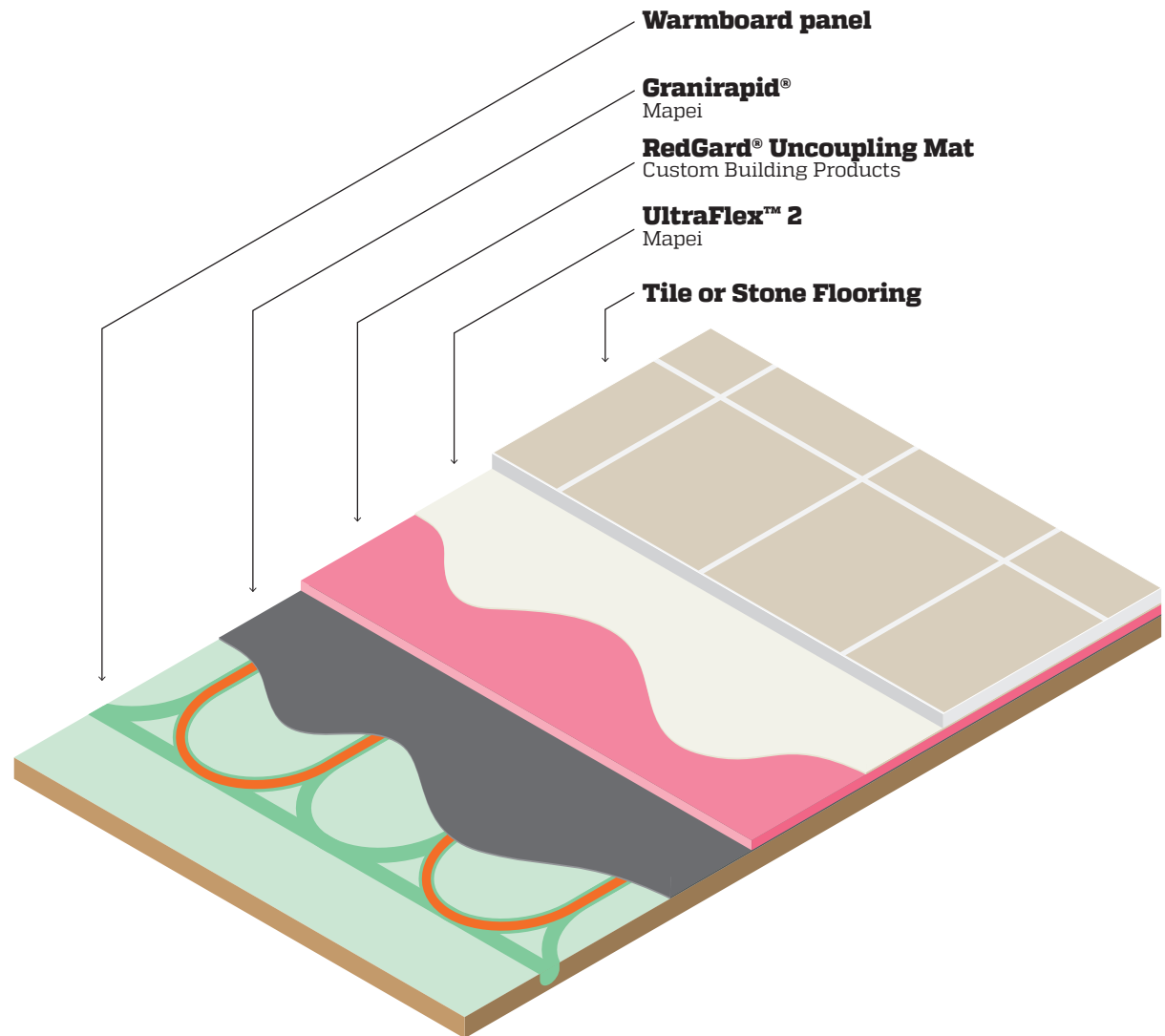
To install, clean the panels and apply the “Mapei Granirapid® Thin-Set Mortar” using a v-notched trowel. Immediately install the RedGard Uncoupling Mat. The next day, follow with Thin-Set using a Square-notched trowel. Finish with tile or stone.

Summary of the TCNA “Bond Strength Test” performed with Warmboard and Mapei Granirapid:

- ▶ Warmboard–S with Granirapid averaged 217 PSI
- ▶ Plywood with Granirapid averaged 240 PSI
- ▶ Minimum requirement is 50 PSI

Test results are available upon request.

This specific assembly was TCNA tested.
Substituting with other comparable brands
NOT recommended.



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



Method 5 **Uncoupling Membrane, Blanke**

27

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).

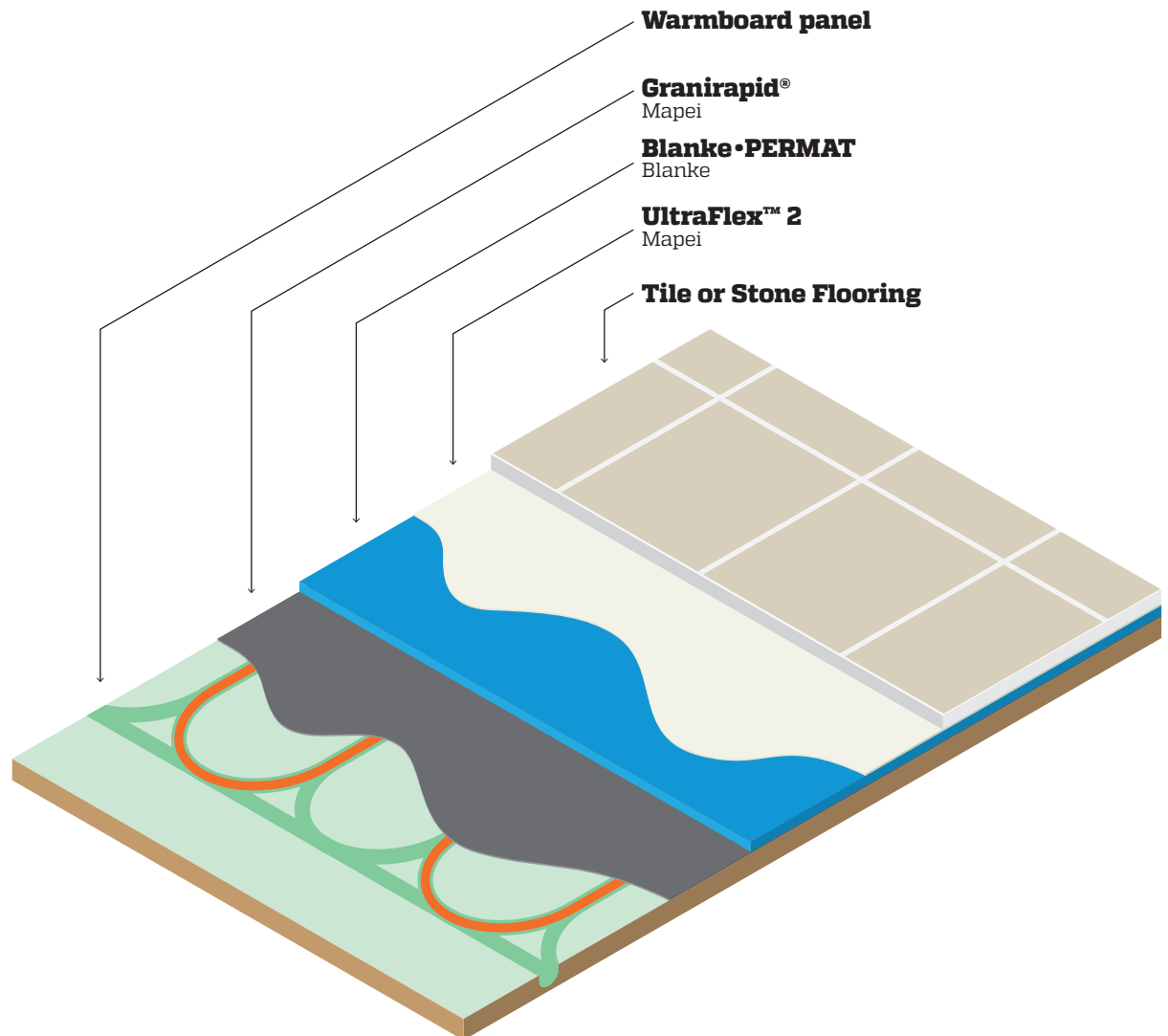
To proceed with this installation, clean panels, trowel on the Mapei “Granirapid Thin-Set Mortar” using a V-notched trowel. Immediately install the Permat. The next day, follow with Thin-Set using a Square-notched trowel. Finish with tile or stone.

Summary of the TCNA “Bond Strength Test” performed with Warmboard and Mapei Granirapid:

- ▶ Warmboard–S with Granirapid averaged 217 PSI
- ▶ Plywood with Granirapid averaged 240 PSI
- ▶ Minimum requirement is 50 PSI

Assembly test results and/or warranty letter from Blanke, Inc. for the use of PERMAT over Warmboard–S are available upon request.

This specific assembly was TCNA tested. Substituting with other comparable brands NOT recommended.



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



Method 6 **Uncoupling Membrane,** **Mapei**

28

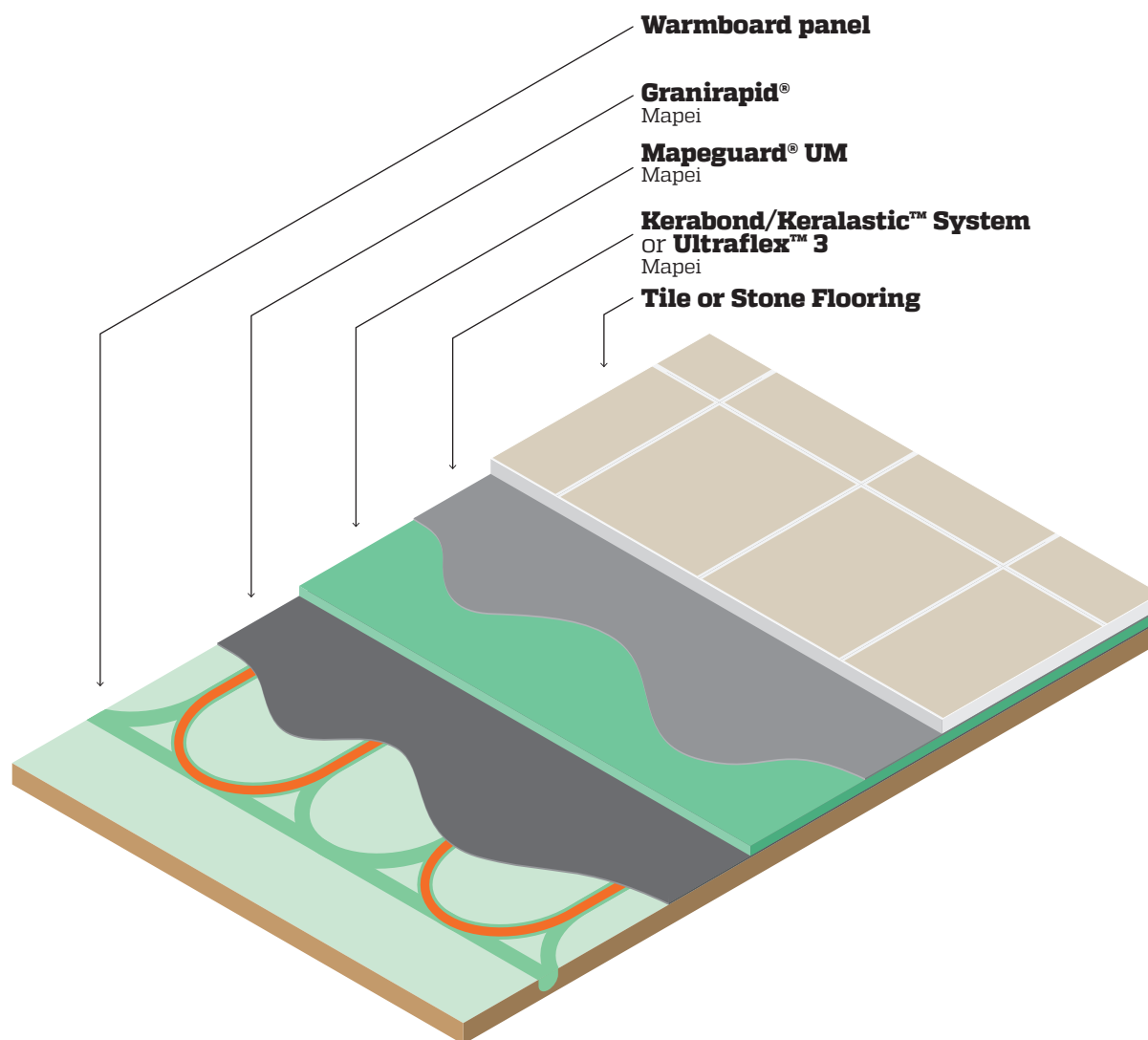
Mapeguard UM is a premium-performance, lightweight, waterproofing and vapor-pressure equalizing underlayment membrane that provides crack suppression for use under ceramic tile and stone installations. Apply a layer of Mapei's "Granirapid Thin-Set Mortar" (a premium rapid-setting and flexible polymer-modified mortar) directly to the Warmboard, using a V-notched trowel, and then install the Mapeguard UM. Wait until the mortar is completely dry below the Mapeguard UM, then trowel on the Kerabond/Keralastic System (or Ultraflex 3) on the topside of the Mapeguard UM, and immediately install tile or stone.

Summary of the TCNA "Bond Strength Test" performed with Warmboard and Mapei Granirapid:

- ▶ Warmboard-S with Granirapid averaged 217 PSI
- ▶ Plywood with Granirapid averaged 240 PSI
- ▶ Minimum requirement is 50 PSI

Assembly test results are available upon request.

This specific assembly was TCNA tested. Substituting with other comparable brands NOT recommended.



Surface temperatures of the finished tile assembly should not exceed 85°F.



Method 7 **Uncoupling Membrane,** **Schluter®**

29

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 made waterproof with minimal effort.

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

Follow all Schluter installation instructions for these products.

The Robinson test completed by Schluter rated this assembly as “light commercial”.

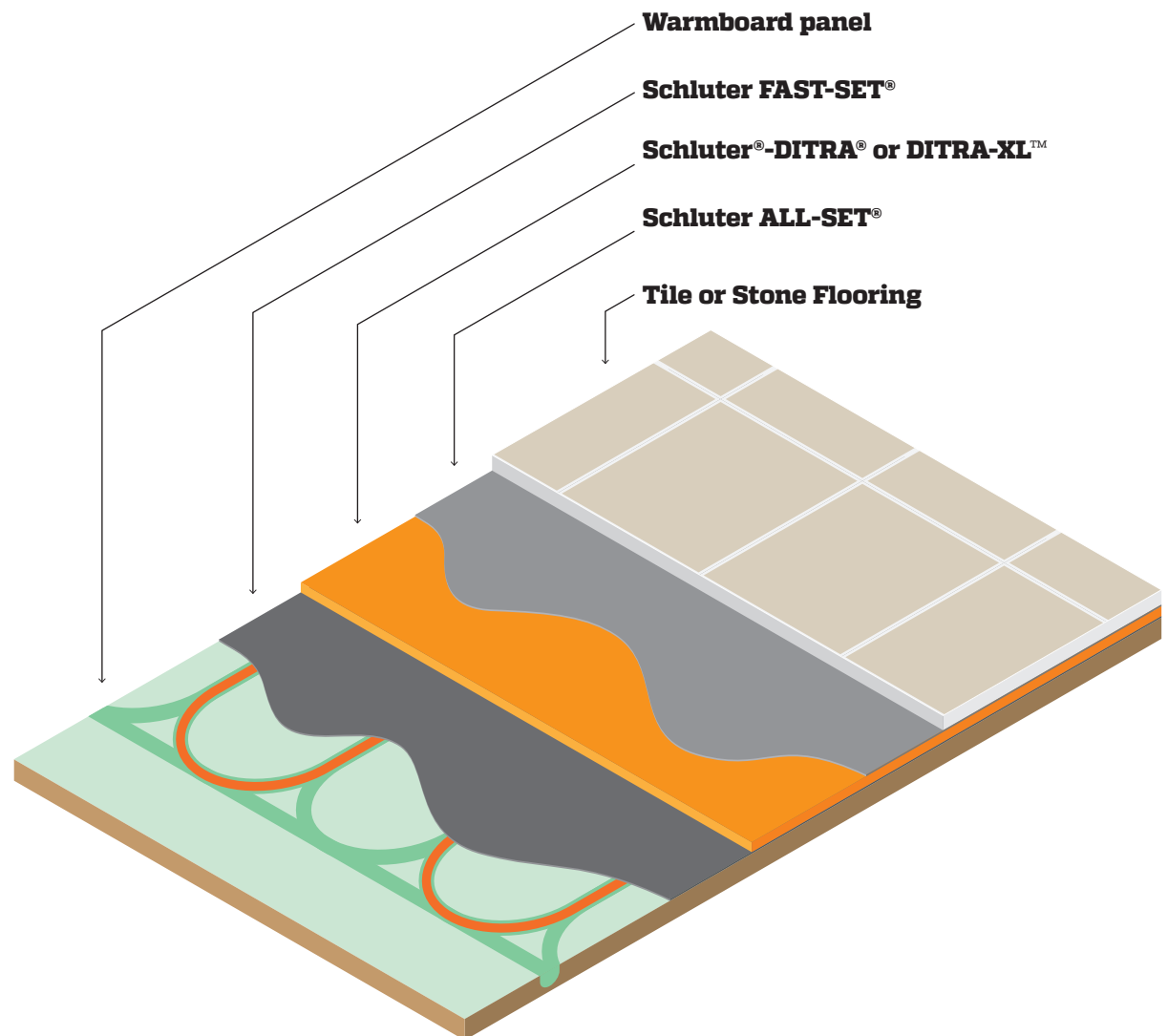
An alternative approved method, Schluter FAST-SET® can be used both above and below the uncoupling membrane.



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



This specific assembly was tested and approved by Schluter (Jan 2020). Substituting with other comparable brands is NOT recommended.



Surface temperatures of the finished tile assembly should not exceed 85°F.



Installing Carpet

Padding and carpet is a very common finish floor to use over Warmboard. The carpet cushion (padding) can be installed directly over Warmboard. Before installing the carpet cushion it is necessary to fill all of the empty grooves to provide an even surface for installation (scrap PEX tubing is a good option). 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.

When choosing a carpet cushion/carpet assembly we recommend a product that has a low R-value rating. By keeping this R-value low, the system can use the same water temperatures beneath all finish flooring types. To achieve this one temperature system, it is best to purchase a carpet and carpet cushion assembly that does not exceed an R-value of 2.0–2.5. Higher values may require creating a two temperature system.

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

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

RECOMMENDED PADDING OPTIONS

Company	R-value	Product
Leggett & Platt 1.800.866.9446 lpcarpetcushion.com	0.80	Arcadia
	0.70	Aurora, Laguna, Coronado,
	0.60	Solano

Company	R-value	Product
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"	R-0.31
	3/8"	R-0.47
	1/2"	R-0.62
Waffle Rubber	1/4"	R-0.62
	3/8"	R-1.00
	1/2"	R-1.33
Fiber/Hair/Jute	1/4"	R-0.97
	3/8"	R-1.62
	1/2"	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.

Installing Cork Flooring

31

Cork flooring has a naturally high insulation value so it is important to choose one that is 1/4" to 1/2" 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).

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

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



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 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. A good product to use is "Dri Tac 7500" (dritac.com, 1.800.726.7845).

CORK LAMINATE PRODUCTS

Cork laminate products work well with Warmboard. These 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 type of cork floor installs as a floating floor and requires no adhesive or nailing for proper installation, allowing the homeowner more flexibility if they ever decide to change the floor covering.



Follow all installation instructions provided by your finish flooring manufacturer



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



Installing Vinyl

32

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. LVF is a very durable material and could be a great option for areas of the home expecting a lot of wear and tear.

For all vinyl installations, 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)

If the vinyl is being used in conjunction with other types of flooring, consider the underlayment which will help keep floor heights consistent between flooring types.

We recommend using the “stencil method” on page 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 underlayment is too high in moisture, they will shrink from the floor heating and create an installation failure.

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



Follow all installation instructions provided by your finish flooring manufacturer



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



Installing Linoleum

33

For all linoleum installations, we recommend installing a substrate underlayment between the Warmboard and the vinyl finish floor.

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

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



SUGGESTED UNDERLAYMENTS

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

If the linoleum is being used in conjunction with other types of flooring, consider the underlayment which will help keep floor heights consistent between flooring types.

We recommend using the “stencil method” on page 23 to avoid tubing damage. For tile Backer board installation, see page 22.



Follow all installation instructions provided by your finish flooring manufacturer



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



Flooring R-values

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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 Guide only for Australia

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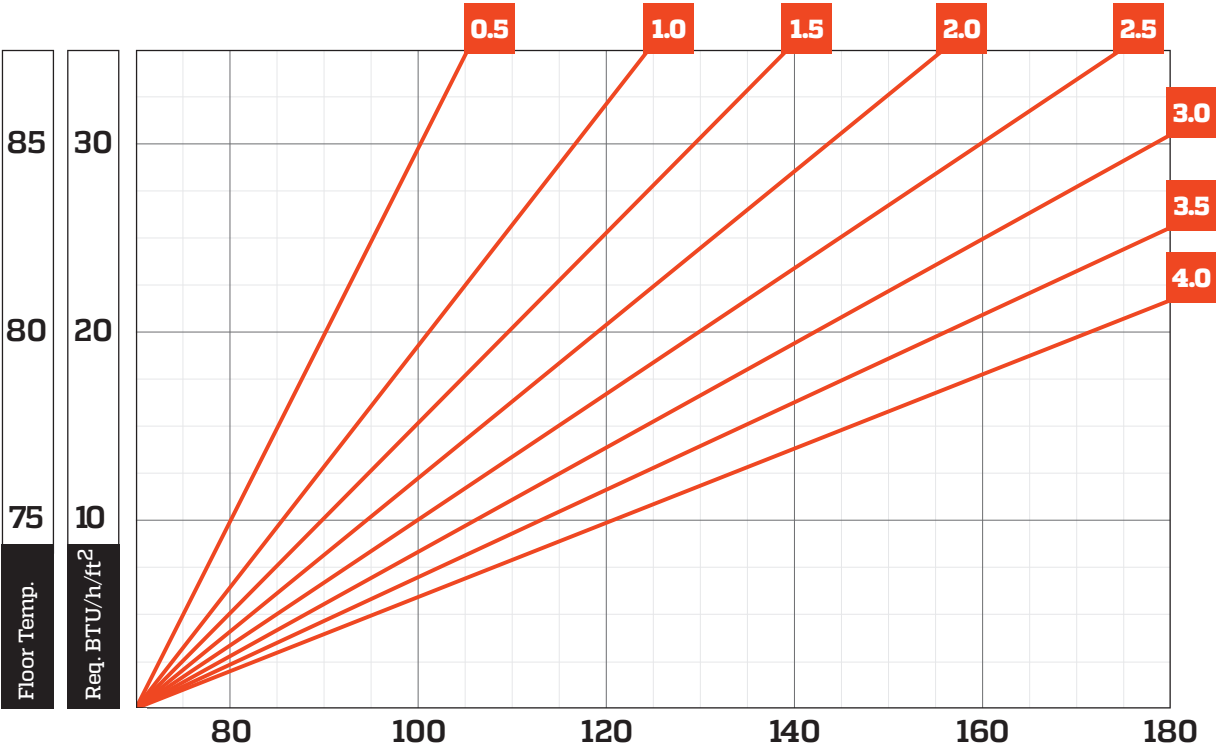
A list of hardwood manufacturers who endorse their products for use with Warmboard. Other brands of hardwood can also be installed.

Company	Solid	Engineered
Anderson Tuftex andersontuftex.com 800.441.7429	some	n/a
Armstrong, Bruce, Robbins armstrong.com 800.223.2823	some	no
Arrigoni Woods arrigoniwood.com 888.423.6668	yes	yes
Authentic Pine Floors authenticpinefloors.com 800.283.6038	yes	yes, under 6"
Bellawood Hardwood Floors bellawood.com 800.HARDWOOD	some, floating only	no
Boen Hardwood Floors boen.com 888.897.0800	yes	n/a
BR-111 Exotic Hardwood br111.com 800.525.2711	yes	no
Broad-Axe Flooring Company broadaxeflooring.com 802.257.0064	n/a	yes
Carlisle Wide Plank Floors wideplankflooring.com 800.595.9663	yes	yes
Craft Artisan Hardwood craftfloor.com 877.828.1888	yes	yes
Dinesen dinesen.com +45.7455.2140	n/a	yes
Goodwin Heart Pine Company heartpine.com 800.336.3118	n/a	yes
Hallmark Hardwood Floors hallmarkhardwoods.com 888.551.0888	yes	yes

Company	Solid	Engineered
The Heartpine Company heartpinecompany.com 434.234.8199	yes	yes
Heritage Wide Plank Flooring heritagewideplankflooring.com	n/a	yes
Homerwood Hardwood homerwood.com 814.827.3855	yes	no
Junkers Hardwood Floors junkershardwood.com 800.878.9663	most	yes
Karelia Hardwood Floors kareliafloors.com 888.840.3435	n/a	yes
Launstein Floors launstein.com 888.339.4639	yes	n/a
Lauzon Hardwood Flooring lauzonflooring.com 800.665.6765	yes	no
LM Flooring lmflooring.com 972.417.9900	some, floating only	n/a
mafi mafi.com 647.409.5984	yes	n/a
Mannington Wood Floors mannington.com 856.935.3000	yes	yes
Mirage Floors miragefloors.com 800.463.1303	no	yes
Mountain Lumber mountainlumber.com 800.445.2671	yes	yes
Mohawk Hardwood Flooring mohawk-flooring.com 800.266.4295	no	yes

Company	Solid	Engineered
Monarch Plank Hardwood monarchplank.com	some	yes
Plyboo plyboo.com 866.835.9859	yes	n/a
Quarter-Sawn Flooring quarter-sawnflooring.com	yes	n/a
Reward Hardwood Flooring rewardflooring.com	some	yes
Schotten & Hansen schotten-hansen.com	yes	yes
Shannon & Waterman shannonwaterman.com 844.315.2520	yes	yes
Shaw Hardwood Floors shawfloors.com 800.447.7429	some	no
Signature Hardwoods signaturehardwoods.com 866.554.4252	n/a	yes
Southern Wood Floors southernwoodfloors.com 888.488.7463	yes	no
Tarkett Wood Floors home.tarkett.com 888.639.8275	some	no
Thermory Flooring & Decking thermoryusa.com 585.591.2333	yes	yes
Vintage Flooring vintageflooring.com 877.256.0231	yes	some
What's It Worth wiwpine.com 512.328.8837	n/a	yes

Water Temperature Chart



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

Assumes 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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