



Warmboard-S installation guide

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10 important installation highlights

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

1. Review the AutoCad drawings supplied by Warmboard, Inc. Check and confirm floor plan dimensions, joist, or Trust Joist International (TJI) layout.



Verify that the joist (TJI) direction and location of the pull are correct.

2. Review our shop drawings: some tubing loops may need to be installed before walls are framed and some after framing. If you are not familiar with the time line of this process, call us for assistance. After tubing is installed and roof sheeting is framed, we recommend using Masonite or Lauan in the high traffic areas of the home to help protect the tubing. Remove the protection when the finish floors are ready to be installed.
3. When installing panels, gap $\frac{1}{8}$ " on the 4' butt side. This gapping is not necessary on the tongue and groove side of the panel.
4. Use the provided alignment pins when installing panels (see page 5).
5. **Only use Warmboard approved tubing** (see page 4). Use electrical nail plates to hold down tubing and remove them before the installation of finish floors. Silicone or other types of adhesives should not be used.
6. Do not exceed a 300 foot tubing length when a field revision is required.
7. Custom routes require a $1\frac{1}{2}$ horsepower router minimum. A Porter Cable router will interface with the provided template guides. Do not attempt a custom route without the proper template guide attached to the router (see page 6).
8. Warmboard, and the entire radiant industry, requires the surface temperature of the finished floors not to exceed 85°F.
9. When installing over joists, a minimum of R-19 insulation is required underneath the panels to prevent downward heat loss.
10. Review the installation manual before installing finish floors.



CAUTION!

Should installed panels be exposed to rain, do not install the subfloor insulation until the panels have returned to a moisture content that is acceptable.

Approved tubing list

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

Only use a type of tubing listed below. This will ensure a silent interface between the pex tubing and the aluminum groove in Warmboard-S. Installing other types of tubing may create a ticking noise as the tubing expands during operation. This noise is created by the outer layer of the EVOH barrier rubbing against the aluminum.

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

Pex Aluminum Pex tubing 1/2" ID

- ▲ AIM: Pex AL Pex
- ▲ Allied Pipe Systems: Pex AL Pex
- ▲ Aqua Therm: Pex AL Pex
- ▲ ComfortPro: Pex AL Pex
- ▲ EHT (Efficient Heating Technology): Pex AL Pex
- ▲ Everhot: Pex AL Pex
- ▲ Excel: Pex AL Pex
- ▲ Henco: Pex AL Pex
- ▲ Hydro-flex: Pex AL Pex
- ▲ HYDRONX: Pex AL Pex
- ▲ Inferno: Pex AL Pex
- ▲ Infloor Heating Systems: Pex AL Pex
- ▲ Mr. Pex: Pex AL Pex
- ▲ RHT: Pex AL Pex
- ▲ Rifeng: Pex AL Pex
- ▲ Roth: Pex AL Pex

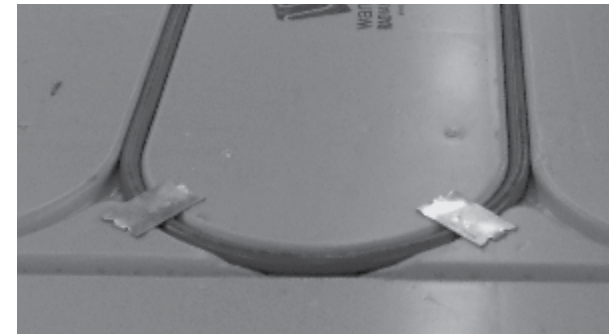
- ▲ Uponor: Multi-Layer composite tubing (MLC)
Pex AL Pex
- ▲ Watts: Pex AL Pex
- ▲ Weil-McLain: Pex AL Pex
- ▲ WSD (Willow Springs Distributing) Pex AL Pex
- ▲ Zurn Alumaticor: Pex AL Pex

Standard Barrier Pex 1/2" tubing ID

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



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



CAUTION!

Viega Fostapex is not approved as the diameter is too large for our tubing channel.

Unlisted brands of tubing may be acceptable.
Check with our Technical Department to confirm.

DO NOT USE silicone or other adhesives when installing any Standard Barrier or Pex Aluminum Pex Tubing.

Necessary tools

Installation kit includes (supplied with each order)

- ▲ 3 Custom routing templates/guides (wood)
- ▲ 1 Router bit, $\frac{5}{8}$ "
- ▲ 2 alignment pins
- ▲ 1 Porter Cable template guide
- ▲ 1 Porter Cable guide lock nut



Additional materials and tools (for on-site use)

- ▲ Porter Cable router, $1\frac{1}{2}$ horsepower minimum
- ▲ Electrician nailing plates
- ▲ Heavy roller (typically a linoleum roller)
- ▲ Warmboard approved tubing
- ▲ Shop vacuum
- ▲ Drill motor with a $1\frac{1}{4}$ " drill bit
- ▲ Pex tubing cutter
- ▲ Felt tip marking pen
- ▲ Warmboard panel and tubing plans
- ▲ Tubing un-coiler
- ▲ 4" grinder or dremel



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

Choosing the correct router

FIRST AND ALWAYS

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

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



CAUTION!

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



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



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



Custom routing

For technical assistance call
1.877.338.5493

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Check list

- ▲ Review all tubing layout plans. Using a felt tip marker and wood templates (included in installation kit) mark all areas on Warmboard-S that will require custom routing
- ▲ Prepare router with router bit, template guide and template guide lock nut



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

Procedure

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



Visit warmboard.com/videos for further instructions.



5/8" Router Bit

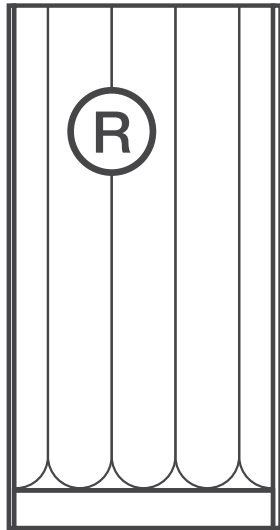
Template Guide

GuideLock Nut

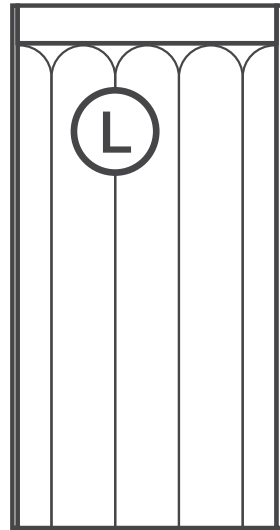


Panel types

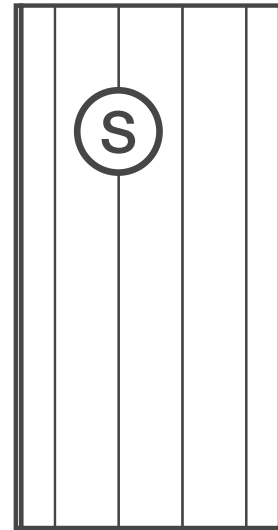
The following are 6 panel types used during a Warmboard-S installation.



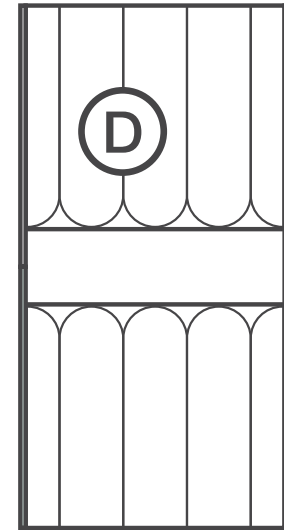
Right Panel



Left Panel

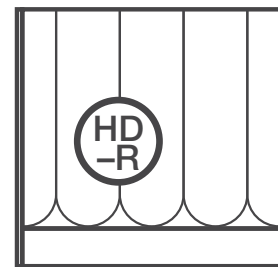


Straight Panel

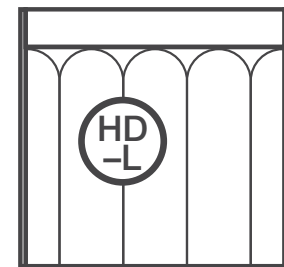


Double Panel

These panels are created by cutting the standard Double Panel in half.



Half Double Panel, Right



Half Double Panel, Left

NOTE Read all instructions before beginning the installation process.

Review supplied working drawings including floor plan dimensions, joists and TJI layout prior to installation.

Fastening Warmboard-S to joists / tubing preparation



Industry accepted subfloor installation practices are generally followed

For traditional joist application, fasten with panel adhesive and 2³/₄" screws, ring shank nails, or 10D common nails. Apply common sense when sizing fasteners for TJI's or Truss systems. When sizing a nail or a screw for a TJI or Truss system, size the fastener in order to grab as much flange as possible. Do not size a nail or screw that will penetrate the bottom side of the flange. **Always refer to architectural specifications on the nailing pattern. If not specified, APA (American Panel Association) recommends a 12" inside, 6" edges pattern.**

As sheets are placed, alignment pins are tapped into place on the two outer most channels, across the seam between the adjacent panels, to ensure proper channel alignment (see photo). Pay close attention to the panel layout plan as the work proceeds. Per APA guidelines all subfloor panels, including Warmboard-S, should be gapped 1/8" on the 4' side.



Panel preparation prior to tubing install

Using a felt tip marker, and as per the tubing plan, mark the bury points where each loop starts and stops, the location of any manifolds, and the paths of any supply/return leaders from a given loop to a manifold or the boiler panel. Mark locations of any custom channels, which may be required due to unusual architectural features or where plumbing interferes with the regular tubing patterns. At each bury point drill a shallow 30° angle 3/4" hole in the channel in the appropriate direction so that the leader can pass from the channel to the under floor area, in the correct direction to lead to the appropriate manifold location.

Cleanliness of channels

Inspect the channels at the joints between panels for any excess of panel adhesive which may have squeezed up between sheets at the channels. Use the 4" grinder to remove any excess. Using a leaf blower, shop vac or broom (leaf blowers are the quickest and easiest way to clean the channels) clean off any debris or dust from the subfloor surface and the channels. Cleanliness is important for easy tubing installation, so take care with this step.

Exposure to weather

Warmboard-S panels are rated Exposure 1. Technically, they can be exposed to the elements for 1 year and still serve as structural subfloor. That said, Warmboard-S panels will still respond to moisture like any plywood product. This means swelling. Whenever possible, it is advantageous to avoid exposing the panels to rain or snow. If Warmboard panels are exposed to weather, since they are protected on the top side by the aluminum skin, a common reaction is "edge swelling." This means the edges swell up with moisture creating an uneven surface.

The panels will return close to their original shape when the moisture leaves the panels. If the panels have already been installed, one way to speed up this process is to install the tubing and get the system running. The heat will speed up the evaporation process. If the panels are installed over a crawl space, it is essential that the crawl space is completely dry and well ventilated. If the panels are installed over a slab, the slab must be completely dry with no water intrusion.

Installing over existing subfloor

Preparation prior to installation

- ▲ The existing subfloor is required to be flat and level before the installation of Warmboard-S. Inspect the subfloor for evenness along the joints and flatness between the joists.
- ▲ If necessary, sand the subfloor near the joints, install extra blocking, and refasten to flatten uneven areas. Also inspect for squeaks and refasten as necessary.
- ▲ The existing subfloor and Warmboard-S panels need to be completely dry and should have a moisture content reading of 8-12% before, during and after installation.

Installation of Warmboard-S

- ▲ Review Warmboard shop drawings and notice the stagger of end joints and where the first panel starts.
- ▲ Fasten Warmboard-S panels down using exterior decking screws, or ring shank nails.
- ▲ Use a grid pattern of 6" on the edges and 12" on the inside to determine the length of fastener, total the thickness of existing subfloor and Warmboard-S. For example if the existing subfloor is $\frac{3}{4}$ " thick and Warmboard-S is $1\frac{1}{8}$ " thick, the total depth is $1\frac{7}{8}$ ". The required fastener would be $1\frac{3}{4}$ ". It is important to size the fastener so it will grab a large amount of the subfloor without penetrating all the way through the wood.
- ▲ When using a ring shank nail purchase a .099".
- ▲ The use of a construction adhesive is optional (when used with mechanical fasteners as mentioned above).

Installing over concrete slab

Benefits

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

Concrete slab requirements

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

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

Testing for moisture

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

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

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

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

Installation method 1

Install a 6 or 10-mil polyethylene vapor retarder directly to the slab, overlapping two feet (2') at the seams. Continue installing Warmboard-S using Tapcons or Split Drive Anchors. We recommend a minimum of 21 fasteners per panel.

Installation method 2

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 them to the sleepers with screws or ring shank nails and construction adhesive.

Installation method 3

Install a 6 or 10-mil polyethylene vapor retarder directly to the slab, overlapping two feet (2') at the seams. Next, install the $\frac{1}{2}$ " Homasote Comfort Base or Homasote 440 Soundbarrier over the entire slab (adding a R-value of 1.2). Gap all Homasote panels $\frac{3}{16}$ " from all adjoining panels and $\frac{3}{8}$ " from walls. Use fasteners to attach the entire assembly to slab. We recommend 21 fasteners per panel. Review the installation instructions of the Homasote Comfort Base or the 440 Soundbarrier at homasote.com



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

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

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

Use a $\frac{1}{4}$ " x $2\frac{1}{2}$ " flat head split drive anchor.

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

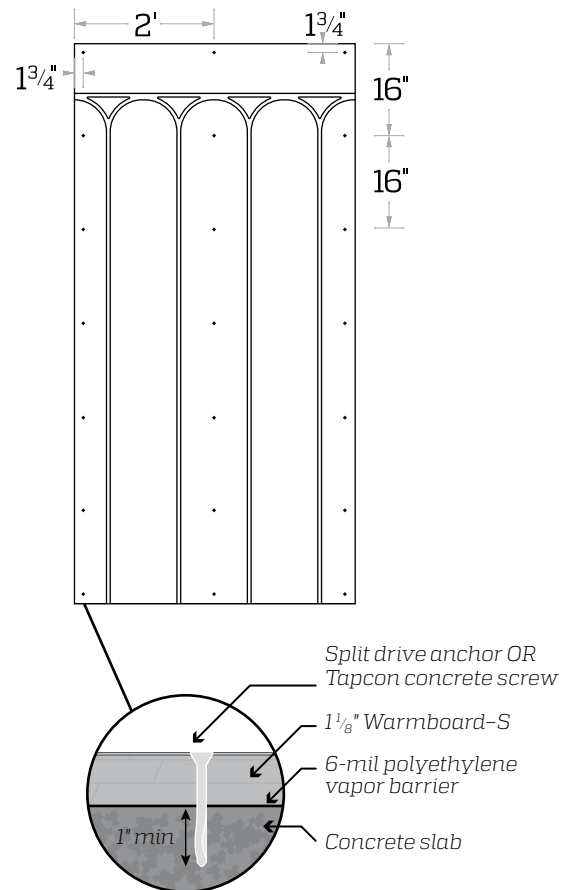


Before installation of a Tapcon fastener, drill a pilot hole $\frac{1}{2}$ " deeper than the Tapcon will reach. Draw the bit in and out of the pilot hole repeatedly to loosen excess material. Remove the excess using a shop vacuum.

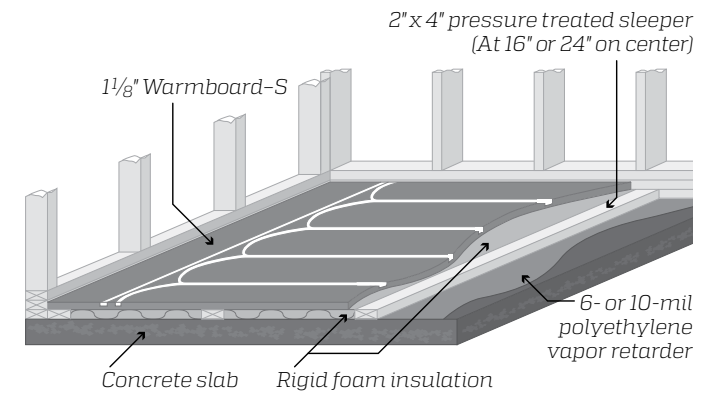


Predrill with Warmboard-S in place using a high-quality masonry bit. Drilling depth should be $\frac{1}{2}$ " deeper than the required specification without drilling through the slab. All concrete drilling should be done with a heavy duty rotary hammer drill.

Fastening pattern over concrete



Fastening pattern over sleepers



Preferred method

$2\frac{1}{2}$ " x $\frac{1}{4}$ " Flat head split drive anchor
Use $\frac{1}{4}$ " high-quality masonry bit



$2\frac{1}{4}$ " x $\frac{1}{4}$ " Flat head Tapcon concrete screw
Use $\frac{3}{16}$ " high-quality masonry bit

Tubing installation

Using Pex Aluminum Pex (No EVOH Outside Barrier)

You will find that Pex Aluminum Pex is easy to manipulate into the grooves because it holds its shape well. It is important to use electrician nailing plates on the turns to help hold the tube in while it establishes its memory. Silicone or other tubing adhesives should *not* be used. Once you are ready to begin finish floor installation, simply remove the plates and the tubing will stay in the groove.

As with all tubing installation, cleanliness of the grooves is very important. Please take extra care to make certain that the grooves are thoroughly cleaned prior to tubing installation.



Tubing should be installed as soon as possible after the subfloor is fastened in place. Mount a coil of Warmboard-approved Pex tubing on the tubing un-coiler. Begin the first loop by measuring the length of leader necessary to reach from the bury point to the manifold, plus a few extra feet for margin of error. Mark the bury point on this leader. Mark its loop number and whether it is the supply or return. Tape the end of the tube to keep debris out of it. Guide the tube into the channels following the course indicated on the tubing plan. Roll the tubing into the channel with the weighted roller pressing it firmly into the channel, flush with the top surface.

As you roll the tubing in, check from time to time to ensure that the tubing is flush with the top surface. If it is flush you will barely be able to notice it as you walk on it. If it is not flush, you will notice it easily. If it is not flush there are usually two causes:

- ▲ Excess panel adhesive squeezed up and remains at a seam between panels
- ▲ Debris in the channel

Both of these possibilities are unlikely if you have followed the steps above regarding channel preparation and cleanliness.

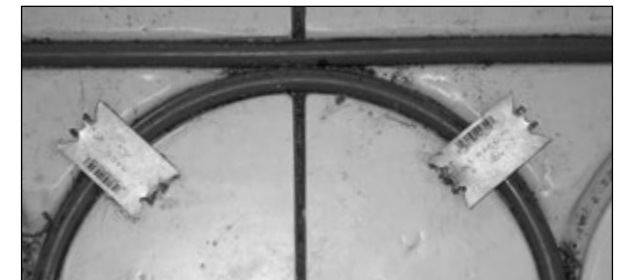


The use of nail plates is often necessary to secure tubing in channels. **REMOVE ALL PLATES** before the installation of finish floors.

When you come to the end of the loop, measure out a similar amount of tubing for the other leader back to the manifold or boiler panel. Tape the end of the tube and mark it as a supply or return, then mark the leader with its loop number. Insert this leader into the bury hole. You may find that at the bury points there are slight bumps above flush as the supply and return leaders tend to spring up at those points. Use electrician cover plates to temporarily hold the leader flush.



If the tubing is damaged during installation, a repair coupling must be installed. It is crucial for the tubing manufacturer to provide these components. Generally, a nipple and two compression fittings are used. These fittings are too large for our Warmboard channel so the channel where the repair will be placed must be modified. The depth and width of the groove should be enlarged with the use of hand or power tools. We recommend a sharp hand chisel, grinder or router (see page 14)



A final and important step is to pressurize the loops. This will be helpful in the event that during subsequent construction, a tube is inadvertently damaged. If the tubes are left under pressure, any damage will be noticed quickly. If freezing is unlikely this can be done by attaching a temporary manifold to the loops and applying street water pressure to the system. If freezing is expected, then air pressure will accomplish the same purpose. Once this is done, carpenters can return to the site and begin framing walls and otherwise proceed with construction in the typical manner.

Job site considerations

PEX tubing is especially tough once embedded in its channel. Normal construction activity will not damage it. Of course, care must be taken to avoid nailing a tube or using a sharp cutting tool directly on top of a tube. All tradespeople working on a Warmboard site must take note of the easily visible tubes and must exercise reasonable care to avoid puncturing a tube.

Weather is always a factor in construction. There are certain times of the year when it is difficult to install a Warmboard-S system. Good construction planning can avoid these problems to a great degree.

For the following reasons, it is best to plan a Warmboard installation for a dry day when the temperature will be above 40°F.

- ▲ Pex-al-pex tubing becomes stiff and difficult to work with below 50°F. Below 40°F the coil will need to be warmed immediately prior to installation.
- ▲ Channels must be reasonably dry and clean prior to installing the tubing into the channels. (Warmboard-S is typically fastened to the floor joists and the tubing is installed on the same day)



Protecting panels & tubing

Most Warmboard designs require the tubing to be installed before the walls. We recommend installing the tubing, framing walls, and then covering the panels and tubing with Masonite or Lauan in high traffic areas. Remove all the panel protection before installing finish floors.

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



Installing solid wood flooring

FIRST AND ALWAYS

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

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

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

Avoid gapping/cupping of hardwood

Use a wood species that is dimensionally stable. There are three types of cuts from the tree: Quartersawn, Riftsawn, and Plainsawn. Quartersawn is nearly all vertical grain lumber which is a better quality cut and dimensionally stable. Riftsawn is the next best choice. Anything wider than 3¼" is referred to as plank flooring. Anything narrower than this is called strip flooring. In general, strip flooring is more dimensionally stable. However, plank flooring has been successfully installed over Warmboard-S in many projects with widths of up to 12".



Acclimate wood

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

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

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

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

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

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

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

Installing traditional strip and plank hardwood

FIRST AND ALWAYS

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



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

We recommend 3 installation options (all common methods)

- ▲ Nail hardwood directly to Warmboard-S
- ▲ Nail and glue hardwood directly to Warmboard-S
- ▲ Glue hardwood directly to Warmboard-S (no fasteners)

Warmboard approved adhesives

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

Warranty letters from these companies are available upon request.

Nail directly to Warmboard-S

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

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

Nail and glue directly to Warmboard–S

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

Installing the hardwood perpendicular to the tubing pattern is the easiest method. It is important to see the tubing as the planks are nailed to avoid tubing damage. It is recommended to tongue nail at a 45 degree angle at 6" on centers and use 2" flooring nails. Occasionally, plank flooring may need to run the same direction as the tubing, and nailing the plank could cause tubing damage. Should this occur, DO NOT NAIL – the troweled on glue will successfully bond the plank to the Warmboard–S panel. Be sure to use one of the approved adhesives listed on pages 17 and 19.

Glue directly to Warmboard–S

Should you choose to glue the hardwood directly, know that the aluminum coating on the Warmboard–S panel acts as the required vapor retarder. Be sure to use one of the approved adhesives listed on pages 17 and 19.

Operating the radiant heating system

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

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



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

Installing engineered, laminate and bamboo flooring

FIRST AND ALWAYS

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



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



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

We recommend 4 installation options (all common methods)

- ▲ Floating floor method
- ▲ Glue only (Glue planks directly to Warmboard-S [no fasteners required])
- ▲ Nail the planks directly to Warmboard-S
- ▲ Nail and glue planks directly to Warmboard-S

Warmboard approved adhesives

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

Warranty letters from these companies are available upon request.

Floating floor method

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

Glue directly to Warmboard–S

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

Nail directly to Warmboard–S

Should you choose to nail engineered or laminate flooring directly, know that the aluminum coating on the Warmboard–S panel acts as the required vapor retarder. You do not need to install additional material between Warmboard–S 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. We recommend to tongue nail at a 45° angle at 6" on centers and use 2" flooring nails.

Occasionally, plank flooring may need to run the same direction as the tubing, and nailing the plank could cause tubing damage. Should this occur, **DO NOT NAIL** – either glue with an approved adhesive or face nail the plank. While the planks can be successfully nailed down parallel to the tubing pattern, this method may require extra labor. Strategic planning with the layout can avoid face nailing and gluing in many locations.

Nail and glue directly to Warmboard–S

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

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

Acclimate wood

See page 16.



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

Hardwood manufacturers

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

	Engineered	Solid Wood		Engineered	Solid Wood		Engineered	Solid Wood
Anderson Wood Floors 864.833.6250 andersonfloors.com	some	no	Heritage Wide Plank Flooring 877.777.4200 heritageplankflooring.com	n/a	yes	Plyboo 866.835.9859 plyboo.com	yes	n/a
Armstrong, Bruce, Robbins 800.2233.2823 armstrong.com	some	no	Homerwood Hardwood Flooring 814.827.3855 homerwood.com	yes	no	Schotten & Hansen schotten-hansen.com	yes	yes
Arrigoni Woods 888.423.6668 arrigoniwood.com	yes	yes	Junkers Hardwood Floors 800.878.9663 junkersh hardwood.com	most	yes	Satin Finish Hardwood Flooring 800.60.SATIN satinfinish.com	yes	no
Authentic Pine Floors 800.283.6038 authenticpinefloors.com	yes	yes, less than 6"	Karelia Hardwood Floors 888.840.3435 kareliafloors.com	n/a	yes	Shannon & Waterman 844.315.2520 shannonwaterman.com	yes	yes
Award Hardwood Floors 715.849.8080 awardfloors.com	yes	yes	Launstein Floors 888.339.4639 launstein.com	yes	yes	Shaw Hardwood Floors 800.441.7429 shawfloors.com	some	no
Bellawood Hardwood Floors 800.HARDWOOD bellawood.com	some, floating only	no	Lauzon Hardwood Flooring 877.427.5144 lauzonltd.com	yes	no	Southern Wood Floors 888.488.7463 southernwoodfloors.com	yes	no
Boen Hardwood Floors 888.897.0800 boen.com	yes	n/a	LM Flooring 972.417.9900 lmflooring.com	some, floating only	n/a	Swedish Flooring 360.752.0350 swedishflooring.com	yes	n/a
BR-111 Exotic Hardwood Floors 800.525.2711 br111.com	yes	no	Mannington Wood Floors 856.935.3000 mannington.com	yes	yes	Tarkett Wood Floors 800.842.7816 tarkett-floors.com	some	no
Broad-Axe Flooring Company 802.257.0064 broadaxeflooring.com	n/a	yes	Max Windsor Hardwood Floors 909.477.6698 maxwindsor.com	most	n/a	The Woods Company 888.548.7609 thewoodscompany.com	n/a	yes
Carlisle Wide Plank 800.595.9663 wideplankflooring.com	n/a	yes	Mirage Floors 800.463.1303 miragefloors.com	most	no	Thermory Flooring and Decking 585.591.2333 thermoryusa.com	yes	yes
Columbia Forest Products 800.654.8796 columbiaflooring.com	yes	no	Mountain Lumber 800.445.2671 mountainlumber.com	yes	yes	Torlys 800.461.2573 torlys.com	yes	n/a
Dinesen +45 7455 2140 dinesen.com	n/a	yes	Muskoka Hardwood Flooring 800.461.5386 muskokaflooring.com	yes	no	What It's Worth 512.328.8837 wiwpine.com	n/a	yes
Goodwin Heart Pine Company 800.336.3118 heartpine.com	n/a	yes	Mohawk Hardwood Flooring 800.266.4295 mohawk-flooring.com	yes	no	Zickgraf Hardwood Company 800.243.1277 zickgraf.com	n/a	yes, less than 5"
Hallmark Hardwood Floors 888.551.0888 hallmarkhardwoods.com	yes	yes	Nordstar Hardwood Flooring 207.799.0010 nordstar.net	some	n/a			

Installing tile

22

Warmboard-S is a nominal 1¹/₈" thick, 4' x 8' sheet of structural tongue and groove subfloor that is rated Exposure 1. Tile or stone set to Warmboard-S is subject to all of the tile setting requirements of any ordinary unheated wooden subfloor.

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

TCNA testing

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

TCNA performance ratings and description

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

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

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

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

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



Warmboard recommended assembly methods and test results

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

Method 1: Backer Board

Performance Rating: Extra Heavy
Page 23

Method 2: 3/4" Mapei Mud Bed

Performance Rating: Extra Heavy
Page 25

Method 3: 3/8" Mapei Self-leveling Underlayment

Performance Rating: Extra Heavy
Page 26

Method 4: Uncoupling Membrane Custom SpiderWeb

Performance Rating: Light Commercial
Page 27

Method 5: Uncoupling Membrane Blanke • Permat

Performance Rating: Light Commercial
Page 28

Method 6: Uncoupling Membrane Schluter Ditra

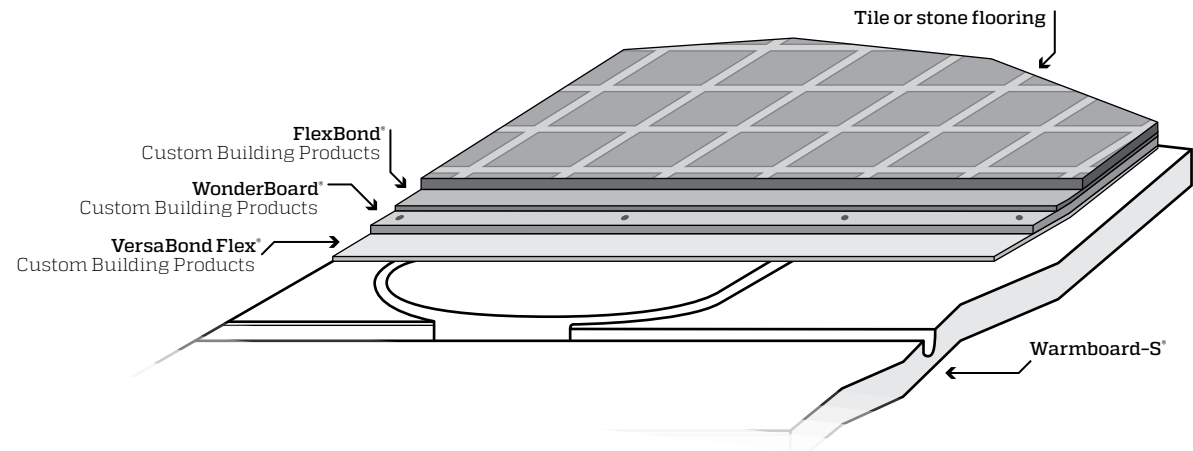
Performance Rating: Light Commercial
Page 29

Method 1 Backer Board

There are a variety of Cementitious Backer Units, or CBU's available. Backer Board has the advantage of being low mass and are relatively inexpensive to install. Also the available thicknesses of $\frac{1}{4}$ " and $\frac{1}{2}$ " provide a base for tiled areas to match up well with adjacent finish floors.

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

A warranty letter from Custom Building Products for the use of WonderBoard® over Warmboard-S and this TCNA testing assembly and results are available upon request.



Backer board must run perpendicular to the Warmboard-S panels. Seams should also be staggered. Take special care while fastening to avoid tubing damage.



You may substitute with other comparable brands that meet ANSI standards.



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

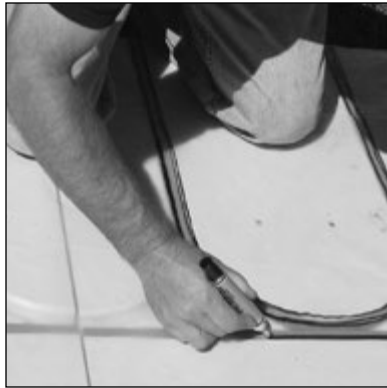
Installation Tip Use a stencil to avoid tubing damage with Backer Board

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



1.

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



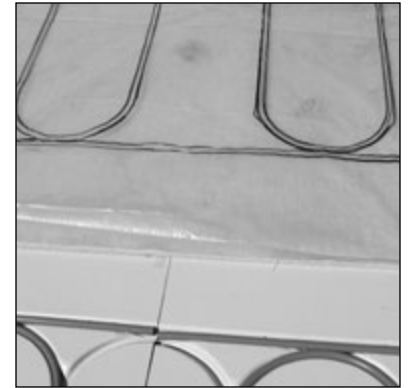
2.

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



3.

Trowel a coat of thin-set over the Warmboard-S panel and place the Backer Board over the appropriate location (review any information on previous page as needed).



4.

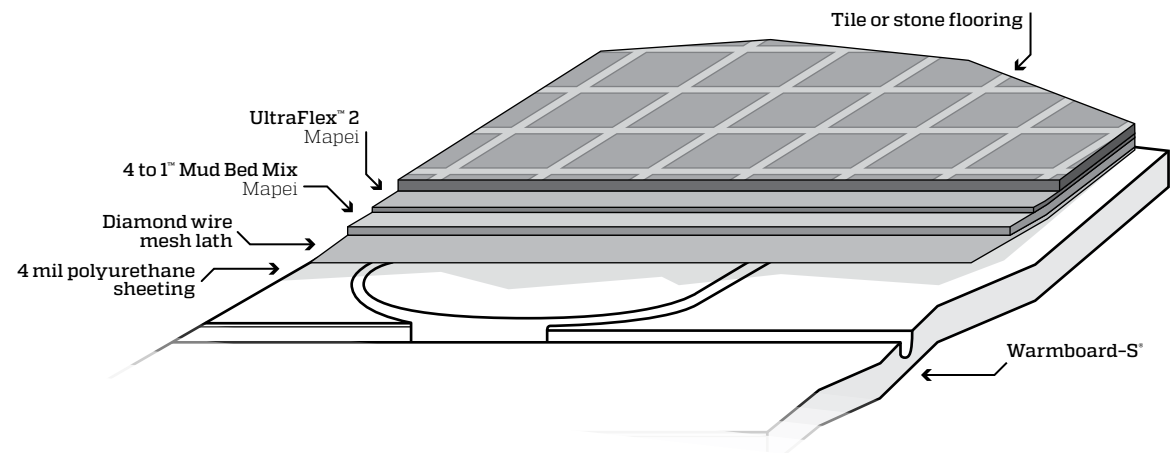
Align the stencil over the Backer Board and tape down the corners. Mark safe fastening locations with a drill bit, before removing the stencil and fastening as normal.

Method 2 Mortar Bed $\frac{3}{4}$ " thick with "4 To 1™ Mud Bed Mix" by Mapei®

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

When applying mortar beds, install a 4 or 6-mil polyethylene to serve as a cleavage membrane. Fasten down a diamond wire mesh lath over the membrane using crown staples and finish with a minimum $\frac{3}{4}$ " mortar bed (Mapei® 4 to 1™ Mud Bed Mix or equal). After the mortar bed has cured, thin-set and tile or stone may then be applied.

A warranty letter from Mapei for the use of "4 to 1 Mud Bed Mix" over Warmboard-S and this TCNA testing assembly and results are available upon request.



Take care to avoid tubing damage.



You may substitute with other comparable brands that meet ANSI standards.



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

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

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

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

A warranty letter from Mapei for the use of “Ultraplan Easy” over Warmboard-S and this TCNA testing assembly and results are available upon request.



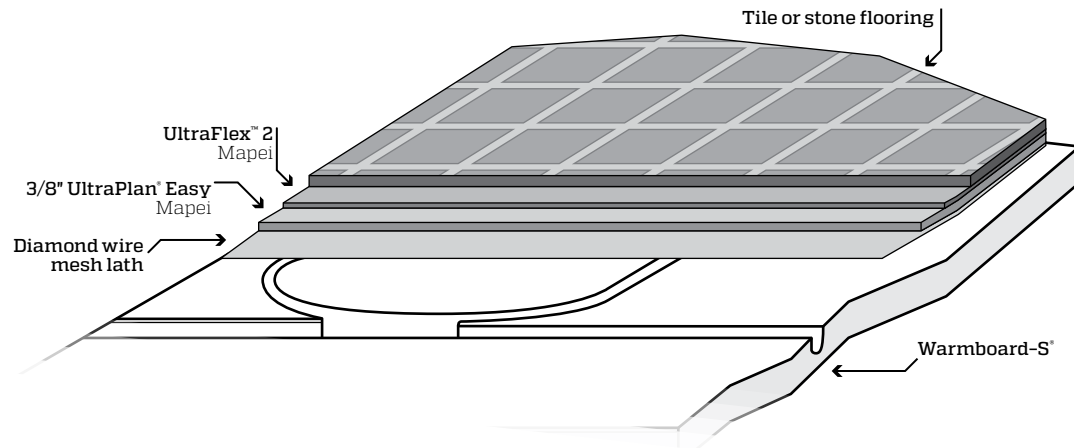
Take care to avoid tubing damage.



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



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



Method 4 Spiderweb™ Uncoupling Mat by Custom Building Products

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

To proceed with this installation, clean panels, trowel on “Mapei Granirapid® Thin-Set mortar” (mix per Mapei’s instructions) using a $\frac{1}{4}$ " x $\frac{3}{16}$ " V-notched trowel. Immediately install SpiderWeb Mat. Follow next day with thin-set using $\frac{1}{4}$ " x $\frac{1}{4}$ " square notch trowel. Finish with tile or stone.

A warranty letter from Custom Building Products for the use of SpiderWeb over Warmboard-S and this TCNA testing assembly and results are available upon request.



Take care to avoid tubing damage.



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



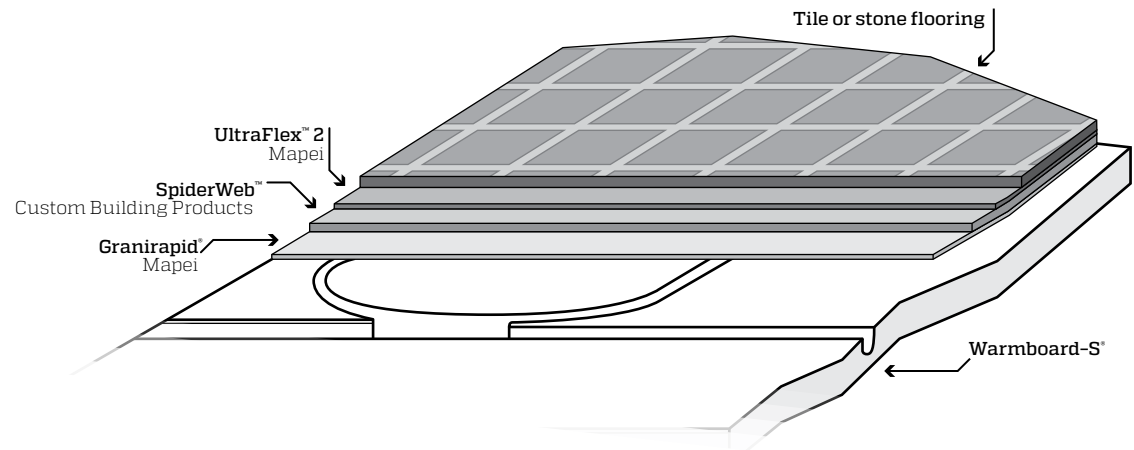
The surface temperatures of tile or stone must not exceed 85°F.

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

Warmboard-S with Granirapid averaged 217 PSI.

Plywood with Granirapid averaged 240 PSI.

Minimum requirement is 50 PSI.



Method 5 Blanke • PERMAT uncoupling membrane

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

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

A warranty letter from Blanke for the use of Permat over Warmboard-S and this TCNA testing assembly and results are available upon request.

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

Warmboard-S with Granirapid averaged 217 PSI.

Plywood with Granirapid averaged 240 PSI.

Minimum requirement is 50 PSI.



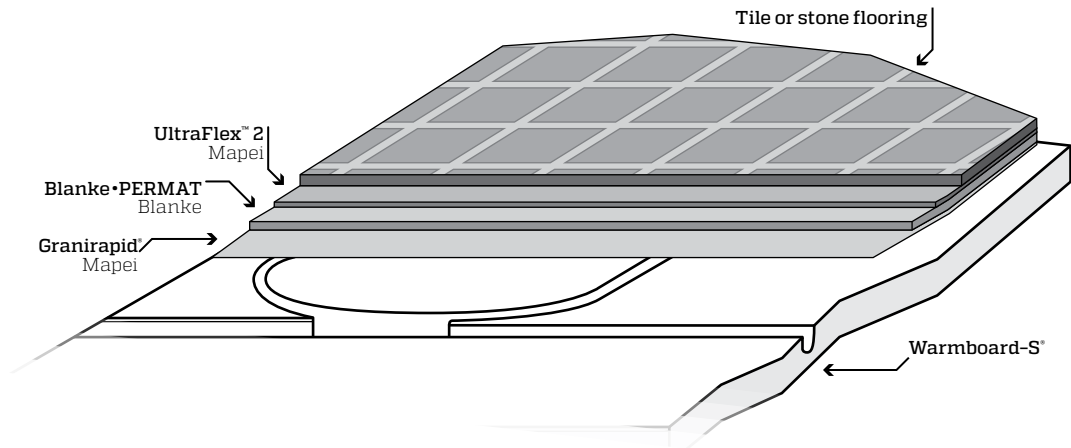
Take care to avoid tubing damage.



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




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





Method 6 Uncoupling membrane “Ditra” by Schluter

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

The TCNA testing assembly and results can be made available upon request.

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

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

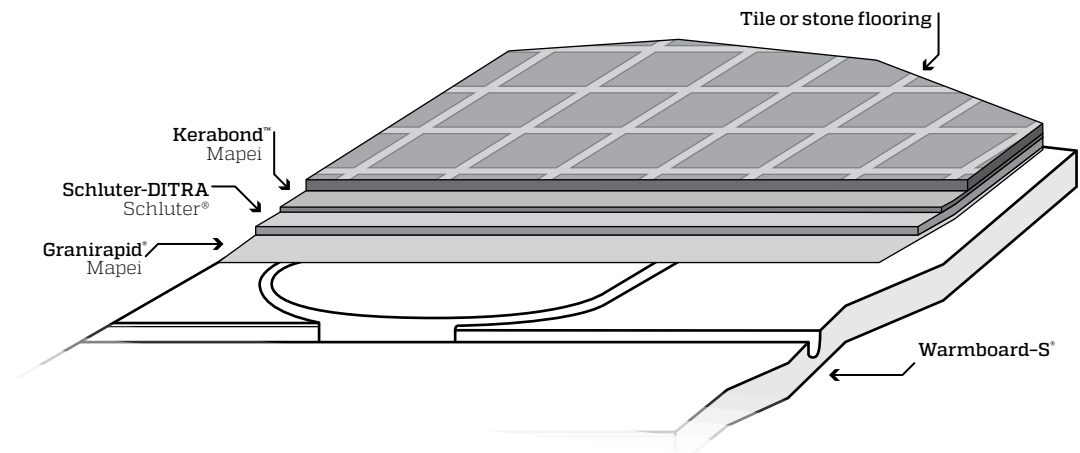
 The surface temperatures of tile or stone must not exceed 85°F.

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

Warmboard-S with Granirapid averaged 217 PSI.

Plywood with Granirapid averaged 240 PSI.

Minimum requirement is 50 PSI.



Tile information resources



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



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



CAUTION!

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

Ceramic tile backer board resources

USG Durock and Fiberock

Georgia-Pacific

JamesHardie

Wonderboard

Uncoupling membrane resources

Blanke

Custom Building Products

Schluter

Additional resources

American National Standards Institute (ANSI)
ansi.org

Tile Council of North America (TCNA)
tileusa.com

Mapei
mapei.us

Installing carpet

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

Sponge Cushion, Inc.
1.800.435.4062
commercial-carpetcushion.com

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

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

Leggett & Platt
1.800.866.9446
lpcarpetcushion.com

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

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

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

Carpet and padding R-values

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



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

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

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

Installing cork flooring

FIRST AND ALWAYS

Follow all installation specifications provided by the cork manufacturer.

Cork flooring has a naturally high insulation value so it is important to choose one that is $\frac{3}{8}$ " to $\frac{1}{2}$ " 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).

Installation of standard cork flooring

The installation of an underlayment is required over the Warmboard surface before standard cork flooring is installed. Care should be taken when fastening the underlayment to Warmboard-S because the tubing is obscured during this step. We recommend installing a $\frac{1}{4}$ " 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).

Installation of cork laminate products

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



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



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

Installing vinyl

FIRST AND ALWAYS

Follow all installation specifications provided by the vinyl manufacturer.

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

The installation of underlayment is required over Warmboard-S before the vinyl is installed. Care should be taken when fastening the underlayment to Warmboard-S because the tubing is obscured during this step. We recommend installing a $\frac{1}{4}$ " or $\frac{1}{2}$ " APA listed plywood underlayment with a sanded face. For complete installation details, refer to the "Engineered Wood Construction Guide" at apawood.org. Complete the installation of vinyl by following all the manufacturers guidelines and specifications.



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



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

Installing linoleum

FIRST AND ALWAYS

Follow all installation specifications provided by the linoleum manufacturer.

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

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



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



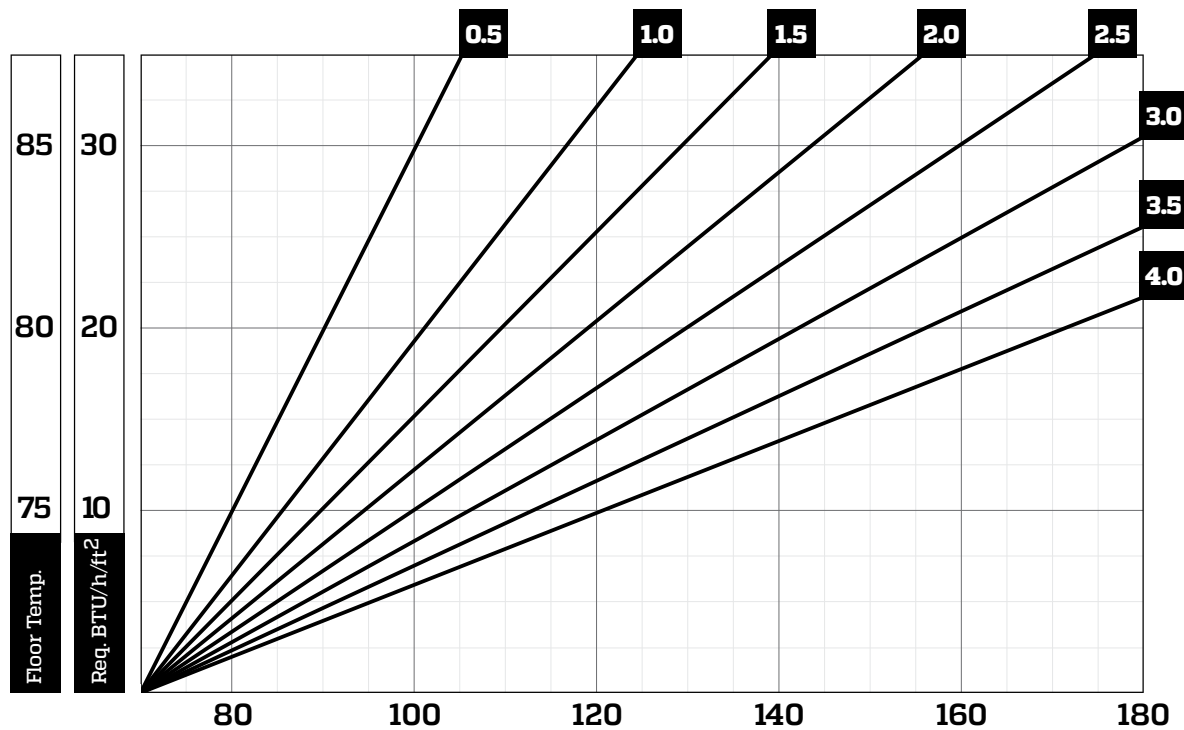
When using a plywood or OSB (or equivalent) underlayment it is crucial to fully acclimate panels before installation. If the underlayment panels are too high in moisture content, the panels will shrink from the floor heating and create an installation failure.

Finish floor R-values

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Material	Typical R-value	R-value per inch	Typical thickness	Material	Typical R-value	R-value per inch	Typical thickness
Plywood	0.825	1.10	0.750	Carpet	0.700	2.80	0.250
OSB	1.050	1.40	0.750		1.050	2.80	0.375
Softwood	0.825	1.10	0.750		1.400	2.80	0.500
Ash	0.750	1.00	0.750		1.750	2.80	0.625
Maple	0.750	1.00	0.750		2.100	2.80	0.750
Oak	0.638	0.85	0.750	Wool Carpet	1.575	4.20	0.375
Pine	0.975	1.30	0.750		2.100	4.20	0.500
Fir	0.900	1.20	0.750	Sheet Vinyl	0.200	1.60	0.125
Engineered Bamboo	0.720	0.96	0.750	Vinyl Composition Tile (VCT)	0.200	1.60	0.125
Engineered Wood	0.250	1.00	0.250	Linoleum	0.400	1.60	0.250
	0.375	1.00	0.375		0.200	1.60	0.125
	0.625	1.00	0.625	Dense Rubber Flooring	0.250	1.30	0.325
	0.750	1.00	0.750	Recycled Rubber Flooring	1.100	2.20	0.500
Engineered Wood Flooring Pad	0.200	1.60	0.125	Cork	1.125	3.00	0.375
Carpet Pad/Slab Rubber 33 lb	0.320	1.28	0.250	Cork/MDF/Laminate	1.175	2.35	0.500
	0.480	1.28	0.375	Brick	3.375	2.25	1.500
	0.640	1.28	0.500	Marble	0.400	0.80	0.500
Carpet Pad/Waffle Rubber 25 lb	0.620	2.48	0.250	Ceramic Tile	0.250	1.00	0.250
	1.240	2.48	0.500	Thin-set Mortar	0.050	0.40	0.125
Hair Jute	1.940	3.88	0.500	MDF/Plastic Laminate	0.500	1.00	0.500
	1.250	3.88	0.325	Laminate Floor Pad	0.300	1.92	0.160
Prime Urethane	1.400	4.30	0.325				
	2.150	4.30	0.500				
Bonded Urethane	1.350	4.20	0.325				
	2.100	4.20	0.500				

Water temperature chart



Average of supply/return water temperature at manifold for good dynamic performance

Assumes a designed ambient air temperature of 70°F

■ = R-value (thermal resistance)



Steady State Performance will require 10% lower supply temperature.

R-value = Resistance value of floor covering

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

Assumes minimum R-19 insulation below the floor.

Warmboard-S is one component of a complete radiant system.

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



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

