BY JOHN SPIER

Photos by John Spier

A Radiant Panel Primer

I've lived for many years in a home with radiant floor heat, and I prefer it to any other type of heating system. The combination of comfort, efficiency, and cleanliness, along with ease of use and low maintenance, is hard to beat, and many of my clients are choosing radiant heat for their homes as well. While the radiant heat in my own home was a little out of the ordinary—the radiant tubing was integrated into a 90,000-pound structural concrete slab—most people opt for more conventional construction. The best system I've seen to deliver hydronic radiant heat over a wood-framed floor uses factory-made panels with pre-cut grooves for the tubing.

These panels were originally developed and sold by Stadler-Viega as "Climate Panels"; similar products are now being made by other companies, including Uponor, whose system I used in this project. These "on top" radiant panels (installed directly over an existing subfloor) are an evolving technology—those I used here are a marked improvement over ones I used just a year ago.

The basic concept is the same: Modular plywood panels assemble to create a subfloor with grooves that accept PEX tubing. The system I installed uses 5⁄16-inch-diameter tubing, but systems using 3⁄8-inch-diameter tubing are also available. (Larger-diameter tubing loses heat more slowly, so longer loops can be used in the layout). The panels are backed with a thin layer of aluminum (about the thickness of flashing) that helps distribute heat more evenly. The radiant panels I install are usually covered with tile or wood flooring.

DESIGNING THE SYSTEM

As with most hydronic heating systems, the PEX tubing can be supplied with water or antifreeze heated by just about any type of water-heating appliance, such as a boiler, or even with water heated by the sun. Additionally, there are many options for controls, manifolds, pumps, and other distribution technologies.

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Design and engineering of a complete system is job specific and beyond the scope of this article, but most good plumbing and heating supply houses or contractors have engineers available to review your plans and help you design the system. As the building contractor, I am responsible for installing the actual panels that hold the tubing. Interestingly, when I first started installing these systems many years ago, my heating contractor told me that the actual panel installation was a job for carpenters, not plumbers.

The first step is developing an overall plan that includes the tubing requirements and the number of loops for each room you are heating. The total amount of tubing that can be put in a given space is usually determined by the square footage of the room. The panels typically have a 7-inch spacing between grooves, which results in approximately 1.7 linear feet of tubing per square foot of floor area. In reality, the layout usually produces numbers that are somewhat less than that, so rather than calculating by square footage, I divide the width of the space by 7 inches to get the number of runs, and then multiply that number by the length of the room to get the linear footage of tubing that I'll need.

For most distribution systems, the length of each loop shouldn't be more than about 300 feet—longer lengths are difficult to pump efficiently and result in a temperature drop from one end to the other that's too great to produce heat effectively. So dividing the total tubing length in a room by 300 gives you the number of loops needed. From there, I find a location for the manifold, and then develop a layout scheme that will allow all of the loops to begin and end at the manifold.

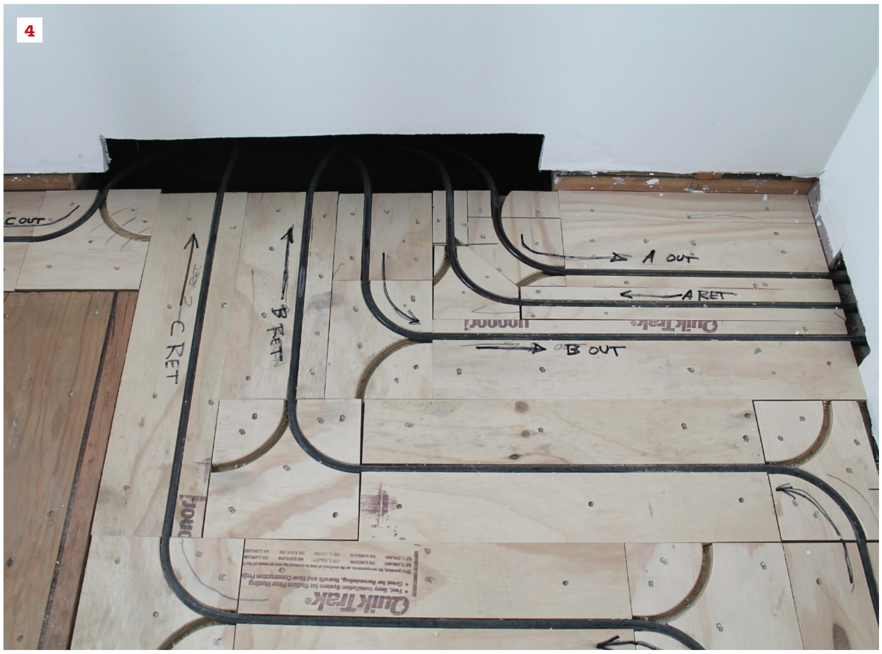
COMMON-SENSE LOOP DESIGN

A heating engineer can design a layout that precisely matches the loops to the Btu requirements of the different parts of a space, but following a few basic rules can work as well. I lay out my loops so that the outbound legs first serve areas with the greatest heat requirements, such as bathrooms and along exterior walls, especially north-facing walls or walls with many windows or doors. I set up the loops so that as the fluid cools, it returns through a path closer to the interior. I also try to make the loops in the higher-load areas shorter, while the loops for interior areas can be a bit longer.

Additionally, I design my layout to avoid running tubing under cabinetry or built-ins, or in other areas where it makes no sense to distribute heat. Lastly, if I'm installing wood flooring, I try to run the tubing perpendicular to the flooring direction wherever possible to keep the tubes visible when I'm fastening the flooring planks.

INSTALLING THE PANELS

For most of my projects, radiant floor panels are installed on OSB or plywood subflooring, which I clean and scrape carefully to ensure a flat surface. I grind down any high spots and fill low spots with self-leveling filler. The panels themselves come



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either as assemblies of six panels attached together accordion-style, or as single panels. I usually buy only six-panel assemblies and cut singles from an assembly as I need them **(1)**. There are also return panels with semi-circular loops that connect the ends of the straight runs. If I need to direct the tubing in a perpendicular direction, I cut off a quarter-turn section from a return panel or cut a smaller portion of an arc to direct the tubing at an angle.

I snap reference lines to keep the panels square and parallel within the space, and then run a row of single panels along one wall as a guide, with a return panel positioned at the end **(2)**. The panel assemblies come with the ends of the panels staggered to align and interlock them as they are installed. To fit them against the return panel, I cut the ends of a whole assembly flush in one shot on a chop saw **(3)**. Then it's just a matter of working across the floor, adding panels or assemblies as needed. If I need a narrower width, I simply rip it on a table saw.

The panels are nicely milled, so once I've started straight and square, the entire installation usually goes quite smoothly. Large, open spaces go easily and quickly, but smaller, more complex rooms such as bathrooms can be challenging—often involving many runs of single widths, with lots of quarter turns and offsets. In these spaces, I often dry-fit all the panels before nailing them in, and as I install them, I keep track of the flow direction with arrows on the panels **(4)**.

ATTACHING THE PANELS

Uponor recommends screwing the panels down with 10 screws per panel, but I've had good luck with galvanized ring-shank subflooring nails that have good pull-out resistance. I shoot them in with the same coil gun that I use for siding installation, driving nails about every 6 inches along both sides of every panel.

Once the panels are installed and all of the loop paths checked and confirmed, it's time to install the tubing. First, the floor is swept and the grooves carefully vacuumed clean; one small pebble or stray nail under the tubing can puncture it, with a resulting leak that can be difficult to repair later. My plumbing contractor generally sends a couple of guys with a roll dispenser to install the tubing **(5)**, but I find it cost effective to be on hand to help them. The tubing often needs some persuasion with a hammer and block to snap it into the grooves, and as a carpenter, I'm much better at that operation than the average plumber.

Once the tubing is installed and connected to a manifold, it can be air-tested, and then hooked up and supplied with heat. We install wood flooring directly over the radiant panels. In tiled areas, the installer puts in a cleavage membrane and installs the tile on top of the membrane **(6)**. Clients are always happy with a radiant floor system. And as the contractor, we love having that warm, comfortable radiant heat underfoot as we finish the rest of the interior.

John Spier owns Spier Construction, a building and remodeling company on Block Island, R.I.

Getting Kickout Flashings Right

BY MARK PARLEE

I founded my own framing and siding company back in 1990, and while my brother still runs the siding division, much of my work these days comes from consulting on failed exteriors. On most of these jobs, there is one detail—the kickout flashing at roof-wall intersections—that I see done wrong *most* of the time. In a neighborhood of 30 homes, I expect to find at least 28 with exterior problems, and most of these will have no kickouts. When they do exist, they will be of substandard quality.

Photos by Mark Parlee

Some builders do recognize this as a vulnerable spot, and in a good-intentioned but feeble effort, often smear gobs of extra caulk into the siding notch. Others will install a piece of metal flashing (recognizing that a flashing is required by code), but this metal is rarely large enough to deflect roof run-off into the gutter. The resulting damage from the overflow—gallons and gallons of water regularly pouring over the wall area below—can be catastrophic. I've had jobs we ended up remediating that had earthworms in the wall. The sheathing and framing had rotted all the way to grade level to such an extent that the wall had essentially turned to dirt.

DO IT RIGHT THE FIRST TIME

The photo above shows a correctly detailed kickout on an EIFS stucco exterior. This kickout is particularly important because it terminates directly at a window opening—a fairly common occurrence, but one that can be especially devastating: If the kickout is wrong, chances are high that the window flashing is worse, and there is

A pre-made, one-piece TPO kickout, like this one from DryFlekt, is large enough to deflect roof runoff into the (yet-to-be-installed) gutter.

With horizontal siding, the author installs a trim board along the rake, keeping it a minimum of 1 inch above the roofing.

little hope of keeping water out of the wall. Water can quickly find its way to interior finishes, leading to extensive mold—problems that carry enormous liability and a higher price tag. It would be so much easier and less expensive to invest in $15 worth of flashing to begin with.

The details are essentially the same for all cladding types. The process starts with a large, one-piece kickout flashing with a return that is big enough to prevent runoff from overflowing the top. We typically use ones made by DryFlekt (dryflekt.com). Unlike with a site-made metal kickout, you don't need to worry about making bends, and the flashing won't corrode. The ones from DryFlekt are made of a thermoplastic polyolefin, or TPO, which is pretty good at resisting UV degradation and stands up well to a wide range of temperatures, so it's unlikely to become brittle and crack. We have put in hundreds of these over the last decade and have never had a problem.

We usually begin by installing a piece of peel-and-stick flashing, folding it into the corner between the roof and the wall. The kickout goes in next, followed by standard step flashings. The job shown at top left is typical for a reroof, where we cut in and begin detailing the intersections first. The roofer, of course, will come along later and slide new shingles between the steps. And the WRB will be folded down.

We bed the edge of the WRB in a thick bead of sealant, and then bring the siding down, keeping it at least 1 inch above the finish roofing. For stucco, stone, or masonry veneer, we terminate the cladding with a weep screed held off the roof 1 inch. For horizontal siding, we typically install a trim board along the rake, which will simplify future reroofs (see photo, bottom left). This board has a simple aluminum Z-flashing along the top edge to protect the exposed edge of the trim board and can be applied directly over the WRB, because any water that gets behind the WRB will drain out onto the step flashing.

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