PM
Plumbing & Mechanical

07/03/2002

Plateless In Radiantville
John Siegenthaler, P.E.

A one-size-fits-all approach to radiant tubing installation can land you in hot water.

John Siegenthaler P.E.

Plateless In Radiantville
John Siegenthaler, P.E.

By John Siegenthaler P.E.

A one-size-fits-all approach to radiant tubing installation can land you in hot water.

I'm writing this column at the end of what has been a long and at times discouraging week. All told, I've received three "what went wrong with this system" calls. All involved "plateless" staple-up radiant floor installations in which tubing was stapled directly to the underside of a wooden floor deck.

In the first case, the 1/2-inch PEX tubing that was stapled to the underside of the plywood subfloor was "migrating." The installer told me that some tubing runs had moved about 2 feet since being stapled in place. The system was also making objectionable "ticking sounds" each time the zone thermostat called for heat.

Ticking sounds due to expansion/contraction movement of the tubing are an all too familiar complaint in such systems, especially when reset control is either not used, or is not properly adjusted. However, the migration of the tubing was a new one for me. The only thing that came to mind was that the staples were installed at an angle, and thus allowed a "ratcheting effect" to occur in which the tube moved past the staple while expanding, but was prevented from returning when it cooled.

Needless to say, the owner of this system was not happy. The installer was trying to resolve the issue as amicably as possible. We discussed several possibilities for remedying the situation. Unfortunately, the tubing was already closed in behind a drywall ceiling. It was too late to consider what I'm sure would have made a major difference in performance — heat transfer plates. That option gone, we moved on to implementation of reset control with the proper settings that would allow almost continuous circulation through the system. The less on/off cycling, the less piping movement, and, hence, the less ticking.

Incidentally, upon inspecting the job, a representative of the tubing manufacturer found that the staples used were not the staples sold by his company (even though they were obtained from another tubing manufacturer for exactly the same purpose with the same type of tubing). The use of nonbrand-X staples was hence cited as the cause of the problem.

Two days later I got a call from another very reputable radiant installer who was retained to perform "triage" on another plateless staple-up installation. In this one, the tubing was stapled to the underside of the subfloor about every 3 to 5 feet. The heat transfer plates were omitted because the original installer considered them too expensive and unnecessary. Mind you this system was installed in a house that probably cost about $500,000.

Again, the problem wasn't discovered until the tubing was rendered inaccessible by a drywall ceiling. Minimal amounts of underside insulation were used, and adding more was now next to impossible.

I have every confidence the radiant doctor will do his best with what he has to work with, but thermal miracles are hard to come by. In the end, the original installer may be convinced that heat transfer plates and proper underside insulation really are less expensive than defense attorneys.

Three Strikes

The last call came from a company just getting started with radiant floor heating. The plateless staple-up was installed under bedroom floors covered with carpet and pad. One inch of foil-faced foam insulation board was pressed up against the underside of the tubing. The space below this insulation was a partially heated basement. The water temperature to the floor circuits was regulated by an injection mixing system, and reached 148 degrees F at -10 degrees F outdoor design. Guess what the complaint was? You got it — inadequate heat output in the carpeted rooms. The owner was dissatisfied and withholding the remaining payment for the system. This is the hard way to

be initiated into the radiant heating business.

I've long held reservations about "universal" use of plateless staple-up radiant installations. In my opinion, they're a possibility only in situations where the required upward heat flux is less than 15 Btu/hr/sq. ft. They may be suitable for rooms having mostly interior walls, floors, and ceilings, but not a ski chalet with 25-foot ceilings, and a gable full of glass.

In addition to complaints of inadequate heat output, some plateless staple-up systems have caused serious thermal degradation of finish floors. The problems have included cracked ceramic tiles, color striping of vinyl flooring, carpet, and warped hardwood floors.

Most of these problems are the consequence of poor heat diffusion from the stapled tubing to the other flooring materials. I call this situation "thermal constipation." The heat is there in the tubing; it just has a very difficult time flowing outward and upward through the remainder of the flooring sandwich.

The contact area between the stapled-up tubing and the subfloor is often a tiny percentage of the overall surface area of the tubing. The situation only gets worse when the tubing is filled with water and operated at high temperatures. It's not long before the tubing looks like wires drooping between utility poles. This severely limits conduction heat flow. Convection and radiation are the only remaining vehicles to move the heat, and neither has good "geometry" with which to do so.

Oversimplified

It seems that too many installers have the notion that the plateless staple-up method is all they need to know about installing radiant tubing. Many assume that cranking up the water temperature is the solution for areas having higher heat loss. Some will even tell you not to waste too much money on underside insulation because everyone knows that "heat rises."

Where do these installers get the idea that plateless staple-up is a one- size-fits-all approach to radiant?

Certainly part of the problem is that they don't know (or at least respect) the fact that conduction heat transfer requires ample contact area between the tubing and the other materials in the floor. There's nothing magical about PEX, PEX-AL-PEX, EPDM, or copper tubing that allows any of them to sidestep basic physics.

If plateless staple-up is such a versatile installation method, why wasn't it used with copper tubing during the radiant boom of the 1940s and 1950s? Why wasn't it around when PEX tubing made its initial appearance in the North American market in the early 1980s? Why isn't it currently used in Europe?

Do I dare suggest that some installers are simply too — and I'll be gentle — disinterested to inform themselves about where plateless staple-up works, and where it doesn't? The same question applies to some wholesalers, and Web-based distributors of radiant heating hardware.

I think it's time for everyone involved in the sale of tubing for floor heating applications, from manufacturers on down, to reassess their criteria on where plateless staple-up installations are appropriate. It's time for installers to know when tubing suppliers will and won't stand behind this type of installation.

Sure, plateless systems cost less than plated systems. Likewise, three lengths of flex duct dangling from bailing twine cost less than a properly designed and installed forced air distribution system. Roll roofing costs less than 30-year warranted shingles. A light bulb screwed into a porcelain base costs less than a chandelier.

Isn't it odd that most buildings in which plateless staple-up radiant heating systems are installed don't use roll roofing, or light bulbs screwed into porcelain bases?

No Excuses Required

Radiant "newbies" often feel that because the competition is willing to roll the dice with a questionable plateless installation, they should also temporarily forget about thermodynamics to get the job. Further pressure for such a decision often comes from a thrifty but technically uninformed owner who flashes a lower price quotation when the cost of doing it right is presented.

What's the point of installing a $20,000 system that stands a better than average chance of generating complaints or even litigation, rather than a $23,000 system that generates higher profits and referrals? The radiant industry is about selling comfort, quality, and efficiency. Those who choose to do otherwise should move on before scarring the market for those who want to do it right.

Those who will prosper in the radiant heating industry are those who take the time to learn about and respect the basic heat transfer principles involved in each type of installation. Professionals who know what it takes to do the job right, and are prepared to politely walk away when circumstances require otherwise.

Footnote: By the time you read this, the results of an ASHRAE research project in which several types of radiant floor constructions (including plateless staple-up) were tested under controlled laboratory conditions should be released. Initial interpretation of the results indicate a substantial increase in floor heat output when plates are used in staple-up installations. If you install staple-up radiant systems, I urge you to review the findings of this report and incorporate them into your design and installation decisions.