Indoor Environment & Energy Efficiency
IE3
BUSINESS INTELLIGENCE FOR PROFESSIONAL CONTRACTORS

Radiant Cooling in Commercial Buildings

Posted by Sandra Sabo

August 14, 2017

A decades-old use of hydronics is enjoying a slow but steady comeback throughout North America.

Although Dan Foley installed his first radiant heating system in 1991, 20 years passed before he completed a radiant cooling project. Now Foley, the owner and president of Foley Mechanical in Lorton, VA, typically has several radiant cooling projects in progress at once. He sees the hydronics application as a continued growth area for his business, particularly for new construction.

"Radiant cooling is conducive to commercial construction techniques, where the floors are poured concrete over steel decking, and to hard surfaces like stone, tile, or dyed concrete," notes Foley. His radiant cooling projects have included a number of luxury residences—ranging up to 42,000 square feet—that are houses in name only because they feature commercial mechanical systems.

"Like a lot of technologies, radiant cooling was around for decades before it was 'discovered,'" says Lance MacNevin, director of the engineering, building, and construction division of the Plastics Pipe Institute in Irving, TX. In the 1930s, for instance, iron pipes embedded in floors and ceilings often provided radiant heating and cooling in commercial buildings. The introduction of PEX (crosslinked polyethylene) tubing in the 1970s began rekindling interest in circulating warm or chilled fluid through plastic pipes embedded in floors, walls, or ceilings. In recent years, with the development of more sophisticated control systems, the technology has drawn the interest of environmentally minded architects and design engineers.

"Commercial buildings have always used hydronics to move heat around because it's so much more efficient. It takes far less energy to circulate water through a building than to blow air through it," adds MacNevin. "It's really just a learning curve to do radiant cooling as well." He notes that radiant cooling systems use fluid chilled in the range of 58 to 60 degrees, which doesn't require much energy generation.

Rising Popularity

According to the Center for the Built Environment (CBE) at the University of California Berkeley, radiant cooling and heating systems are becoming more common in commercial buildings throughout North America, particularly those designated as ultra-low and zero-net energy buildings. One recent study conducted by CBE found that buildings with radiant systems for both heating and cooling used less energy when compared to peer buildings and national benchmarks, while still maintaining the comfort of occupants.

With many new commercial buildings pursuing LEED certification, radiant systems also have the potential of earning a significant number of points in LEED's energy environment category. In fact, says MacNevin, "I've heard that, in the last 10 years, more than 50 percent of all the LEED-rated buildings in North America include radiant heating, radiant cooling, or both."

Commercial architects—the people who generally specify radiant cooling systems—not only like the resulting energy efficiency but also the greater design freedom. "With radiant cooling, you can control temperature without huge ducts, fans, and registers," Foley explains. "Architects like burying cooling in the floor because it gives them clean lines to work with."

Radiant cooling pairs especially well with the expansive areas of glass that are a hallmark of modern architecture; as the sun's energy pours through the windows, the fluid flowing through the plastic tubing captures the heat and carries it away, instead of allowing it to become trapped in the floor. Another advantage is a reduction in noise. With radiant cooling, both a building's ductwork and fans can be downsized, which makes the moving air quieter.

While the architect and engineer may have the say about radiant cooling in the design phase, the general contractor typically selects the HVAC contractor that will install the system. If you'd like to position your company as a highly qualified subcontractor, here are several recommendations:

Get up to speed. "Since the early days of radiant cooling, the industry has learned a lot about proper design and installation. But, like a lot of specialties, this knowledge is still not yet commonplace," MacNevin observes. In addition to reading trade publications and engineering manuals, you can build your expertise by attending training classes offered by trade groups and industry consultants. You might also look into being certified as meeting the ASSE Series 19210 Hydronics Heating and Cooling Installer Professional Qualification Standard.

"Radiant cooling can handle about 50 percent of the sensible load—the temperature you can measure on a thermometer—but you have to control the humidity as well," says Foley, noting that all of his radiant cooling jobs are paired with radiant heating. That adds another layer of complexity to master, with radiant cooling calling for tighter tube spacing and higher flow rates of fluid through the tubing.

"Concrete doesn't change temperature quickly, so while it's cooling down, for example, you'll need to be blowing cool air through the ducts," Foley adds. "That all has to be designed and built into the control strategy—which is where our skill and expertise as HVAC contractors can really shine."

Identify experts to work with. According to MacNevin, most radiant cooling systems are designed by licensed engineers with the support of a system manufacturer. It becomes the contractor's responsibility to install the system as designed, after completing the manufacturer's training courses to master tubing installation, manifolds, testing, and so forth. Notes MacNevin, "It's not rocket science, but there's only one chance to get the tubing installed correctly, before the concrete is poured."

Think ahead to servicing and maintenance. All mechanical devices fail eventually, observes Foley, so he always takes a conservative approach and incorporates back-up systems. "Say I had a job that needed 20 tons of cooling. I'd put in four 5-ton chillers instead of one 20-ton chiller so if one broke I'd still have back-ups," he says. He ensures all joints, connections, and valves are placed in the building's mechanical room or closet; in the floor, he uses one continuous link, or multiple links, of piping that connect to an accessible manifold.

Foley also guards against jamming the system's components into the mechanical room haphazardly. "If you have to come back on a 100-degree day when the system isn't working, you want easy access," he says. "That means leaving room around the equipment so you can service it and having proper valves—so you can close two valves and change a component, like a circulating pump, without having to drain the entire system."

Keep an eye on other subcontractors. When the day for pouring concrete arrives, Foley Mechanical always has an employee at the building site to keep watch on the embedded tubing. While the PEX tubing isn't fragile, a nick from a shovel, rake, or tool can create problems. "Plenty of electricians and plumbers have drilled through the PEX or cut it, but I've never had a pipe just fail," says Foley, who pressure tests a radiant system for leaks using 100 PSI.

Document your work. "When you're doing the job, write down where every pipe, valve, and pump is, because your memory will get hazy when you come back five years later," advises Foley. He uses pipe markers and commercial-grade placards to identify each piece of equipment and what area of the building it services, in addition to keeping a binder in the mechanical room with the system's detailed schematics and instruction manuals. He also keeps an electronic copy of the building's mechanical plans in his office and a print copy on site, to facilitate troubleshooting.