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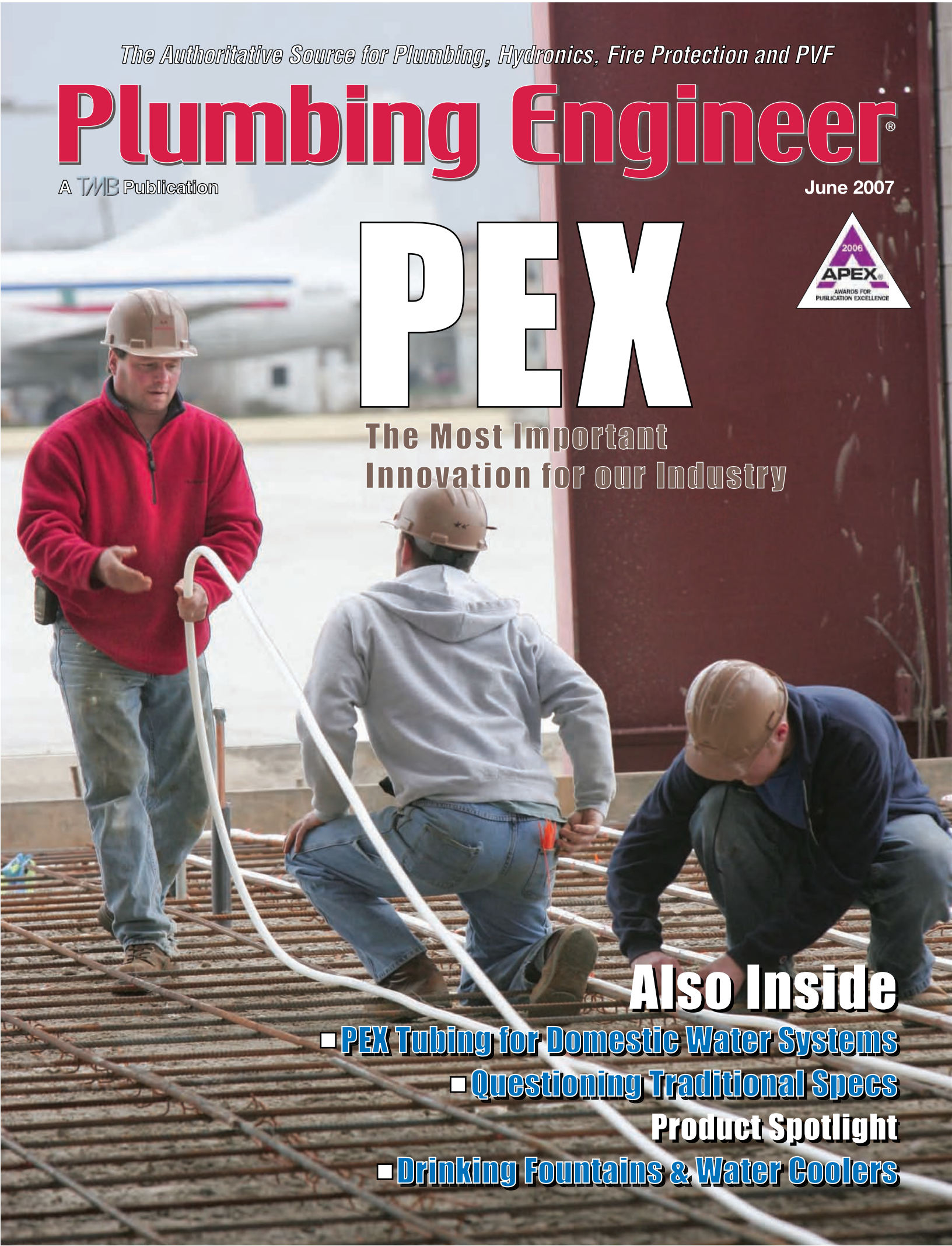
PEX

The Most Important Innovation for our Industry



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PEX

The Most Important Innovation for our Industry, 20 Years

By John Vastyan

If you've never given a moment's consideration to the impact that PEX tubing has had on the hydronics industry, consider where we were 15 or 20 years ago. The hydronics industry wasn't looking so good. We were replacing boilers, but that's just about it. Even the word *boiler* elicited a crinkled-nose response from architects, engineers and builders. Among homeowners-well, they may as well have stumbled upon a corpse. It seemed to be, in fact, a dying industry.

Sure, we'd seen radiant heat before, but it came and went all too quickly as water had its way with black iron pipe, and as chemicals in concrete attacked copper tubing, too. Want a sprinkler in your floor? Me neither.

Then it happened. The marvel of cross-linked polyethylene (PEX): proven for years in hardy European environs and installed by hard-core hydronic professionals. It swam across the Atlantic and hit our shores with exuberance, unleashed on open terrain. Its impact in the early 1990s was so fast, and our market so ready for the uplift, that it resuscitated the hydronics industry and gave birth to another.

Fortunately, the emergence of the radiant heat industry in North America coincided with a substantial increase in commercial and residential construction. For years, it has been the fastest growing segment in the heating industry and has brought new meaning to the concept of comfort in the home or workplace. We owe some gratitude to the magic of PEX.

How much gratitude? Consider this: According to the Radiant Panel Assn.'s most recent survey of radiant tube suppliers, tubing sales between 2004 and 2005 appear to have stalled at 333 million lineal feet, and growth during the last 10 years has been averaging 19% per year. Furthermore, in light of the most recent response from suppliers, growth numbers will likely be back in the double digits for 2006.

Using an average hydronic job size of 3,000 sq. ft. would put installations at 150,000 to 160,000 in 2005, representing industry revenues of approximately 2 billion dollars. This would include not only tubing, but also all the supporting equipment such as controls, pumps, heat sources and labor.

To me, the most startling statistic is seeing where the industry sprang from during the past 15 years—from 20 million lineal feet to nearly 350. Only cell phones and Xboxes can report that sort of meteoric thrust.

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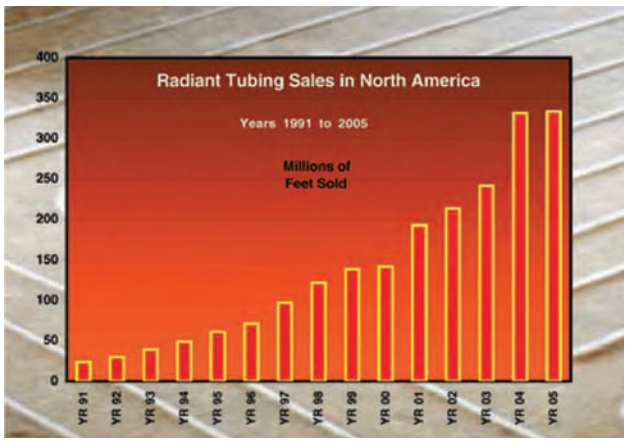

Source: RPA

Of course, there are other products on the market that help to make the radiant heat market as diverse as it is, and as ready to please: multifunctional manifolds; sophisticated microprocessor controls; outdoor reset; mod-con boilers and EPDM synthetic rubber hose as an option to the otherwise all-PEX tubing lineup ("Onix," by Watts Radiant)—just to name a few.

But the radiant heat business hasn't gone it alone. The plumbing industry quickly decided that it wanted to get in on the fun. And, as it's been on the radiant side, the PEX entry was fortuitous.

Today, we can buy all brand and variety of PEX tubing for potable water systems at a fraction of the cost of black pipe and copper, install it in a fraction of the time and with a lot less hassle. So, as the Chinese feather their nests by importing metals on an unprecedented scale, at least we've got an alternative. And, fortunately, the substitute is better in every regard for those of us in the plumbing industry.

Sleek, artful, modular manifold systems have been developed by many suppliers. Red pipe for hot, and blue for cold. There are quick-connect, snap-on fittings such as those introduced last year by Watts Water Technologies, giving warp speed to installations while shaving labor costs dramatically.

For many, the most exciting facet of the world of PEX has been its impact on the hydronic industry. Because from it has sprung an exciting industry all unto itself, fulfilling its promise to provide uncompromised comfort; consistent, high-efficiency heat distribution; superb installation flexibility and—something we haven't known for a long time—*consumer demand.*

It's at work like magic in the residential industry. But the spill-over, the glamour and unmatched capability of radiant heat has led to an exciting boost to its application in the industrial and commercial sectors, too—sophisticated systems designed by engineers. How else could we melt snow so capably at hospital helipads, sidewalks and wheelchair ramps? Or to provide radiant heat to an entire high-rise, integrate radiant delivery with geothermal to meet the highest levels of best LEED certification for new schools and college facilities, or to create strategically-located "hot spots" at airports where large volumes of snow can be dropped off for a quick goodbye?

Let's take a look at two commercial applications that point to the tremendous versatility of PEX heat distribution.

A Field of (Pipe) Dreams

In the world of pro football, the field is the game's foundation. If it is unsafe, the entire franchise is at risk. A $20 million QB can fall hard and spend the rest of the season in recovery. Or the field is condemned, posing another threat, one that packs a punch to the team's revenue.

"The condition of the field can be our worst nightmare, or an answer to dreams," says an unnamed sports turf professional.

There's a new trend afoot that has the artificial turf makers on edge—real grass. Lush, living, carefully nurtured and, now, hydronically conditioned turf is all the rage. What gives real turf an advantage, and players the best surface going, lies hidden in the soil where roots receive warmth from miles of pipe that circulate heated fluids.

If You Pipe It, They Will Play

One of the most advanced turf conditioning systems in the NFL is now hard at work under the 93,200 sq. ft. playing field at Gillette Stadium in Foxborough, MA, home of the New England Patriots.

The new radiant heating/turf warming system at Gillette Stadium, manufactured by Watts Radiant, uses 153,000 lineal feet of PEX tubing that feeds warmth to the soil. The manufacturer has installed similar systems for other sports facilities, including Safeco Field, the Champion Diamondbacks' field and the Chicago Bears practice field.

Even with new developments in irrigation and soil management, the ability to grow turf is directly related to the root zone temperature. Constant root zone temperatures help to accelerate turf growth, which allows for faster repair of damaged areas and also helps to maintain a more pliable soil condition.

With a turf conditioning system in place, and doing its job, the result is a healthy grass playing surface that is better cushioned, causes fewer skin abrasions or deeper, more serious injuries, and plays well.

Does it melt snow? Well, yes. And no.

A turf warming, or turf conditioning, system is similar to a snowmelt system, but there are key differences. "The main difference is what our goal is," says Watts Radiant engineer Kolyn Marshall, who designed the intricately piped system for Gillette Stadium. "In a snowmelt system we are trying to melt snow at the surface. To do this, we need a surface temperature greater than 32 degrees. In a turf system our target isn't the surface, but rather an area 6 in. to 10 in. down where the root zone is. This layer is designed to maintain anywhere between 50 and 60 degree temperatures, depending on the turf, soil conditions and climatic conditions."

There will be times when a turf system will melt snow, though it's really not designed to. According to Marshall, most turf systems aren't operational during the weekends when most games are played.

"The underground pipes are usually moving fluids [a

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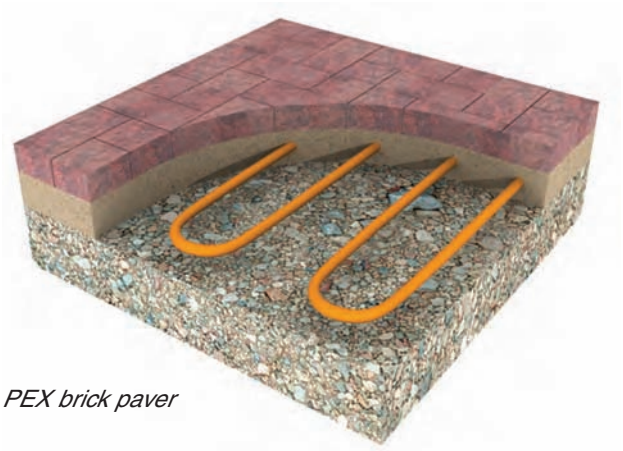
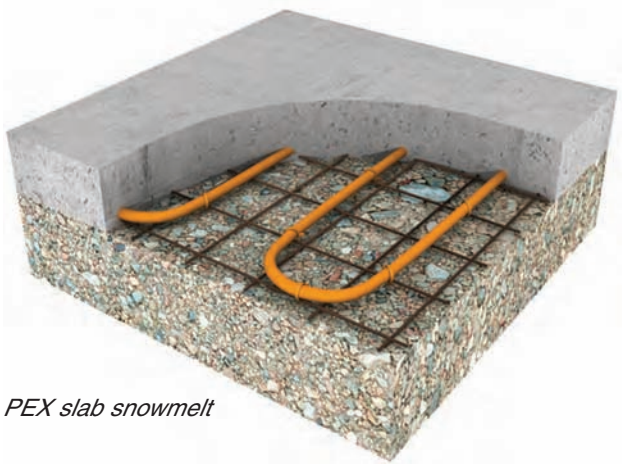


PEX brick paver



PEX slab snowmelt

water/glycol antifreeze mix] Monday through Friday," says Marshall. "Typically, the radiant system in the field is turned off a few days before game day—just the opposite of what you'd think. If it did snow, and the system was on, there's a chance that slush would form, becoming a real problem, endangering both players and field."

It's a Grassroots Thing

Radiant turf warming systems are rapidly being integrated into the design of new and reconditioned professional field projects. "There's more to a radiant turf system than just installing tubing under the soil," says Marshall.

According to the Patriots's field superintendent, before a radiant design can be done, "We 'design' the soil conditions; most professional fields are multilayered beginning with a solid base of compacted earth."

Aeration of the soil is a key consideration. Different fields will require different aeration techniques, but one thing is the same: Something must penetrate the field in the aeration process. The radiant tubing and any irrigation equipment must be deep enough not to be damaged.

According to Marshall, once the physical properties of the material and conditions and the tubing depth are determined, a preliminary radiant design is begun. This phase of the design process determines the amount of tubing required to cover the field, the BTU load, supply water/glycol temperature and flow rates.

"Over the years, and since the field's installation a few years ago, our soil temperature tests have been perfect," added the field superintendent. "We're seeing very uniform heat at the 9-in. deep root zone mix. There's minimal temperature variance throughout the whole zone."

No Two Are Alike

Zoning a radiant turf warming system plays a critical role. It's influenced by mechanical constraints, field abuse—which areas need faster recovery—and solar exposure, based on knowing when certain areas of the playing field will be warmed by the sun.

For the Patriots, a six-zone system was created with three zones on either side of the 50-yard line. Tubing runs parallel to the sidelines, from the end zones to the midfield and back. Four inch manifolds were installed along each end zone for the 3/4-in. PEX pipes to connect to.

According to Marshall, supply and return manifolds were installed in trenches along each end zone. Main supply and return lines were placed in trenches that ran along the sideline. The mechanical access is located in the corner of one of the end zones. Twelve 4-in. black iron supply/return lines access the mechanical room at one point. PEX tubing lengths were 425 ft., which allow for the tubing to go from the manifolds to the 50-yard line and back.

Special factory-produced elbows were made to accommodate the curvature of the field. The tubing is secured to the field with the use of Watts Radiant RailWays and is spaced 8 in. on center. While the system was under the pressure test, sensors were installed in the field

The mechanical system consisted of six zone circulators and a DDC temperature control system. The DDC allowed for remote access to the system, remote monitoring and history tracking. The zone load is approximately 10.5 million BTUs and the total system load is nearly 12 million BTUs. This load is supplied by an Alfa-Laval heat exchanger interfaced with the venue's power plant located in the stadium.

Success Soars from Air Shipper's New Facility

Mission Critical: Your assignment, should you accept it, is to airlift your cargo to a remote mountain air strip. Or to arrive at a major metro airport with celebrities, military high brass, or donor organs intact, with no time to spare. Start your engine. You're already late.

Move over FedEx. This Ohio air transport firm takes over when "overnight" won't do. They've delivered hearts on ice to dozens of transplant patients, and special ops experts to unscheduled meetings with the President. Moved rare animals to zoos or radioactive payloads. All in a day's work.

AirNet Systems Inc. is the nation's leader in the critical-time air delivery business. AirNet is much smaller than FedEx or UPS, but it is geared for faster, more nimble service. Their fleet of 130 aircraft—based in Los Angeles, Seattle, Boston, Tampa and other cities all over the country—fly more than 600,000 miles weekly, guaranteeing that if tomorrow is just too late, their same-day service will get the delivery there today—anytime, anywhere, coast-to-coast, 7 days a week, 365 days a year.

The firm specializes in time-sensitive cargo deliveries. "It's demanding work, and business is good," says Joel Biggerstaff, AirNet's chairman of the board and CEO.

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PEX installed at this hospital helipad helps to melt snow.

When Biggerstaff made plans to expand the hub facility operations in Columbus, OH, he envisioned a new hangar for the air transport service firm. It would need to accommodate growth, be comfortable, energy-efficient and highly functional. His vision came to life after years of planning and 2 years of construction, enabling AirNet to consolidate the operations of three smaller facilities and to relocate its operations from Columbus' main airport to Rickenbacker International, 15 miles to the south. The $25 million project offered several advantages.

The new, 148,000 sq. ft. facility also doubled the hangar space—now with an open area 350 ft. by 150 ft. in size—permitting larger aircraft to be loaded and unloaded inside and provides valuable sorting space to ease congestion under-roof.One of the key enhancements to the new facility is the extensive radiant heat and snow meltsystem installed by Columbus-based Muetzel Plumbing & Heating Co. to heat the immense, 50,000 hangar.

Warm Floors, Aircraft & Cargo

"Fortunately, the owners were predisposed to radiant for one key reason—comfort," says Hanse Cromer, a heating expert with the manufacturer's rep firm, Steffens-Shulz. "The rapid pace that their people work at is stressful enough. Warm floors and heat that would also gently warm the aircraft, as well, was perfectly suited to the need.

"With large sliding doors, and the possibility of more than one of them being opened at one time, heat within the facility will be flushed out quickly," added Cromer. "But with radiant the recovery time is fast, and most of the heat stays in the high-mass floor, and in the mass on the floor—the aircraft and stacked cargo, for instance. For an application like this, radiant is the only way to go."

Radiant system planning and design for the enclosed space began many months before installation. Because of the floor's great size, Muetzel and experts from the project's general contracting firm and Cromer, settled on a plan that would create four separate, 13,250 sq. ft. slabs, each measuring 75 ft. by 150 ft.

For the extensive 1-zone, 7-manifold system, the radiant design "team" prescribed the use of 55,000 lineal feet of 3/4 in. RadiantPEX tubing manufactured by Watts Radiant. The system was designed to provide up to 25 BTUs per square foot. Each slab would have accessible, recessed sensors and the entire system would be responsive to outdoor reset controls.

And, outside the hangar's four large bay doors, Muetzel crews also installed tubing for 10,000 sq. ft. of snowmelted concrete slab to streamline maintenance of the area immediately beyond the doors, and for easier maneuverability of taxiing jets and planes, even in the midst of winter's worst. All arteries of the extensive heating system lead to and from the strategically located mechanical room where, as the heart of the system are two, stacked 1.5 million BTU, fan-assisted, sealed-combustion Pennant boilers by Laars Heating Systems. The new units operate at 85% combustion efficiency and offer four-stage control to meet demand as needed, providing considerable energy savings.

"The system was designed so that, at full heat load, all eight stages of firing would be used," adds Cromer. "And because the fully-automated, idling radiant and snowmelt system would be in some stage of operation throughout the entire winter season, we pretty much eliminated the possibility of some unexpected winter condition catching them by surprise."

The single floor sensor, embedded in the slab, and snow melt controls, are handled by a HeatTimer microprocessor control. The system was set to maintain a floor temperature of 80-82 °F. The technique was chosen because—with the large, opposing bay doors, which would occasionally be open at the same time during the winter season—it would be so difficult to maintain a specific air temperature. The digital control also monitors outdoor temperature and, at 36 °F, the snowmelt system is activated. The control is coupled with a three-way motorized valve. By design, the valve opens slowly until a prescribed supply-and-return differential temperature is achieved. This gradually mixing of heated glycol solution into the snowmelt tubing prevents thermal shock to the slab.

The 40/60 mix glycol snow melt system was separated from the main indoor heating system through the use of a shell-and-tube heat exchanger. An outdoor-reset system sets system temperatures. For the most part, the hydronic system is set to idle throughout the winter months, with programmed instructions to keep outdoor slab surface temperatures—thanks to the network of PEX tubing—at a steady 35 °F.

Today, the only emergencies that AirNet is contending are the rigors of getting packages and people to distant places when—as they slogan goes—every second counts. Through rain, sleet or hail, their new facility in Columbus will help them get the job done, on time.

PEX tubing wins again. ■

About the Author

John Vastyan *is a trade journalist and president of Manheim, PA-based Common Ground, a communications firm focused on the radiant heat, plumbing and mechanical, geothermal, HVAC, hydronics and water quality industries.*