By Mike Breault

GOING CUSTOM for year-round comfort

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416-781-2221

Custom work often goes hand-in-hand with longer timelines and interesting systems and products. This is evident through ongoing work at a 5,000 squarefoot modern residence in west Toronto that Tropical Heating and Air

Conditioning, a 14-person firm, started in 2012.

"Our staff has a wide knowledge base, especially in regard to hydronic applications," says Bob Williams, the company's vicepresident. "That specialty allows us to offer a great deal to clients seeking a more complex system, or systems, as is often the case.

"This has been an on-and-off project," he continues. "But it includes some elements that stretch out the timeline, from concrete construction to geothermal."

Four ground-source heat pumps draw from 10 vertical bore holes to supply both hydronic and forced air systems. Polished concrete floors throughout the home include 8,600 lineal feet of half-inch oxygen barrier PERT tubing. A 175,000 BTUH condensing boiler provides backup heat, DHW and heat for a snowmelt system.

All told, 22 zones of radiant heat and three zones of air conditioning come out of two mechanical rooms; the main room downstairs and a smaller room on the second level.

"Space for components is the biggest challenge here," says Williams. "And running all that pipe and ductwork through a solid concrete structure takes a lot of foresight. You need to use the available space as efficiently as possible."



CLOSE QUARTERS

Geothermal Solutions, the drilling subcontractor, ran all the HDPE tubing from the exchange field to the mechanical room, which is where Tropical took over. The main flowcentre circulates the water/ alcohol solution through the field and into a 26-gallon hydroseparator. From here, flowcentres on each of the four heat pumps draw fluid as needed to condition the home. As a result, the room has one-and-aquarter-inch HDPE pipe running in all directions.

"To us, professional appearance is second only to functionality, and that's hard to maintain with HDPE pipe," says Williams. "We really wanted a system that allowed us to dry-fit an entire loop to make sure it's all square, plumb and level."

While looking for a solution, Williams spoke with Tim Rickards at The Hydronics Group, a Toronto-based wholesaler who supplied most of the equipment on the job. Rickards suggested that Tropical look at a pipe fusion system that uses radio frequency (RF) electromagnetic technology to fuse pipe.

The RF system for welding plastic pipe uses radio frequency energy emitted from the system's portable control unit to energize a thin strip of reactive metal moulded into each fitting. The material heats up to the point of fusing the pipe and fitting together to form a joint that's stronger than either the pipe or fitting alone.

The system allows the user to dry fit the pipe and fitting together, position them as desired, then simply clamp the tool around the fitting to complete the weld – with no risk of burns.

"The system really allowed us to tidy up the geothermal piping," says Williams. "But it also cut our labour hours down. For example, while a technician is fusing one line, he can be simultaneously dry fitting the next one."





OVERCOMING OVERLOADS

According to Williams, Toronto's geothermal installations are few and far between, as a result of small lot sizes. "Most of the geothermal work in Ontario is in more rural areas, where bigger yards are conducive to drilling or trenching exchange fields."

At the concrete home, there was room enough in the yard to drill 10 bore holes, for a total of 10 tons of geothermal exchange. But, the heat pumps in the home total 16 tons.

As a result, BK Consulting Engineers, with input from Rickards and others at The Hydronics Group, designed a flexible system that overcomes the challenge.

The home's main mechanical room includes three geothermal heat pumps; water-to-air units of two and four tons, and a six-ton waterto-water unit for the home's extensive radiant floor system. An additional, four-ton water-to-air unit is on the home's second storey.

"We're able to accommodate more installed capacity than the exchange field can supply based on two factors," explains Rickards. "First, the home is rarely, if ever, going to call for maximum input from all four units at once. Also, the condensing boiler is backup for the radiant system, which handles the brunt of the heating demand."

To avoid getting what geothermal specialists call a "cold field" – where the exchange field becomes depleted of energy to the point that it can't produce enough heat for the structure – the incoming water temperature is monitored.

An aquistat on the main line into the mechanical room is programmed to shut off the water-to-water unit if the incoming water dips below 32°F. At this point, the natural gas boiler supplies heat to the radiant system, as well as an 80-gallon DHW tank and 1,200 square feet of driveway snowmelt.

In the summer, with the smaller cooling load and the water-to-water unit out of service, there's no concern of overtaxing the exchange field's ability to reject heat into the ground. While the home's design heat load is 150,000 BTUH, the cooling load is only 75,000.

"What this design does," explains Rickards, "is cut down on exchange field expense, while using it to its full capacity without ever having to worry about overdrawing it."

DOUBLE DUTY RADIANT

Each room in the home is an independent heating zone. Radiant tubing was installed on nine-inch centres, except where exterior walls consist of large expanses of glass. Here, six-inch centres were used on the perimeter.

"Right now, the system is supplying 100°F water to the radiant loops," says Williams. "Once the home is occupied, that'll fluctuate depending on the desired indoor temperature and outdoor ambient temperature."

The owner also wanted the option to use the radiant system for cooling. The way the air conditioning system is designed, the water temperature in the slab can be dropped to 70°F without risking condensation on the floors.

"We're able to focus on the custom home market because we can offer unique solutions," says Williams. "And that's a result of experience, relationships with other professionals, and a willingness to adapt to emerging technologies and practices."



Mike Breault is the Canadian HVAC product manager for Watts Water Technologies (Canada). He can be reached at michael.breault@wattswater.com.

