Ready to go at 50 below

North Pole, Alaska: Men and machinery take on the rigors of winter

Nicknamed the "Icemen," the 354th Fighter Wing flies out of Eielson Air Force Base near North Pole, Alaska. "Ready to go at 50 below" is their motto, and rightly so. F-16 fighter jets and their crews need to be in top condition, ready to move out at a moment's notice. So do the mechanical systems on base.

Of course, the Alaskan climate dishes out an ice-cold punishment all its own. "Our average temperature in January is negative 10, but it dips well below that," said Al Morlan, superintendent for Slayden Plumbing and Heating, based in North Pole. "And when the winds kick in, it's downright brutal, even for locals."

In 2008, Eielson AFB undertook the construction of 349 new, multiple-family housing units (or multiplexes), and 99 existing units received mechanical system upgrades, all completed by Slayden P+H. Neither the general contracting firm, Fairbanks-based Osborne Construction, nor Slayden P+H, are newcomers to military work. For the past four years, Slayden has installed over 1,000 mechanical systems in facilities nearly identical to the ones at Eielson. They've got it down to a science.

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Double espresso for Henry Ford

Others see it as life in the fast lane, a caffeine-fueled rush to get a lot of groundwork done between winter seasons. No wonder it seems that there's a coffee shack on every corner in Alaska, even in some of the most rural spots. Dark coffee and espresso help the locals leap from each deep freeze into the next one, a period of about 120 days.

In the North Pole region, there's a four-month period when ground can be broken and foundation work safely concreted or poured, including radiant heat work. In late July, dozens of crews at the new housing development at Eielson were moving at an amazing pace to outrun the coming of the next freeze, expected within six or seven weeks.

If Henry Ford had invented the mass production of houses, not Model Ts, he'd have been just as comfortable here, surrounded by construction teams, each focused on a task they've repeated for months with little variation.

Within one block, all facets of construction were underway simultaneously. At the beginning of a cul-de-sac, excavators were moving soil for a poured footer. The concrete truck, spinning slowly, had just arrived. The footer crew was 10 minutes behind schedule.

Modular housing on steroids

Next to that foundation was another one where the footer had cured sufficiently to cover with rigid foam insulation and reinforcement wire. Thirty feet away was another multi-housing unit, its foundation work advanced by exactly 24 hours. Here, a crew was attaching radiant PEX tubing to the re-wire, with taped-shut tubing ends tied to temporary rigging where, perhaps by the very next day, the tubes would be connected to a radiant manifold and attached to the wall of a preassembled, modular mechanical room. A different concrete truck was on its way down the street, bound for this site, ready to pour the slab floor, concealing the tubing.

And, next door, now moving into the curve of the cul-de-sac, a forklift gently placed a small, modular component of the home onto the slab; this six-foot by six-foot, covered section was the mechanical room. The roof was temporary, but it served its purpose, permitting key mechanical components to be installed in advance. Within a week or two, the rest of the building would rise up beside it. By that time the mechanical team will be a few blocks away, repeating the process.

"All the new units need to be under roof and heated by the first of October," said Morlan. Quite a task, considering excavation for new housing units on the 500-acre site had only begun in mid-April.

Units in every stage of completion, from excavation to occupation, could be seen from any vantage point on base last summer. Over the past two summers, the military essentially built a town with a population of 1,500 in nine months. Three or four 1,800-sq.-ft. homes make up each well insulated, slab-on-grade multiplex. Each is hydronically heated, with delivery best suited to the Alaskan climate; radiant heat downstairs, fin-tube baseboard upstairs.

District heating makes a comeback

We're on a military base, and a big one at that. Naturally, they have a few secrets. So when we asked to see the source of all these Btu, we were told that the main steam plant was

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Slayden Superintendent Al Morlan (left) with Jason Chalstrom, civil and mechanical building jobsite supervisor. In the background is one of three large mechanical buildings where steam heat is exchanged with water, then pumped to the multiplexes.

off limits. Nonetheless, we learned that it's a large, super clean, emission scrubbed, bituminous coal-fired, cogeneration plant. Waste steam from the power turbines is piped through deep, super-insulated underground pipes to all of the housing developments and also to new, radiantly heated aircraft hangars.

The main steam plant and the backup plant both receive coal from a rail line running through the base. Here, 420-degree steam is channeled toward three large mechanical buildings located throughout the base.

These buildings identically match the surrounding housing units, right down to the color of siding and placement of windows. Instead of carpet, couches and hi-def TVs, the front door opens to expose two stories of heavily-insulated heat exchangers and piping.

The steam arrives at the mechanical buildings at 80 psi and is there reduced to 15 psi, before running through Taco U Tube heat exchangers. All the mechanical buildings house three 24-inch diameter, cylindrical steam-to-water exchangers, totaling nine for the whole base. There's one for each eight-inch loop.

"The exchangers each handle 8,000 pounds of steam per hour," said Jason Chalstrom, civil and mechanical building jobsite supervisor. "That's nearly 650 tons of hydronic capacity per hour." Crunching numbers, that's well over seven and a half million Btu an hour, for each of the nine massive heat exchangers. All with waste steam.

Keeping up with each heat exchanger is a 32,000 lb./hour, steam driven condensation pump. To keep the system components clean and running smoothly, Taco 4900 series air and dirt separators serve each loop.

At one of Slayden's jobsite prefab assembly stations, Al Morlan (center) poses proudly with his two sons, Allen Jr. (left) and Joshua (right).

Chalstrom explained that a glycol solution leaves the heat exchanger at 180 degrees and gets distributed to numerous substations. The substations, which look like large garden sheds, then circulate glycol to four multiplexes, each of which consists of four 1,800 sq. ft. single family apartments. Victaulic fittings and couplings were used on all the piping throughout the project, regardless of size.

"The entire system puts 26 miles of ductile iron Utilidor piping to use," said Chalstrom. Every inch of buried steam, glycol, or sewer line on base is wrapped in Owens Corning SSL II fiberglass pipe insulation. Even inside the building, the insulation doesn't stop. In the mechanical room and through the walls of the home, all pipes are wrapped.

The mechanical rooms for all the multi-family units are identical, located at the end of the building nearest the substation for that area. From the substation, glycol enters the building in an insulated three inch main.

"We used Taco's new cast iron or stainless steel 2400 pumps to draw glycol from the three inch pipe, supplying the multiplex mechanical rooms," said Morlan. "As far as light commercial pumps go, they're compact, yet with a range of up to 150 gpm and up to 52 feet of head. We can get a lot done with them, while easily fitting four in each small mechanical room."

A pair of Taco 008 circulators draws water from the primary loop; one supplies the upstairs baseboard while the other feeds an indirect-fired water heater. Because low temp water is needed for the radiant slab, Taco mixing valves are used to reduce the water's temperature before it's pumped throughout the slab.

Above and beyond the call of duty

"At some point after the first 62 housing units were installed, military managers wisely decided to put hot

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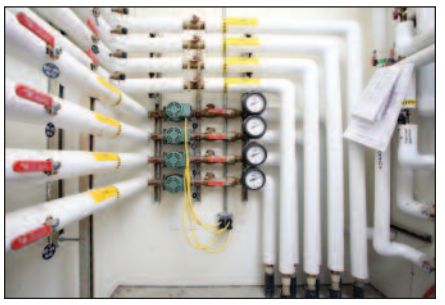
water recirc systems in each home," said Morlan. "We hadn't figured that into the bid, but on a long-term job like this, we were able to make the adjustment easily enough."

The remaining 287 units all



The similarity of mechanical room arrangements and prefabrication of piping layouts helps to keep the large-scale project running on schedule.

received Taco 006 pumps connected to a dedicated hot water recirculation line. "The electricians weren't enamored with the surprise of added work, but they didn't have to go far for power because the Taco zone control was three feet away, mounted on the same wall," said Morlan.

"We prefabricate the components of the mechanical rooms," explained journeyman plumber Alan Morlan Jr. "Once in place, the mechanical systems are snapped together like puzzle pieces." Al Sr. has both his sons working under him at Eielson AFB. Alan Jr. joined the Slayden team in 2002. Joshua, the younger, is now an ABC apprentice plumber and works with his brother assembling mechanical rooms.

It all starts at the temporary prefab shop set up outside the construction area. Inside, one worker cut copper pipe, another scoured and polished. A soldering table was set up with supports for each system component, like a template. Because all the systems are identical, all the tubing, elbows, valves and circulators went in at exactly the same spot.

Adjacent to the shop, tractor-trailer shipping containers, side-by-side, were full of mechanical system parts. One container was full of circulators, hundreds of them, stacked on heavy metal shelves, all arranged according to part numbers.

Next to the pump container were several dedicated exclusively to copper, holding giant quantities of ½-inch to two-inch pipe, no small fortune in raw material for this job. Next door is another container dedicated to flanges, valves, solder and gauges.

"It's a great way to store all the raw materials and components that we need on site," said Joshua Morlan. "It's like having a supply house here on base, but at the pace we're moving, we didn't have much choice. Even a small delay on this jobsite could become a huge problem. So, rather than run the risk, we just stockpiled before we started."

"Set-up for this project was more extensive than many entire jobs we've done before," said Joshua. "But hey, when you've got four months to do most of a year's work, it all pays off in the long run." ●

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