



EXCEEDING EXPECTATIONS: Most of Fujitsu's H and J-Series ductless products meet — and often exceed — the criteria to be classified as CCHPs. (Courtesy of Fujitsu)

Ductless Heat Pumps Thrive in Cold Climates

Next-generation mini splits are proving they can easily handle harsh winters

[Joanna R. Turpin](#)

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For the last few years, much of the focus on [cold climate heat pump \(CCHP\) technology](#) has centered on air-source ducted systems, which are designed to deliver efficient, comfortable heating, even in regions that experience extreme winter temperatures. However, an increasing number of ductless heat pump solutions are proving they can stand up to the cold just as effectively.

This progress stems from ongoing innovation by manufacturers, who have improved cold-weather performance through the use of inverter-driven compressors, advanced controls, and other cutting edge technologies. As a result, these ductless CCHPs are not only viable, but often ideal for homes in regions with harsh winters.

New Technologies

Numerous ductless heat pump systems are now available for cold climates. These include most of Fujitsu's AIRSTAGE H and J-Series ductless products, which meet — and often exceed — the criteria to be [classified as CCHPs](#), said Chris Mottinger, regional sales manager for Midwest USA at Fujitsu General America Inc.

"Fujitsu's XLTH (extra low temperature heating) models offer even greater heat outputs at low ambient conditions," said Mottinger. "Within the new R-32 AIRSTAGE H-Series XLTH products, Fujitsu offers the Orion XLTH+ single zone wall-mount system from 9,000 to 15,000 Btuh with greater than 90% of nominal capacity at -22°F outdoor temperature."

Other H-Series CCHPs that have rated heating performance down to -15°F outdoor temperature include the Orion XLTH single zone wall-mount systems; Centauri XLTH single zone non-wall-mount systems; and the Aquilla XLTH multizone systems with two to four zones. For residential/light commercial, the AIRSTAGE J-Series single phase VRF utilizes R-32 and is offered in 2- to 4-ton outdoor units.

"All Fujitsu systems have no hard lock out for mechanical heating below the rated temperatures we post and continue to heat far below these conditions," said Mottinger. "In addition, Fujitsu's XLTH CCHPs include a metal fan guard, which is most capable of withstanding the colder elements. A factory-installed base pan heater activated on temperatures below 36°F prevents freezing condensate, which reduces noise, damage to the fan blade and condenser, and improves system performance. Lastly, additional base draining holes are designed to discharge melted water through holes located at the bottom of the unit."

Daikin offers single zone mini-split and multi-split products designed for cold climates including the Aurora single zone system, which launched last year. The system uses R-32 and is available with wall-mounted indoor units (IDUs) ranging from 9,000 to 24,000 Btuh, said Connie Schroder, ductless portfolio leader at Daikin Comfort Technologies North America Inc.

“Daikin Atmosphaera, launched in 2021, was the first residential ductless unit in North America using R-32,” said Schroder. “It’s available with wall mount IDU in sizes from 9,000 to 24,000 Btuh. Both units feature built-in Wi-Fi, allowing end users to control their system via app, without the need to purchase additional parts. Atmosphaera has premium efficiency compared to Aurora, being more mid-level.”

According to Schroder, these systems are optimized for cold weather, with the compressor and refrigerant playing a key role in maintaining performance.

“R-32 has the ability to deliver more capacity in low-ambient conditions compared to R-410A,” she said. “Beyond this, the materials that make up the unit, such as PCBs, fan blades, cabinets, etc., are designed to withstand harsh conditions.”



MORE CAPACITY: Daikin Atmosphaera uses R-32, which can deliver more capacity in low-ambient conditions compared to R-410A. (Courtesy of Daikin)

Mitsubishi Electric Trane HVAC US (METUS) offers an extensive line of all-electric, all-climate, single- and multi-zone ductless heat pumps designed for cold climates, said Matt Bynum, senior manager of product marketing at METUS. The equipment utilizes R-454B, and their most popular series includes the Mitsubishi Electric MUZ-FX and MUZ-GX outdoor units, paired with the MSZ-FX and MSZ-GX indoor wall-mounted units, which are part of the M-Series product line.

“Our advanced Hyper-Heating Inverter (H2i) technology delivers efficient heating down to -13°F, and for some products, guaranteed operation down to -22°F, ensuring year-round comfort even in the harshest winter climates,” said Bynum. “Our inverter-driven compressors adjust speed and output dynamically to match heating demand. This delivers consistent comfort, minimizes energy waste, and extends system life, particularly important during frequent temperature fluctuations in cold climates.”

Some METUS systems also include flash injection technology, which injects a specialized refrigerant mixture into the compressor to boost system capacity and efficiency in extreme cold. Advanced Frost Detection allows for longer continuous heating by reducing the frequency of defrost cycles, which enhances comfort in frigid temperatures. Additionally, improved heat exchanger geometry and advanced coil coatings increase surface area and thermal transfer, optimizing performance in low-temperature conditions, said Bynum.



HYPER HEATING: Hyper-Heating inverter (H2i) technology from METUS ensures year-round comfort in harsh winter climates. (Courtesy of METUS)

The new energy-efficient Hitachi airHome Series features HeatForce technology, which lowers utility costs while delivering reliable comfort — even in low ambient conditions. This includes the Hitachi airHome 600, which can achieve 100% heating capacity at 5°F, and the airHome 800, which maintains 100% heating capacity at -4°F and provides heating down to -22°F. Both systems launched in November 2024 and utilize R-32, said Samuel Vivar, ductless split product portfolio manager at JC Residential and Light Commercial LLC.

“Hitachi’s HeatForce technology combines a large-capacity accumulator optimized to meet the unique demands of low-temperature condensing, as well as a cascade vector DC inverter system that precisely controls compressor speed to enhance energy efficiency,” said Vivar. “We’ve also optimized the heat pump with on-board intelligent controls that are equipped with Adaptive Defrost Technology.”

This technology is important, explained Vivar, because in cold ambient conditions, frost can quickly build up on the condenser coil, reducing heating capacity and potentially causing system failure. Unlike traditional heat pumps that rely on preset defrost cycles, airHome heat pumps use intelligent sensors and Adaptive Defrost technology to detect and manage frost in real-time. Base pan heaters further prevent ice buildup by draining defrosted water.

“Combined, these features not only maximize performance in cold climates, they also help to provide unmatched comfort for homeowners,” he said.



COLD CLIMATES: The Hitachi air365 Max is a light commercial unit designed for use in cold climates. (Courtesy of Hitachi)

Ductless CCHP Installation

According to manufacturers, contractors installing ductless CCHPs should follow several key best practices. For example, Schroder emphasized the importance of mounting the outdoor condensing unit 2 to 4 inches above the expected snowfall line to ensure proper operation.

“Our equipment has several holes in the outdoor unit drain pan to allow condensate to drain freely, which helps prevent ice from forming, which damages the coil,” she said. “Contractors also need to take care that this condensate won’t be in a place that could become a slipping hazard once it re-freezes on the ground.”

If a ductless heat pump will be the sole source of heating and cooling, Mottinger stressed the importance of performing an accurate load calculation. This ensures the system can meet heating demands at low ambient design temperatures without being oversized for cooling.

“It is important to not just select the heat pump based on nominal capacity, but true performance at the low ambient design condition,” he said. “Proper selection and installation play a critical role in preventing additional defrost cycles and condensate issues on the project. A backup or secondary heat source is not required if the steps above are followed.”

Vivar agrees that accurately sizing equipment for extreme conditions is key to ensuring successful installations in cold-climate applications. He added that contractors should also understand the required piping length, diameter, and insulation requirements.

“We’ve developed several heat pump models to provide the flexibility contractors need when selecting equipment,” he said. “For contractors interested in building their cold-climate heat pump expertise, Hitachi offers hands-on training courses from our state-of-the-art Irving, Texas training facility, as well as local training centers throughout the U.S.”

When specifying and installing Mitsubishi Electric ductless CCHPs, HVAC contractors should consider several key factors to ensure optimal performance, especially in challenging cold-climate applications, said Bynum. These include:

- **Defrost cycles:** All-climate heat pumps periodically defrost to remove frost from the coil, which can reduce heating. Mitsubishi Electric uses advanced defrost control algorithms to minimize these cycles, which helps maintain consistent indoor comfort.
- **Condensate management:** In subfreezing conditions, outdoor condensate can freeze and accumulate around the base, potentially causing issues. Elevated base pans, drain holes, and optional heaters can help prevent ice buildup. Proper installation height and drainage are also essential.
- **System sizing and location:** Accurate sizing ensures efficiency and comfort, and outdoor units should be placed away from drifting snow and have proper clearance. Mitsubishi Electric offers performance data to help select the right model.
- **Electrical considerations:** Verify that electrical service matches system requirements and allow for base pan heater hookups if needed for added freeze protection.

Another consideration is backup or supplemental heat. “Thanks to Mitsubishi Electric’s Hyper-Heating Inverter (H2i) sumo technology, our CCHPs provide excellent capacity at low temperatures, reducing the need for backup heat in many applications,” said Bynum. “In extremely cold regions or in homes with marginal insulation, a supplemental heat source may be recommended for peace of mind during severe cold spells. Mitsubishi Electric systems can integrate seamlessly with these sources when needed.”

Maintenance

After ductless CCHPs are properly installed, regular maintenance is essential. Clean coils and heat exchangers are especially important for maintaining performance in cold climates, said Vivar, where small issues can quickly escalate into major problems.

“The Hitachi airHome series heat pumps have been designed to streamline maintenance with their built-in FrostWash technology,” he said. “This unique automated self-cleaning feature is applied to both the indoor and outdoor units to trap and freeze accumulated dust and dirt and hygienically flush it away from the system. Not only does this preserve airflow capacity, it can also help to prevent natural odors and enhance IAQ.”

Regular maintenance is recommended for all ductless units, said Schroder, who provided the following checklist:

- Clean filters;
- Change batteries in remote controller;
- Wipe down the indoor unit cover for dust and dirt;
- Inspect blower wheel for dirt and clean if needed;
- Inspect indoor and outdoor coil for dirt and clean if needed;
- Inspect indoor unit drain pan and drainpipe and clean if needed; and
- Inspect EEV valve body and clean if needed.

“For CCHPs, it’s especially important to inspect the outdoor unit drain pan and clean if needed, removing leaves, pine needles, etc., as debris can plug up drainage holes,” said Schroder. “It’s also good to re-check that there is proper clearance underneath the unit for the snowline and adjust if needed.”

As OEMs have noted here, cold-weather ductless heat pumps offer an energy-efficient and reliable solution for heating in even the harshest winter conditions. With proper system selection, installation, and maintenance, contractors can ensure year-round comfort and performance for their customers.



Joanna Turpin is a Senior Editor at *The ACHR NEWS*. She can be contacted at 248-786-1707 or joannaturpin@achrnews.com. Joanna has been with BNP Media since 1991, first heading up the company’s technical book division before moving over to *The ACHR NEWS*, where she frequently writes about refrigerants and commercial refrigeration. She obtained her bachelor’s degree in English from the University of Washington and worked on her master’s degree in technical communication at Eastern Michigan University.