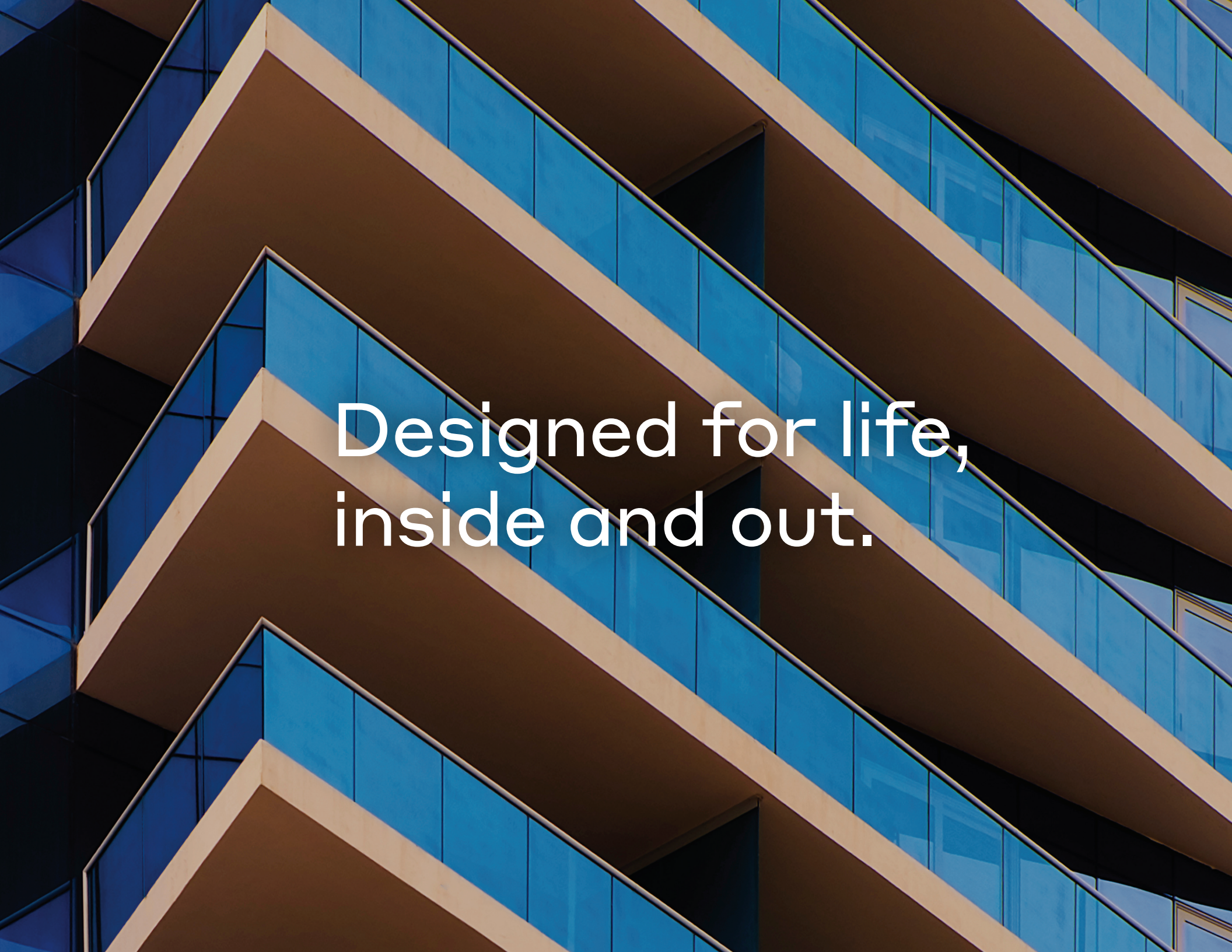
MITSUBISHI ELECTRIC
HEATING & AIR CONDITIONING

ecodanPro®

CAHV — an ecodanPro family commercial air-to-water heat pump


Designed for life,
inside and out.

Leading all-electric HVAC innovation for more than 40 years.

Mitsubishi Electric offers innovative and evolving heating and cooling solutions for any application in any climate. Our ducted and ductless mini-split and Variable Refrigerant Flow (VRF) heat pump systems bring superior energy efficiency, comfort, and performance to any home or building. We are proud to provide not only cutting-edge products but also design and technical training and unmatched end-to-end support.

At Mitsubishi Electric, we strive to create better environments, inside and out. The adoption of all-electric heat pumps and sustainable building is more than a trend, it is the future. Discover the balance between enjoying the spaces where you live and work, while creating sustainability for the world around you.

What is ecodan®Pro - CAHV?

Introducing the CAHV

Part of the Mitsubishi Electric ecodanPro family of air-source heat pump solutions, the CAHV is an all-electric heat pump water heater which can reduce system on site emissions compared to combustion-only systems.

The CAHV was engineered to be a low-carbon alternative to fossil fuel-burning systems, and in certain conditions, can reduce carbon emissions[1], depending on operating conditions and COP, and where grid electrical generation emissions are favorable.

This innovative water heater uses R-454C refrigerant, which has a Global Warming Potential (GWP) of 148.

Low-GWP (148) refrigerant R-454C

136,480 BTU/h capacity

Operating temperature down to -13°F

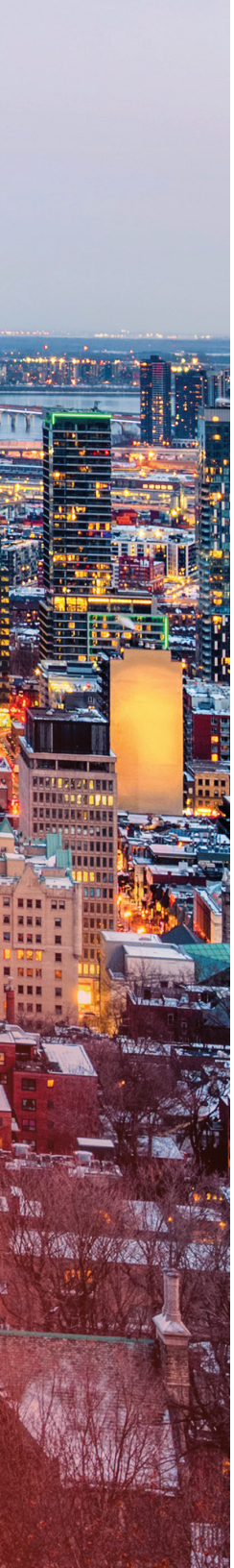
Up to 165°F maximum LWT at 14°F outdoor temperature

High-efficiency inverter technology

Modular design provides flexible solutions

[1] Carbon emissions from the CAHV will be dependent upon the following factors: conventional boiler efficiency; CAHV leaving water temperature; ambient conditions; and local grid electrical generation emission rates.

A heat pump for any application



With an operating nominal capacity of 136,480 BTU/h and the capability to be used as a single unit or part of multiple unit system, the CAHV can be used to either supplement or replace conventional heating sources in commercial heating hot water systems.

Depending on climate, and with proper separation of heat exchangers, the system can also be used for domestic hot water production. Other applications for the CAHV include providing sanitary hot water and pool heating with separation heat exchangers, multi-unit residential radiant heat, and underfloor heating. The CAHV also delivers reliable space heating, sanitation, and laundry solutions for the hospitality sector, in addition to reducing power consumption in industrial settings against other electric-only heating solutions.

Why use ecodan®Pro - CAHV?

All-weather operation

Heat pump water heaters work by absorbing energy from the outside air and transferring it into the refrigerant. The heat exchanger uses this absorbed heat energy to warm incoming water. The CAHV has a nominal Coefficient of Performance (COP) of 2.85[2]; however, higher COPs may be achieved, depending on water temperature, operating mode, and ambient conditions[3].

[2]Under normal heating conditions at the outdoor temperature of 7 °CDB/6 °CWB (44.6 °FDB/42.8 °FWB), the outlet water temperature of 45 °C (113 °F) and the inlet water temperature of 40 °C (104 °F).
[3]For instance, the COP could exceed 7.0 when in efficiency priority mode with ambient >85 °F & LWT<= 95 °F. Performance data does not include defrost operation.

- Multi-family residential
- Industrial facilities
- Hospitality and recreation centers
- All-electric spaces
- Hospitals

The CAHV can achieve up to 165° F outlet temperature down to 14° F ambient temperature for continuous heating provision. Within the ambient temperature ranges between 14° F and 109 ° F, the system is also able to deliver water flow from 77° F up to 165° F without the need for boost heaters, if sized properly to cover the load conditions in that temperature range.

When operating in temperatures as low as 5° F, the CAHV reduces energy consumption for any discharge water temperature target between 77 to 165° F compared to all-electric heating hot water systems[4].

[4]Even in high-capacity mode, above 5 °F ambient, COP is above 1.0. With COP above 1.0 energy consumption is lower than electric-only heat.

Innovative technology

Flash injection and scroll compressor

Mitsubishi Electric designed the CAHV with flash injection technology and a scroll compressor. The flash injection supplies cooler refrigerant to the compressor when the unit is operating to control discharge superheat. This control is dynamic and based on ambient temperature and water temperature and varies throughout the entire operating range[5].

The scroll compressor delivers performance across a wide ambient temperature range, from -13° F to 109° F, including up to 165° F output water temperatures at ambient conditions down to 14° F, for year-round comfort and capacity[6].

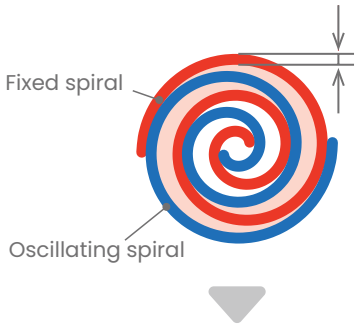
The low density of the CAHV's refrigerant requires an increased volumetric rate to be discharged. The scroll compressor was designed to allow the tooth of the fixed spiral section to be thinner while maintaining its strength. The thin, long, strong tooth increases the extrusion volume from the discharge section. This increased strength allows for achieving necessary increased mass flow rate with lower rotational mass.

[5]See Section 7 ("Control") of the Control Service Manual. [www.MitsubishiPro.com/catalog]
[6]See the product specification section (Section 1) of the Data Book. [www.MitsubishiPro.com/catalog]

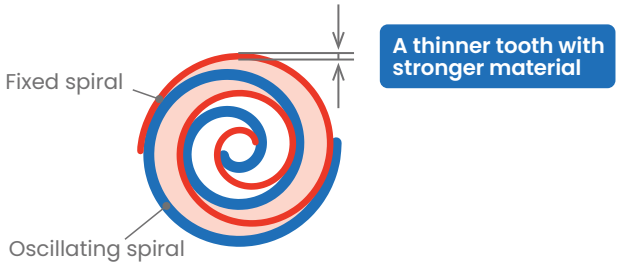
Inverter technology

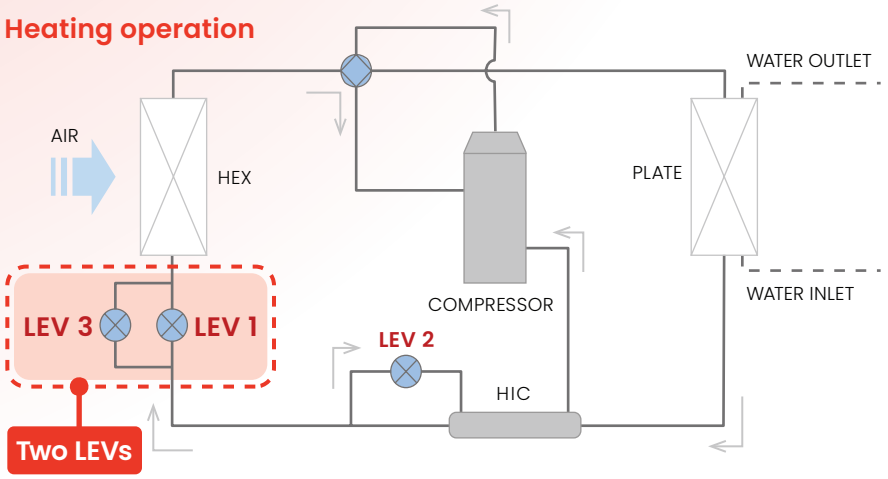
The compressor utilizes inverter technology to minimize the ON/OFF frequency during “part load” operating conditions (such as summer and shoulder seasons) compared to fixed speed compressor technology. This reduces cycling losses associated with frequent compressor ON/OFF intervals and allows compressors to operate for longer periods of lower frequency, reducing wear on the equipment.

Spiral design with equal tooth thicknesses used in the conventional method



New spiral design with different tooth thicknesses





Linear Expansion Valves

Two linear expansion valves (LEVs) are placed in parallel to secure refrigerant circulation volume and control circuit pressure. Using these two valves, refrigerant circulation is managed even in outdoor temperatures as low as -13° F.

Optimized design and controls

Streamlined installation and maintenance

Compared to gas and fuel oil boiler systems, the CAHV system does not have components such as fuel storage tanks, flues, combustion air controls, fuel regulators, eliminating the maintenance and inspections for such components. With the system's modular design, it is scalable and contains smart controls for staging and lead-lag operation of modules, reducing up-front controls cost and complexity compared to conventional heating plants requiring staging.

Multiple unit-ready

Up to 16 CAHV modules can be connected and controlled with one remote controller, to control main building supply or return blended water temperature with included remote sensor accessory. This provides necessary staging and lead lag operation to meet main building hot water supply temperature setpoint without additional controls.

Rotation function

When using two or more CAHV units in the system and system load is reduced, auto-rotation equalizes run time across units reducing unequal wear compared to multi-module systems.

Flexible configurations

The system includes external outputs for backup heaters, an analog capacity control input, and defrost signal. The Monobloc (packaged) system simplifies installation with a self-contained refrigeration circuit, eliminating the need for field refrigerant piping and additional large refrigerant charges.

Onboard controls

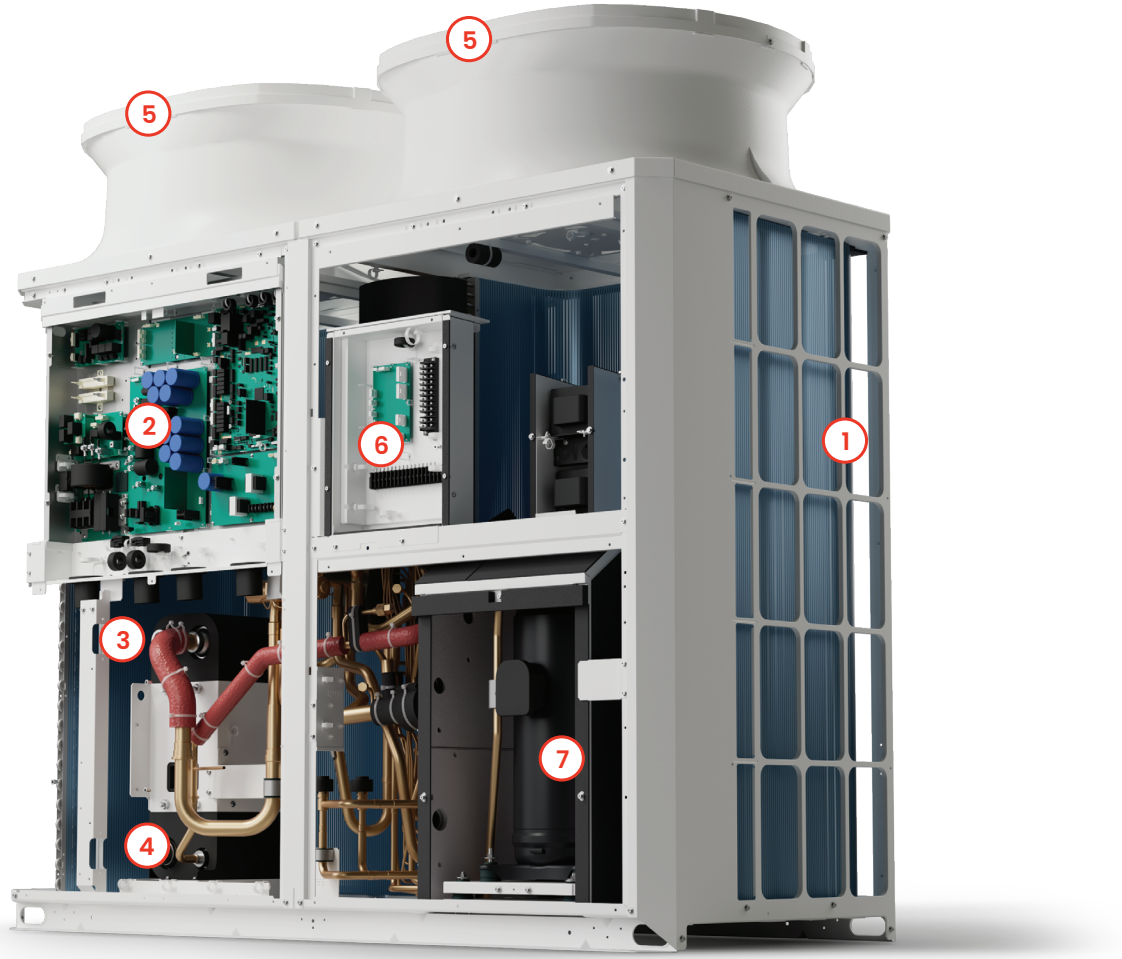
The CAHV is M-NET compatible. Owners can connect to CITY MULTI® central controllers or operate without as a standalone, with no plant manager control required. For more advanced controls, an analog input by a third-party Building Management System also allows for the ability to remotely control the CAHV system capacity output or leaving water temperature set point remotely.

Key components

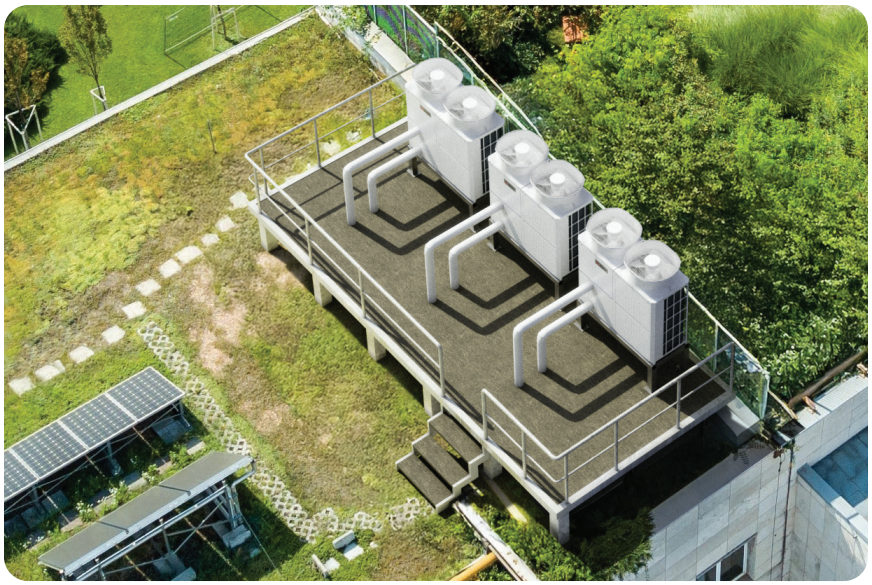
The unit is constructed of a sheet metal chassis with mounting feet like other conventional CITY MULTI® equipment. Major components include an air-to-refrigerant evaporator, direct commutated fan, direct commutated compressor, and integral refrigerant to water heat exchanger (HX).

Please note the piping connection to refrigerant to water HX are 1-1/2" grooved

1. **Heat exchanger (Refrigerant to air)**
2. **Main control panel**
3. **Refrigerant to water HX**
4. **1-1/2" grooved piping connections**
5. **Evaporator fans**
6. **Sub control panel**
7. **Compressor**



Applications



All-electric spaces

The CAHV is a suitable water heating system for building owners looking for ways to future-proof their buildings. In rural areas where there is scarcity of natural gas availability, the CAHV unit provides the advantage of an all-electric solution.

Again, when operating in temperatures as low as 5° F, the CAHV unit reduces energy consumption for any discharge water temperature targeting between 77 to 165° F, compared to all-electric heating hot water systems[7].

Multi-family residential

With field-provided separation heat exchangers, the CAHV can provide both domestic hot water and heating, making it a good choice for multi-family apartment or condominium applications that require both hot water and radiators or underfloor heating.

When the system is added to a retrofit project to deliver radiant heating, installation costs can be lowered by using the existing radiant underfloor heating piping rather than installing entirely new, costly systems.

[7]Even in high-capacity mode above 5 °F, ambient COP is above 1.0. With COP above 1.0 energy consumption is always lower than pure electric-only heat.

Hospitality and recreation centers

The CAHV can be used for hotels and health centers that require space heating, showers, and laundry services. The system can also be used for recreation centers for heating swimming pools and sanitary water.

Industrial facilities

The CAHV can be used for factory production where hot water is needed in the manufacturing process, like food production. The all-electric CAHV system can also deliver hot water heating to industrial buildings. Increased COP may be achieved for lower water temperature applications, common in food production or industrial settings[8].

The CAHV can accommodate multiple types of building and facility heating needs, such as parts washing and painting lines. The ability to combine up to 16 CAHV units on a single control system allows for peak combined nominal output per system of 136,480 BTU/h per unit or 2,183,680 BTU/h total (output is dependent upon ambient and leaving water conditions).

With higher capacity needs, multiple CAHV systems can be added to a building hot water loop, each up to 16 modules, each with separate controls or control by BMS for system staging systems, making size of applications highly scalable.

[8]For instance, the COP could exceed 7.0 when in efficiency priority mode with ambient >85 °F & LWT<= 95 °F.

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