



ecodan[®]pro

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



Designed for life,

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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.

We are renewable in all we do. This encompasses how our products function, leveraging both hybrid, water source, and all-electric heat pumps, and how they're assembled, with nearly 100% recyclable materials. We offer technology that contractors and customers don't have to think about after installation. In fact, Mitsubishi Electric has one of the industry's lowest incidence rates. Our industry leading warranty is even better when installed by a Diamond Contractor®.

We are exacting in how we build our technology, scrutinizing every component to ensure it functions in harmony with the system. This is why we manage every step of the manufacturing and assembly process, upholding the highest quality standards from start to finish.



The INVERTER advantage

Mitsubishi Electric heat pumps use inverter-driven compressors, which use variable speed technology to control the speed of the motor. This allows for precise regulation of heating and cooling output according to demand, while minimizing the amount of energy required. Conventional compressors turn on and off to meet the set point, causing large temperature and energy swings. The inverter eliminates the wasteful stop and start cycle. Just as your heart always beats, and automatically beats faster when you exercise, our compressors are always active with the inverter enabling it to adjust conditioning as soon as temperature changes are detected.



We are exacting in how we build our technology, scrutinizing every component to ensure it functions in harmony with the system.



Mitsubishi Electric quality

Our customers depend on our heat pump systems to maintain their comfort, even in harsh environments. Because of this, we've developed one of the industry's most rigorous inspection processes. We check for every possible point of failure in every step after the sale: delivery, installation and operation.

We perform advanced airflow testing during development, where we measure every corner of the room with more than 2,500 sensors to ensure even temperature distribution. An operation noise test is performed in an anechoic chamber with an extremely low 10 dB(A) of background noise.

This confirms that the heat pumps run ultra quiet operations, with a minimum sound level of 19 dB(A).

Our products are also subjected to a wide range of safety tests, including combustion testing, to confirm safe operation under various conditions. Combustion testing is done by assuming accidental firing and replicating abnormal conditions that cause breakage of pressure components. With the transition to the low-Global Warming Potential (GWP) refrigerants, we have built leak detection sensors into our units as an added safety measure. We also perform drop/strength tests, transport vibration tests, and many other product checks to ensure that quality and performance are maintained.

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.



-  **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



The CAHV was engineered to be a low-carbon alternative to fossil fuel-burning systems, and in certain conditions, can reduce carbon emissions¹, 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 GWP of 148.

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

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 range².

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 capacity³.

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.

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.

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 at a lower frequency, reducing wear on the equipment.



	Air-to-Air Heat Pump	Air-to-Water Heat Pump
How heat is released from the refrigerant	By blowing air across the refrigerant pipes within an air handling unit.	CAHV transfers heat from brazed plate refrigerant to water heat exchanger (HX).
How the building/space is heated	By heating the air within the room(s).	Releasing heat from water flowing.
Indoor requirements	Individual air handling units or ductwork to distribute hot air to different rooms.	Radiators, underfloor heating, air handlers, or fan coils.
Additional features	Can also be used to provide cooling by reversing the process and removing heat from a space.	Can be paired with a hot water tank to store and deliver hot water (DHW) tank by using a separation HX.

²See Section 7 ("Control") of the Control Service Manual.

³See the product specification section (Section 1) of the Data Book.

Why use ecodan®Pro - CAHV?



All-weather operation

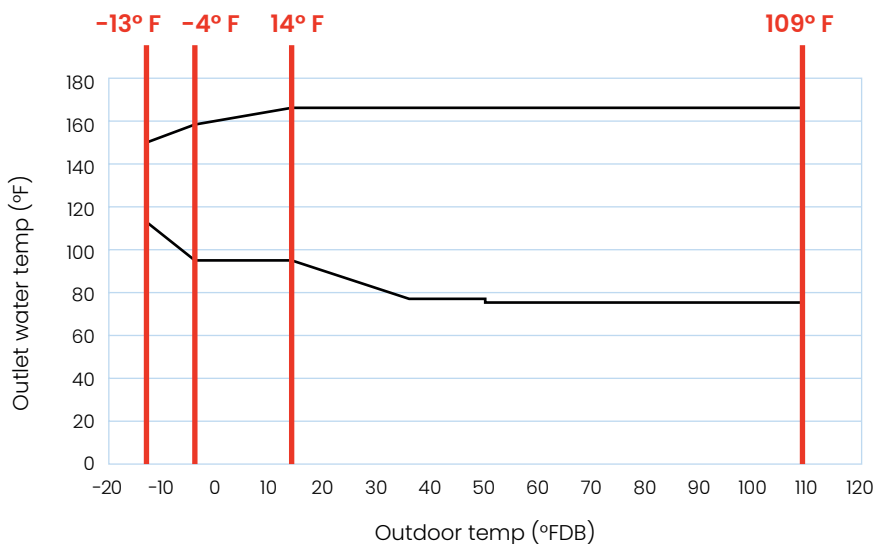
Heat pump water heaters work by absorbing energy from the outside air and transferring it into the refrigerant.

The CAHV has a nominal Coefficient of Performance (COP) of 2.85⁴; however, higher COPs may be achieved, depending on water temperature, operating mode, and ambient condition⁵.

Operating 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 systems⁶.

- 149° F max LWT at -13° F OAT
- Thermal lockout at -18.4° F
- Restart at -13° F



(Outdoor temp. -13° FDB/Outlet water temp. 113-149° F)

(Outdoor temp. -4° FDB/Outlet water temp. 95-158° F)

(Outdoor temp. 14° FDB/Outlet water temp. 95-165° F)

(Outdoor temp. 109° FDB/Outlet water temp. 75.2-165° F)

*Stops operation at the outdoor temperature of -18° F or below.

*Stops operation at the inlet temperature of 161.6° F or above.

⁴Under 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).

⁵For instance, the COP could exceed 7.0 when in efficiency priority mode with ambient >85° F & LWT<= 95° F.

⁶Even 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.

Applications for ATW

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 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.



Multi-family residential



Office and industrial facilities



Hospitality and retail



Healthcare facilities



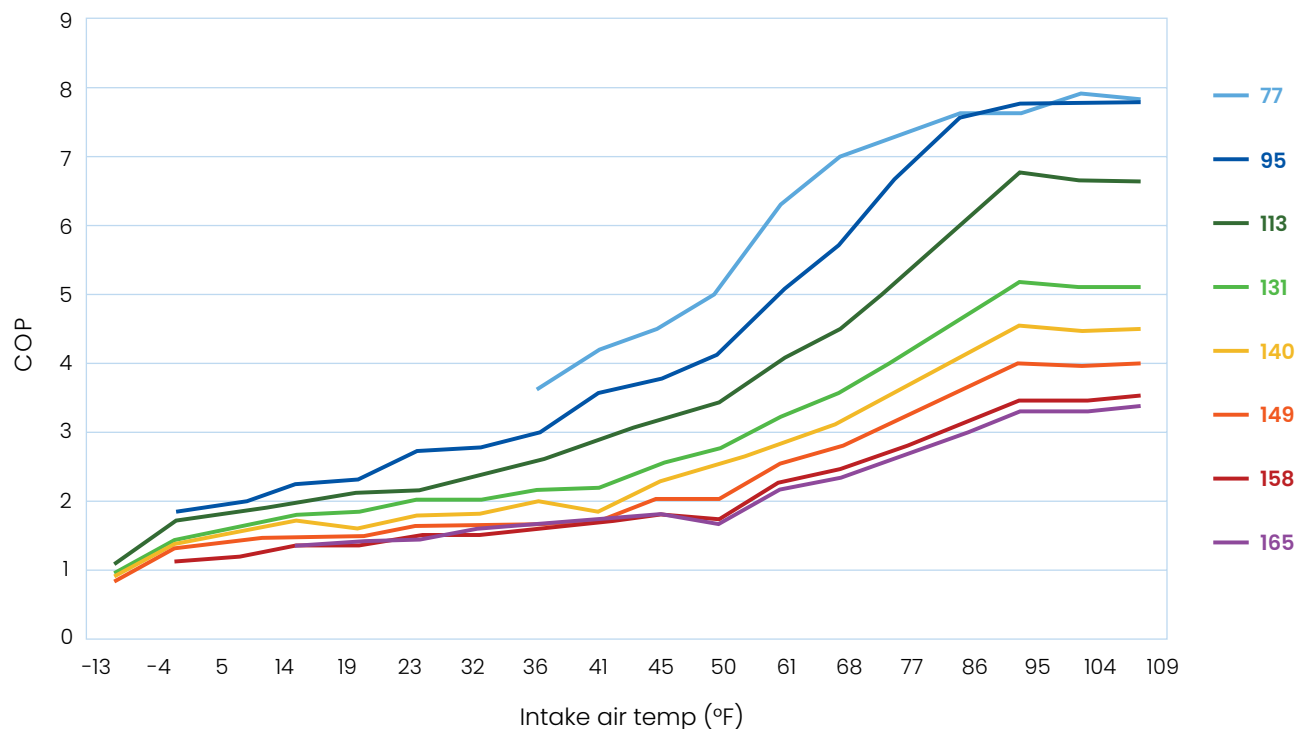
Schools



All-electric spaces

Efficiency priority

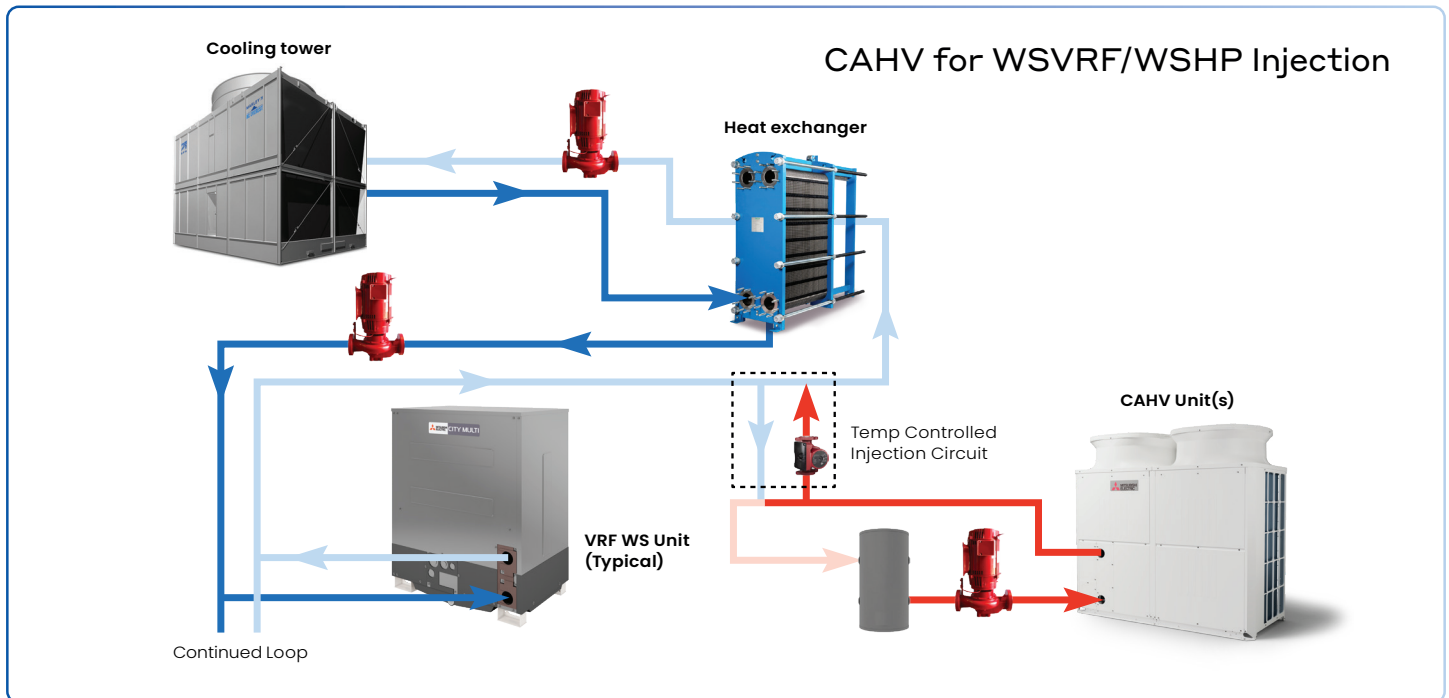
COP at various outlet water temperatures.



Capacity or COP shown is at 85% RH ambient conditions and other ambient humidity conditions can have additional impacts on capacity and/or efficiency ; defrost operation not included.

Benefits for boiler-tower conventional WSHP loops

CAHV operating COP can be maximized with lower water temperature applications, such as injection heat for closed condenser water loops, such as for WSHP's or WS VRF Units. CAHV water temperatures should be maintained higher to facilitate defrost. Other considerations for injection circuits may be required when serving lower temperature water loops, especially during low ambient operation. Consult with a Mitsubishi Electric representative for guidance. Reference Application note 2044 on MitsubishiPro.com for additional guidance.



Carbon footprint impact

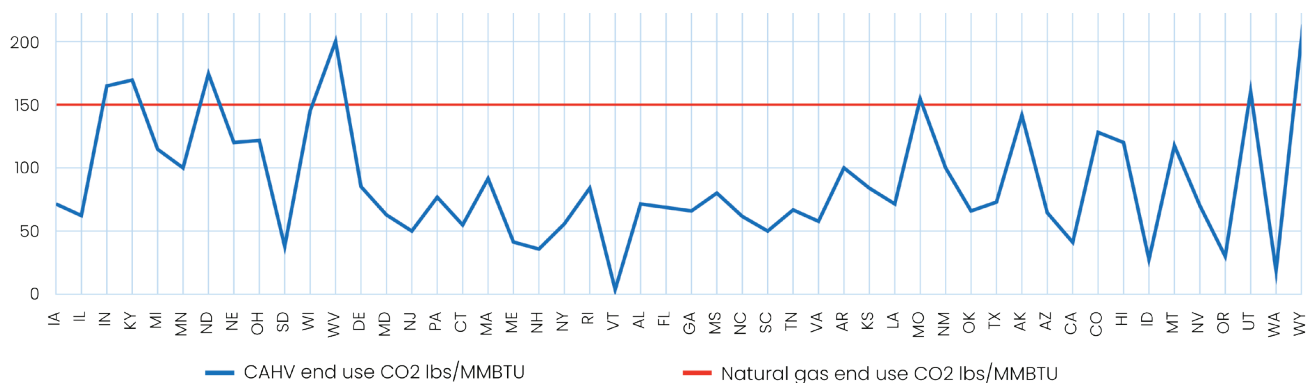
CAHV vs natural gas (2022 eGrid data based)

Even when natural gas is plentiful in certain regions, environmental benefits can exist in terms of emissions when utilizing the CAHV product. Looking at state average winter temperatures and typical COP for the CAHV with state grid emission data, CO₂ emission can be well below that of natural gas in many states with lower design water temperatures.¹

¹. Defrost not included

Carbon Footprint Impact - CAHV vs Natural Gas Boiler

Note: State Average Winter Temperature Based 95° F LWT, Natural Gas Boiler Condensing Assumed (95% AFUE); Does not include defrost data.



A modern office interior with large windows, wooden floors, and several desks with computers. The scene is brightly lit, suggesting a sunny day. The office is clean and organized, with a professional atmosphere.

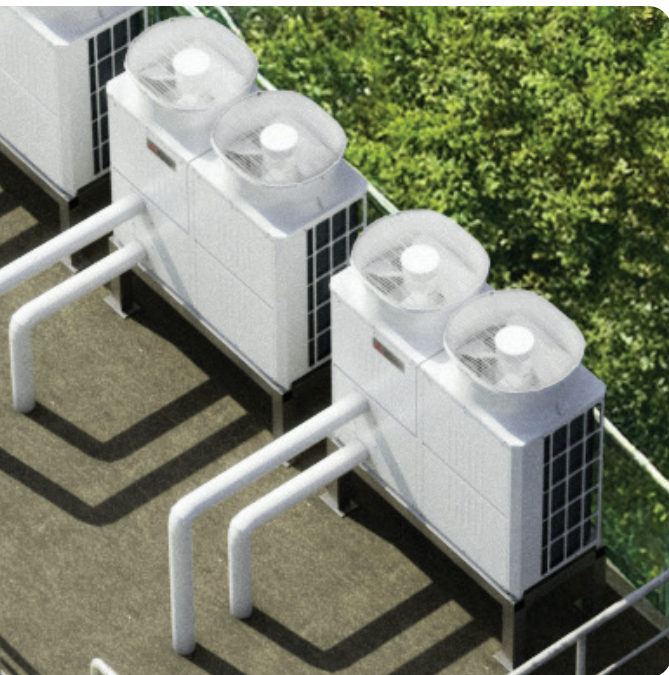
Applications

and benefits

An aerial view of a rocky coastline with waves crashing against the shore. The water is a deep blue, and the rocks are a light brown color. The scene is dynamic and powerful, with the waves creating a lot of white foam as they break.

02

A heat pump for any application



Common applications

The most common application for the CAHV product is installation in a building closed heating hot water system to unload a main hot water boiler during favorable ambient conditions and/or provide sole source heat depending on climate.

This would typically be installed in a primary-secondary pumping configuration with the CAHV system decoupled from the main hot water distribution system to preferentially treat the return water from the building with the CAHV unit/s.

- Nominal 40KW heating output (136,480 BTU/h).
- Efficiency Priority & Capacity Priority Modes (>40KW).
- Low-GWP refrigerant (R454-C) with GWP of 148.
- COP of 2.85 at 44.6° F DB, 113° F outlet water temperature.
- COPs over 4.0 at water outlet temp of 77° F.
- Supplies high temperature hot water (up to 165° F).
- Operable at low outdoor temperature (-13° F).
- Staging capability with up to 16 modules in a single system with factory-standard controls, including auto rotation and lead/lag functionality.
- Direct drive staging and capacity control by BMS.



Streamlined installation and maintenance

The CAHV is all-electric, reducing the need for the inspections, safety measures, and maintenance related to fossil fuel combustion systems.

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.

Standard controls and system size (Number of modules)

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 set point without additional controls.



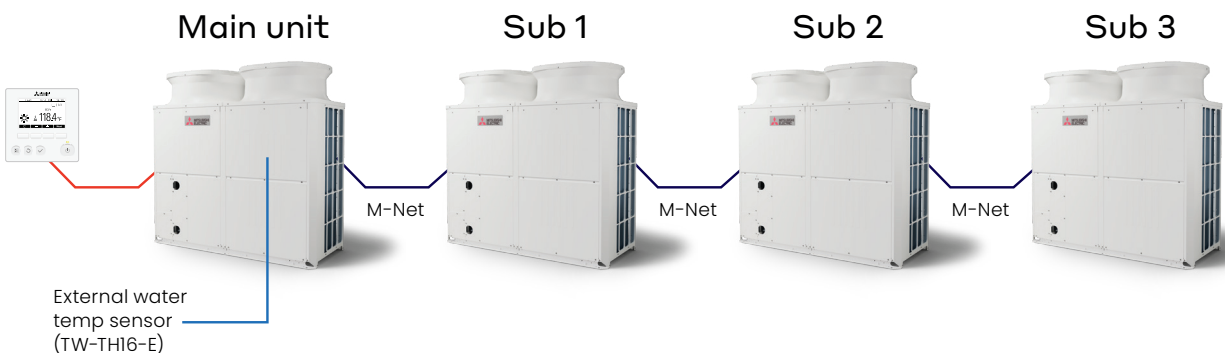
Comfortable



Reduced refrigerant leakage points



Low operation noise



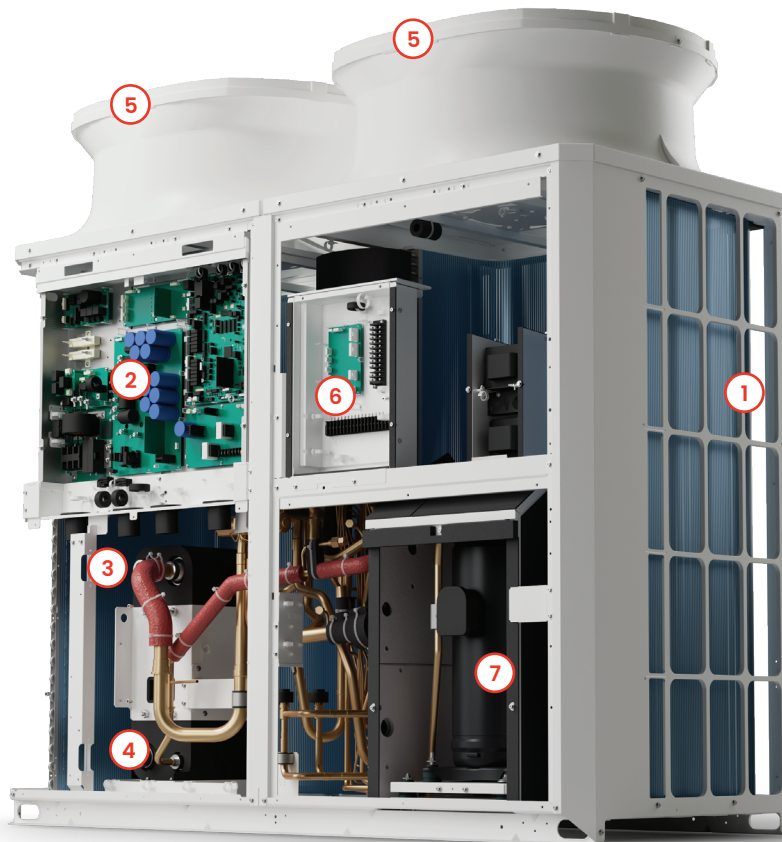
- In case of a multiple unit system, water temperature control is based on TW-TH16-E.
- No additional control box needed.
- Main unit decides target outlet temperature of each sub-unit and number of units to operate to achieve the target outlet temperature.
- Each unit increases or decreases the compressor frequency based on the difference between the preset and the current water temperatures.

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



Brazed plate HX and simple applied design

A simple stainless brazed plate refrigerant-to-water heat exchanger is present on the CAHV unit, allowing for simple hydronic applied applications with typical piping accessories and fittings that are familiar to the applied hydronics industry. No proprietary hydronic pumping or pump controls required, or complex air purge or pump calibration cycles to complete.

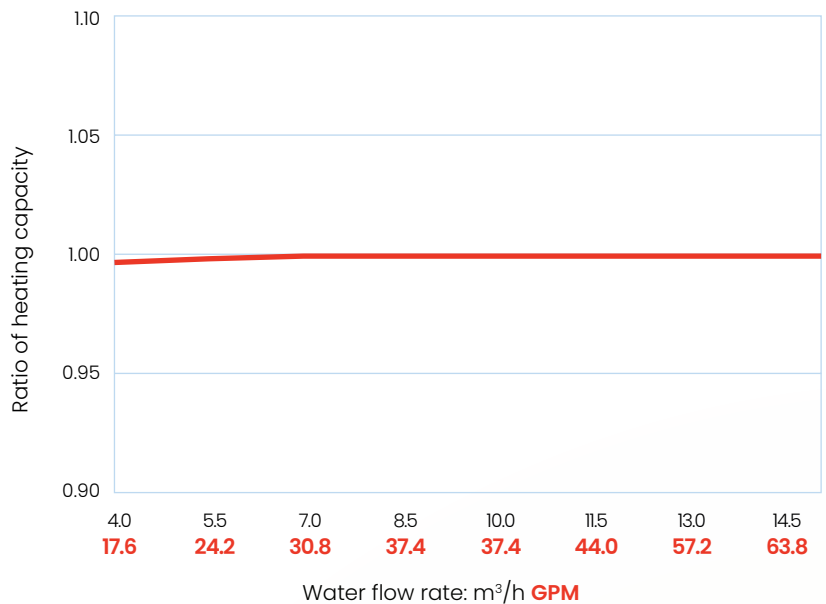


Typical third-party pumps can be applied to the main central station pumping system serving one or more CAHV units manifolded together, following basic hydronic practices such as the use of centralized expansion tanks and more robust, centralized main air separators.

Water flow rate range

The CAHV unit allows for a wide operating flow range through the brazed plate HX with minimal impact to capacity from around 20 GPM up to 66 GPM.

To maximize delta T, especially in colder climates, most designs would be closer to 30 GPM design flow, at least above the minimum 17.6 GPM allowed. A field-provided flow switch must be installed on each CAHV unit wired to proof of flow to protect slightly below this minimum allowed flow.



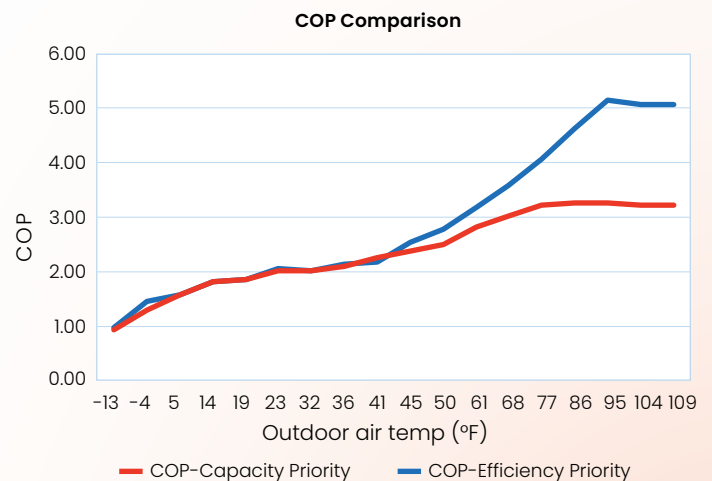
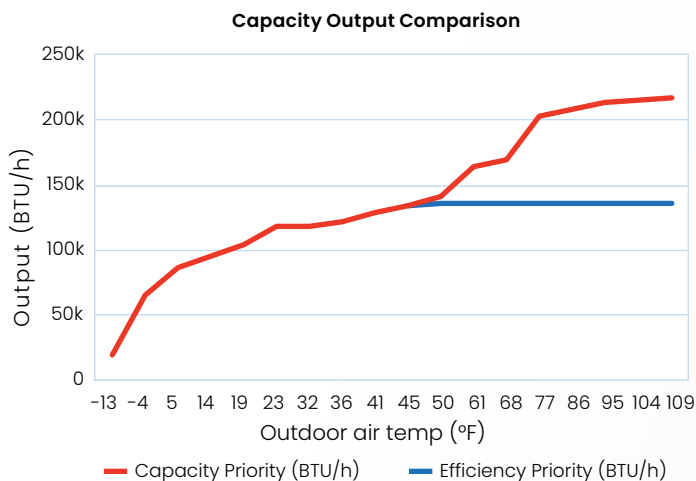
Capacity vs Efficiency Priority modes

The CAHV unit can achieve higher heating output beyond the nominal 40kW rating in a high-capacity priority mode.

This occurs at higher ambient conditions, allowing for reduced total CAHV install cost for warmer climates or applications where loading is greater in the summer months or to displace a larger percentage of conventional heating sources in summer periods, such as for domestic hot water production or other year-round process heating needs. The trade-off for higher heat output during these warmer periods is increased power consumption and a reduced COP.

*Detailed specifications on page 19.

Example comparison between Capacity vs Efficiency Priority Mode at 131° F LWT



Capacity or COP shown is at 85% RH ambient conditions and other ambient humidity conditions can have additional impacts on capacity and/or efficiency. Defrost not included.

Capacity or COP shown is at 85% RH ambient conditions and other ambient humidity conditions can have additional impacts on capacity and/or efficiency. Defrost not included.

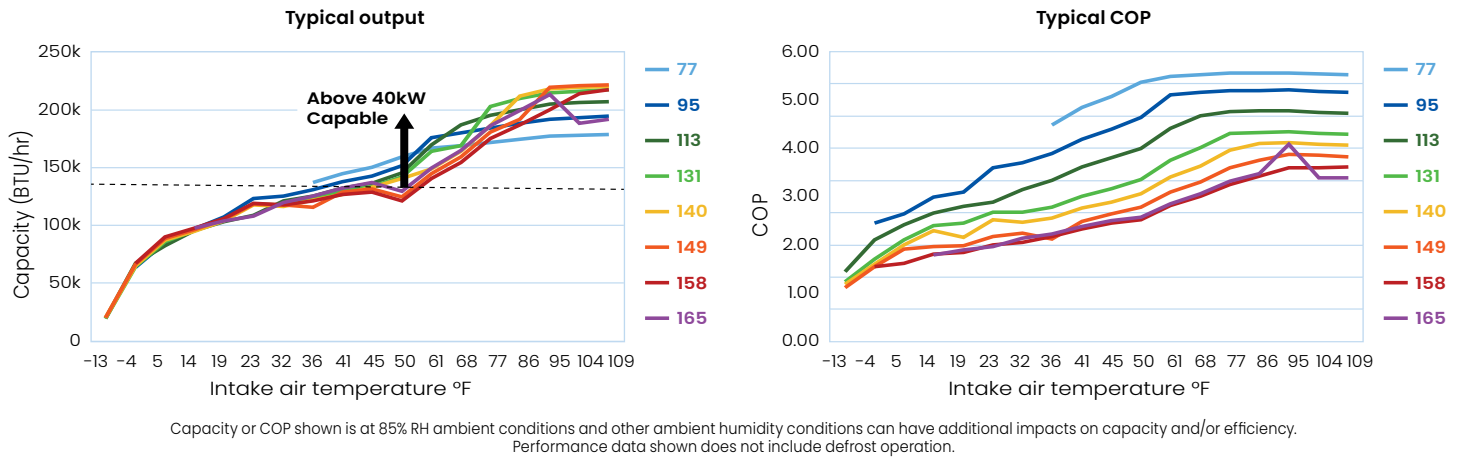
Capacity comparison		Intake Air Temperature (° F)																	
Defrost not included	LWT (° F)	-13	-4	5	14	19	23	32	36	41	45	50	61	68	77	86	95	104	109
Efficiency Priority	131	19,630	62,290	86,070	95,500	104,630	118,220	117,650	112,630	129,570	133,810	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480
Capacity Priority	131	19,630	62,290	86,070	95,500	104,630	118,220	117,650	112,630	129,570	133,810	142,140	164,360	168,970	203,060	209,660	214,790	216,130	217,270

COP comparison		Intake Air Temperature (° F)																	
Defrost not included	LWT (° F)	-13	-4	5	14	19	23	32	36	41	45	50	61	68	77	86	95	104	109
Efficiency Priority	131	0.97	1.44	1.58	1.80	1.84	2.03	2.01	2.15	2.18	2.52	2.77	3.19	3.57	4.08	4.63	5.17	5.10	5.09
Capacity Priority	131	0.93	1.28	1.58	1.80	1.84	2.01	2.01	2.09	2.25	2.37	2.51	2.81	3.01	3.23	3.25	3.25	3.23	3.22

Output and COP comparisons

Capacity at various outlet water temperatures

Capacity Priority (DATA BOOK values)

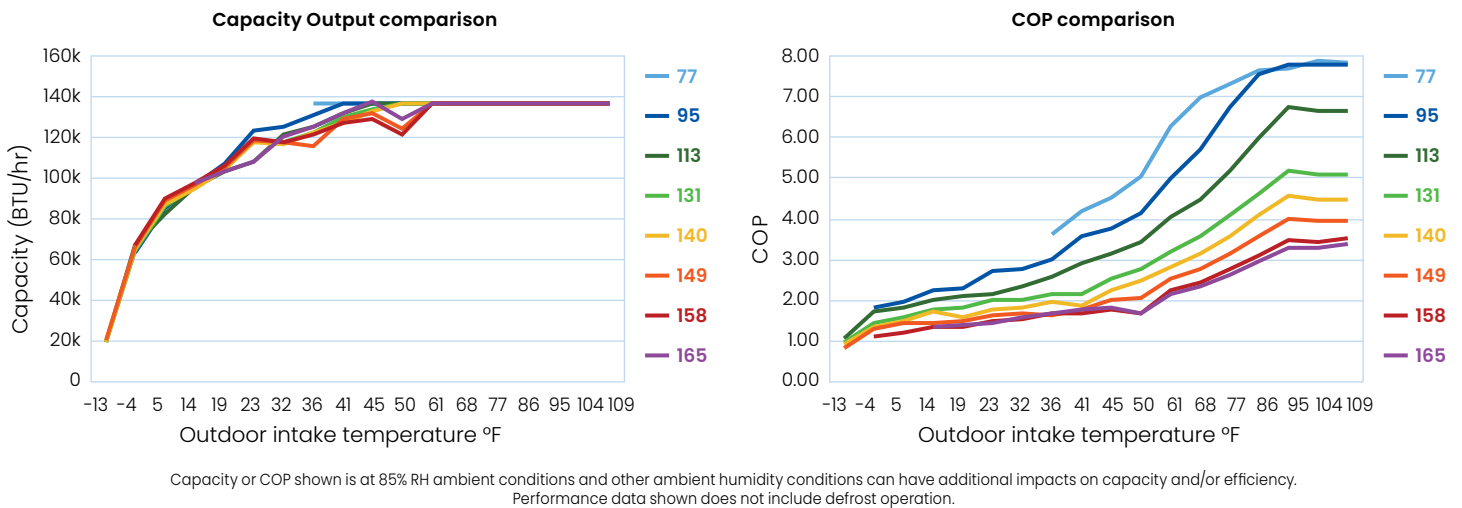


Capacity Priority mode operating capacity

Capacity		Intake Air Temperature (° F)																	
		-13	-4	5	14	19	23	32	36	41	45	50	61	68	77	86	95	104	109
Outlet Water Temperature° F	77	-	-	-	-	-	-	-	136,890	144,980	150,280	159,500	166,700	169,020	171,890	174,730	177,300	178,110	178,450
	95	-	63,750	85,190	96,820	107,370	123,110	125,440	130,570	137,900	142,770	151,520	176,160	180,290	183,840	188,000	191,890	193,410	194,670
	113	19,350	67,420	82,610	95,530	103,290	108,460	121,140	125,530	132,100	136,480	145,130	169,430	186,780	195,260	200,140	204,600	206,060	207,310
	131	19,630	64,290	86,070	95,500	104,630	118,220	117,650	122,630	129,570	133,810	142,140	164,360	168,970	203,060	209,660	214,790	216,130	217,270
	140	20,070	65,220	87,310	94,950	104,050	117,810	116,330	121,990	126,960	132,670	140,570	148,900	164,270	186,270	212,140	217,940	219,190	220,260
	149	20,410	66,690	88,970	96,260	104,910	118,180	117,850	115,560	129,090	131,350	124,540	144,790	159,530	180,990	191,730	219,210	220,570	221,580
	158	-	67,080	90,010	97,720	106,100	119,180	117,830	120,970	126,820	128,650	121,170	140,420	154,480	174,790	187,180	199,950	214,150	217,670
	165	-	-	-	97,540	103,550	107,920	119,920	125,150	131,930	137,100	129,120	149,640	164,620	186,270	199,470	213,080	188,440	191,540

Defrost not included

Efficiency Priority (DATA BOOK Values)



Efficiency Priority mode operating capacity (100% = 136,480 BTU/h (40.0kW))

Capacity		Intake Air Temperature (° F)																	
		-13	-4	5	14	19	23	32	36	41	45	50	61	68	77	86	95	104	109
Outlet Water Temperature° F	77	-	-	-	-	-	-	-	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480
	95	-	63,750	85,190	96,820	107,370	123,110	125,440	130,570	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480
	113	19,350	67,420	82,610	95,530	103,290	108,460	121,140	125,530	132,100	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480
	131	19,630	64,290	86,070	95,500	104,630	118,220	117,650	122,630	129,570	133,810	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480
	140	20,070	65,220	87,310	94,950	104,050	117,810	116,330	121,990	126,960	132,670	136,480	136,480	136,480	136,480	136,480	136,480	136,480	136,480
	149	20,410	66,690	88,970	96,260	104,910	118,180	117,850	115,560	129,090	131,350	124,540	136,480	136,480	136,480	136,480	136,480	136,480	136,480
	158	-	67,080	90,010	97,720	106,100	119,180	117,830	120,970	126,820	128,650	121,170	136,480	136,480	136,480	136,480	136,480	136,480	136,480
	165	-	-	-	97,540	103,550	107,920	119,920	125,150	131,930	137,100	129,120	136,480	136,480	136,480	136,480	136,480	136,480	136,480

Defrost not included

A low-angle shot of a modern, multi-story apartment building with white balconies and large windows, set against a clear blue sky. The building's facade is light-colored, and the balconies have glass railings.

System operation and specifications

A close-up of a blue surface covered in numerous small, clear water droplets, creating a textured, bubbly appearance.

03

Operation and specifications



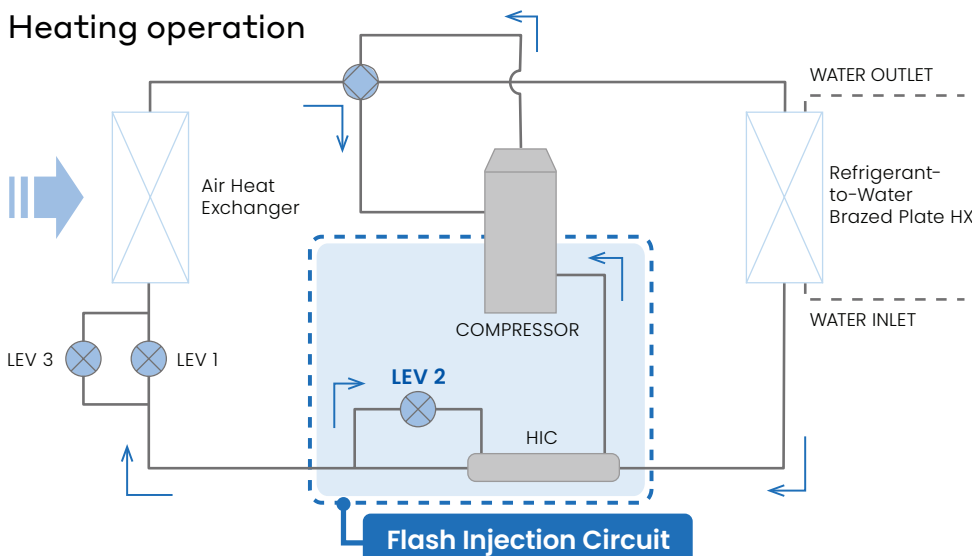
Low running costs and wide operating temperature range

The CAHV is a dedicated inverter-driven air source heat pump system that may be employed as a sole source heat pump water heater, depending on climate, or in conjunction with other supplemental hot water heaters.

Compressor specification with Flash Injection

The CAHV unit utilizes Flash Injection technology for compressor cooling. This allows the compressor to operate at higher sustained speeds increasing mass flow rate and maintaining higher heat output through colder ambient conditions vs conventional compressor technology.

Heating operation



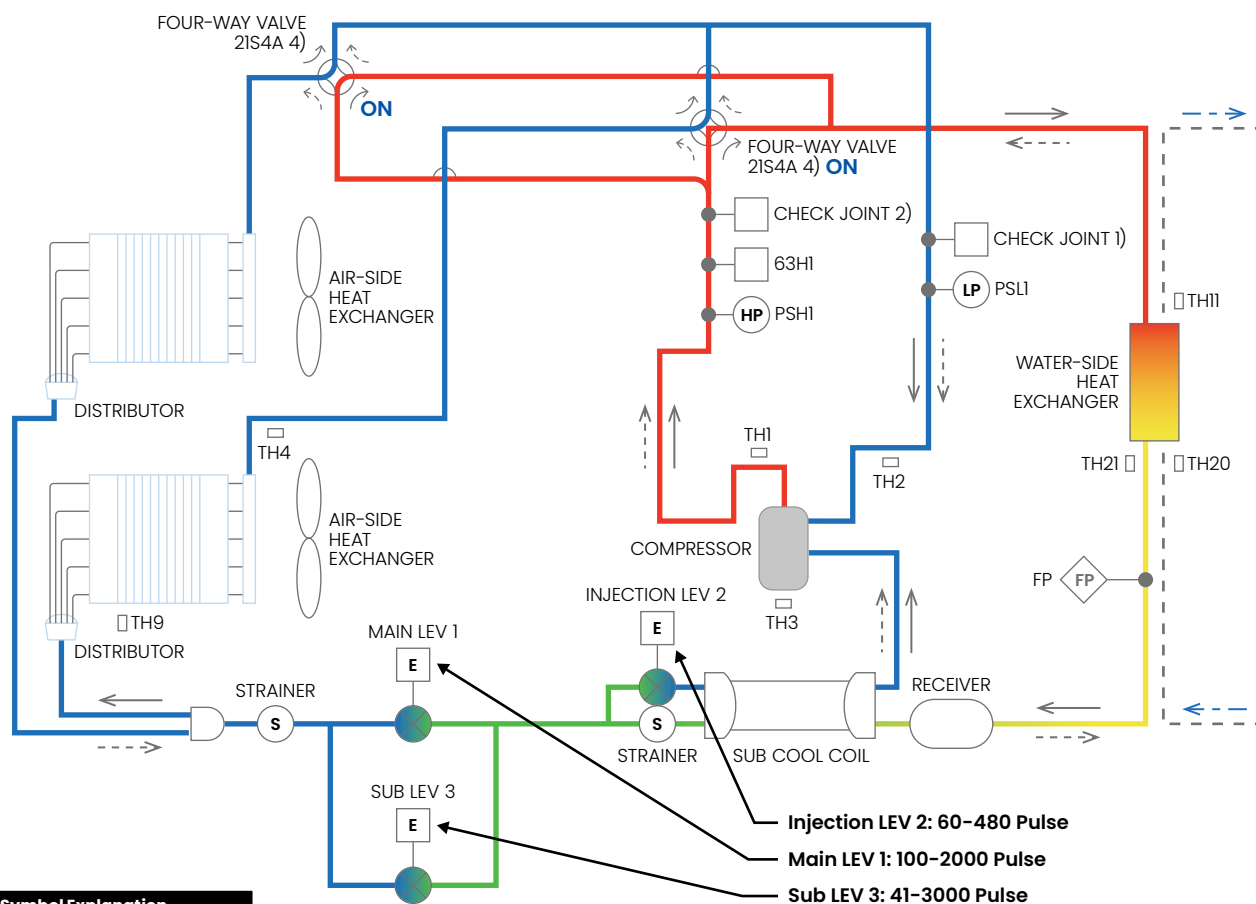
High performance even at a low outdoor temperature

This injection circuit is controlled to maintain the compressor discharge temperatures in a safe operating range, through extreme climate conditions when fully loaded at maximum speed to ensure longevity.



Refrigerant circuit diagram

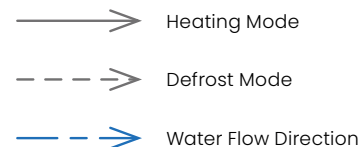
Heating mode



Symbol Explanation

FP	Fusible Plug
PSH1	High Pressure Sensor
PSL1	Low Pressure Sensor
63H1	High Pressure Switch
TH1	Discharge Temp.
TH2	Suction Temp.
TH3	Compressor Temp.
TH4	Heat Exchanger Temp.
TH9	Outdoor Air Temp.
TH10	Water Inlet Temp.
TH11	Water Outlet Temp.
TH21	Water Heat Exchanger Temp.

Refrigerant flow direction

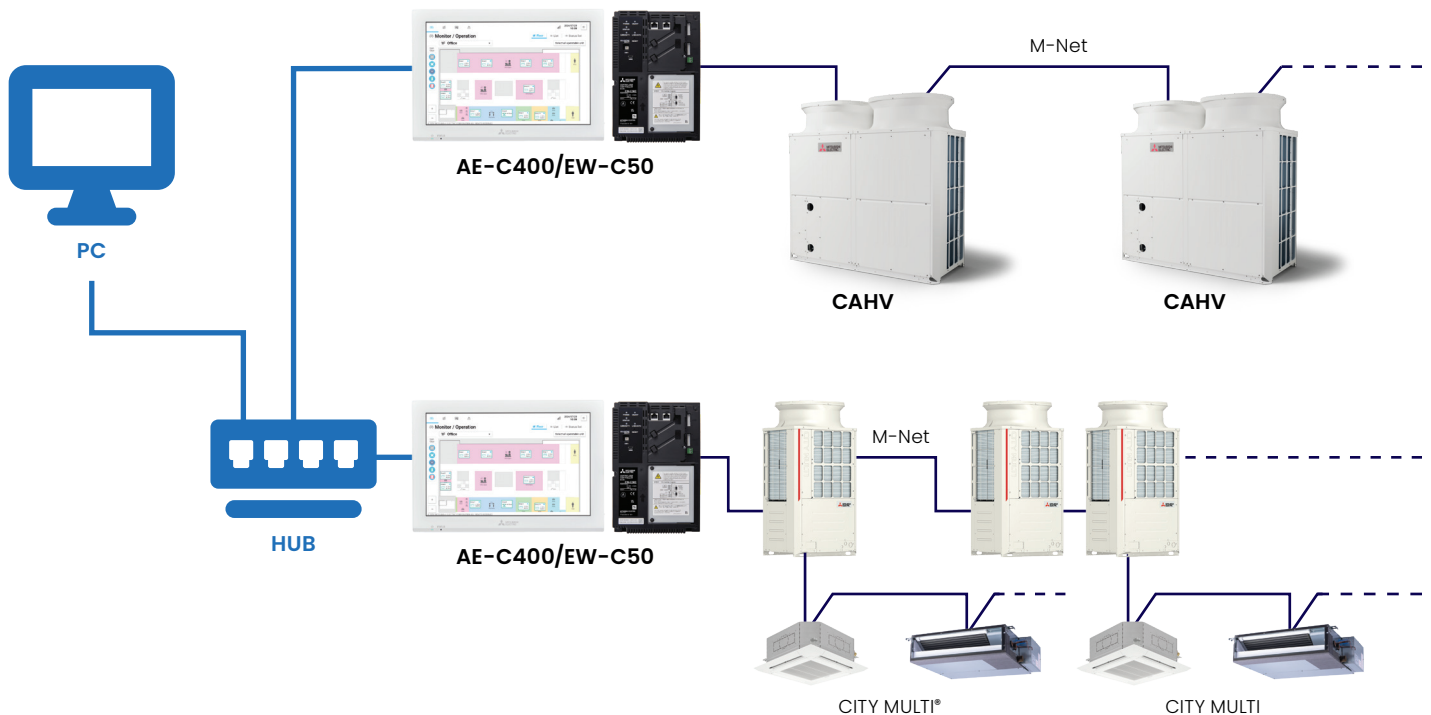


Using the controls and features

Centralized remote controller

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.

System configuration



Major functions

Operation/Setting

- ON/OFF
- Hot water/Heating/
HeatingECO/Anti-Freeze
- Snow/Regular
- Scheduled operation
(daily/weekly/annual)

Display

- Operation mode
- Current water temperature
- Error code

113° F

45° C

Default heating

149° F

65° C

Default hot water

AE-C400/EW-C50

The CAHV-R136YAU(-BS) is connectable to the AE-C400 that centrally controls up to 50 units, or 50 systems connected via M-NET.

The central controller allows for remote adjustment of operating mode and target set temperature, as well as monitoring error status and setting schedules.

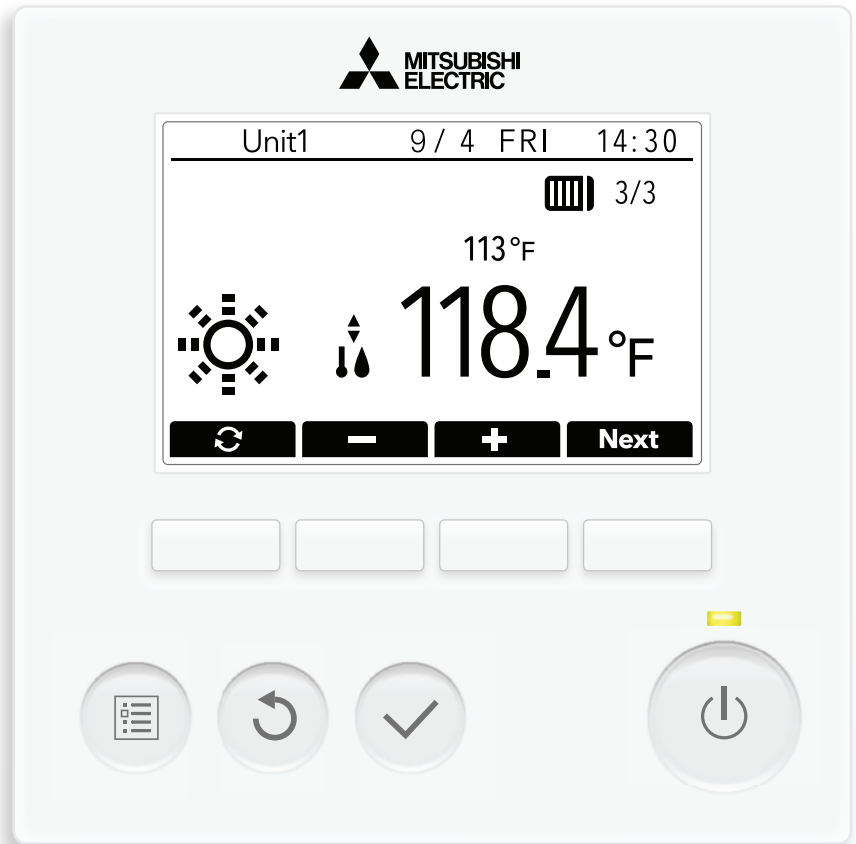
Using the remote controller

PAR-W31MAA

The PAR-W31MAA can control up to 16 indoor units with one remote controller..

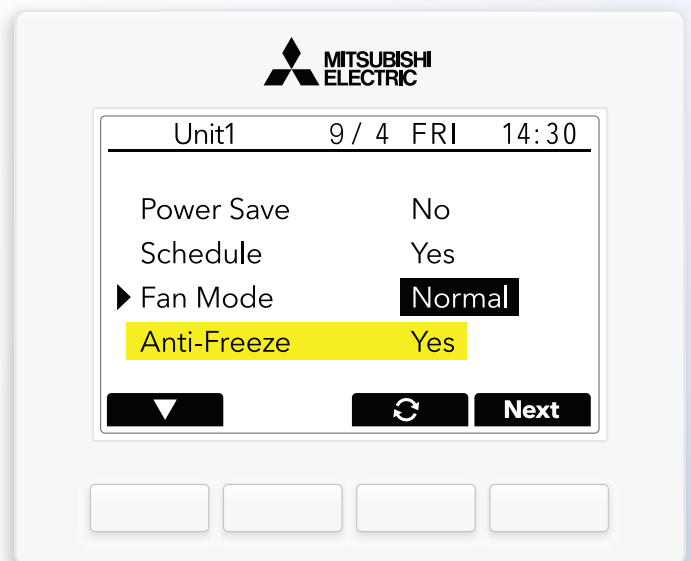
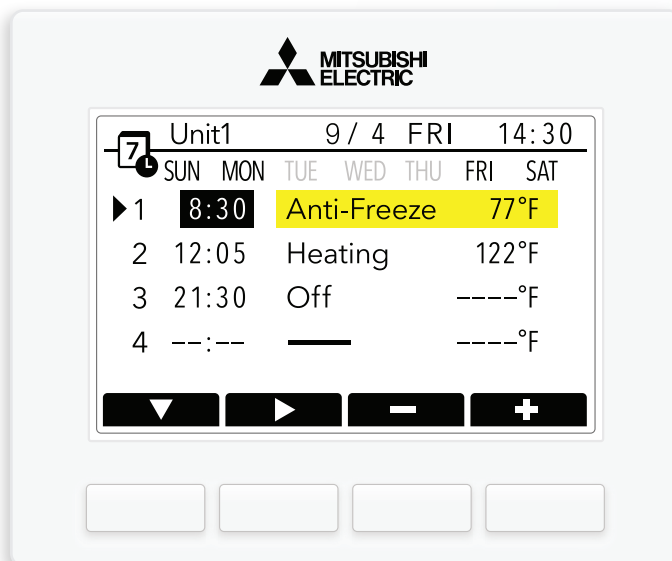


- ON/OFF
- Operational mode select
- Temperature setting
- Scheduling
- Power save functionality with scheduling
- Can control up to 16 units



Anti-Freeze mode

When the ambient temperature drops to a certain (low) level, heating operation at low flow temp can be started automatically for freeze protection. When Anti-Freeze mode is enabled by the remote controller, the system will run automatically to maintain 77° F water temperature during idle periods to prevent freezing conditions and to allow for rapid startup when heating is needed again.

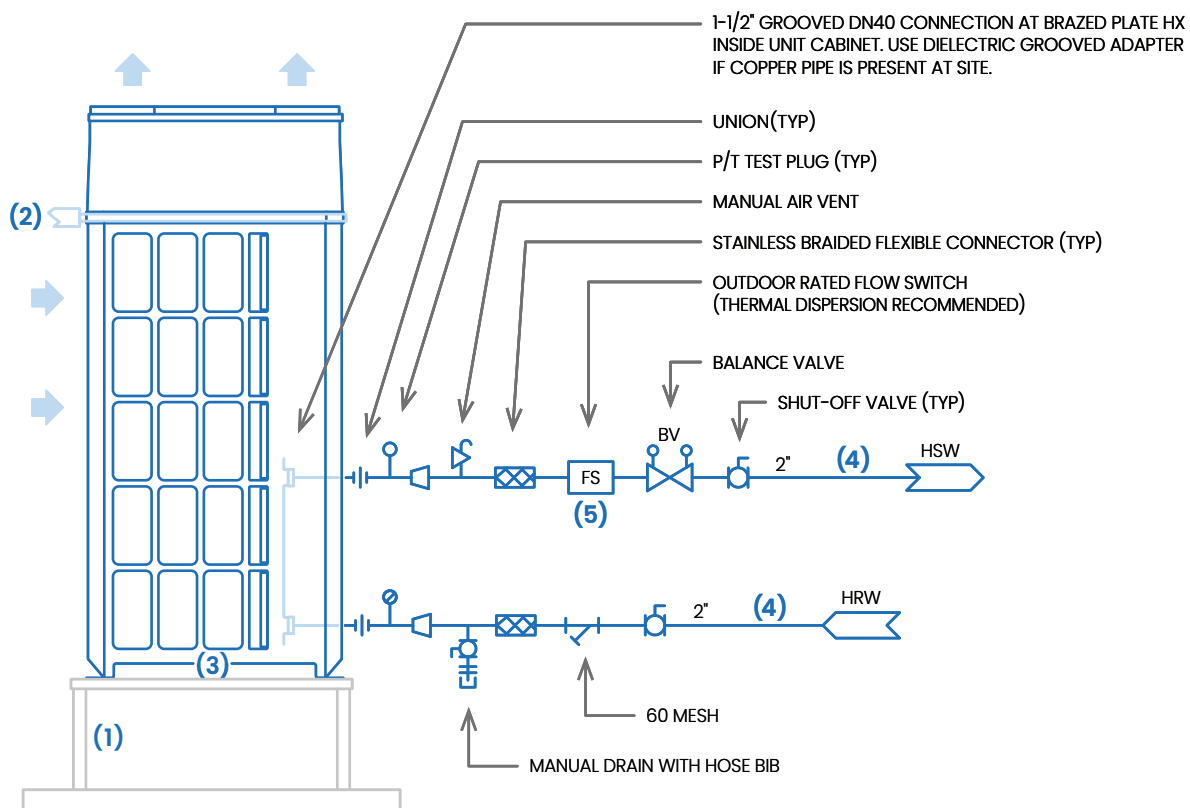


Basic flow piping requirements

Constant flow piping

For basic constant flow to a CAHV module, the below diagram summarizes minimum piping provisions. Note the requirement for a 60 mesh strainer, field flow switch, means of balance, and other required basic specialties for venting, draining, and servicing.

Main pump indoors



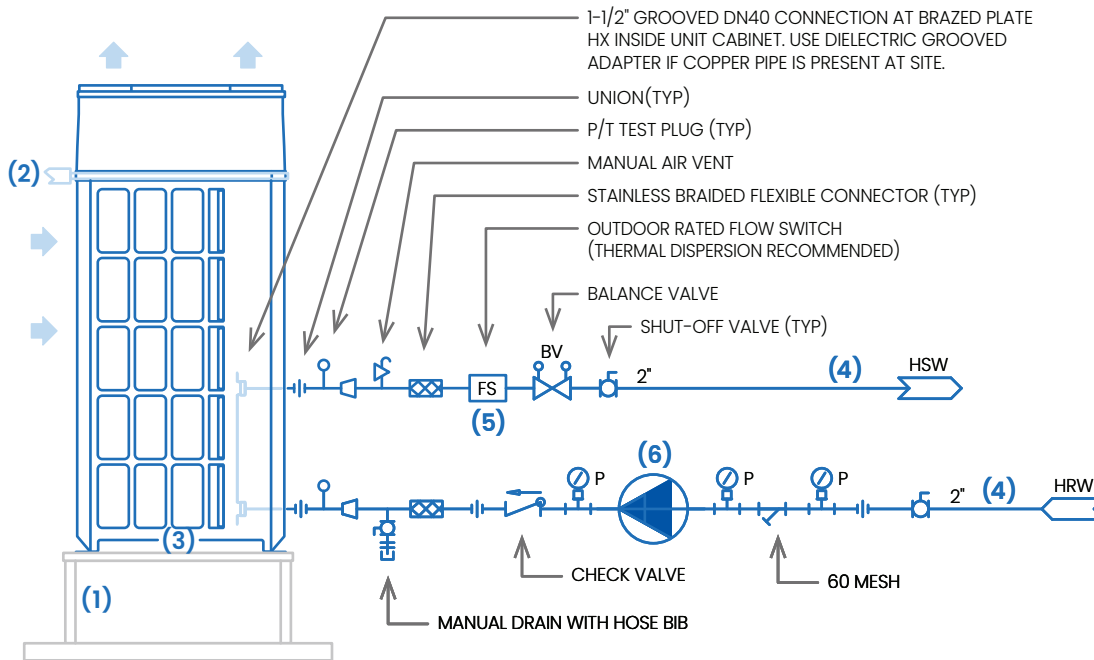
Notes:

1. In cold climates, install the unit on a minimum 18-inch high raised open base to prevent damage from snow.
2. Provide seismic bracing where required by jurisdiction (by contractor).
3. In cold climates, heat trace unit base pan (by contractor).
4. In cold climates, heat trace all water piping outdoors (by contractor). Ensure heat trace and insulation covers all exposed hydronic accessories.
5. Tie flow switch to unit proof of flow input (CN221, 1-3). Power to flow switch by others. Accessory thermal flow switch available from METUS.

Variable flow piping

To achieve variable primary plant flow when multiple CAHV units are present, either a dedicated tertiary pump per CAHV unit can be utilized or alternately, with some additional field controls, a two-position valve can be interlocked to each CAHV unit then a variable primary pump used to achieve variable primary flow.

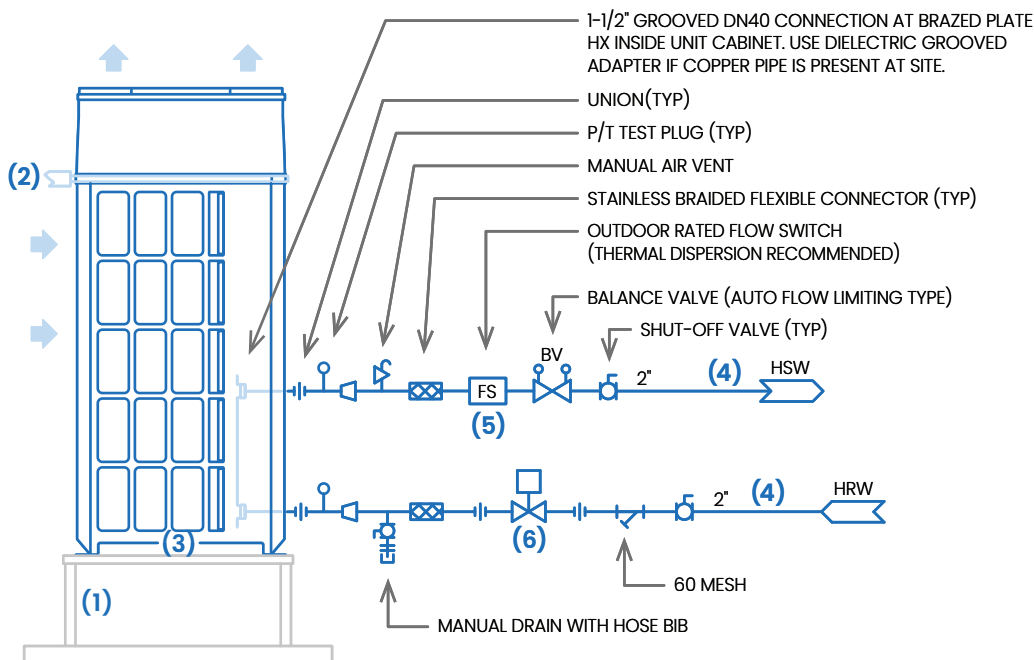
Tertiary outdoor pump per CAHV



Notes:

1. In cold climates, install the unit on a minimum 18-inch high raised open base to prevent damage from snow.
2. Provide seismic bracing where required by jurisdiction (by contractor).
3. In cold climates, heat trace unit base pan (by contractor).
4. In cold climates, heat trace all water piping outdoors (by contractor). Ensure heat trace and insulation covers all exposed hydronic accessories.
5. Tie flow switch to unit proof of flow input (CN221, 1-3). Power to flow switch by others. Accessory thermal flow switch available from METUS.
6. Pump (by contractor) - recommend direct commutated / digital pump for ease in balancing, outdoor rated with disconnect by E.C., tied to TB5 (70-71) on CAHV.

Two-position valve per CAHV central VFD pump indoors



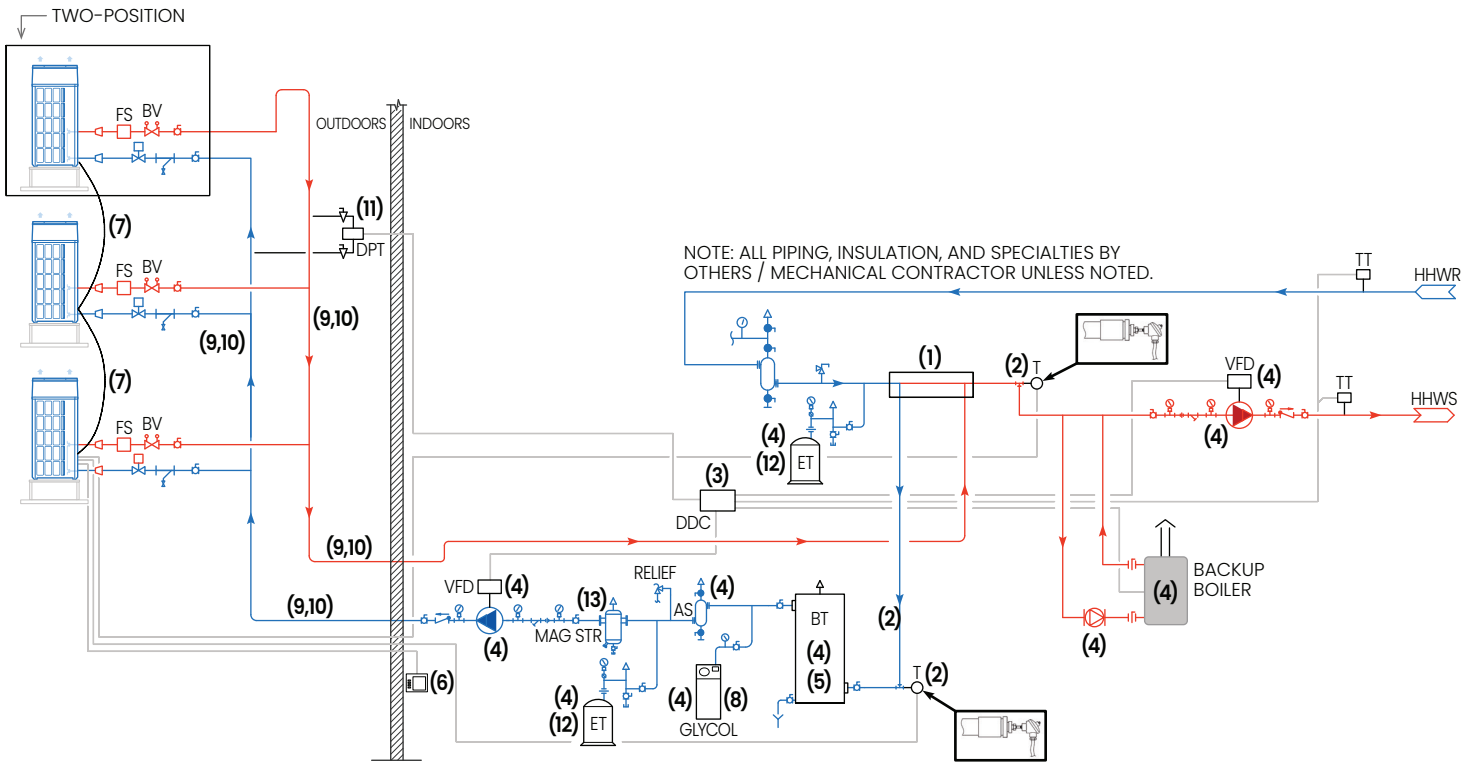
Notes:

1. In cold climates, install the unit on a minimum 18-inch high raised open base to prevent damage from snow.
2. Provide seismic bracing where required by jurisdiction (by contractor).
3. In cold climates, heat trace unit base pan (by contractor).
4. In cold climates, heat trace all water piping outdoors (by contractor). Ensure heat trace and insulation covers all exposed hydronic accessories.
5. Tie flow switch to unit proof of flow input (CN221, 1-3). Power to flow switch by others. Accessory thermal flow switch available from METUS.
6. Motorized two position valve normally closed, outdoor rated. Valve and transformer by others. Tied to TB5 (70-71) on CAHV.

Sample typical application for building heating hot water loop connection

This is illustrated in the diagram below with a variable speed primary pump for multiple CAHV units each with their own interlocked two-position control valve.

This piping diagram is general in nature to illustrate one method of tying into a closed loop heating hydronic system. Applications will vary per project and piping requirements may differ from this example provided. All engineering and controls of building distribution piping and/or backup heating, central pump staging and requirements for other hydronic components not shown remain the responsibility of the engineer of record.



Notes:

1. Size decoupler pipe for less than 4FT/sec and 2 to 5 times pipe diameter separation (no less than 2FT).
2. Remote temperature sensing accessory, furnished by manufacturer, field installed - reference install manual. Wired to main CAHV unit in group by M.C. (Up to 16 CAHV's max per group).
3. DDC controls, by TCC, required for total plant and main building distribution loop temperature control includes but is not limited to:
 - 3.1 Pump staging and modulation of secondary pumps.
 - 3.2 Backup boiler staging/control.
 - 3.3 Boiler pump control/interlock.
 - 3.4 Primary CAHV pump VFD control by diff. press transmitter.
 - 3.5 Staging on CAHV system/s.
4. By mech. contractor.
5. 139 Gallons minimum buffer volume required per CAHV unit.
 - 5.1 System volume can be counted.
 - 5.2 When separation HX is present only volume of piping can be counted between CAHV/s and HX.
6. CAHV remote controller - one per system group (16 CAHV's max per group) wired by M.C. to main CAHV unit.
7. All M-Net wiring by M.C. Reference install manuals for details.
8. Glycol must be polypropylene only - 40% max allowed.
9. Insulation and jacket all piping per code based on service temp.
10. Heat trace of outdoor piping in colder climates advised, and in addition to glycol depending on climate or glycol burst protection - by M.C.
11. Differential pressure transmitter for CAHV main pump control, installed by M.C.. Furnished and wired by TCC.
12. Redundant expansion tanks not required if loops are not separated by HX or there is no planned isolation of the CAHV loop from main building loop. Expansion tank must cover worst case volume for combined loops with single expansion tank location - determined by engineer of record.
13. Magnetic strainer (by M.C.) recommended for older existing piping, duplex strainers recommended for serviceability.



Technical

specifications



04

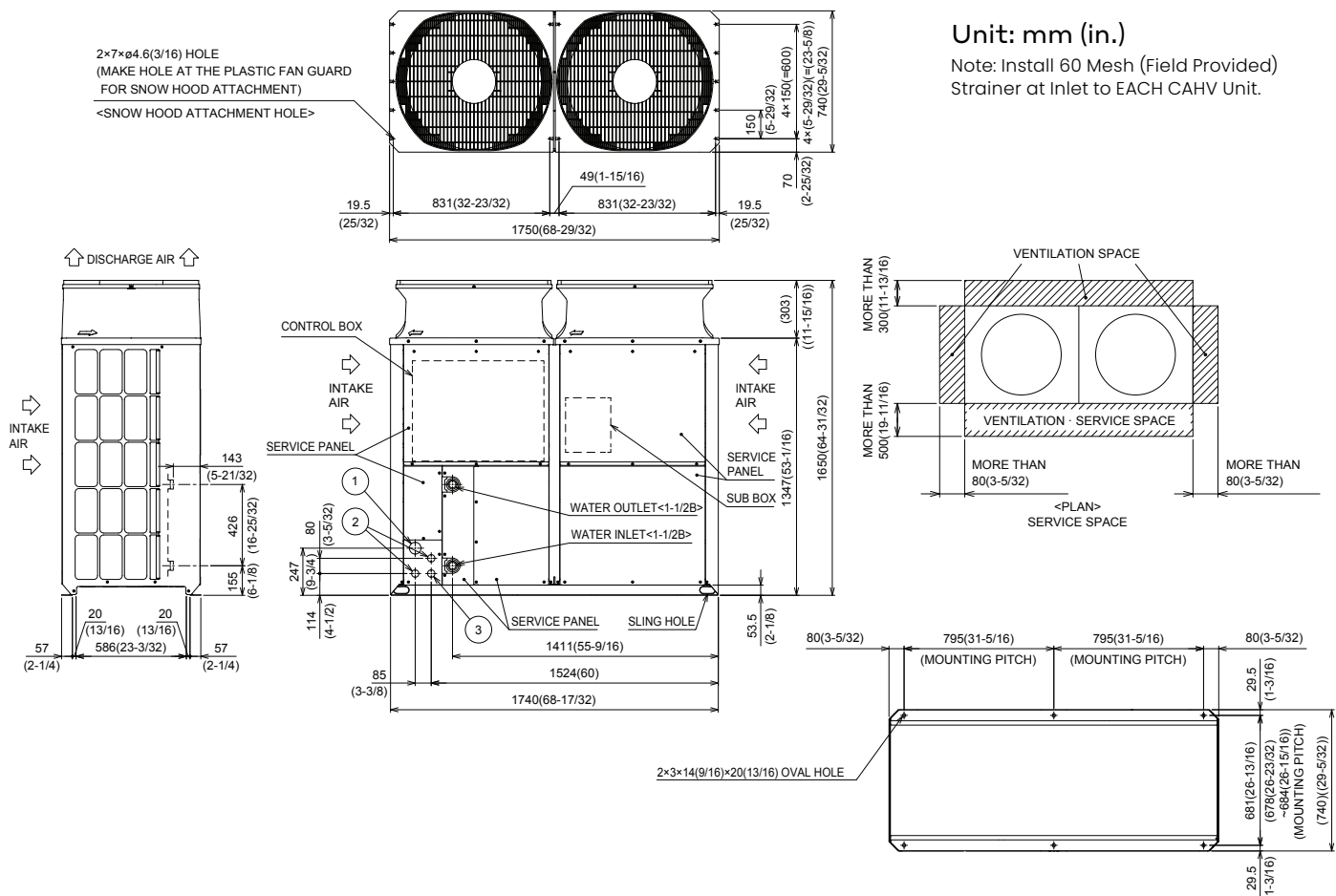
460V CAHV Air-to-Water Heat Pump specifications

Unit option

Standard model.....CAHV-R136YAU
Seacoast (BS) model.....CAHV-R136YAU (-BS)

Accessories

Snow Guard Side (2 In Kit).....SGC-1
Snow Guard Rear (2 In Kit)SGC-2
Snow Hood (1 In Kit, Requires 2)SHC-1
Remote Sens. (Requires 2 for Group Cntrl.) TW-TH16-E
Remote Controller.....PAR-W31MAA
Grooved Coupling (Includes Qty 2).....HJ-40A



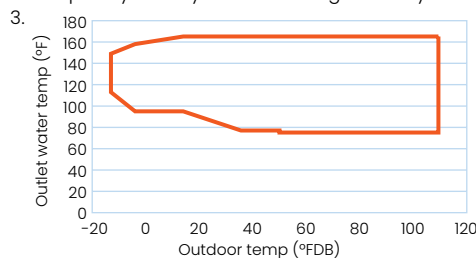
Usage	Specifications
1. Power Cable Inlet	ø62(2-15/32) Knockout Hole
2. Signal Cable Inlet (Low Current Cable)	ø35(1-13/32) Knockout Hole
3. Signal Cable Inlet (High Current Cable)	ø35(1-13/32) Knockout Hole

Notes:

- Please install the Drain Pan, because defrosting water or dew condensation water drops from holes on the Unit Base.
- The detachable leg can be removed at site.

Specification			System
Unit Type			CAHV-R136YAU (-BS)
Power source			3-phase 3-wire 460 V 60 Hz
Capacity (EN14511) *1		kW	40.0
		BTU/h	136,480
	Power input	kW	14.03
	Current input	A	19.6
	COP (kW/kW)		2.85
Minimum Circuit Ampacity (MCA)		A	41.0
Maximum Overcurrent Protection (MOP)		A	60.0
Water pressure drop *1		kPa (psi)	10.2 (1.47)
Temperature range *3	Outlet water temperature	° C (° F)	24-74 (75-165)
	Outdoor temperature (D.B.)	° C (° F)	-25-43(-13-109.4)
Circulating water volume range			4.0 m3/h-15.0 m3/h (1056.8 G/h-3963 G/h)
Sound pressure level		dB (A)	65
(measured 1 m below the unit in an anechoic room) *1 *5		dB (A)	72
Water pipe diameter and type	Inlet	mm (in)	38.1 (1 1/2"), housing type joint
	Outlet	mm (in)	38.1 (1 1/2"), housing type joint
External finish			Acrylic painted steel sheet
External dimensions H × W × D		mm (in)	1650 × 1750 × 740 (64-31/32 × 68-29/32 × 29-5/32)
Net weight		kg (lbs)	372 (820)
Design pressure	R454C	MPa	3.85 (558)
	Water	MPa	1.0 (145)
Drawing number	Wiring		KW94L286
	External appearance		KW94L288
Heat exchanger	Water-side		Copper brazed stainless steel sheet
	Air-side		Plate fins and copper tubes
Compressor	Type		Inverter scroll hermetic compressor
	Manufacturer		MITSUBISHI ELECTRIC CORPORATION
	Starting method		Inverter
	Motor output	kW	12.1
	Lubricant		FVC32EA
Fan	Air flow rate	m³/min	150 × 2
		L/s	2500 × 2
		cfm	5297 × 2
	External static pressure		10 Pa (1 mm H2O)
	Type and quantity		Propeller fan × 2
	Control and driving mechanism		Inverter control, direct driven by motor
	Motor output	kW	0.92 × 2
HIC (Heat Inter-Changer) circuit			Copper pipe
Protection devices	High pressure		High-pressure sensor and switch set at 3.85 MPa (643 psi)
	Inverter circuit		Overheat and overcurrent protection
Defrosting method			Auto-defrost mode (Reversed refrigerant cycle)
Refrigerant	Type and factory charge	kg (lbs)	R454C, 9.0 (19.8)
	GWP *4		148
	Flow and temperature control		LEV and HIC circuit

- Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB (44.6°FDB/42.8°F WB), the outlet water temperature of 45° C (113° F) and the inlet water temperature of 40° C (104° F). Tolerance of capacity and COP is based on AHRI 551/591.
- Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB (44.6°FDB/42.8°F WB) when the unit is set to the "Capacity Priority" mode through the dry NC-contact.



Outdoor temp. -25°CDB/Outlet water temp. 45-65° C
(Outdoor temp. -13°FDB/Outlet water temp. 113-149° F)
Outdoor temp. -20°CDB/Outlet water temp. 35-70° C
(Outdoor temp. -4°FDB/Outlet water temp. 95-158° F)
Outdoor temp. -10°CDB/Outlet water temp. 35-74° C
(Outdoor temp. 14°FDB/Outlet water temp. 95-165° F)
Outdoor temp. 43°CDB/Outlet water temp. 24-74° C
(Outdoor temp. 109°FDB/Outlet water temp. 75.2-165° F)

*Stops operation at the outdoor temperature of -28° C (-18° F) or below
*Stops operation at the inlet temperature of 72° C (161.6° F) or above

Unit converter

Kcal = kW × 860
BTU/h = kW × 3,412
cfm = m3/min × 35.31
lbs = kg/0.4536

- IPCC 4th assessment report.
- The sound pressure level is a value measured in an anechoic room in accordance with the conventional method in JRA4060.
 - Due to continuing improvements, specifications may be subject to change without notice.
 - Do not use steel pipes as water pipes.
 - Keep the water circulated at all times. Blow the water out of the pipes if the unit will not be used for an extended period of time.
 - Do not use ground water or well water.
 - Do not install the unit in an environment where the wet bulb temperature exceeds 32°C (90° F).
 - The water circuit must be a closed circuit.

208V CAHV Air-to-Water Heat Pump specifications

Unit option

Standard model.....CAHV-RI36TAU

Seacoast (BS) model.....CAHV-RI36TAU (-BS)

Accessories

Snow Guard Side (2 In Kit).....SGC-1

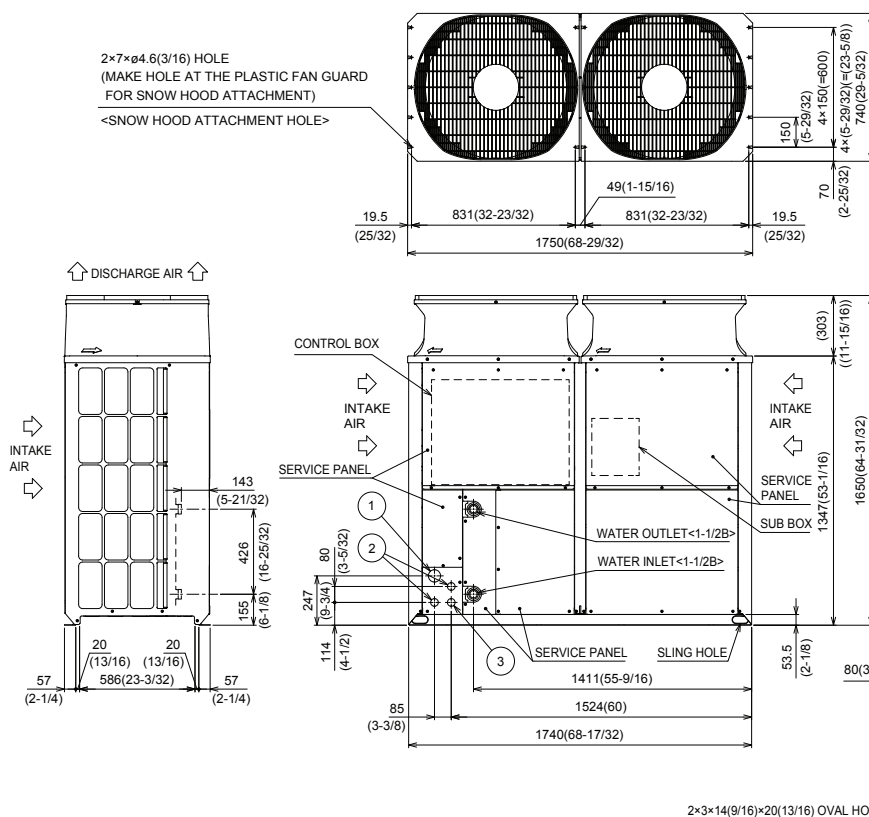
Snow Guard Rear (2 In Kit)SGC-2

Snow Hood (1 In Kit, Requires 2)SHC-1

Remote Sens. (Requires 2 for Group Cntrl.) TW-TH16-E

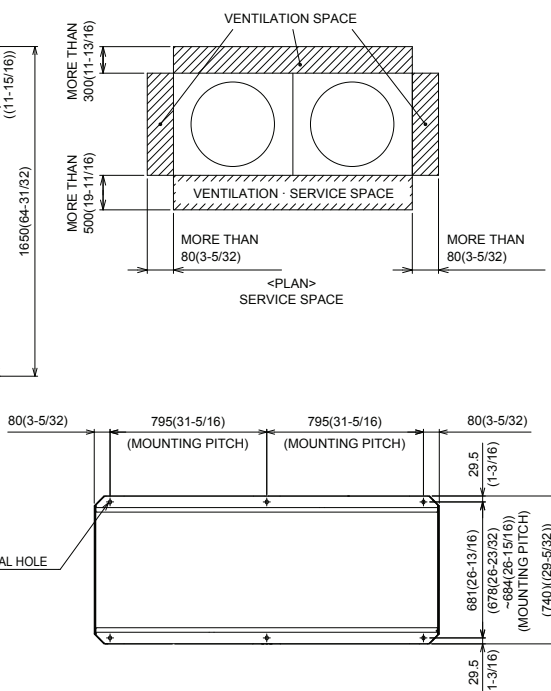
Remote Controller.....PAR-W31MAA

Grooved Coupling (Includes Qty 2)HJ-40A



Unit: mm (in.)

Note: Install 60 Mesh (Field Provided)
Strainer at Inlet to EACH CAHV Unit.



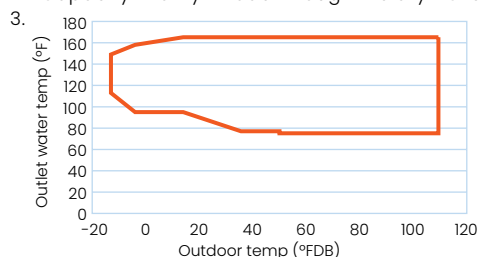
Usage	Specifications
1. Power Cable Inlet	ø62(2-15/32) Knockout Hole
2. Signal Cable Inlet (Low Current Cable)	ø35(1-13/32) Knockout Hole
3. Signal Cable Inlet (High Current Cable)	ø35(1-13/32) Knockout Hole

Notes:

- Please install the Drain Pan, because defrosting water or dew condensation water drops from holes on the Unit Base.
- The detachable leg can be removed at site.

Specification			System
Unit Type			CAHV-R136TAU (-BS)
Power source			3-phase 3-wire 208-230 V 60 Hz
Capacity (EN14511) *1		kW	40.0
		BTU/h	136,480
	Power input	kW	14.03
	Current input (208 V)	A	43.3
	Current input (230 V)	A	39.2
	COP (kW/kW)		2.85
Minimum Circuit Ampacity (MCA)		A	72.0
Maximum Overcurrent Protection (MOP)		A	110.0
Water pressure drop *1		kPa (psi)	10.2 (1.47)
Temperature range *3	Outlet water temperature	°C	24-74
	Outdoor temperature (D.B.)	°C	-25-43
Circulating water volume range *6		m³/h	4.0-15.0 (1056.8-3963.0)
Sound pressure level (measured 1 m below the unit in an anechoic room) *1 *5		dB (A)	65
		dB (A)	72
Water pipe diameter and type	Inlet	mm (in)	40A (1-1/2 B), housing type joint
	Outlet	mm (in)	40A (1-1/2 B), housing type joint
External finish			Acrylic painted steel sheet
External dimensions H × W × D		mm (in)	1650 × 1750 × 740 (64-31/32 × 68-29/32 × 29-5/32)
Net weight		kg (lbs)	362 (798)
Design pressure	R454C	MPa (psi)	3.85 (558)
	Water	MPa (psi)	1.0 (145)
Drawing number	Wiring		KW94R804
	External appearance		KW94L288
Heat exchanger	Water-side		Copper brazed stainless steel sheet
	Air-side		Plate fins and copper tubes
Compressor	Type		Inverter scroll hermetic compressor
	Manufacturer		MITSUBISHI ELECTRIC CORPORATION
	Starting method		Inverter
	Motor output	kW	12.1
	Lubricant		FVC32EA
Fan	Air flow rate	m³/min	150 × 2
		L/s	2500 × 2
		cfm	5297 × 2
	External static pressure		10 Pa (1 mm H2O)
	Type and quantity		Propeller fan x 2
	Control and driving mechanism		Inverter control, direct driven by motor
	Motor output	kW	920 × 2
HIC (Heat Inter-Changer) circuit			Copper pipe
Protection devices	High pressure		High-pressure sensor and switch set at 3.85 MPa (558 psi)
	Inverter circuit		Overheat and overcurrent protection
Defrosting method			Auto-defrost mode (Reversed refrigerant cycle)
Refrigerant	Type and factory charge	kg (lbs)	R454C, 9.0 (19.8)
	GWP *4		148
	Flow and temperature control		LEV and HIC circuit
SCCR		kA	5

- 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). Tolerance of capacity and COP is based on AHRI 551/591.
- Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB (44.6°FDB/42.8°FWB) when the unit is set to the "Capacity Priority" mode through the dry NC-contact.



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(Outdoor temp. -13°FDB/Outlet water temp. 113-149°F)
 Outdoor temp. -20°CDB/Outlet water temp. 35-70°C
(Outdoor temp. -4°FDB/Outlet water temp. 95-158°F)
 Outdoor temp. -10°CDB/Outlet water temp. 35-74°C
(Outdoor temp. 14°FDB/Outlet water temp. 95-165°F)
 Outdoor temp. 43°CDB/Outlet water temp. 24-74°C
(Outdoor temp. 109°FDB/Outlet water temp. 75.2-165°F)

*Stops operation at the outdoor temperature of -28°C (-18°F) or below
 *Stops operation at the inlet temperature of 72°C (161.6°F) or above

Unit converter

Kcal = kW × 860
 BTU/h = kW × 3,412
 cfm = m³/min × 35.31
 lbs = kg/0.4536

- IPCC 4th assessment report
- The sound pressure level is a value measured in an anechoic room in accordance with the conventional method in JRA4060.
- The fluctuation of the flow rate must be 10% per minute or less.
 - Due to continuing improvements, specifications may be subject to change without notice.
 - Do not use steel pipes as water pipes.
 - Keep the water circulated at all times. Blow the water out of the pipes if the unit will not be used for an extended period of time.
 - Do not use ground water or well water.
 - Do not install the unit in an environment where the wet bulb temperature exceeds 32°C (90°F).
 - The water circuit must be a closed circuit.

Selecting the installation site

Installation conditions

Select the installation site in consultation with the client

Select a site to install the outdoor unit that meets the following conditions:

- The unit will not be subject to heat from other heat sources.
- The noise from the unit will not be a problem.
- The unit will not be exposed to strong winds.
- Water from the unit can be drained properly.
- Appliance shall not accessible to the public.
- The space requirements are met.

There is possibility of injury due to contact with the unit, so abide by following:

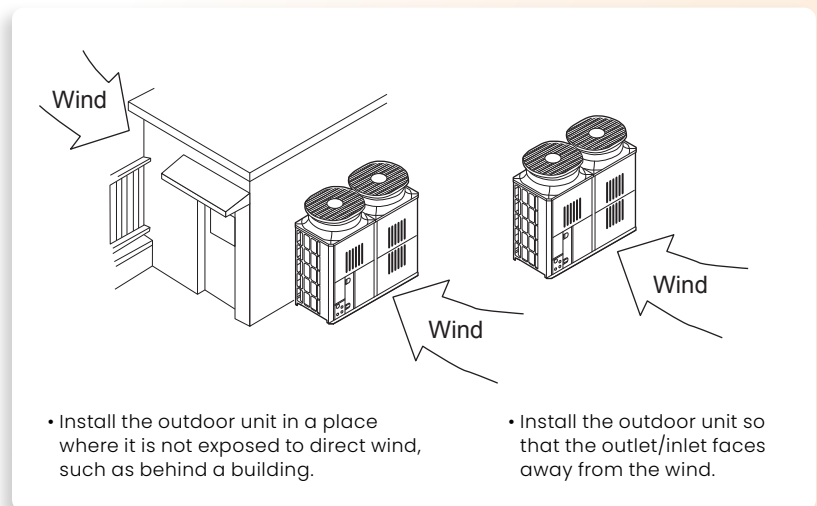
1. Appliances not accessible to the general public.
2. Limit the installation to a place where the general public cannot touch the product.

(For example, please install the unit in the area where the general public cannot enter, install a fence around the unit, etc.)

Provide protection against winds

Using the figures to the right as a reference, provide adequate protection against winds.

A unit installed alone is vulnerable to strong winds. Select the installation site carefully to minimize the effect of winds. When installing a unit in a place where the wind always blows from the same direction, install the unit so that the outlet faces away from the direction of the wind.



Cold climate installation

Observe the following when installing units in areas where snow or strong winds prevail:

- Avoid direct exposure to rain, winds, and snow.
- Icicles that may form under the foundation can fall and inflict personal injury or property damage. Select the installation site carefully to reduce these risks, especially when installing the unit on a roof.
- If the units are installed in the direct line of rain, winds, or snow, install snow hoods (on both the discharge and suction ducts). Use a snow net or snow fence as necessary to protect the unit.
- Install the unit on a base approximately twice as high as the expected snowfall.
- If the unit is continuously operated for a long time with the outside air temperature below the freezing point, install a heater at the base of the unit to prevent the water from freezing at the unit bottom.
- Install snow hoods in regions where the outdoor temperature is -10°C (14°F) or below.

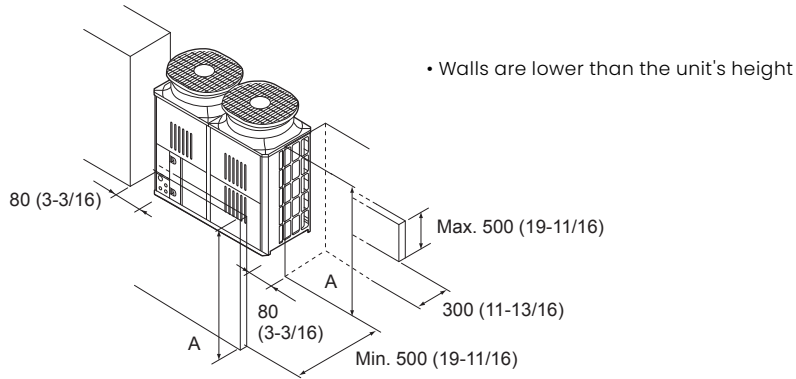
Installation space requirements

Single unit installation

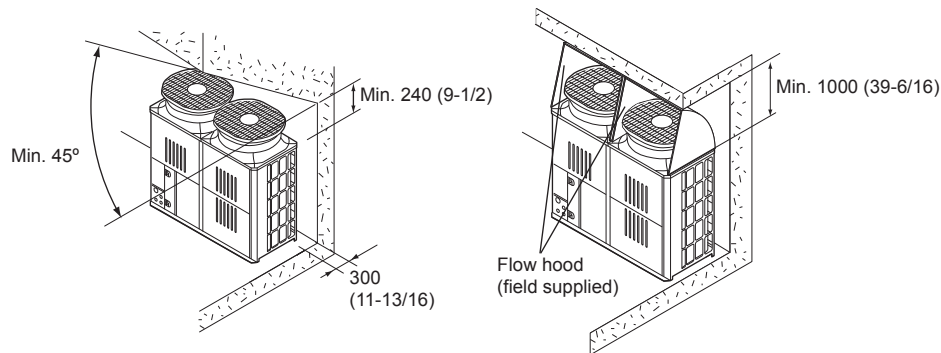
Unit: mm (in.)

Secure enough space around the unit as shown in the figures below:

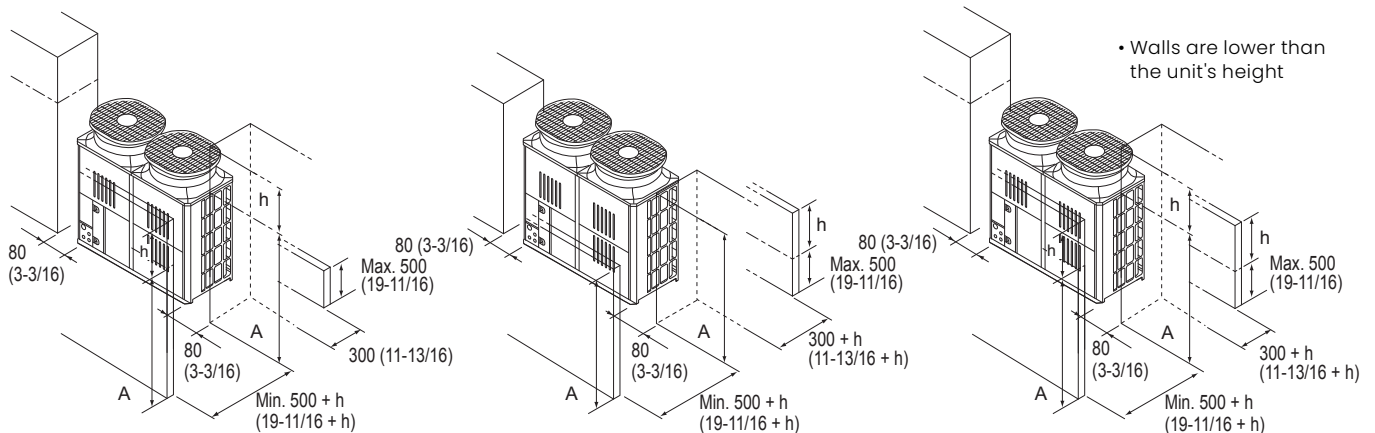
Walls around the unit do not exceed the height limit.



There is a wall above the unit.



One or more of the walls around the unit are taller than the maximum allowable height (h).



Note:

For grouped module installation clearance requirements and additional considerations, reference the published installation manual located at www.MitsubishiPro.com and consult with a Mitsubishi representative.



For questions, call
Customer Care
at 1-800-433-4822.



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TRANE HVAC US**

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