Manufacturer's Roundtable

High Temperature and Hydronic Heat Pump Manufacturers Roundtable

April 8, 2026

WHAT IS CEDA?

The California Energy Design Assistance (CEDA) program is the only statewide utility incentive program for new construction and major renovations.

- Promotes **electrification** and **decarbonization**
- CEDA works in collaboration with project teams to reduce energy demand, consumption, and carbon emissions.
- Serves commercial, public, high-rise multifamily, industrial, and agricultural projects in Pacific Gas & Electric (PG&E), Southern California Edison (SCE), SoCalGas (SCG), and San Diego Gas & Electric (SDG&E) service areas.

WHY PARTICIPATE IN CEDA?

- Receive complimentary **decarbonization** analysis tailored to project goals to identify most effective measures to implement
- Gain analysis of **energy costs and paybacks**
- Receive **financial incentives** to help offset the costs of decarbonization measures
- Demonstrate commitment to high performance building practices and design

INCENTIVES

- $4000 **Design team incentive** per project as a thank you for participation
- Based on the project measure package the design team chooses for implementation

HIGH PERFORMANCE MEASURES

CEDA aims to exceed California's decarbonization standards by identifying high performance measures and providing educational opportunities to explore use cases and best practices.

This not only advances the market, but also qualifies participants for enhanced incentives through our program.

A current list of eligible high-performance measures can be found on our website here.

HAVE A PROJECT TO DISCUSS?

For more information, please contact our program outreach specialists, visit our website, or fill out an interest form

Scan me to enroll a project

CaliforniaEDA.com

Tina Hendrix | Program Outreach Specialist
thendrix@willdan.com
760.585.7577

High Temperature and Hydronic Heat Pumps

In today's webinar, we'll discuss:

What defines a "**high temp**" heat pump

Typical **applications** and **end-uses**

Recent heat pump **innovations**, including the use of **low-GWP refrigerants**

Barriers to high-temperature and hydronic heat pump implementation

How to increase installer and building owner **awareness** of this technology

Today’s Panelists

Matt Rash
Mitsubishi Electric
Trane

Miles Chen
Transom Corporation

Edwin Reek
Daikin Comfort

Sean Jarvie
Flow

Transom Heat Pumps

Established in Barrie,ON in 2017, acquired by Mestek Inc in Dec 2021 Transom as a strategic expansion of their product offering.

The combination of the Mestek resources/market presence, and the Transom technology we are well placed for the fast-emerging **electrification** and **decarbonisation** market

APPLICATIONS

- Apartment buildings
- Rec Centers
- Hospitals
- Long Term Care
- Universities
- Restaurants
- Condominiums
- Office Buildings

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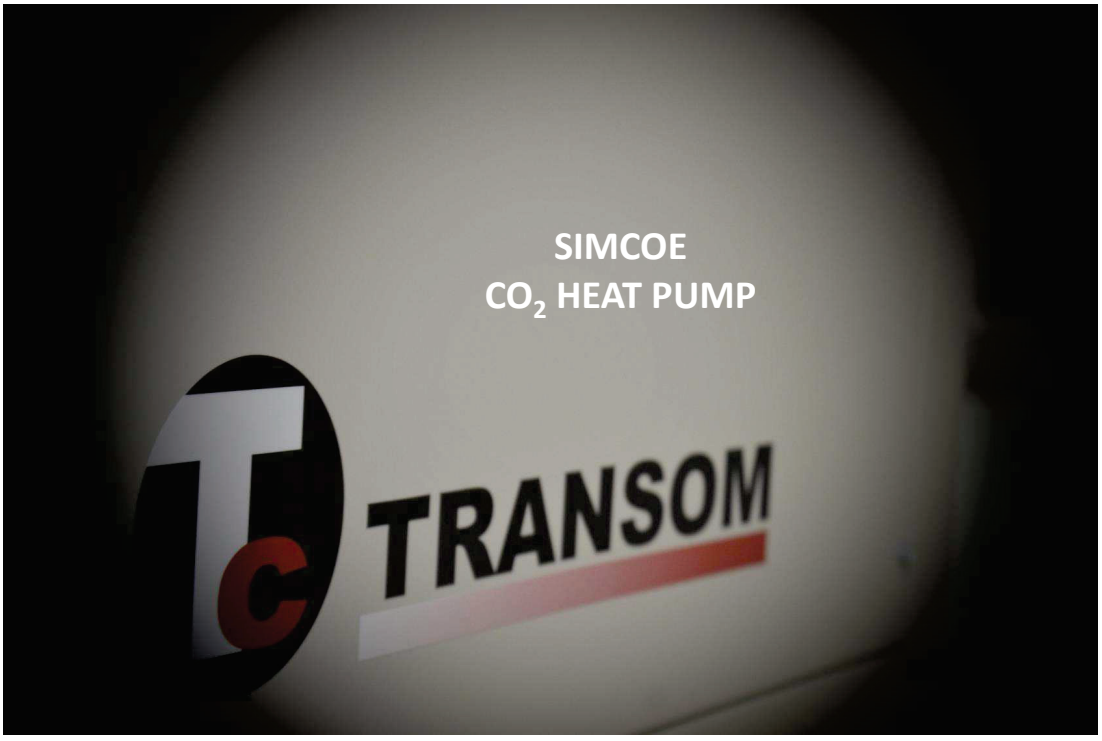
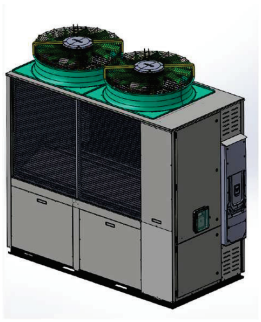
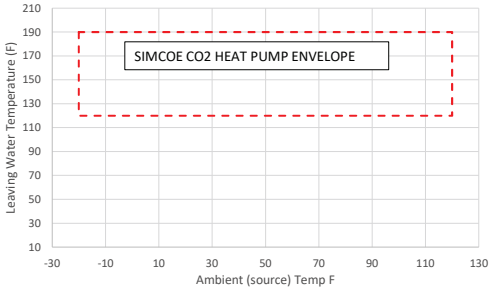


SIMCO$_2$E

CO_2 AIR SOURCE HEAT PUMP





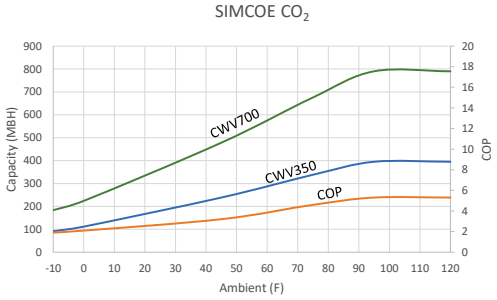
WILL GENERATE 190°F WATER AT -20°F AMBIENT

- **ENVIRONMENTALLY FRIENDLY CO_2, GWP = 1**
- **POTABLE WATER HEATER 120° TO 190°F (DOUBLE WALLED)**
- **AIR SOURCED LOW AMBIENT -20°F**
- **CAPACITIES UP TO 700 MBH**
- **MODULAR DESIGN UP TO 8,400 MBH**

SIMCO$_2$E

CO_2 AIR SOURCE HEAT PUMP

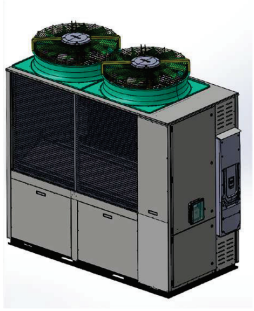
Model Size	350 MBH	700 MBH
Compressor	Variable Recip	Variable Recip
Voltage	208-230/3/60 460/3/60 575/3/60	208-230/3/60 460/3/60 575/3/60



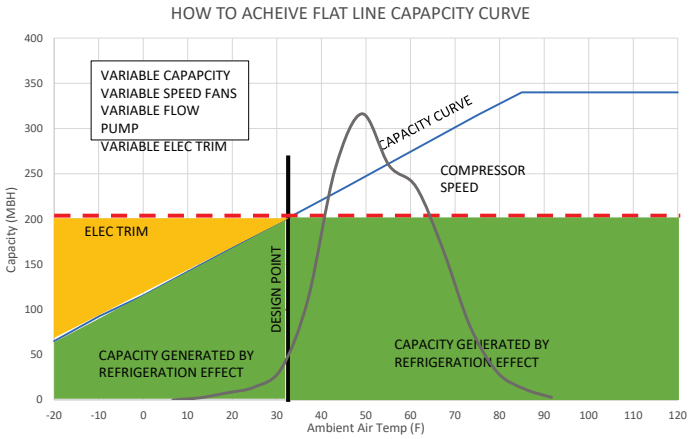
- **VARIABLE CAPACITY**
- **VARIABLE SPEED FANS**
- **VARIABLE FLOW PUMP**
- **VARIABLE ELEC TRIM**
- **DOUBLE WALLED HEX – POTABLE WATER**

SIMCO$_2$E

CO_2 AIR SOURCE HEAT PUMP



WILL GENERATE 190°F WATER AT -20°F AMBIENT



SIMCO$_2$E

CO_2 AIR SOURCE HEAT PUMP

WILL GENERATE 190°F WATER AT -20°F AMBIENT

OPTIONS

1. Back up heater
2. Pump, low or high volume
3. Blower for high static
4. Central controller and sensors
5. Remote control/touch screen display
6. BACnet or Modbus communication
7. Built-in central centrifugal pump
8. Single wall indoor coil
9. Heat tracing of all wetted parts
10. Wind Baffle

POWER AVAILABLE

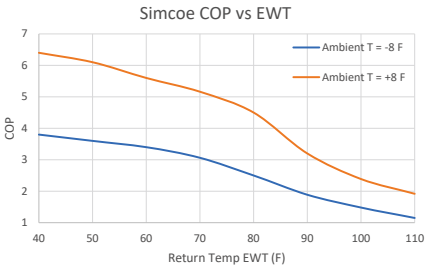
208-230/3/60
460/3/60
575/3/60

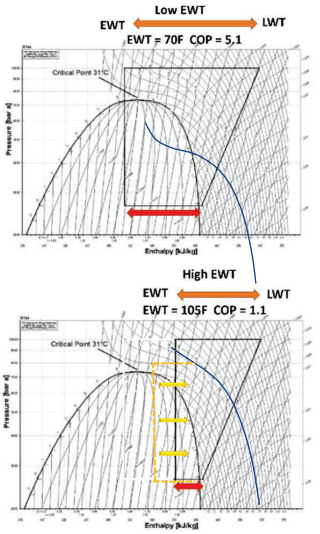
SIMCO$_2$E

CO_2 AIR SOURCE HEAT PUMP

Because CO_2 HP is transcritical it uses a gas cooler instead of condenser. So it is very depended on having a low return water temp to achieve good COP.

A function of Gas Dynamics



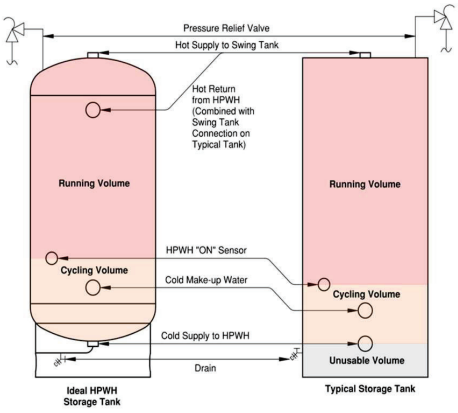


WILL GENERATE 190°F WATER AT -20°F AMBIENT

SIMCO$_2$E

CO_2 AIR SOURCE HEAT PUMP

TANK STRATIFICATION AND SIZING OPTIMIZED THE INSTALLATION



# of HPWHs	1			
# of Storage Tanks	3			

1. Enter equivalent pipe lengths and relative pressure drops to calculate total pressure drop between HPWH and storage tanks.

Pipe Designation	HPHB	HPCB	HPH	HPC
Pipe Size	1.5	1	1.5	1
Flow	10	10	10	10
Equivalent Pipe Length (ft)	10	10	100	100
Pressure Drop (psi/100')	0.42	2.7	0.42	2.7
Total Pressure Drop (ft head)	0.1	0.6	1.0	6.2

Total Pressure Drop:	7.8936	ft head
Available Pump Head:	31	ft head
Safety Factor:	3.9	

2. If safety factor is less than 2, increase HPH and HPC pipe sizes and re-calculate step 1.

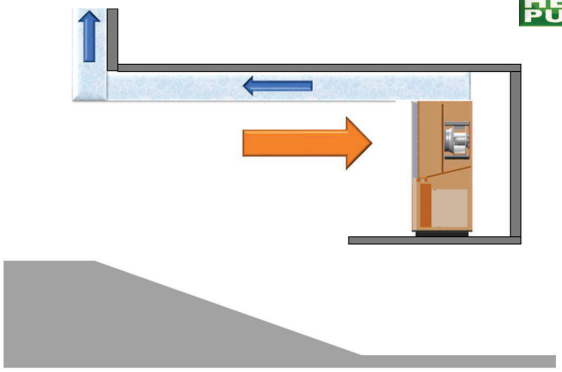
Increase HPH and HPC Pipe Size: yes

	HPH	HPC
Default Pipe Sizes (in):	1.5	1
Updated Sizes (in):	1.5	1

3. Paste this Pipe Size and Insulation Table on the P&ID.

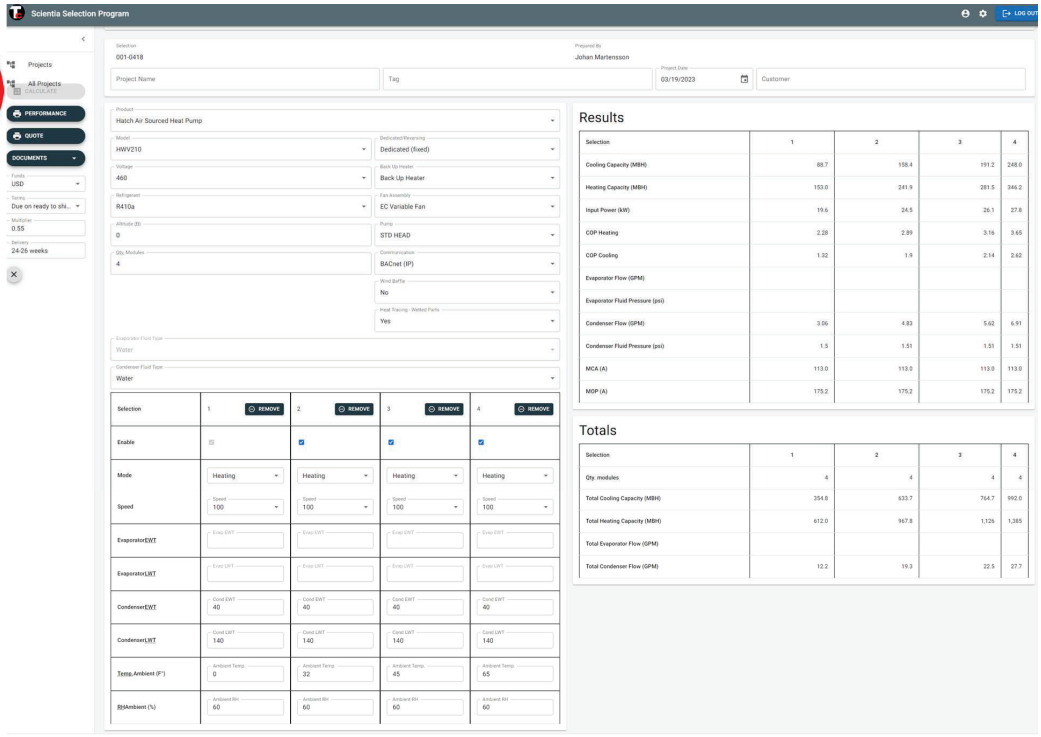
SIMCO$_2$E

HIGH STATIC BLOWER OPTION



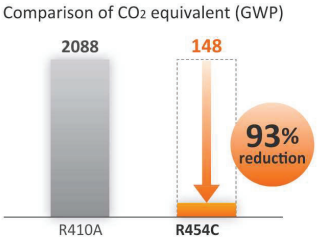
UP TO 1” wc ESP
To prevent discharge air short circuiting

Installed in:
Parking garages;
Penthouse or underground Mechanical rooms



What is CAHV?

- Modular Air-Source Heat Pump Unit – **Low Delta T**
- Used for space heating or domestic hot water
- **40KW**, 136,480 Btu/hr nominal capacity
- Outlet water temp up to **165°F** down to 14°F
  - 149°F at -13°F
- Uses R454C (19 lb., 13.5 oz.)



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CAHV History

- First unit developed in 1986
- First inverter version developed in 2010
- 3 generations of models and 15 years of data

1st Generation – 2011 (R407C)

3rd Generation – 2024 (R454C)

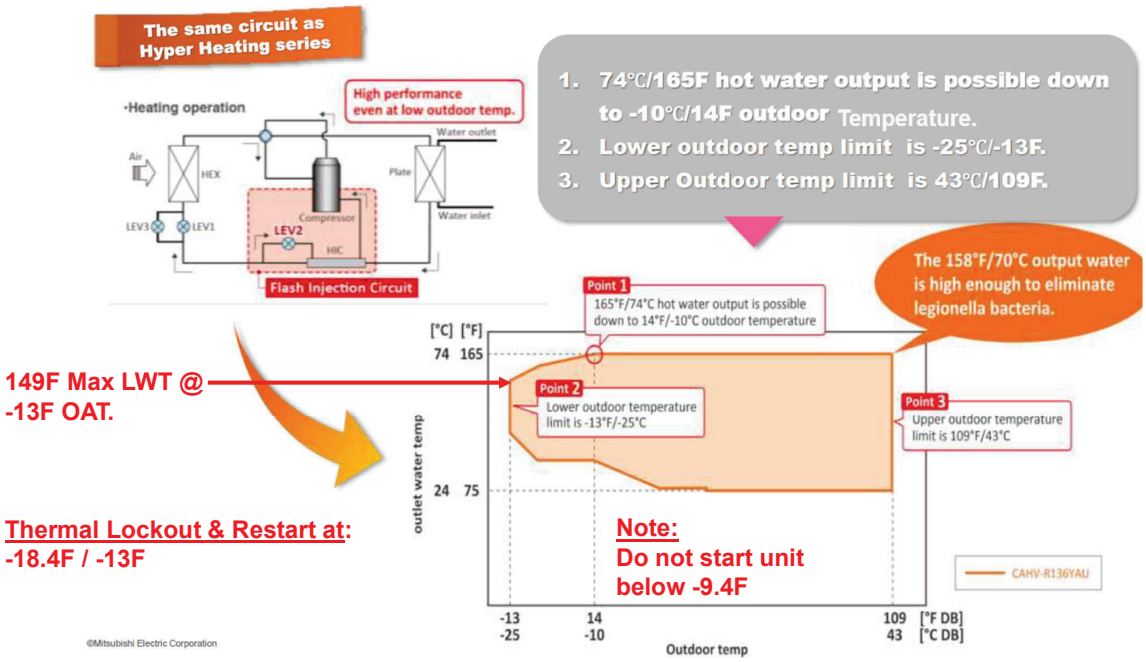
MITSUBISHI ELECTRIC TRANE HVAC US

Features

- Model name: CAHV-R136YAU(-BS)
- Production: AC&R
- 16 units can be connected to a central controller
- Cascade circuit - Rotational operation based on compressor runtime
- **Plant Capacity Range: 20 MBH – 2,184 MBH (16 modules)**
- Hot gas defrost
- Hermetically sealed refrigeration circuit
- Integral brazed plate heat exchanger
- 145 PSI design pressure

MITSUBISHI ELECTRIC TRANE HVAC US

Low Running Costs & Wide Operating Temperature Range

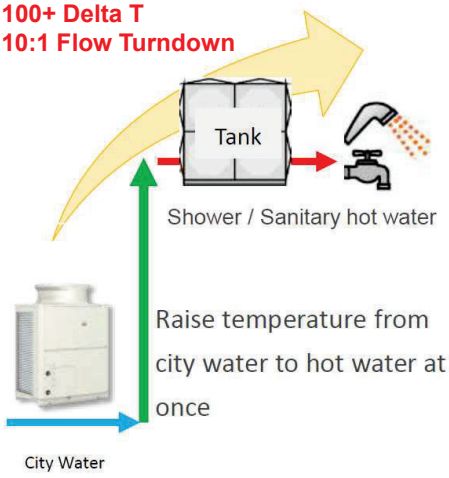


Comparison with QAHV

HIGH DELTA T – HIGH FLOW TURNDOWN

QAHV **Hot water storage**

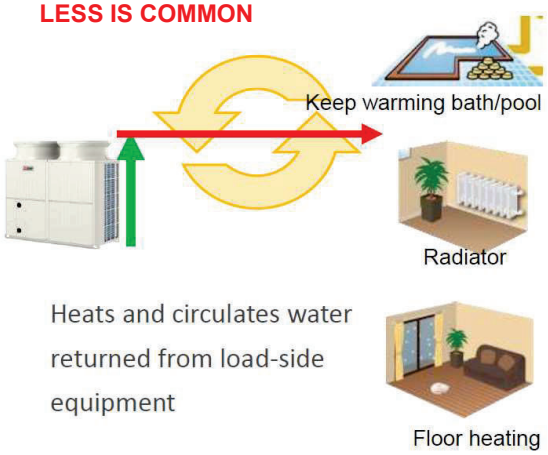
100+ Delta T
10:1 Flow Turndown



LOW DELTA T – LOW FLOW TURNDOWN

CAHV **Hot water circulates**

10F DELTA T OR LESS IS COMMON

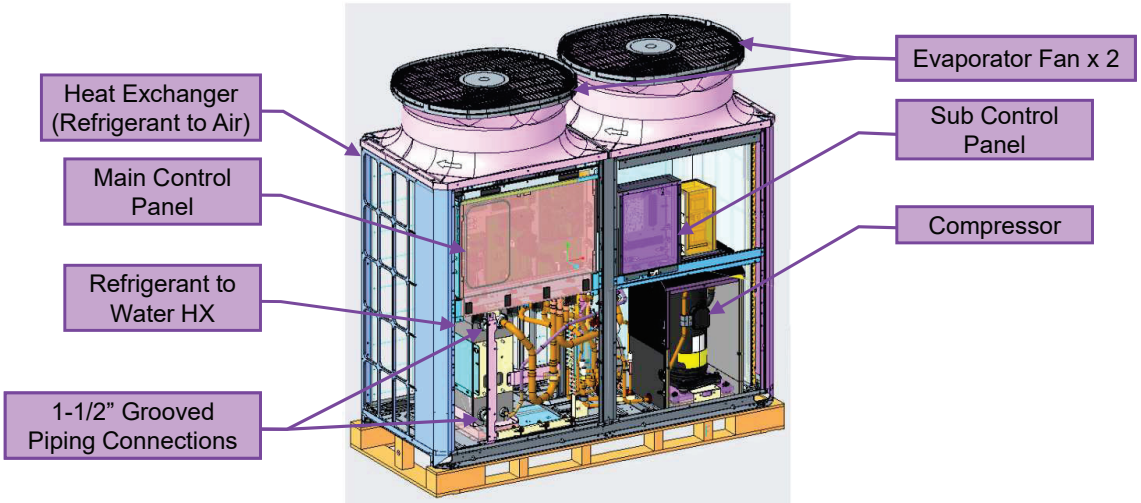


TRANE HVAC US

QAHV vs. CAHV Comparison

	QAHV	CAHV
Application	**Domestic Hot Water**	**Domestic Hot Water or Heating Hot Water**
System Type	**Single Pass**	**Multi Pass**
Heat Source	**Air**	**Air**
Refrigerant	**R744 (CO2)**	**R454C**
Outlet Water Temp	**120-176°F**	**75-165°F**
Nominal Heating Capacity	**136,480 Btu/hr**	**136,480 Btu/hr**
Flow Rate	**0.8-8 GPM**	**18-66 GPM**
Delta T	**100-130°F**	**9°F**

CAHV Components



MITSUBISHI ELECTRIC TRANE HVAC US

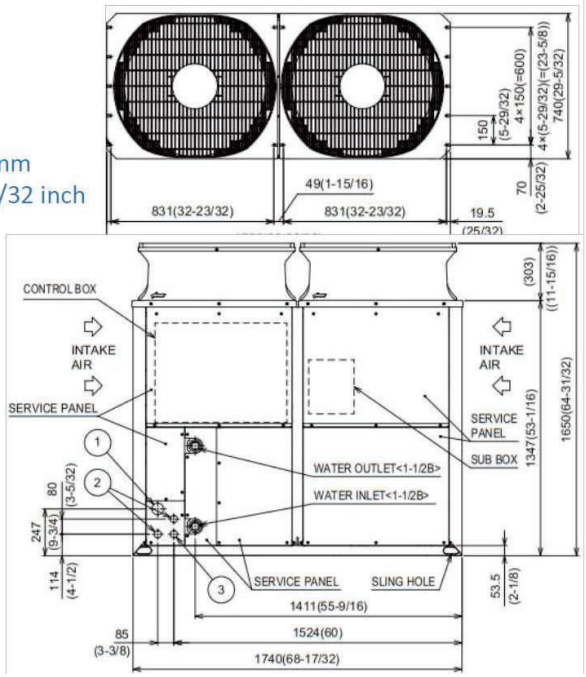
External Drawing

1650mm
64-31/32 inch

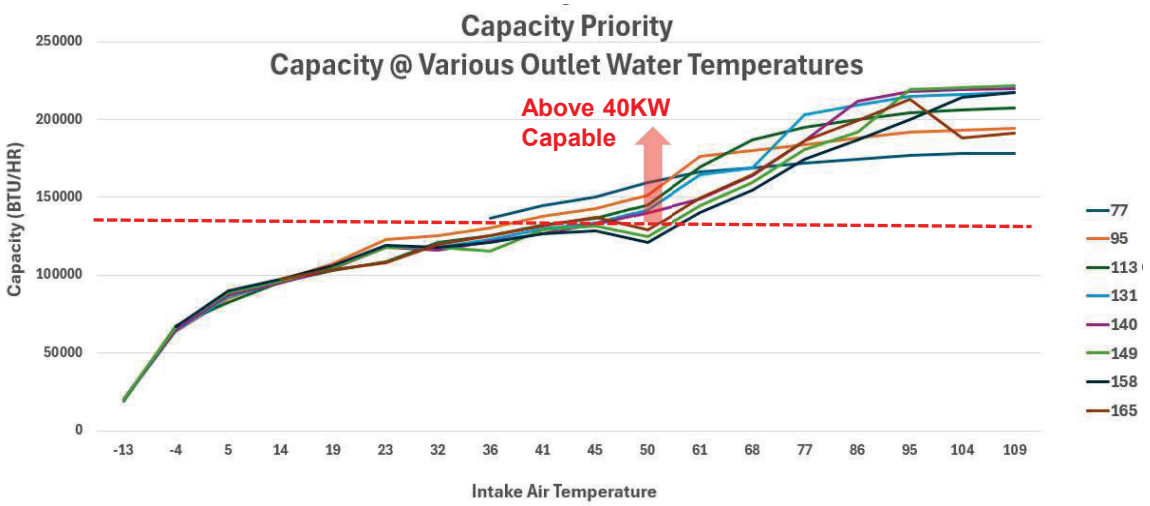
1750 mm
68-29/32 inch

740 mm
29-5/32 inch

For more information, please refer to manuals.



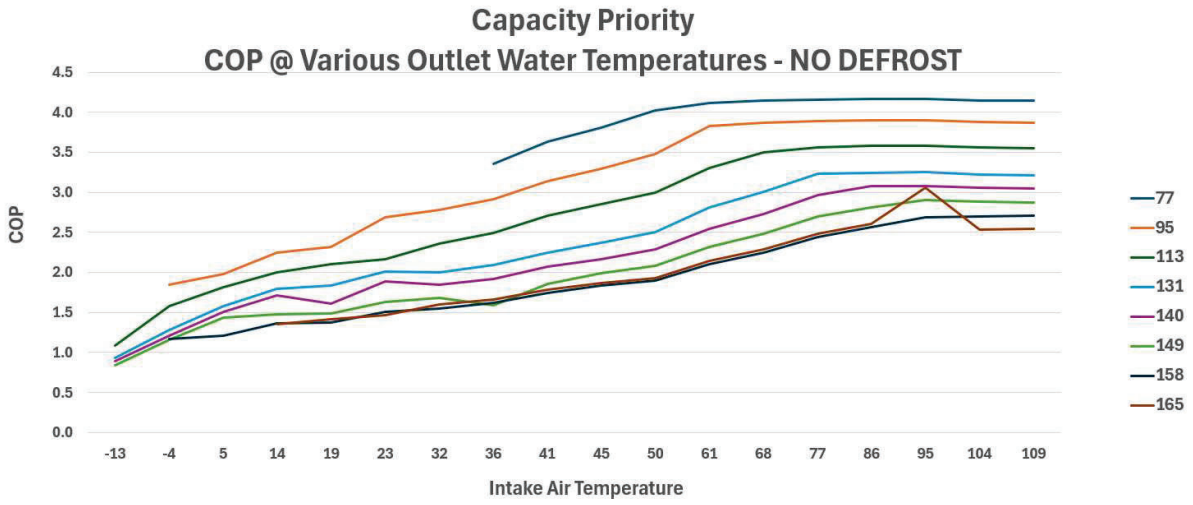
Typical Output - Capacity Priority (DATA BOOK Values)



Note: Defrost not included

MITSUBISHI ELECTRIC TRANE HVAC US

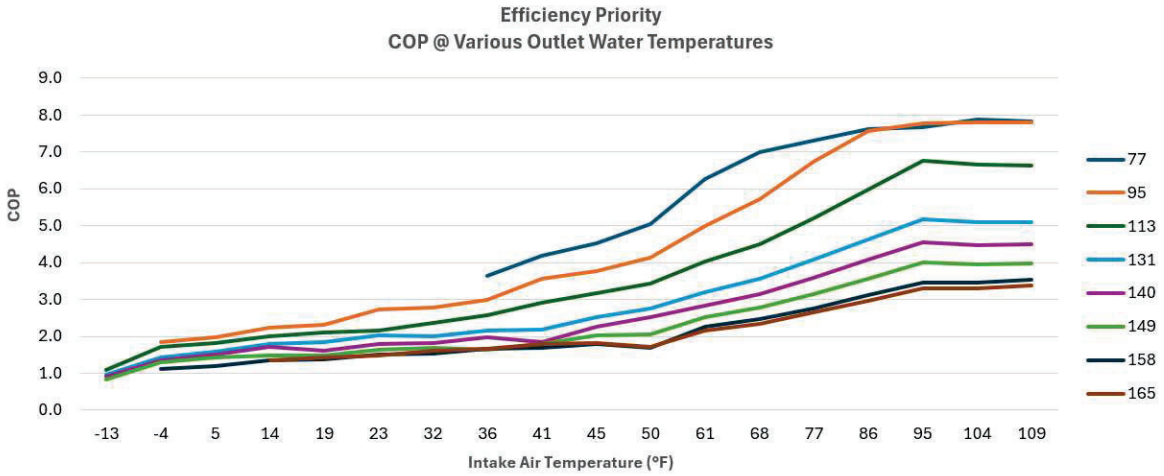
Typical COP – Capacity Priority (DATA BOOK Values)



Note: Defrost not included

MITSUBISHI ELECTRIC TRANE HVAC US

Typical COP – Efficiency Priority (DATA BOOK Values)



Note: Defrost not included

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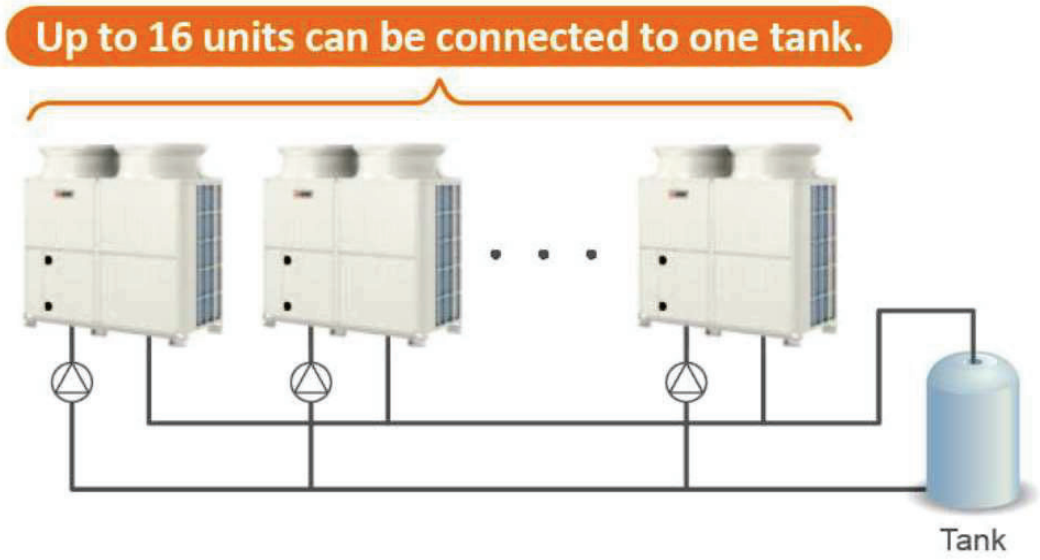
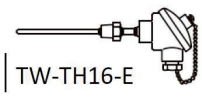
Grouping CAHV Units



MITSUBISHI ELECTRIC TRANE HVAC US

Multi Unit Temperature Control

- **Requires TW-TH16-E Accessory in main water pipe when using group control**



- In case multiple unit system, water temp control is based on TW-TH16-E.
- CAHV software enables the multiple unit control (Up to 16 units)
- No additional control box is required to do this
- **Main unit** decide target outlet temp. of each subunit and number of unit to operate to achieve the target outlet temp.
- **Each unit** increases or decreases the compressor frequency based on the difference between the preset and the current water temperatures.

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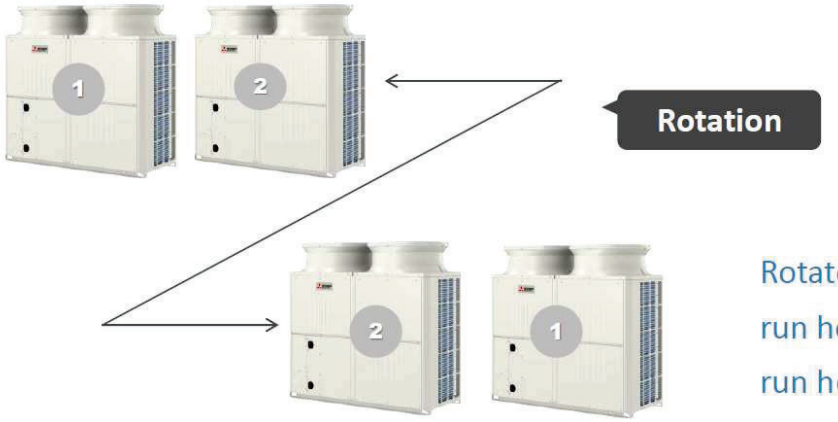
CAHV Rotation Function



Rotate is based on compressor run hours. Unit with the least run hours turn ON first.

MITSUBISHI ELECTRIC TRANE HVAC US

Remote Controller

Individual remote controller

•PAR-W31MAA

PAR-W31MAA offers an easy-to-see full-dot and backlit LCD display. Basic operations, such as ON/OFF, mode switching, water temperature setting and schedule setting, can be performed. Up to 16 units can be controlled with one remote controller.

Major functions

Operation/ setting	ON/OFF
	Hot water/Heating/HeatingECO/Anti-freeze
	Snow/regular
	Demand
	Scheduled operation (daily/weekly)
Display	Operation mode
	Current water temperature
	Error code

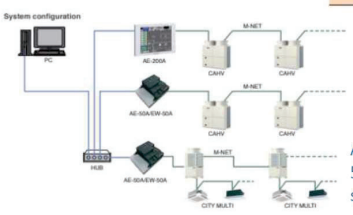
Centralized remote controller

•AE-200A / AE-50A / EW-50A

The CAHV-R136YAU(-BS) is connectable to the AE-200E that centrally controls up to 50 units or 50 systems connected via M-NET.

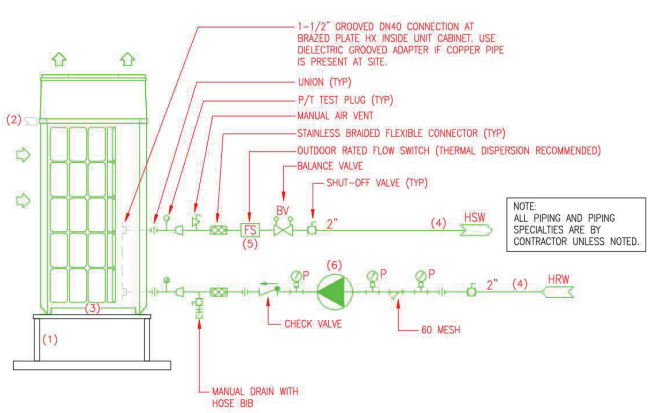
Major functions

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

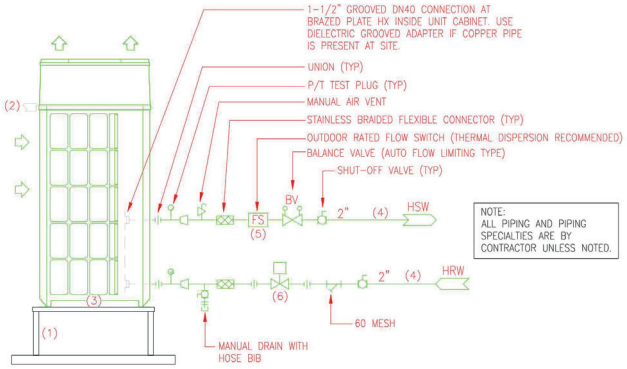


AE-C400A/EW-C50A and AE-200A/AE-50A/EW-50A cannot be in the same system.

Wiring Diagrams w/ CAD Details



Tertiary Pump



Two Position Valves

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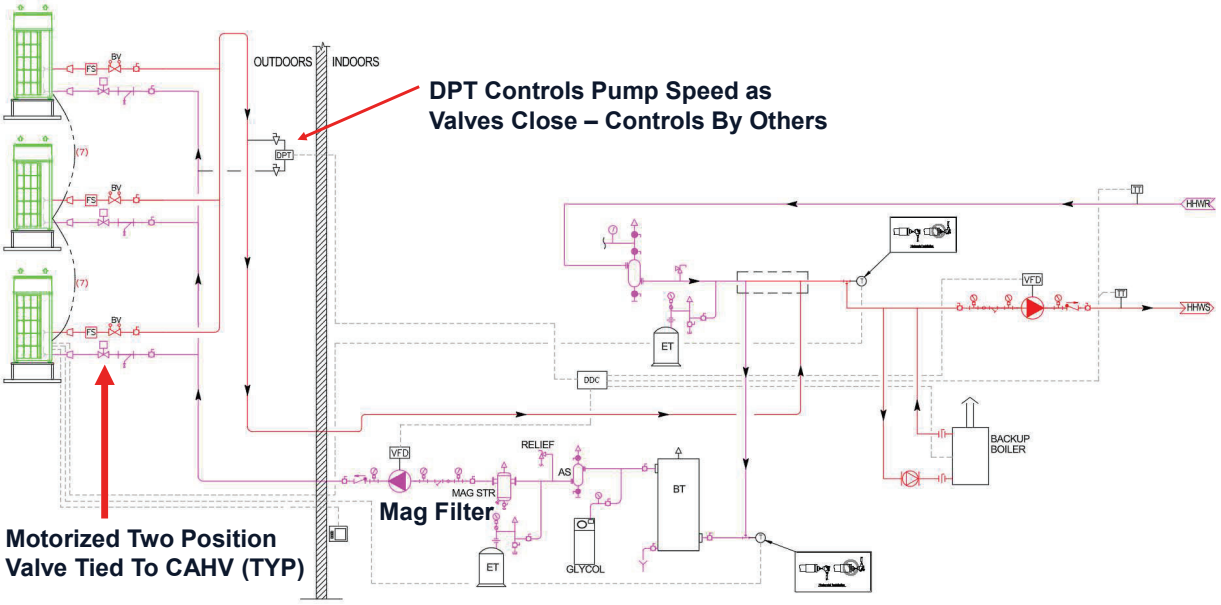
Grouped Systems Scaling – Reduced Pump Quantity



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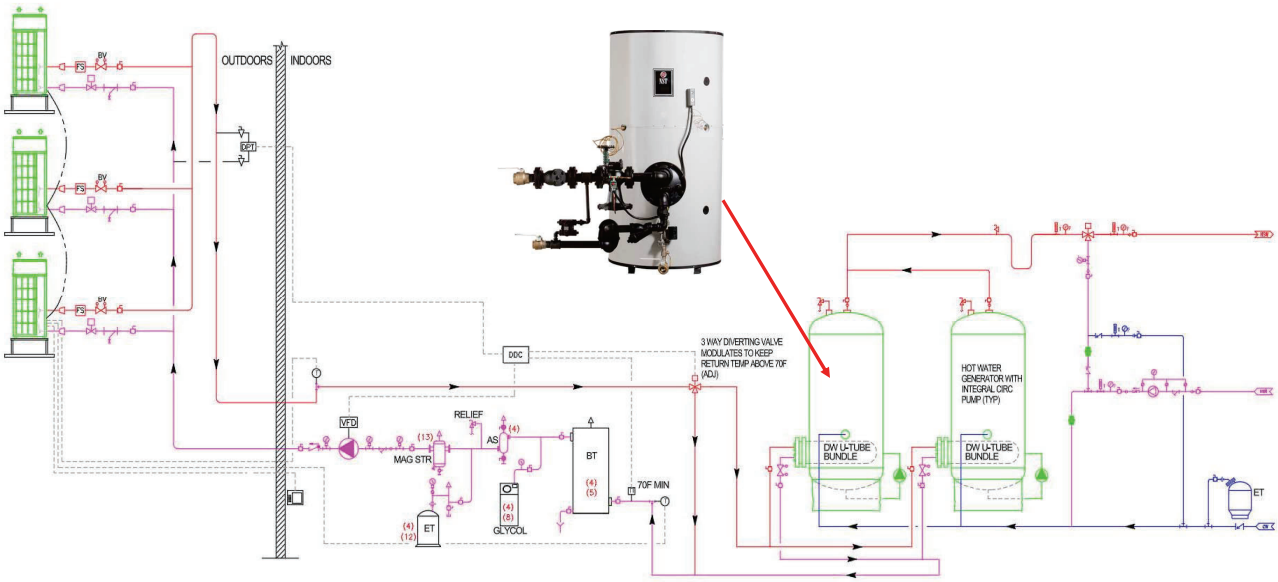
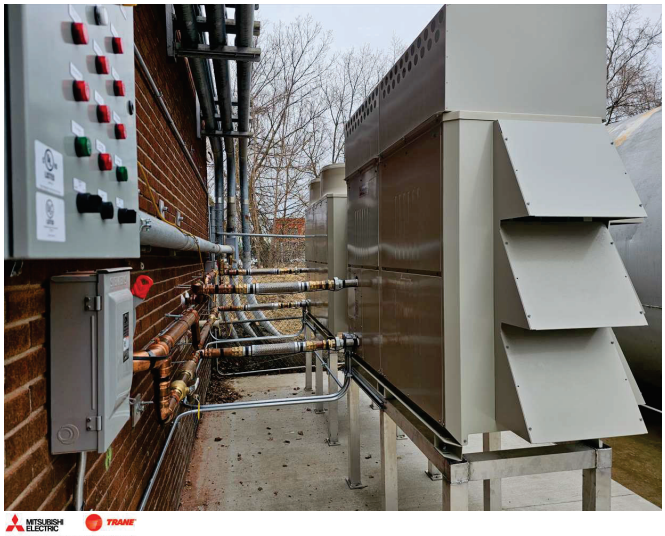
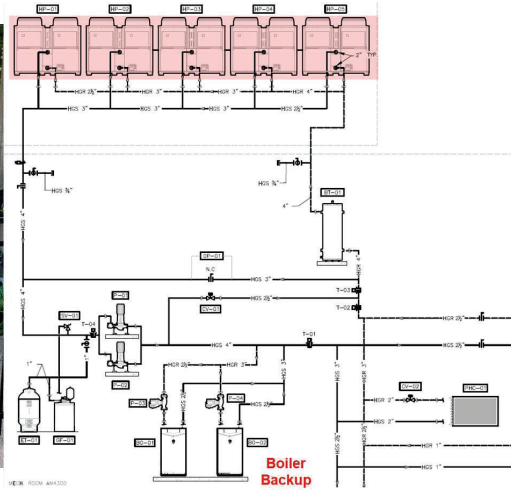
Hot Water Heat (Multi-Pass)
Double Wall Hot Water U-tube Generator



Example Outdoor Mounting – US Pilot Site (Generator Keep Warm)



Previous Generation – Toronto Zoo (Non UL Models)



MITSUBISHI ELECTRIC TRANE HVAC US

CAHV Target Markets

- Targeted retrofits to offset grid emissions with all electric buildings or emissions from natural gas in electrification driven markets.
- Rual area with scarcity of gas with predominate electric/fuel oil sources.
- Leverage for full electrified new construction where loops and coils in terminal devices/air handlers can be optimized for potentially lower water temperatures than traditional hot water systems and to maximize COP.
- Large advantage for lower temperature loop applications (potential manufacturing low temp processes) where COP is maximized.
- **Boiler Injection replacement/offset for WSHP condenser loops – high COP opportunity.**

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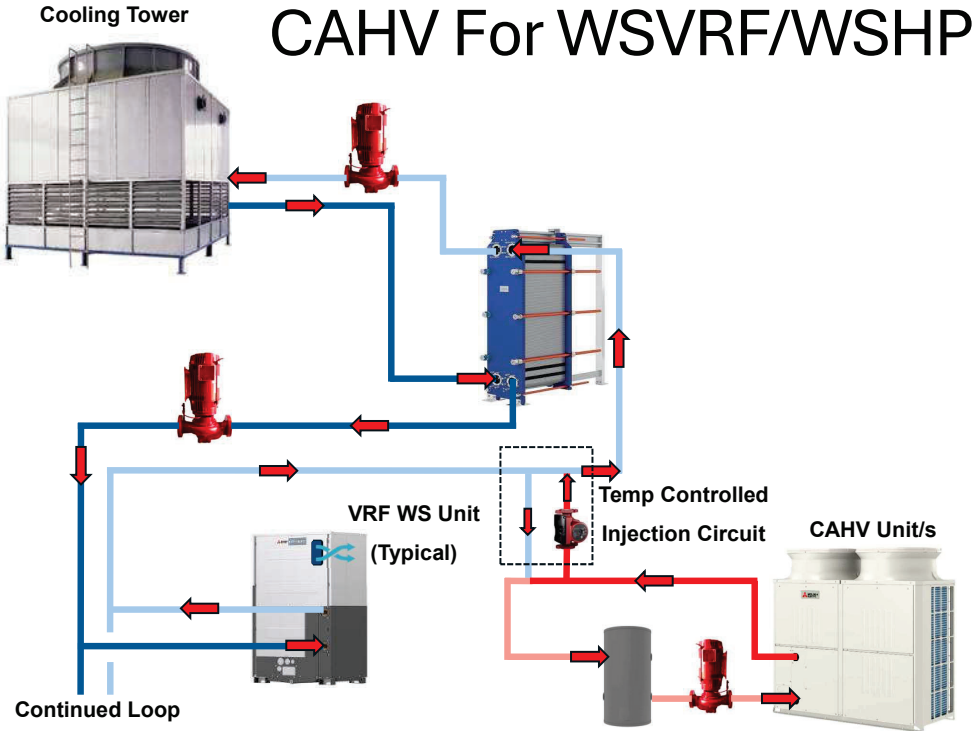
CAHV For WSVRF/WSHP Injection



MITSUBISHI ELECTRIC TRANE HVAC US

Thank You

Advanced Heating and Cooling CO2 Heat Pump

Flow

Environmental Systems Inc

Great Engineering Solution that is Cost Effective

Refrigerants

GWP Phase Down Around the Country and World

Big push for Ultra Low GWP (≤ 10) Refrigerants

HVAC

		Naturals			Synthetic High Pressure			Synthetic Low Pressure				
	Regulation Targets	**R-744 CO2**	R-290 Propane	R-717 Ammonia	R-410A	R-32	R-454B	R-134A	R-513A	R-1234YF	R-1234ZE	R-1233ZD
GWP_{100}	<700	**1**	4	0	1924	677	467	1300	575	1	1	1
ODP	0	**0**	0	0	0	0	0	0	0	0	0	0.00034
Safety Class	A1	**A1**	A3	B2L	A1	A2L	A2L	A1	A1	A2L	A2L	A1
PFAS	No	**No**	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

** GWP is defined by the Intergovernmental Panel on Climate Change (IPCC). There are different edditions. The latest approved is AR5.*

Refrigeration

		Naturals			Industrial and Supermarket						
	Regulation Targets	**R-744 CO2**	R-290 Propane	R-717 Ammonia	R-404A	R-507A	R-407A	R-407C	R-407F	R-448A	R-449A
GWP_{100}	<150	**1**	4	0	3942	2985	1923	1624	1674	1273	1282
ODP	0	**0**	0	0	0	0	0	0	0	0	0
Safety Class	A1	**A1**	A3	B2L	A1	A1	A1	A1	A1	A1	A1
PFAS	No	**No**	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

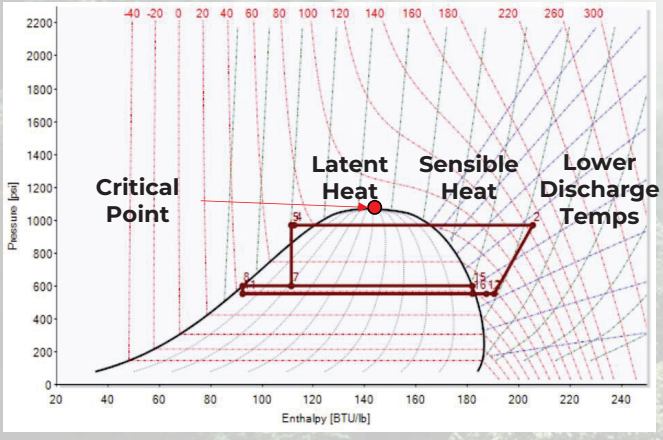
** GWP is defined by the Intergovernmental Panel on Climate Change (IPCC). There are different edditions. The latest approved is AR5.*

Transcritical | **Subcritical**

What is different with a CO2 Heat Pump?

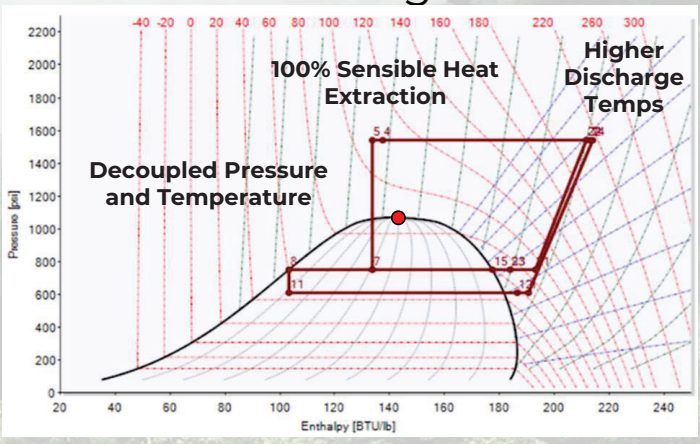
Subcritical

Refrigerant condenses in the condenser



Transcritical

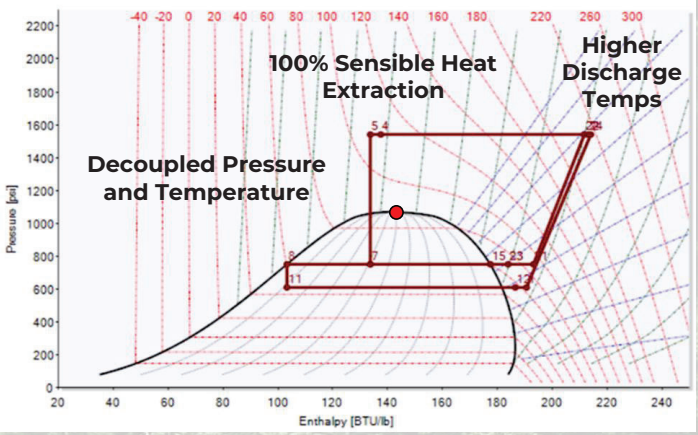
Refrigerant does NOT condense in the gas cooler



Keys to Success with HVAC

- Embrace Transcritical Mode
- Engineer to the Refrigerant
- Develop Flash Gas Strategy
  - Make it an asset
- Controls behave differently than condensing systems
  - Pressure and Temp Independent
- Train and Educate

Transcritical Mode



New Innovations

Seamlessly Transitions Modes

- Cooling Only
- Heating Only
- Simultaneous Heating and Cooling

True Simultaneous Heating and Cooling

- No reversing valves

Massive Operational Range

- -40°F to 120°F ambient outside air temps

High Delivery Temperatures

- Up to 180°F Supply
- High Return Temps
  - WWHP up to 140°F
  - AWHP up to 170°F

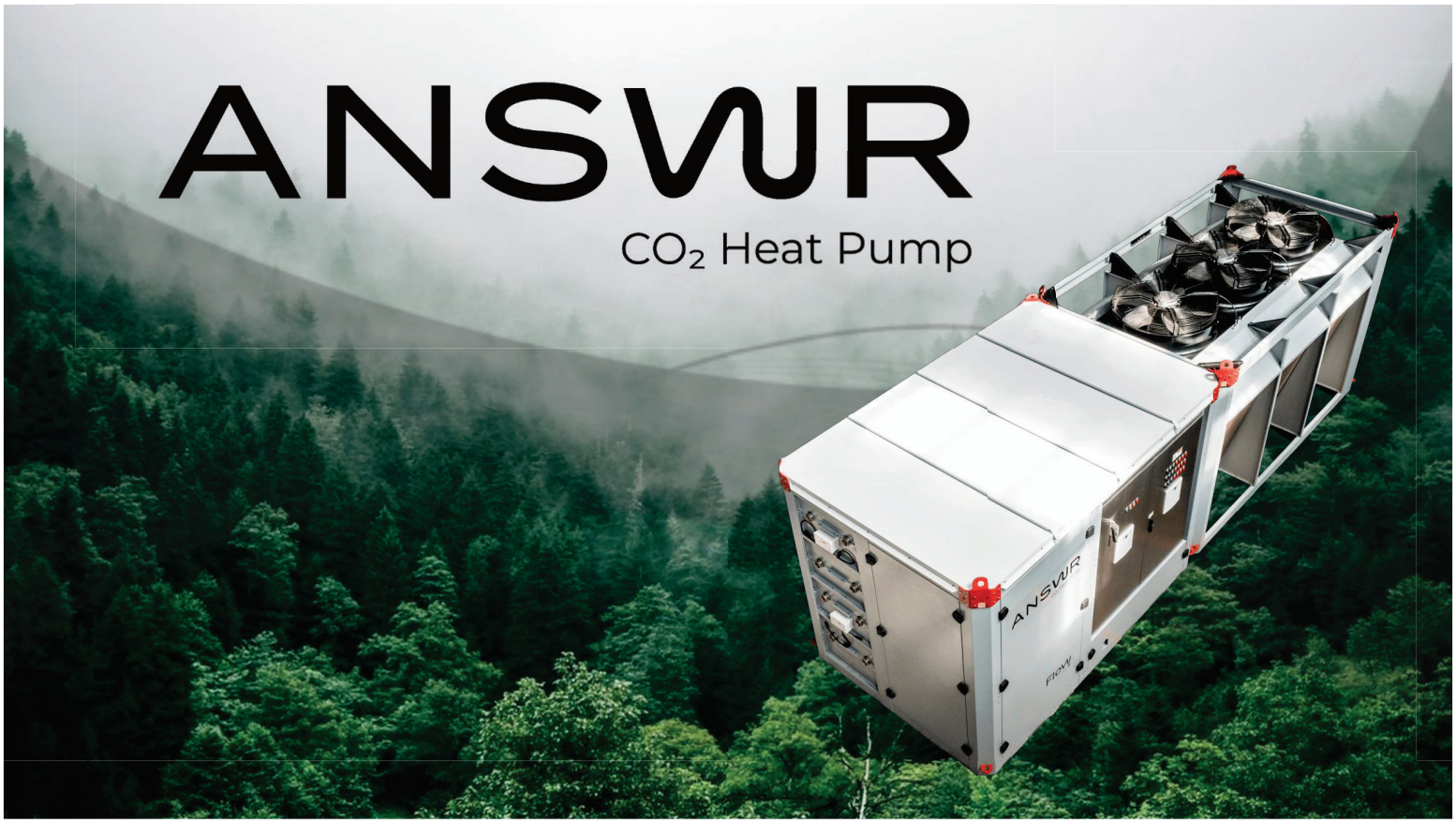
New Frost Mitigation

- Possible to have no defrost derate

Long Splits Possible

- Up to 5 times more than traditional DX

Patented Designs



ANSWR

CO_2 Heat Pump

Air-to-Water and Water-to-Water

HVAC Heating and Cooling

Simultaneous Heating and Cooling

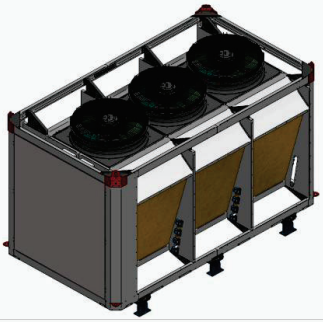
Domestic Hot Water Production

Hot Water Boilers

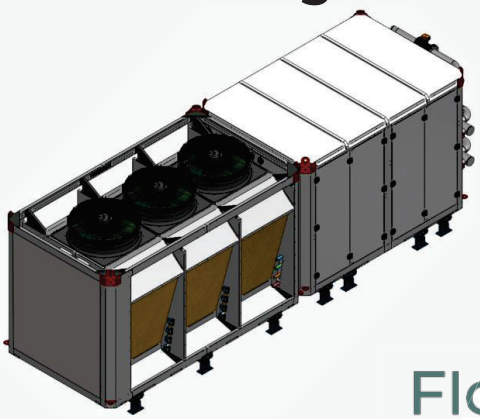
Split System

Heat Pump

Gas Cooler



Packaged

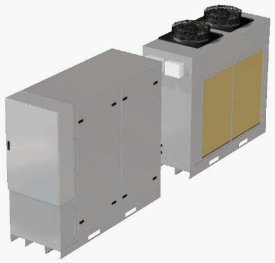


Flow

ANSWR Heat Pumps Are Configurable

Nominal Sizes: 20, 60, 90, 120 Tons

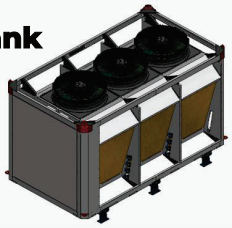
20TR Model
(fits through door and elevator)



Heat Pump(s)

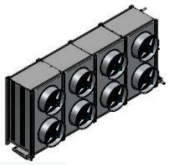
Gas Cooler(s)

V-Bank



Horizontal

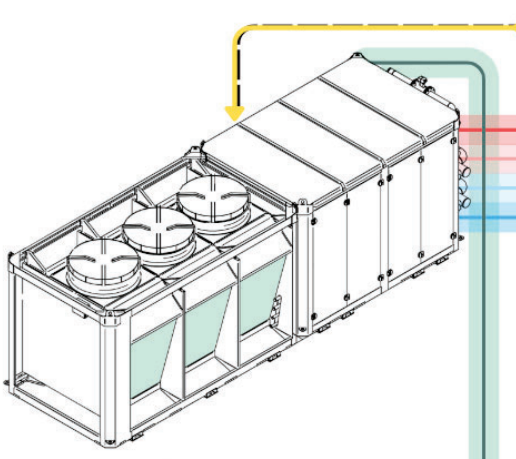
Vertical



Modules are designed for parallel installation

Flow

Multiple Modes of Operation



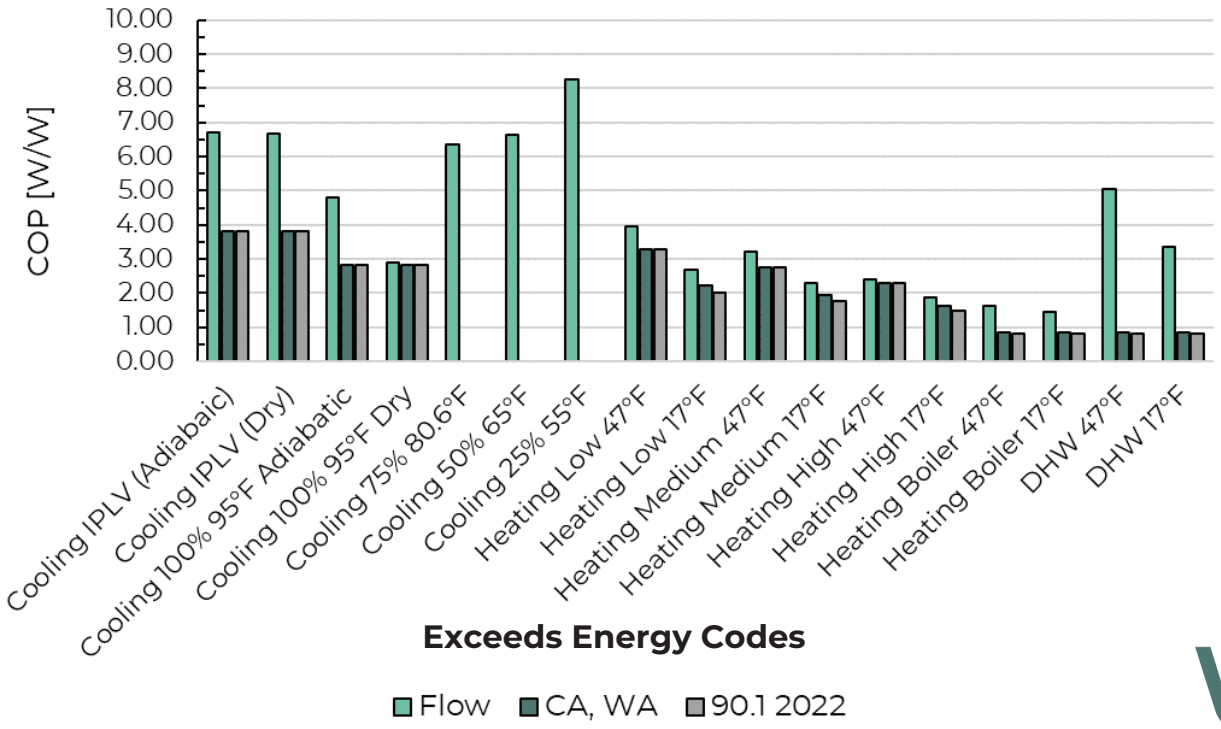
		Supply Temps
TRUE SIMULTANEOUS HEAT + COOL *NO REVERSING VALVE*		
High-Grade Heat	Boilers, Hydronic	90°F to 180°F
Low-Grade Heat or Water Source	AHU, DHW, Radiant, Terminal Units, GEO	90°F to 180°F
Cooling	Chiller, AHU, Radiant, Terminal Units, GEO	*38°F to 75°F
Low-Temp Cooling or Water Source	Dehumid, Low Dewpoint, Cold Chain, WWHP	*38°F to 75°F

*Lower with glycol as low as -20°F

Flow

Air-to-Water Heat Pump

Comparison to Energy Code



Exceeds Energy Codes

Flow CA, WA 90.1 2022

Applications

Multi Family

Institutions

Industrial

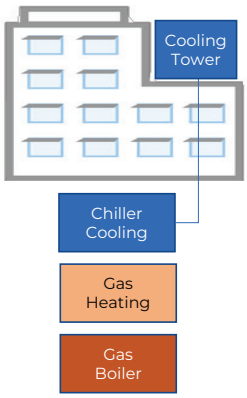
Office

Pharma / Lab

Hospitality

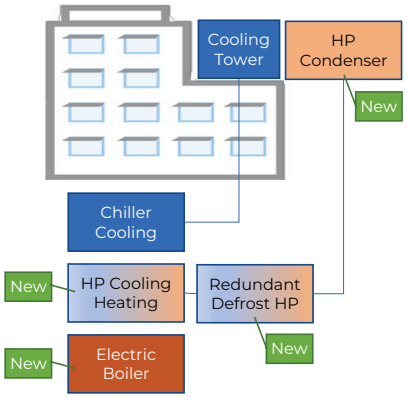
Right Size and Design for the Job

Legacy Systems



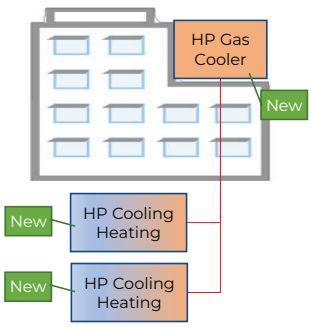
- Many separate systems
- Cooling: Central Chiller with high GWP refrigerant
- Heating: 100% combustible fossil fuel

Synthetic Heat Pumps



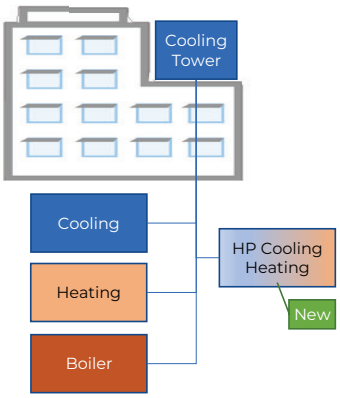
- More equipment
- Cooling: 100% electric central system with high GWP refrigerant
- Heating: HFC/HFO equipment with high GWP's
- Heating Supply Temps >135°F: Electric boiler or booster heat pump

CO2 Heat Pump New Construction



- **Eliminate Redundant Defrost**
- **Eliminate Electric Boiler**
- **Efficient:** 1 power feed, multiple outputs
- **Save Space, less equipment**
- Parallel for **large installations**

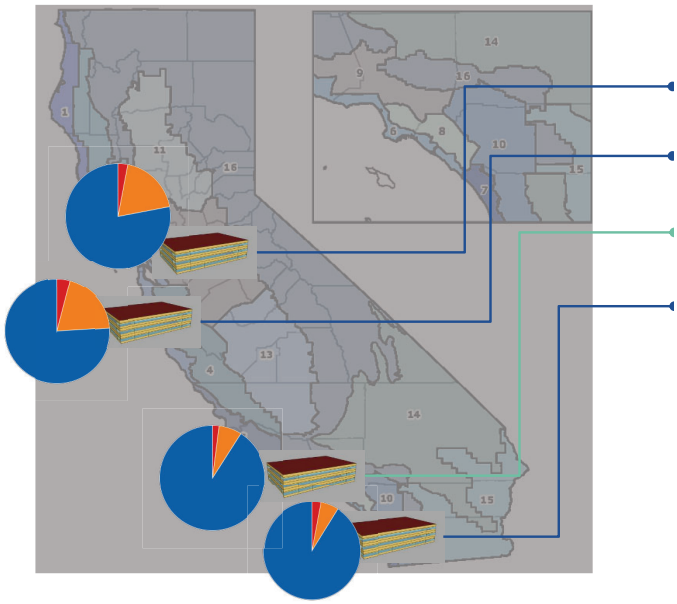
CO2 Heat Pump Retrofit



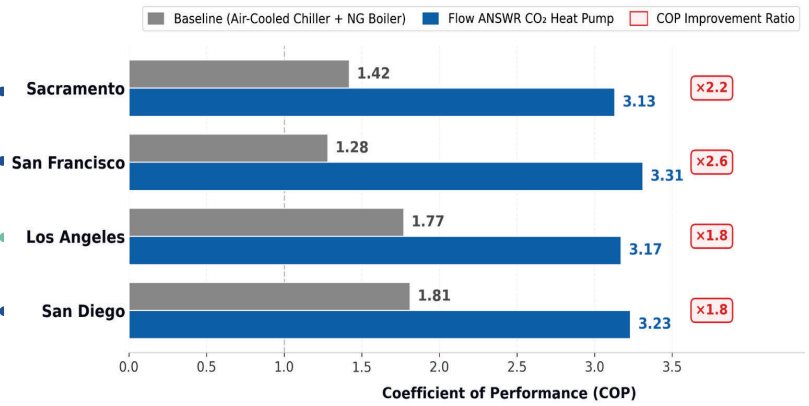
- **No new power feed**
- **Electrify heating, replace chiller**
- **Do not need to change building systems** (pipes, coils, AHU's, etc...)
- **Stage installation**
- **Wide operational range to match load at all OAT**

Modeling Results of HVAC Plant Performance

200,000 sq ft Building

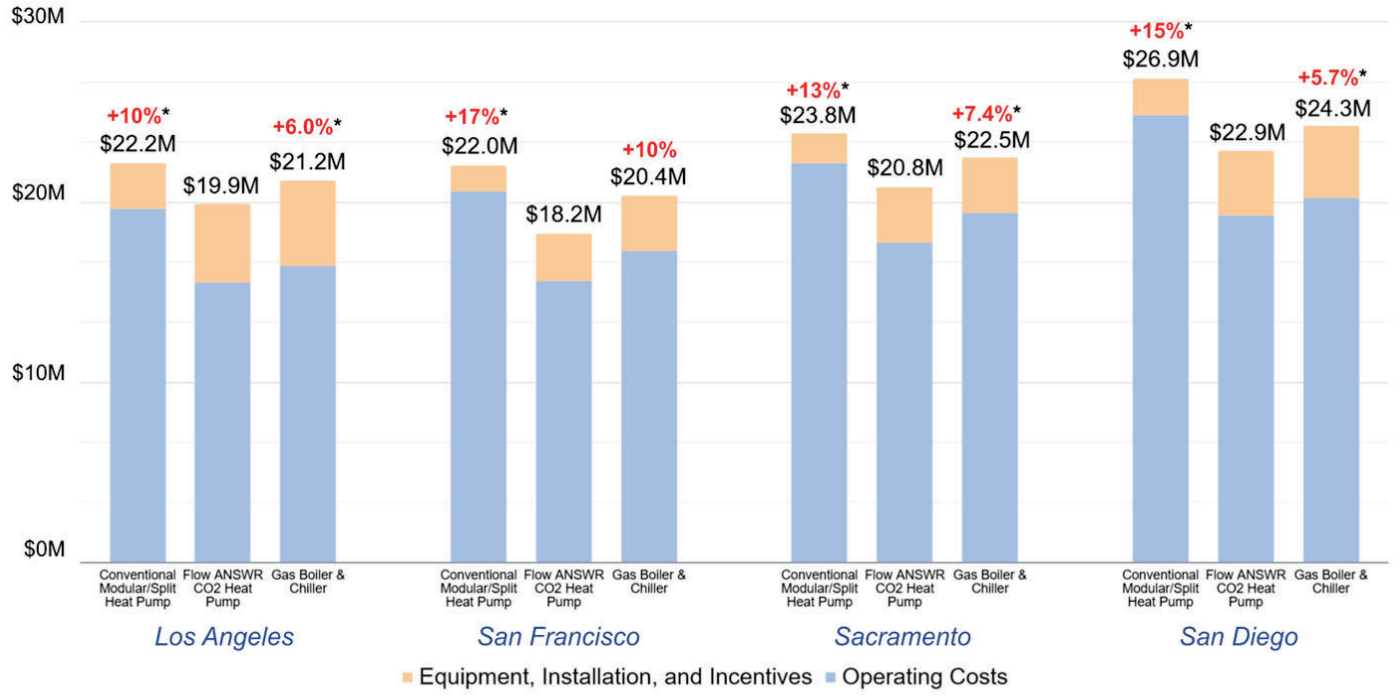


Source: Climate Zone Map of California, CEC



Simultaneous Mode Matters!

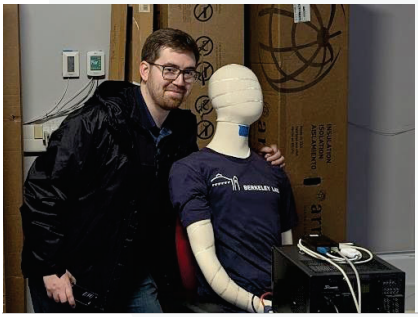
NET PRESENT VALUE (NPV) COST SUMMARY



Due primarily to operational cost savings, Flow's system has a lower NPV, which translates to more available capital for the building owner in this analysis.

BERKELEY LAB

ProspectSV



DMG

Tours & Training

CALIFORNIA ENERGY COMMISSION

Flow


Decarb Training Center
San Jose, CA
ANSWR
Flow


HIGH TEMP HOT WATER HEAT PUMPS
The Empire Technology Prize is focused on groundbreaking solutions to tackle the greatest single source of GHG emissions from New York's tall buildings — heating.
THE CLEAN FIGHT NEW YORK
RMI
EMPIRE TECHNOLOGY PRIZE
NEW YORK STATE
NYSERDA
Supported
WELLS FARGO

Steam Fitters and Pipefitters Local 455
St. Paul, MN

Rogers-based **Flow Environmental Systems** is revolutionizing the way the world heats and cools buildings.

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Nina Axelson
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Congresswoman
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Sean Jarvie
Flow

Jeremy McConkey
Local 455

ANSWR

CO_2 Heat Pump

Contact:
Sales Rep
or
sales@flowenvirosys.com

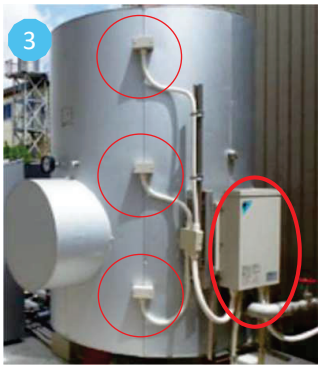
DAIKIN All-Electric Commercial Hot Water Generation system

MEGA·Q

Mega-Q | All-Electric Commercial Hot Water Generation system

Heat Source Unit
- High efficiency inverter air-cooled heat source
- R410A Refrigerant

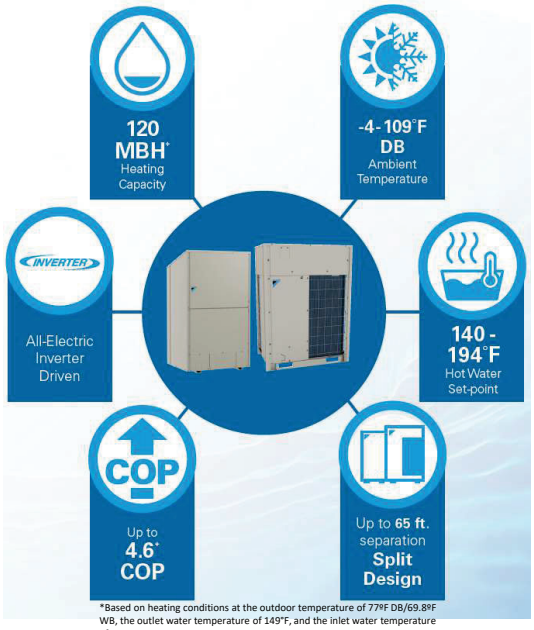
Cascade Unit
- refrigerant-to-refrigerant HX
- refrigerant-to-water HX
- Built-in inverter water pump
- R-134A refrigerant



Tank Controller Kit
- Connects to the hot water storage tank using three water temperature sensors
- Controls up to 6 Mega-Q systems on the same hydronic loop

DAIKIN

Mega-Q | Features & Benefits



*Based on heating conditions at the outdoor temperature of 77ºF DB/69.8ºF WB, the outlet water temperature of 149°F, and the inlet water temperature of 75.2ºF.

- All-Electric Heat Pump Technology for Hot Water Generation
- 120,000 Btu/h (10 Ton) system. Scalable and modular system design allows for up to 6 Daikin Mega-Q systems to connect to the same hydronic loop, achieving total nominal capacity of 720 MBH.
- Dependable hot water generation at ambient temperatures from -4F DB to 109F DB (from -20C DB to 43C DB)
- Customizable high-leaving water temperatures from 140F to 194F (from 60C to 90C) with inlet water temperatures from 41F to 176F (from 5C to 80C).
- Year-round high efficiencies with up to 4.6 COP thanks to Daikin's inverter heat pump and cascade technologies
- Flexible application design with a separation of up to 65 ft. between the heat source unit and the cascade unit.
- Built-in variable-speed water pump increases waterside system efficiencies compared to single-speed pumps and can handle water flow rates of up to 3.8 gallons per minute (GPM).

DAIKIN

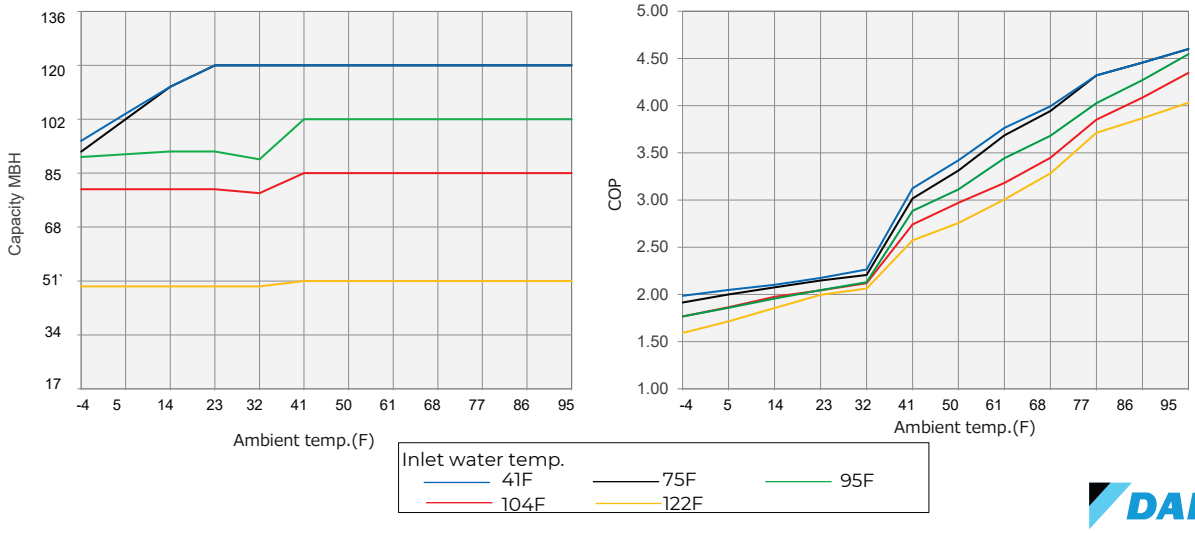
Mega-Q | General Specifications

Nominal Capacity MBH	10 Ton
Capacity @14F	94%*
Capacity @5F	87%*
Ambient Temp Range (DB)	-4F to 109F
Leaving Water Temp Range	140 to 194F
Inlet Water Temp Range	41 to 176F
Control Method	LWT
Integral Inverter Water Pump – Water Flow Rate	3.78 GPM
Max Water Pressure	72.5psi
Sound Pressure	<60dBA
Max Ref. Pipe Length	65ft
*based on 41F EWT, 149F LWT	

DAIKIN

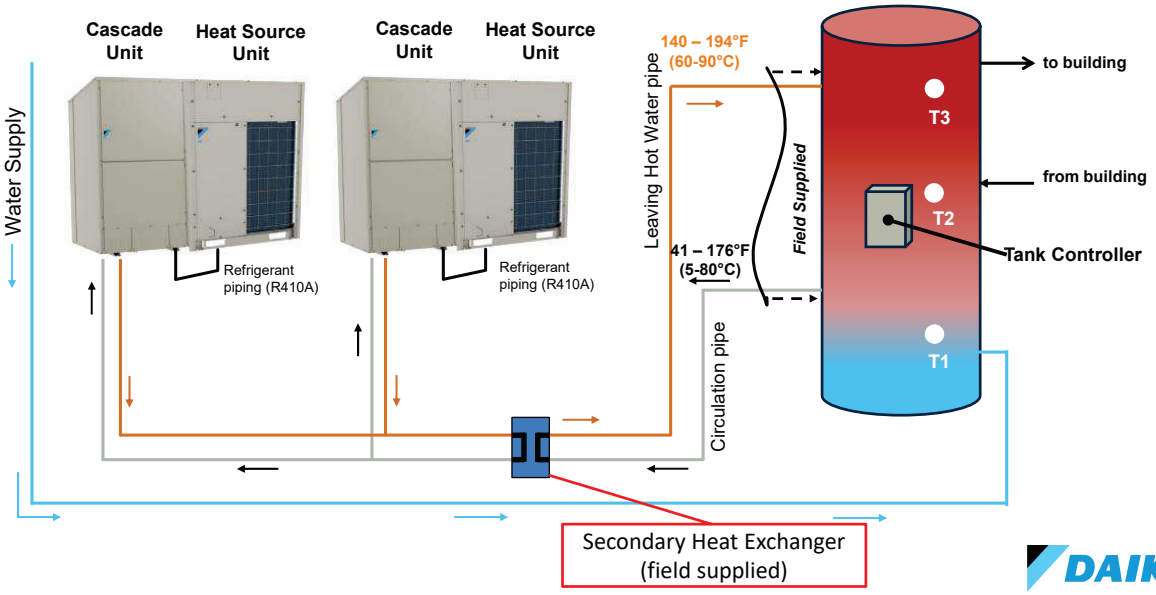
Mega-Q | Performance

- Capacity & COP when the outlet water temperature is 149F
- COPs of up to 4.6 and capacities of up to 87% @ 5F



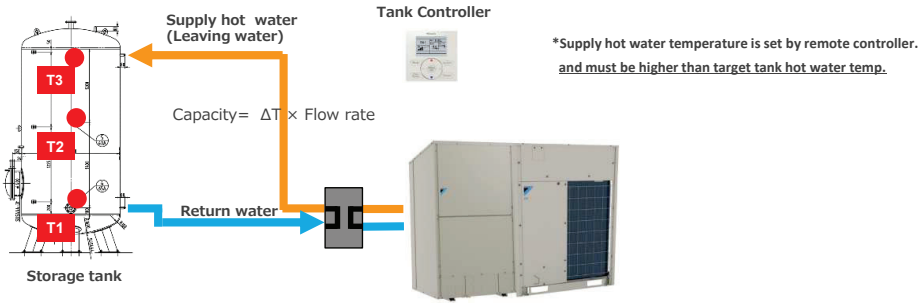
Mega-Q | System Layout

⚠ ***Note: Hot water generated by Daikin Mega-Q is non-potable.***



Mega-Q | System Control

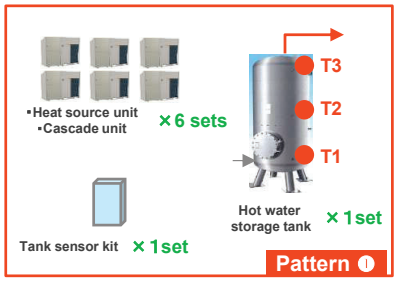
- The target MEGA Q supply water temperature is set by the remote controller
- Tank controller monitors the hot water storage tank via **three water temperature sensors**



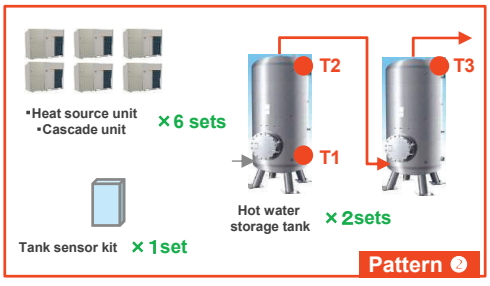
- During operation, the required Mega Q hot water supply capacity is determined by the difference between the **return water temperature, the set leaving water temperature. and the water flow rate**.

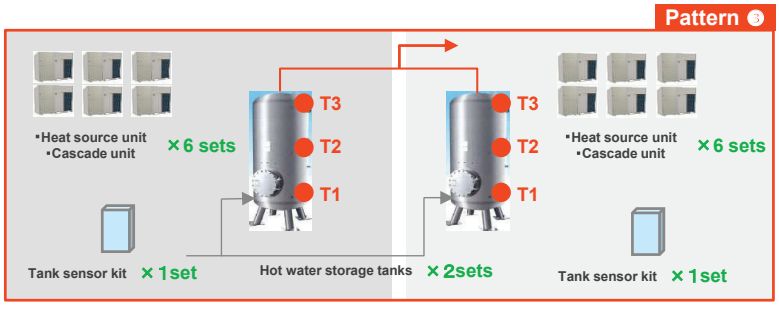
DAIKIN

Mega-Q | System Configurations



- The heat pump hot water unit can be configured from 1 to 6 units according to the amount of hot water used.
- Tanks can be configured as a single tank, in series, or in parallel.





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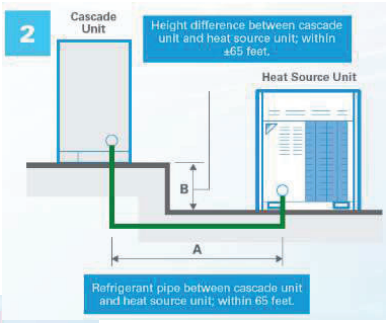
Mega-Q | Installation patterns

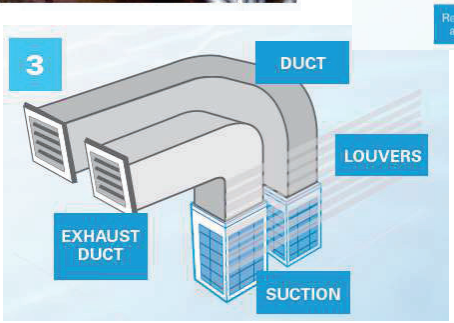
1. The heat source unit & cascade unit installed **outside side by side**

2. The cascade unit can be installed up to **65 ft away** from the heat source unit, with the option to place it **indoors**

3. Both the heat source unit & cascade unit **installed indoors**.

   Note that the heat source unit would need to be **ducted to the outside**





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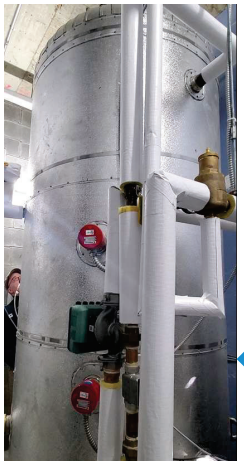
Mega-Q | Split System Design

Tank - Indoors



Cascade - Indoors

Heat Source - Outdoors

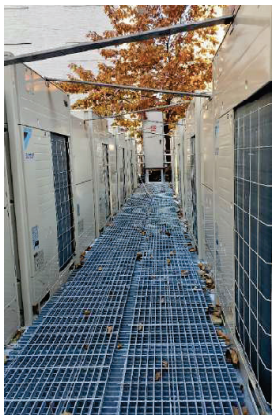
Refrigerant piping

Hydronic Piping

DAIKIN

Mega-Q | Consolidated System Design

Heat Source + Cascade Outdoors



Hydronic Piping

Tank - Outdoors

Mega-Q | Electrical Wiring

Model name	Phase and frequency	Voltage	Minimum circuit amp.	Maximum overcurrent protective device	Communcation line selection
Heat Source unit RXHWQ120MQTJ*	Ø3,60 Hz	208/230 V	55.1A	60A	AWG18 - AWG16
Cascade unit BWLP120TJU	Ø3,60 Hz	208/230 V	43A	50A	AWG18 - AWG16

Mega-Q | Proven Technology

- Over 10 years of success in overseas markets
- Now adapted for North America
- Integrated with US-made heat source units

Thank you!

Edwin Reek
Director, Water Heating Solutions

DAIKIN COMFORT TECHNOLOGIES NORTH AMERICA, INC.
M: (281) 841-9192 | **E:** edwin.reek@daikincomfort.com