HEAT 2O™

TRANE®

MITSUBISHI ELECTRIC

The Future of Commercial Hot Water Heating

Table of Contents

Commercial hot water heating for the future

Domestic hot water accounts for roughly 25% of annual energy usage in typical multifamily buildings[1] and 25% in both passive house[2] and new, multifamily construction[3]. This energy expenditure is costly for building owners and comes at a significant environmental impact in the form of greenhouse gas emissions and climate change.

Until recently, the building industry lacked an energy-efficient solution to providing high volume domestic hot water (DHW) for commercial spaces. In response to this need, we're pleased to introduce the $Heat_2O$™ Hot Water Heat Pump, a revolution in sustainable water heating.

Introducing Heat2O

$Heat_2O$ is an all-electric heat pump water heater designed to produce high volume DHW for commercial facilities in any climate. Energy-efficient and environmentally friendly, $Heat_2O$ uses a natural CO_2 refrigerant with a global warming potential (GWP) of one and an ozone depletion potential (ODP) of zero.

As an engineered solution with manufacturer-level technical support, $Heat_2O$ is fully customizable to best meet the design considerations and priorities of a broad array of application types. This technology can help multifamily buildings, offices, gyms, educational institutions and other large-scale and commercial facilities qualify for sustainability certifications or achieve zero-energy and passive house status. The system's environmentally conscious engineering also translates to energy savings for building owners, who experience reduced operating costs while their tenants and occupants enjoy reliable hot water.

These benefits can be enjoyed regardless of location. Climate zone is not a limiting factor for this innovation, as $Heat_2O$'s high-performance design allows the system to operate at high capacity even in cold climates. Buildings from the hot American Southwest to snowy New England can experience high performance and energy savings with $Heat_2O$, all while minimizing their carbon footprint.

1 U.S. Energy Informational Administration
2 Passive House Institute US
3 Bonneville Power Administration

$Heat_2O$™ and heat pump basics

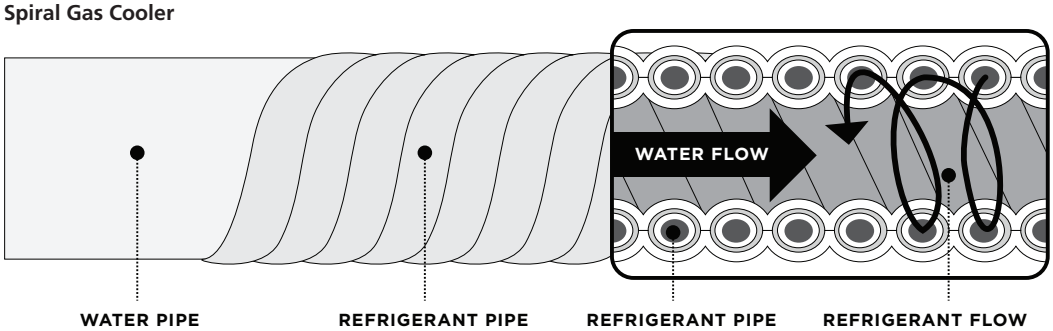
DHW heat pump water heaters transfer ambient thermal energy from outdoor air to potable water by cycling refrigerant. Natural CO_2 refrigerant enables $Heat_2O$ to supply hot water up to 176° F even in low ambient conditions. The heat pump's fan pulls outdoor air across an evaporator coil where liquid refrigerant absorbs heat as it changes to a low-pressure gas. With the refrigerant carrying heat captured without burning fossil fuels, the heat pump's compressor pressurizes the gas raising the temperature and transfers the refrigerant to a gas cooler. The gas cooler then transfers heat from the superheated refrigerant gas to the incoming city water. This is accomplished without the use of fossil fuels reducing the carbon footprint associated with water heating.

$Heat_2O$ uses a Twisted Spiral Gas Cooler unique to Mitsubishi Electric. This patented technology achieves highly efficient heat exchange with three refrigerant lines wrapped around a twisted water pipe. The refrigerant flows in the opposite direction of the water. Running the refrigerant lines along the pipe's grooves increases the heat conductive area while the spiral helps create a vortex in the pipe, accelerating the turbulence effect of water and reducing pressure loss in the heat exchanger. Additionally, the copper pipes make for double-walled construction.

An INVERTER scroll compressor further increases $Heat_2O$'s energy efficiency by enabling the system to modulate the refrigerant flow and heating capacity to match loads. Variable capacity gives the system greater control over energy use than fixed-capacity hot water heat pumps.

Using these methods, $Heat_2O$ offers a coefficient of performance (COP) of up to 4.52, meaning it can provide over four times more energy as heat than it consumes in electricity. Compared to electric-resistance water heaters, $Heat_2O$ offers energy savings of 60 to 70% for building owners and tenants. Combined with incentives from utilities, energy savings can ultimately offset first costs.

Patented Twisted Spiral Gas Cooler



Cold-climate performance and scalability

Flash injection circuit

$Heat_2O$ continues to deliver 100% heating capacity at ambient temperatures of 36° F and can supply 176° F hot water at temperatures as low as -13° F. This performance is achieved through flash-injection technology. In extreme cold, $Heat_2O$'s compressor operates at speeds much higher than usual to maintain discharge pressure and keep the evaporator's refrigerant cool enough to capture ambient heat. The injection circuit supplies a small amount of mixed-phase refrigerant to the compressor through a specially designed port, ensuring stable operation at high speeds. With $Heat_2O$, even building owners in climate zones 5 and 6 can increase sustainability while reducing energy costs for high-volume DHW.

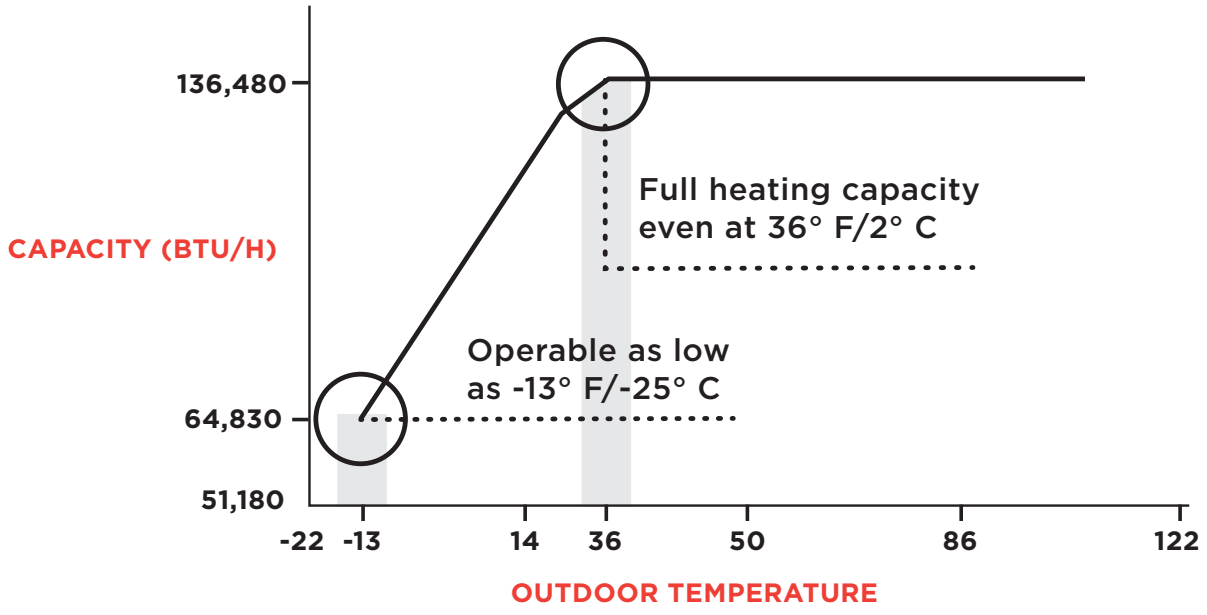
Performance:

- 100% water heating capacity of 40 kW at ambient temperatures as low as 36° F
- 50% water heating capacity at ambient temperatures as low as -13° F (176° F water temperature)

Scalability

$Heat_2O$ can provide highly efficient DHW for most commercial buildings, including large-scale facilities. Using Mitsubishi Electric's unique Mitsubishi Network (M-NET) communication protocol, the system can be scaled, connecting up to 16 $Heat_2O$ units together. While nominal system capacity is 40 kW (136,484 BTU/H), M-NET allows all units to communicate with one another, enabling cascade operation and a combined total capacity of 2,183,770 BTU/H (640 kW). Units run at the same compressor frequency to achieve a stable leaving water temperature set point. This level of performance is ideal for applications requiring high volumes of hot water on-demand, including universities, hotels and other large facilities.

Heating Capacity



System design

Optimal performance and cost benefits for all-electric heat pumps require proper design, installation and commissioning. This starts with cooperation and information exchange among project team members, including the developer or building owner who will decide whether the facility will participate in utility demand-response programs. Designers must understand the building's demand profile, inclusive of the gallons per hour, duration and timing associated with peak loads and off-peak loads. The system's storage capacity is based on how often the system will run. Additionally, designers account for climate and may make provisions for snow, rain, wind and marine salt.

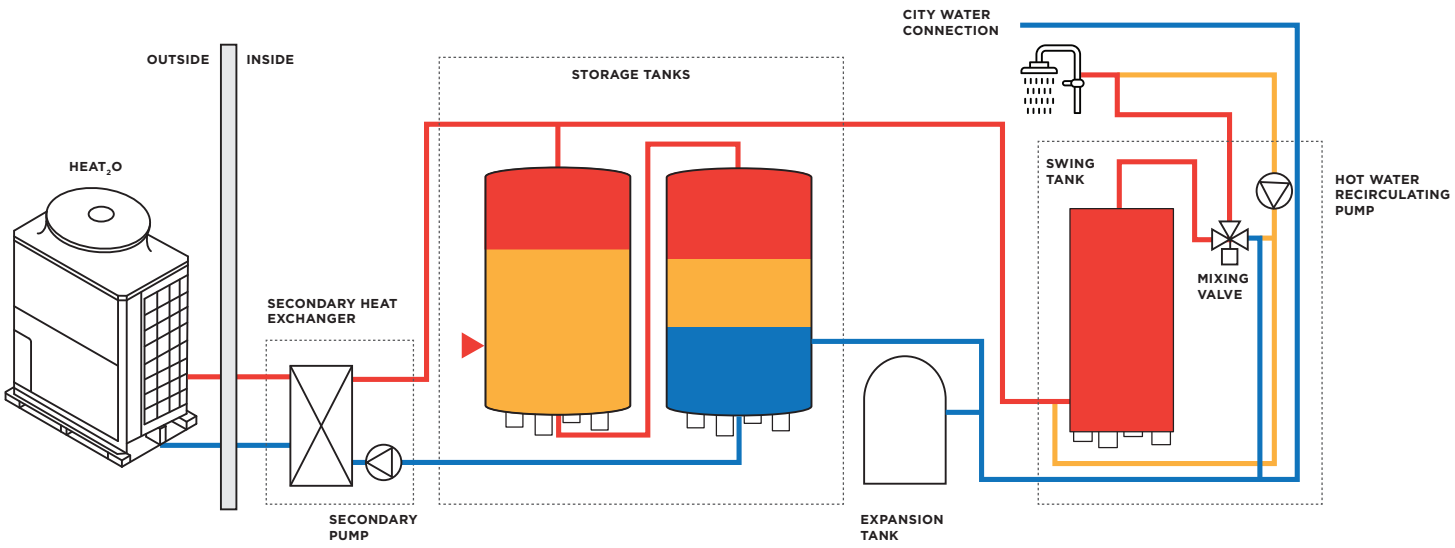
The $Heat_2O$ project team typically includes plumbing engineers, electrical engineers and control engineers. Each trade and discipline should be involved in the earliest stages of the project. The team will also include Trane®/Mitsubishi Electric employees responsible for the startup and commissioning of each $Heat_2O$ system.

Design for hot water recirculation

$Heat_2O$ designs account for hot water recirculation by separating DHW loads. The heat pump water heater handles the difference between the inlet city water temperature and the leaving temperature. The recommended inlet temperature range is 41° F to 145° F, but a high Delta T between inlet and outlet temperatures provides optimal efficiency.

The building's recirculated water is warmer than inlet city water and is often outside the optimal temperature range recommended for the heat pump. To avoid derating and ensure the availability of hot water, $Heat_2O$ designs include a primary storage tank and a swing tank. $Heat_2O$ conditions the cool incoming city water at the bottom of the primary storage tank while the hot water moves to the top, maintaining temperature stratification. During hot water production, the system can feed high-temperature water to the swing tank, which also mixes with warm recirculation water. Water within the swing tank is maintained within a specified temperature range, for example 125° F to 150° F. The $Heat_2O$ swing tank includes a control panel with three electric heating elements for temperature maintenance.

Typical Systems Schematic



Installation requirements and maintenance

Heat$_2$O is typically installed outdoors with common considerations for airflow, space, structural support, acoustics and service access common to heat pumps. Each Heat$_2$O unit must be individually wired to its own dedicated power supply and have one-foot minimum clearance for air intakes. Installation of cold-water inlet and hot-water outlet piping is straightforward.

Maintenance

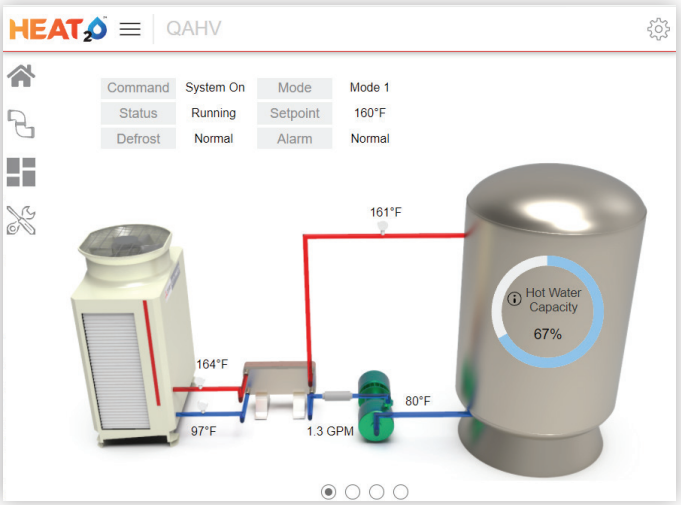
Maintenance primarily consists of maintaining cleanliness. Install a strainer near the Heat$_2$O unit to keep foreign materials from entering the water-side heat exchanger. Clean the external heat exchanger, clean strainers periodically and ensure the internal heat exchanger and secondary heat exchanger are free of scaling and debris.

Heat$_2$O at a glance

- Height: 72.5"
- Width: 48"
- Depth: 30"
- Weight: 882 lbs
- Electrical: 208/230V
- Sound: 60 dB(A), no louder than a conversation

Improved installation quality

As a custom solution, Heat$_2$O includes a complement of parts designed and selected to ensure optimal performance of the heat pump. Using pre-approved parts help control the quality of installations and streamlines the work with pre-assembled and pre-plumbed components.



Hot water storage tanks

Primary storage tank: Includes 6 thermistor locations for more precise measurement of water temperatures compared to most storage tanks, which typically have one thermistor.

- Sizes: 175 gallons, 285 gallons, 500 gallons

Swing tank: Includes electric-resistance elements for the ability to maintain specific temperatures in the swing tank and can provide up to 100% backup capacity for the heat pump.

- Sizes: 150 gallons (with 45 kW electric-resistance element) and 200 gallons (54 kW electric-resistance element)

Secondary heat exchanger: Creates a closed loop to protect Heat$_2$O from scaling and corrosion from city water, reducing maintenance requirements.

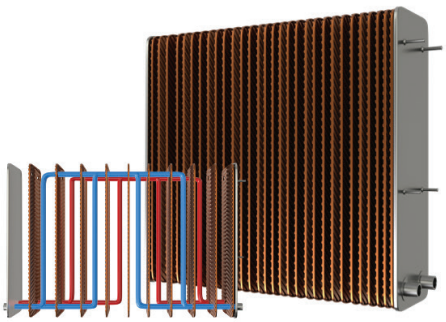
Variable-speed secondary circuit pumps: Varies capacity on secondary circuit according to demand. The speed is controlled using a 0 to 10V signal from the Heat$_2$O units.

Heat$_2$O Components and Tanks

EXTERNAL COMPRESSOR

STORAGE TANKS

SWING TANK

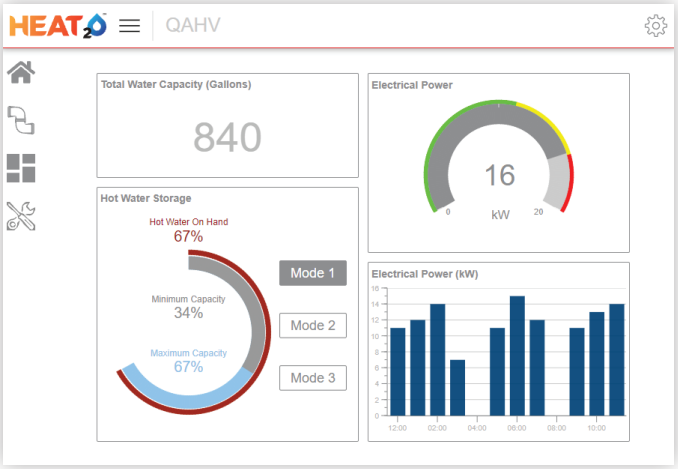


HEAT EXCHANGER

Controls and benefits for utilities

Comprehensive control for efficient operation

A pre-engineered controls package is available to further enhance Heat$_2$O's operation and efficiency. This package seamlessly integrates the heat pumps, tanks, pumps, valves and sensors to monitor and control the system. No additional programming or licenses are required to add the controls to the hardware. An interactive setup guide makes the startup and commissioning process intuitive and easy to follow. Local users can monitor and control operation, modes, set points and tank capacities with the touch screen display through the site local area network or through BACnet® integration to a building management system (BMS). The built-in Energy Monitoring Capabilities and Demand Response Rebate Program (CTA-2045) enables Heat$_2$O to react to demand-response signals from grid operators. Internet access and increased capabilities are available through connection to the Building Connect+ cloud-based controls platform.



BUILDING CONNECT+

Building Connect+ features:

- On/Off mode, temperature mode control and tank temperature set point
- Start-up wizard
- Maintenance tool data
- Flow diagram
- Energy use dashboard
- Data trending
- Alarm management

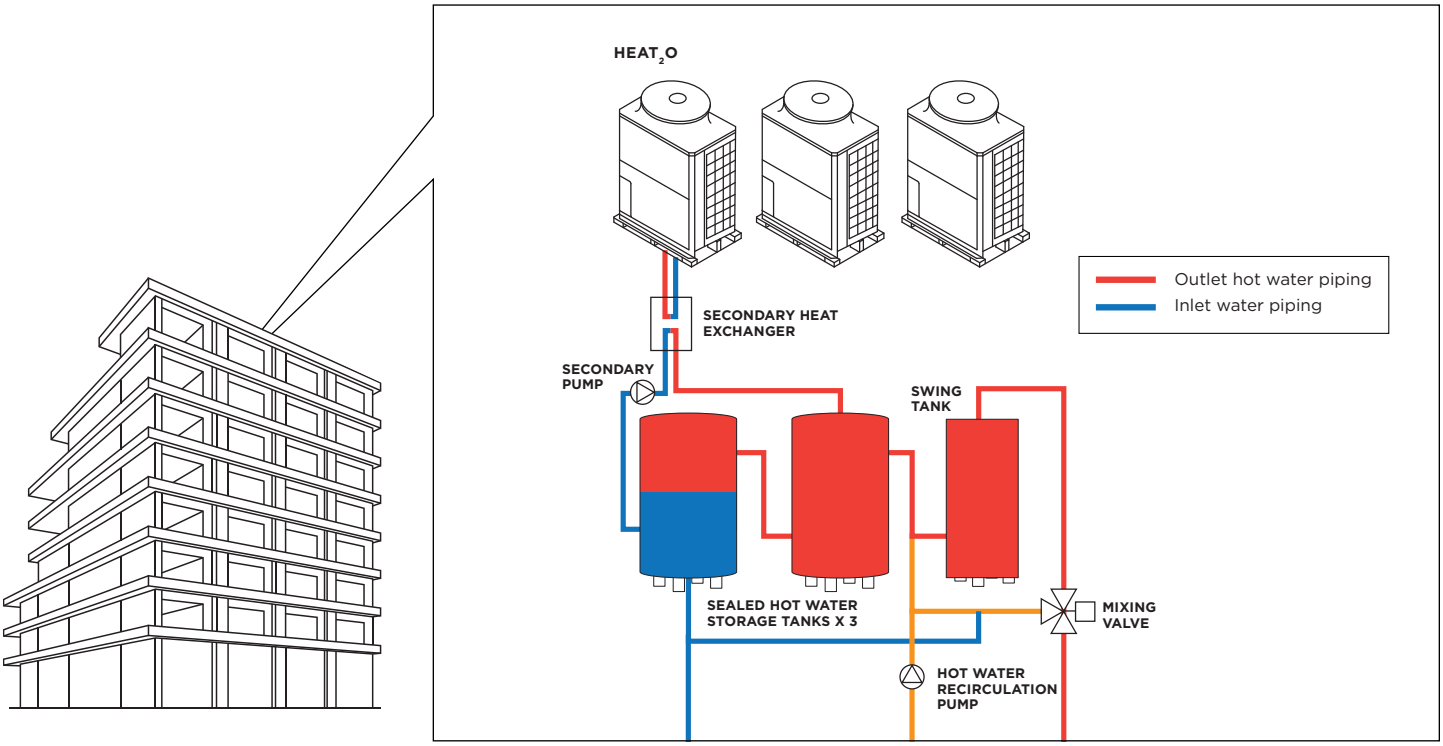
Demand response and utility benefits

During demand-response events, utilities shift energy use to prevent electricity grids from overloading during peak usage times. Building owners can qualify for utility incentives by participating in demand-response programs. Able to send and receive messages defined by the CTA-2045 specification, Heat$_2$O can simplify participation with a utility virtual end node integrated into the system's control panel.

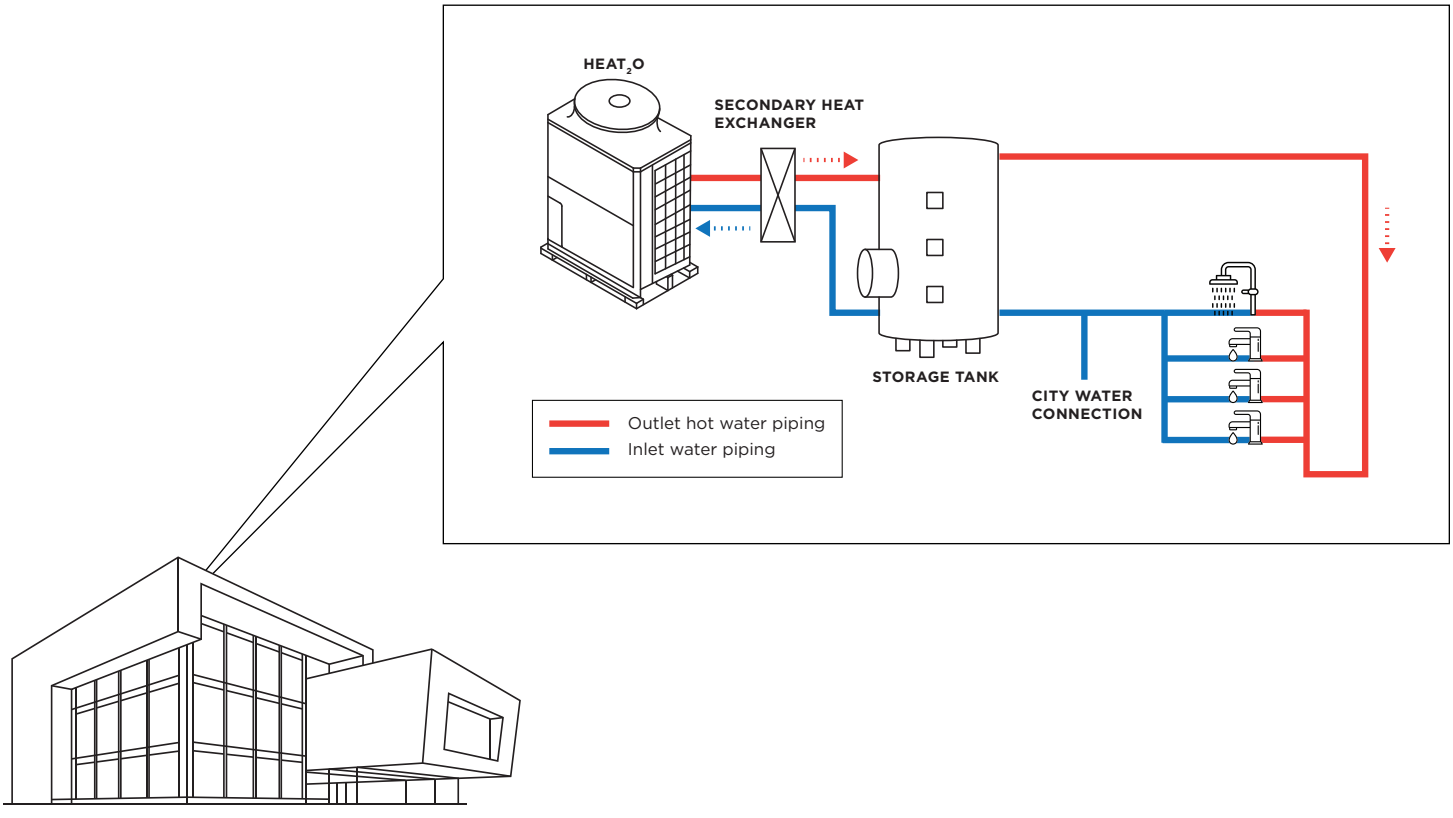
Heat$_2$O units operate at 40 kW in normal mode. In advance of demand-response events, the system can run at 60 kW in capacity mode to fully pre-load tanks with hot water. Once the tanks are depleted, Heat$_2$O can reactivate so building occupants have uninterrupted access to hot water. Primary thermal storage tanks with swing tanks for recirculated water enable the system to handle a higher peak demand.

Applications

Multifamily (Hot Water Recirculation - Swing Tank Required)



Fitness Center (No Hot Water Recirculation - No Swing Tank)



Specifications

QAHV-N136TAU-HPB-(-BS)

Specifications		Model Name
Unit Type		**QAHV-N136TAU-HPB(-BS)**
Nominal Heating Capacity (208/230V)	Btu/h (kW)	136,480 (40)
Guaranteed Operating Range *1	°F (°C)	-13 to 109.4 (-25 to 43)
Outlet Water Tempertaure Range	Primary Circuit only, °F (°C)	120 to 176 (48.9 to 80)
	With secondary HEX, °F (°C)	120 to 158 (48.9 to 70)
Inlet Water Temperature Range	°F (°C)	41 to 145 (5 to 62.7)
External Dimensions (H x W x D)	In. (mm)	72.3 x 48.0 x 29.9 (1837 x 1220 x 760)
Net Weight (Dry)	Lbs. (kg)	868 (394)
Operating Weight	Lbs. (kg)	882 (400)
External Finish		Acrylic painted steel plate <MUNSELL 5Y 8/1 or similar>
Electrical Power Requirements	Voltage, Phase, Hertz	208/230V, 3-Phase, 60Hz
Minimum Circuit Ampacity (MCA)	A	67
Maximum Overcurrent Protection (MOP)	A	110
Recommended Fuse Size	A	70
Short-circuit Current Rating (SCCR)	kA	5
Connection Sizes (Threaded) (In.) 3/4" BSP to NPT adapter included	Cold Water Inlet	3/4 NPT
	Hot Water Outlet	3/4 NPT
Max. Total Line Length	Ft.	196
Vertical Separation - Max Inlet Water Pressure Compared To Tank Pressure	Unit above storage tank, PSIG (Mpa)	Greater than 0 (0)
	Unit below storage tank, PSIG (Mpa)	Less than 72.5 (0.5)
Water Flow Rate Range	GPM	0.79 to 7.9
	L/min	3 to 30
Max. Water Pressure	PSIG	145
Sound Pressure Levels	dB(A)	56
Fan		
Type x Quantity		Propeller fan x 1
Airflow Rate	CFM	7,768
Compressor Operating Range		15% to 100%
Compressor Type x Quantity		Inverter scroll hermetic compressor x 1
Refrigerant		CO2 (R744) 14 lbs. 5 oz (6.5 kg)
Protection Devices	High Pressure	High pres.Sensor & High pres.Switch at 643 PSI (14MPa)
	Inverter Circuit (Comp. / Fan)	Overheat and overcurrent protection
	Fan Motor	Overheat protection
AHRI Ratings	EER	14.01
	COP	4.11

Notes: Unit converter
*1.Under Normal heating conditions at the outdoor temp, 16°CDB/12°CWB(60.8°FDB/53.6°FWB), the outlet water temperature 65°C(149°F), and the inlet water temperature 17°C(62.6°F)
*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 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
*The water circuit must use the closed circuit
*There is a possibility that the unit may abnormally stop when it operates outside its operating range. Provide backup
(ex.boiler start with error display output signal (blue CN511 1-3)) for abnormal stop.

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