Product Data

Aquazone™

Water-to-Water Source Heat Pump

2 to 35 Nominal Tons

NOTE: 50PSW unit shown with special order unit mounted controller.

50PSW025-420 Water Source Heat Pump
with Puron® Refrigerant (R-410A)

Features/Benefits

Carrier's Aquazone™ WSHPs are a flexible, clean solution for tempering ventilation air or, in hydronic applications, as stand-alone boilers/ chillers.

Carrier's Aquazone™ water-to-water source heat pumps (WSHPs) are designed for quality and high performance over years of operation.

- Performance rated according to ISO 13256-2 and ASHRAE 90.1.
- Provides both chilled and hot water.
- Part load performance with 2-stage operation for sizes 025-122 and 240-420 (dual independent refrigerant circuits for sizes 122, 240-420). Size 180 and 210 are single stage units.
- High-efficiency scroll compressors.
- Thermostatic expansion valve (TXV).
- Available mute package.
- Standard low temperature insulation for extended range operation.
- For general service and access to the electrical panel as standard, 3 ft of clearance through the front of the unit is required. We also recommend 3 ft of clearance around the unit to gain access to the heat exchangers on the side and the TXV and liquid line filters on the back.
- Flexible and reliable controls accommodate all systems.
- Non-ozone depleting Puron refrigerant (R-410A).

Premium performance

Aquazone units offer cooling EERs (Energy Efficiency Ratios) to 25.7 and heating COPs (Coefficients of Performance) to 4.6. Efficiencies are in accordance with standard conditions under ISO (International Organization for Standardization) Standard 13256-2 and exceed ASHRAE (American Society of Heating, Refrigerant and Air-Conditioning Engineers) 90.1 Energy Standards.These units offer industry leading energy efficiency and environmental benefits by utilizing Carrier's Puron® refrigerant (R-410A) that eliminates all concerns of mandated refrigerant phase-out of R-22 (HCFC) in 2010. Each unit has been specifically designed for Puron refrigerant to provide years of optimum efficiencies with long life.

Puron® refrigerant (R-410A)

Puron refrigerant (R-410A) is a non-chlorine based environmentally balanced, non-ozone depleting refrigerant. Puron refrigerant characteristics, compared to R-22, have:

- Binary and near azeotropic mixture of 50% R-32 and 50% R-125.
- Higher efficiencies (50 to 60% higher operating pressures).
- Virtually no glide. Unlike other alternative refrigerants, the two components in Puron refrigerant have virtually the same leak rates. Therefore, refrigerant can be added if necessary without recovering the charge.

High quality construction and testing

All units are manufactured to meet extensive quality control protocol from start to finish through an automated control system, which provides continuous monitoring of each unit and performs quality control checks as equipment progresses through the production process. Standard construction features of the Aquazone units include:

Cabinet

Standard cabinet construction consists of heavy gage galvanized sheet metal that provides maximum strength. Cabinet interior surfaces are lined with 1/2 in. thick, 1-1/2 lb acoustic type insulation. All exterior sheet metal surfaces are powder-painted to increase corrosion protection and resilience for long term vitality. Cabinets are designed with service access panels on the front for easy accessibility.

Compressors

Standard high-efficiency scroll compressors are mounted on rubber grommets to large, heavy gage mounting tray plates, which are then isolated from the cabinet base with rubber grommets. This dual level vibration isolation system dramatically increases vibration attenuation.

Refrigeration/water circuit

Units have a sealed refrigerant circuit including a scroll compressor. Refrigerant circuits are provided with standard thermostatic expansion valves (TXVs) for higher accuracy and performance. Also standard are a reversing valve (4-way valve) and load and source water-to-refrigerant coaxial (tube in tube) coil.

Quality assurance

Aquazone units have NRTL (Nationally Recognized Testing Lab) or ETL (Engineering Testing Laboratory) labels and are factory tested under normal operating conditions at nominal water flow rates. Quality assurance is provided via testing report cards shipped with each unit to indicate specific unit performance under cooling and heating modes of operation.

Quiet operation

Rubber grommets are provided for sound isolation and cabinets are fully insulated to reduce noise transmission.

Design flexibility

Extended water temperature range between 25°F and 110°F offers maximum design flexibility for all applications. Factory-installed options are offered to meet specific design requirements.

Safe, reliable operation

Standard safety features for the refrigerant circuit include a high-pressure switch and low-pressure sensor to detect loss of refrigerant. Equipment safety features include water loop temperature monitoring, voltage protection, and source freeze protection. All safety features are tested and run at the

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Features/Benefits (cont)

factory to assure proper operation of all components and safety switches.

All components are carefully designed and selected for endurance, durability, and carefree, day-to-day operation.

The unit is shipped to provide internal and external equipment protection. Shipping supports are placed under the compressor feet.

Ease of installation

The unit is packaged for simple low cost handling, with minimal time required for installation. All units are pre-wired and factory charged with refrigerant. Water connections utilize FPT (female pipe thread), high and low voltage knockouts, and an easily accessible design reduce installation time and save mechanical room space.

Simple maintenance and serviceability

For better flexibility in confined spaces, access for maintenance and service is provided from three sides of the unit. Large access panels on the top, side, and front of the unit maximize exposure for all components. Easy removal of the control box from the unit provides access to all refrigeration components. The refrigeration circuit is easily tested and serviced through the use of high and low pressure ports integral to the refrigeration circuit. All maintenance and service can be completed through the front of the unit, allowing multiple units to be installed side-by-side.

Maximum control flexibility

Carrier's Aquazone™ 50PSW water-to-water heat pumps include a standard factory-installed and configured unit protection module (UPM), which regulates unit operation, features integrated safeties, and simplifies unit troubleshooting.

For more demanding applications, the optional Carrier WSHP Water-to-Water (W2W) Open control provides flexibility for integration into Carrier's i-Vu control system as well as other BACnet[1], Modbus[1], LonWorks[1] and N2[1] control systems.

WSHP Water-to-Water Open Controller

The Water-to-Water (W2W) Open controller continuously monitors and regulates heat pump operation with reliability and precision. This advanced controller features a sophisticated, factory-engineered control program that provides optimum performance and energy efficiency. For added flexibility, the W2W Open controller is capable of stand-alone operation. It can also be integrated with any Building Automation System using the BACnet, Modbus, LonWorks, or N2 protocol. For larger installations, a total of up to 8 stages may be controlled as a singular heating or cooling source. One controller will operate as the master, coordinating others in the system.

Transformer (75 va)

The transformer assists in accommodating accessory loads with a load side short circuit and overload protection via a built-in circuit breaker.

Anti-short cycle timer

The timer provides a minimum off time to prevent the unit from short cycling. The 5-minute timer energizes when the compressor is de-energized, resulting in a 5-minute delay before the unit can be restarted.

Random start relay

The relay ensures a random delay in energizing each different WSHP unit. This option minimizes peak electrical demand during start-up from different operating modes or after building power outages.

High and low pressure refrigerant protection

Refrigerant protection safeguards against unreliable unit operation and helps prevent refrigerant from leaking.

1. Third-party trademarks and logos are the property of their respective owners.

High and low voltage protection

Voltage safety protection guards against excessive or low voltage conditions.

Automatic intelligent reset

Automatic intelligent reset will automatically restart unit 5 minutes after shutdown if the fault has cleared. Should a fault occur 2-4 times sequentially (field selectable), lockout will occur.

Source freeze protection (selectable for water or antifreeze)

This field-selectable switch for water and water/glycol solution systems initiates a fault when temperatures exceed the selected limit for 30 continuous seconds.

Alarm relay setting

A selectable 24-v or pilot duty dry contact provides activation of a remote alarm.

Service test mode with diagnostic LED (light-emitting diode)

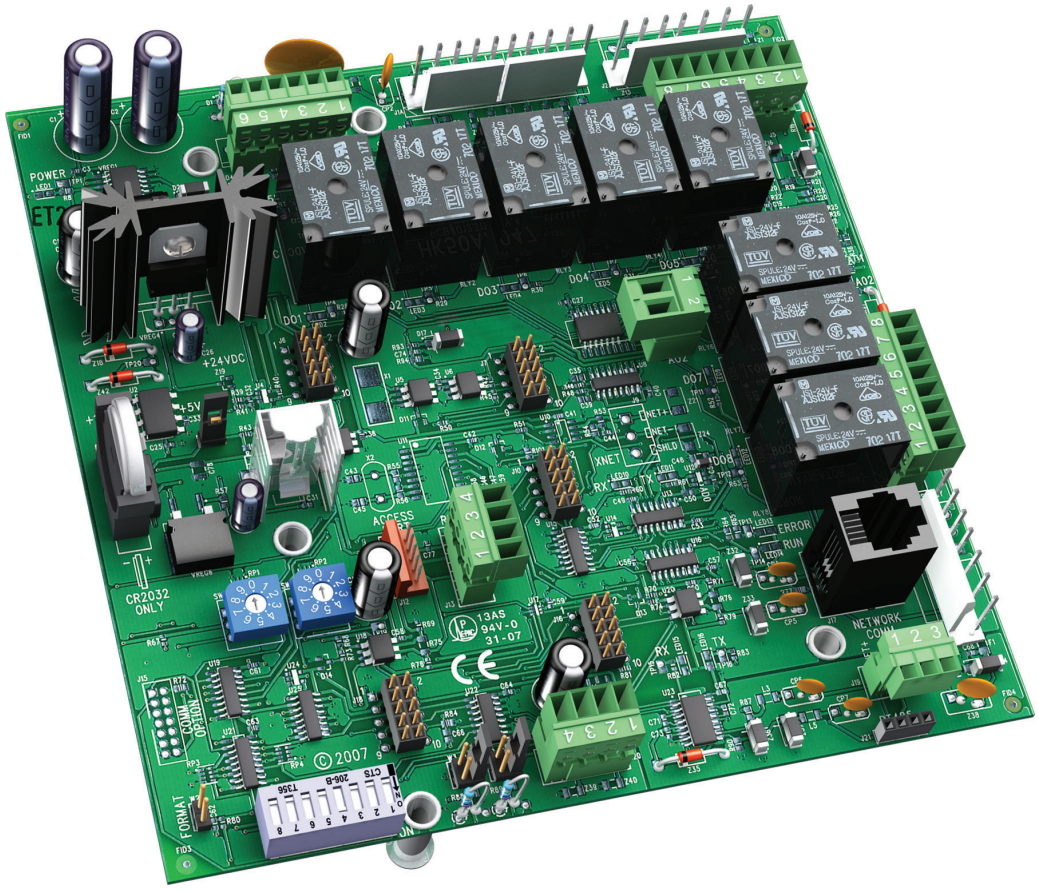
The Test mode allows service personnel to check the operation of the WSHP and control system efficiently. Upon entering Test mode, time delays are sped up and the Status LED will flash a code to indicate the last fault experienced for easy diagnosis. Based on the fault code flashed by the status LED, system diagnostics are assisted through the use of Carrier-provided troubleshooting tables for easy reference to typical problems.

LED visual output

An LED panel indicates high pressure, low pressure, low voltage, high voltage, air/water freeze protection, condensate overflow, and control voltage status.

Features/Benefits (cont)

WSHP Water-to-Water Open Controller



Complete C and Deluxe D Packages

Complete C and Deluxe D Package Capabilities

CAPABILITY	COMPLETE C PACKAGE	DELUXE D PACKAGE
Anti-Short Cycle Timer	X	X
Random Start Relay	X	X
High and Low Pressure Refrigerant Protection	X	X
High and Low Voltage Protection	X	X
Automatic Intelligent Reset	X	X
Accessory Output	X	X
Performance Monitor	X	X
Source Freeze Protection	X	X
Alarm Relay Setting	X	X
Service Test Mode with Diagnostic LED	X	X
LED Visual Output	X	X
Transformer	75 or 100 va	75 or 100 va
EMS Relay		X
Pump/Valve Relay		X
Phase Monitor (3-Phase Only)		X

Energy Management Switch (EMS)

Enables a 24 vac external signal to control the operation of the WSHP.

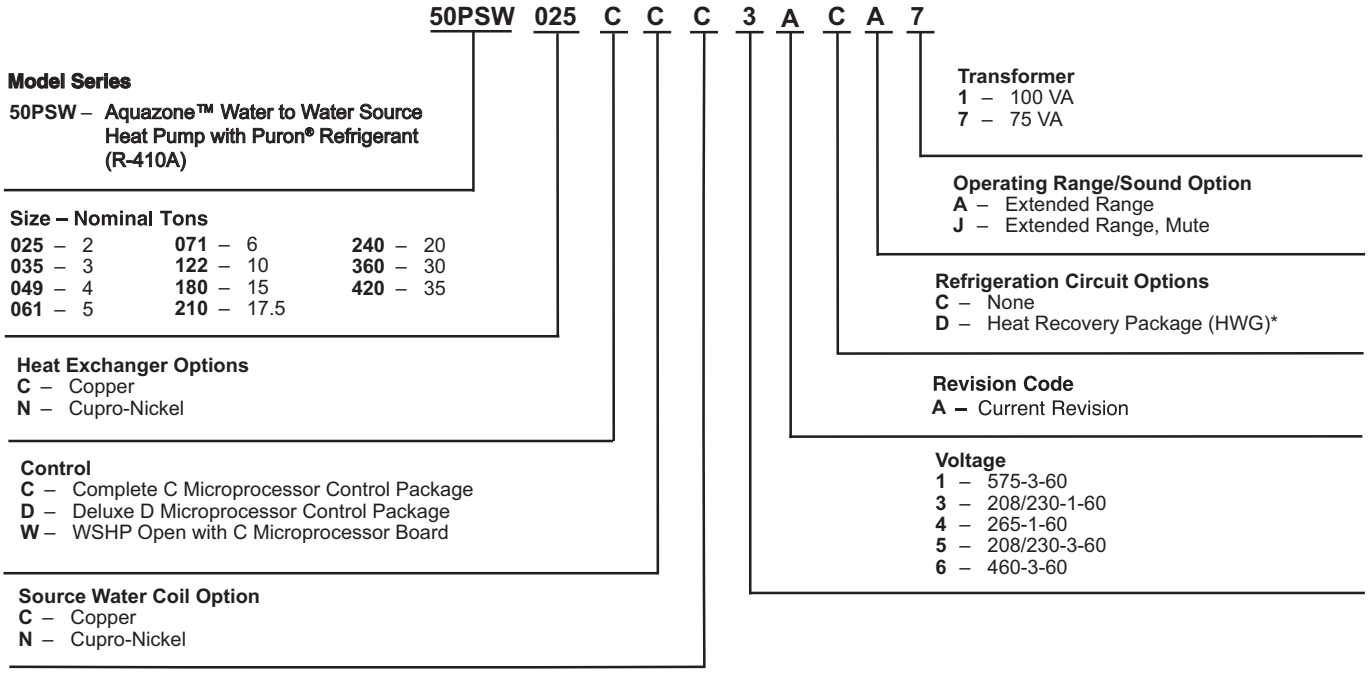
Pump-Valve Relay

Provides a signal between an isolation valve and a secondary pump.

Phase Monitor

3-Phase Line Monitor that protects against phase loss, phase reversal, and phase unbalance. Ideally suited to protect your unit's scroll compressor(s) from reverse rotation.

Model number nomenclature



*Available only for 025-071 sizes.

AHRI/ISO capacity ratings

50PSW Capacity Unit Ratings

50PSW UNIT SIZE	SOURCE FLUID FLOW RATE gpm	LOAD FLUID FLOW RATE gpm	WATER LOOP HEAT PUMP				GROUND WATER HEAT PUMP				GROUND LOOP HEAT PUMP			
			COOLING		HEATING		COOLING		HEATING		COOLING		HEATING	
			LOAD TEMP 53.6°F SOURCE TEMP 86°F		LOAD TEMP 104°F SOURCE TEMP 68°F		LOAD TEMP 53.6°F SOURCE TEMP 59°F		LOAD TEMP 104°F SOURCE TEMP 50°F		LOAD TEMP 53.6°F SOURCE TEMP 77°F		LOAD TEMP 104°F SOURCE TEMP 32°F	
			Capacity Btuh	EER	Capacity Btuh	COP	Capacity Btuh	EER	Capacity Btuh	COP	Capacity Btuh	EER	Capacity Btuh	COP
025 PART	6.0	6.0	15,500	14.70	21,800	4.60	18,500	25.70	17,000	3.70	18,000	22.10	14,900	3.10
025 FULL	6.0	6.0	21,000	13.40	29,000	4.40	24,500	21.20	23,600	3.50	22,500	15.90	18,200	2.95
035 PART	9.0	9.0	21,700	12.73	31,500	4.55	25,500	21.78	24,900	3.45	24,000	18.09	21,600	2.95
035 FULL	9.0	9.0	29,000	12.40	43,000	4.30	34,000	19.95	34,000	3.50	30,000	14.60	26,800	2.80
049 PART	10.0	10.0	29,000	12.85	41,000	4.40	33,500	23.60	32,600	3.40	32,500	19.25	28,100	2.90
049 FULL	10.0	10.0	39,000	12.60	56,000	4.10	45,000	19.70	46,000	3.50	41,000	14.55	36,400	2.80
061 PART	13.0	13.0	37,000	13.30	50,300	4.40	42,500	22.75	40,100	3.40	41,000	18.85	34,400	2.90
061 FULL	13.0	13.0	49,000	12.90	70,300	4.20	55,500	19.65	57,300	3.50	51,000	14.80	44,900	2.85
071 PART	15.0	15.0	43,500	12.45	64,700	4.40	50,500	20.65	51,700	3.35	48,500	17.60	44,500	2.90
071 FULL	15.0	15.0	57,500	12.30	84,100	4.20	64,000	18.80	69,200	3.40	60,000	14.30	53,500	2.80
122 PART	30.0	30.0	54,900	12.30	78,500	4.20	63,500	19.00	63,600	3.40	61,000	16.70	56,000	3.20
122 FULL	30.0	30.0	114,000	13.80	160,800	4.60	130,000	21.30	129,500	3.80	119,500	16.10	102,500	2.95
180 FULL	34.0	27.0	127,000	13.80	180,500	4.50	143,000	20.70	148,500	3.80	132,500	15.90	121,000	3.20
210 FULL	40.0	32.0	164,200	13.20	239,500	4.40	185,500	19.10	194,000	3.70	171,500	15.10	156,000	3.00
240 FULL	56.0	44.0	222,000	13.50	320,000	4.40	249,500	19.20	258,500	3.70	232,500	15.50	206,500	3.00
360 FULL	68.0	54.0	254,000	13.80	361,500	4.50	286,500	20.70	297,000	3.80	265,000	15.90	242,000	3.20
420 FULL	80.0	64.0	328,300	13.20	479,000	4.40	370,500	19.10	387,500	3.70	343,000	15.10	312,000	3.00

LEGEND

COP — Coefficient of Performance
EER — Energy Efficiency Ratio

NOTES:

1. Rated in accordance with AHRI (Air-Conditioning, Heating and Refrigeration Institute) and ISO (International Organization of Standardization) Standard 13256-2 and ASHRAE (American Society of Heating, Refrigeration, and Air-Conditioning Engineers) Energy Standard 90.1 programs.
2. 50PSW units are AHRI certified up to 10 tons.

Use of the AHRI Certified TM Mark indicates a manufacturer's participation in the program. For verification of certification for individual products, go to www.ahridirectory.org.

Physical data

50PSW025-071 Unit Physical Data

50PSW UNIT SIZE	025	035	049	061	071
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll
Quantity	1	1	1	1	1
Maximum Water Working Pressure (psig/kPa)	450/3100	450/3100	450/3100	450/3100	450/3100
Water Connection Size (in.)					
FPT	3/4	3/4	1	1	1
Refrigeration Charge (oz/ckt)	48	59	62	72	90
Coaxial Coil Volume (gal)	0.49	0.49	0.64	0.77	1.05
Operating Weight (lb)	240	250	280	310	430
Shipping Weight (lb)	260	270	300	330	450

50PSW0122-420 Unit Physical Data

50PSW UNIT SIZE	122	180	210	240	360	420
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Quantity	2	1	1	2	2	2
Maximum Water Working Pressure (psig/kPa)	450/3100	450/3100	450/3100	450/3100	450/3100	450/3100
Water Connection Size (in.)						
FPT	1-1/4	1-1/2	1-1/2	2	2	2
Coaxial Coil Volume (gal)	1.00	3.31	3.31	1.00	3.31	3.31
Refrigeration Charge (oz/ckt)	85	210	220	140	210	220
Operating Weight (lb)	720	850	890	1230	1550	1700
Shipping Weight (lb)	740	870	910	1260	1580	1730

Options and accessories

Factory-installed options

Mute package (sound attenuation)

Mute package (sound attenuation) is available for applications that require especially low noise levels. With this option, a double application of sound attenuating material is applied. The mute package, in combination with standard unit noise reduction features, provides high levels of noise reduction.

Heat exchanger options

Heat exchanger options are available for both the load and source coaxial heat exchangers. The load and source heat exchangers are available in cupronickel as an option.

Hot water generator (HWG) / Heat recovery package (HRP)

Hot water generator is available to generate hot water in the ranges of 110 to 140°F. Coil is installed off of the discharge line from the compressor to provide heat for a domestic water supply. The coils is a vented, double wall coil, and also includes a circulating pump, high water temperature limit switch (set at 140°F), discharge gas temperature limit switch and an ON/OFF with built in circuit breaker. The coil is not factory wired to the unit controller.

Field-installed accessories

Y strainers (bronze body)

Y strainers (bronze body) are "Y" type strainers with a brass cap. The strainer screen is made of stainless steel, is available with blow-down valves, and has a maximum operating pressure rating of 450 psig.

Ball valves (brass body)

Ball valves (brass body) are available for shutoff and balancing water flow. The valves are available with memory, memory stop, and pressure temperature ports.

Solenoid valves (brass body)

Solenoid valves (brass body) are available to provide slow operation for quiet system operation.

Hose kit assemblies

Hose kit assemblies provide all the necessary components to hook up a water-side system. Supply hose includes a ported ball valve with pressure temperature (P/T) plug ports, flexible stainless steel hose with swivel and nipple. Return hose includes a ball valve, preset automatic balancing valve (gpm) with two P/T ports, flexible stainless steel hose with a swivel and nipple, balancing valve, and low-pressure drop water control valve.

WSHP Open Equipment Touch™ and System Touch™

The Open Equipment Touch and System Touch touchscreen devices have a color LCD (Liquid Crystal Display) display that allows easy connection to the controllers to view or change the controller's property values including set points, schedule equipment, view trends and alarms and more. The Equipment Touch device provides easy connection to one controller while the System Touch device can access up to 60 controllers when wired together as a network. For more details about the Equipment Touch and System Touch devices, see either the Equipment Touch or System Touch Installation and Setup Guide.

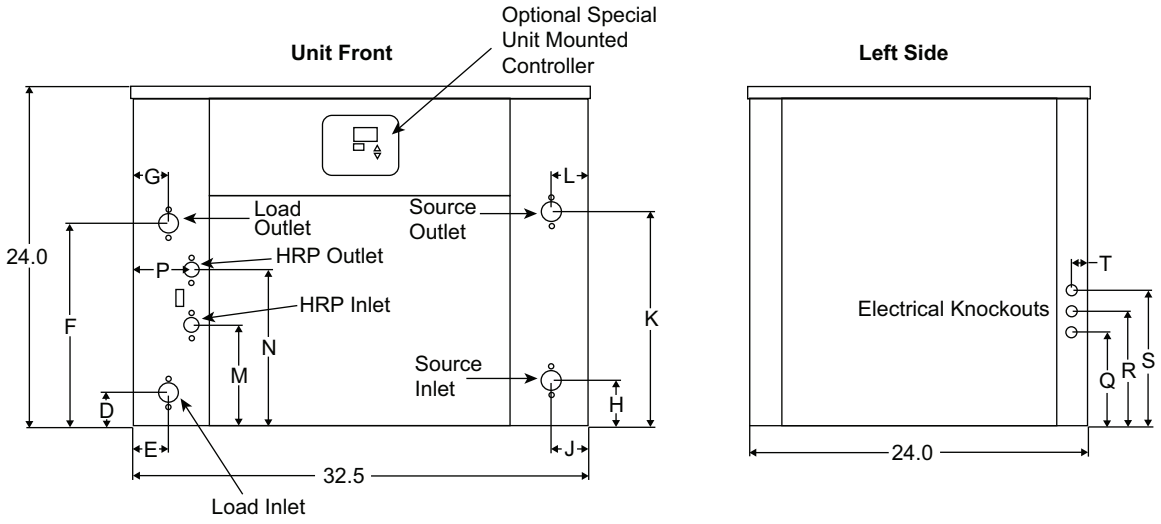
Carrier Thermostat Options

THERMOSTAT TYPE	MODEL	DESCRIPTION
BACNET	Comfortvu BACnet Plus (TBPL-24-H-C/TBPL-24-HM-C)	1. 24 VAC controller with combination space temperature, relative humidity, and motion sensors (temperature, humidity only on TBPL-24-C). 2. Large touch screen backlit display, 7-day scheduling, demand response, remote sensor capability, dry contact. 3. BACnet MS/TP, 1 to 3-stage heat, 1 and 2-stage cool, 1 to 3 fan speeds, WSE, HGRH, HP.
	Comfortvu BACnet (TB-24-C/ TB-24-HM-C)	
WIFI	Connect BACnet Wi-Fi (33CONNECTSTAT43)	1. 24 VAC controller with onboard space temperature and relative humidity sensor. 2. Large touch screen LCD display, 7-day scheduling, demand response, remote sensor capability. 3. BACnet MS/TP (33CONNECTSTAT43 only), up to 4-stage heat, up to 3-stage cool, WSE, HP.
	Connect Wi-FI (33CONNECTSTAT)	
PROGRAMMABLE/ NON-PROGRAMMABLE	Edge Pro 33CS2PP2S-03/33CS2PPRH-03)	1. 24 VAC programmable control with onboard temperature and humidity (temperature only on 33CS2PP2S-03). 2. Backlit display 7-Day Programmable/Non-Programmable, 2-stage heat/2-stage cool, HP (with emergency heat). OR 3. G/E, Dry Contact, Remote Sensor Capability, Pre-Occupancy Purge, Soft Start, Manual/Auto-Changeover, and Bypass Damper Output.
	Comfort Pro (33CSCNACHP-01/ 33CSCPACHP-01)	1. 24 VAC Programmable/Non-Programmable (33CSCNACHP-01) control with onboard temperature. 2. Backlit display, 2-stage heat/2-stage cool G/E; plus 1-stage auxiliary or emergency heat HP and WSHP. OR 3. 2-stage cool/heat only, Passcode protection, remote sensor capability with override, random start, Manual/Auto-Changeover, Outdoor/supply/return temp, and hospitality.

NOTE: See Thermostat product for complete details.

Dimensions

50PSW025-071 Unit



UNIT SIZE	DIMENSIONS (INCHES)															WATER CONN. (FPT)[a]	HRP CONN. (FPT)
	Load Side Water In Height	Left Side to Load Side Water In	Load Side Water Out Height	Left Side to Load Side Water Out	Source Side Water In Height	Right Side to Source Side Water Out	Source Side Water Out Height	Right Side to Source Side Water Out	HRP Water In Height	HRP Water Out Height	Left Side to HRP Water Out	Electrical Knockout Heights			Left Side to Electrical Knockouts		
	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T		
025	2.20	1.70	13.20	1.70	3.75	1.50	14.25	1.95	7.15	11.00	4.25	6.55	8.05	9.55	1.25	3/4	1/2
035	2.30	2.30	14.30	2.50	3.70	2.55	15.70	2.55	7.15	11.00	4.25	6.55	8.05	9.55	1.25	3/4	1/2
049	2.30	2.10	14.30	2.65	2.75	2.65	14.75	2.65	7.15	11.00	4.25	6.55	8.05	9.55	1.25	1	1/2
061	2.80	1.38	14.80	2.63	2.51	2.00	14.38	3.40	7.15	11.00	4.25	6.55	8.05	9.55	1.25	1	1/2
071	3.00	2.25	17.25	2.25	3.25	2.25	17.00	2.25	7.15	11.00	4.25	6.55	8.05	9.55	1.25	1	1/2

NOTE(S):

a. Refers to both load and source fluid connections.
b. All dimensions are within ± 0.125 in.
c. Specifications subject to change without notice.

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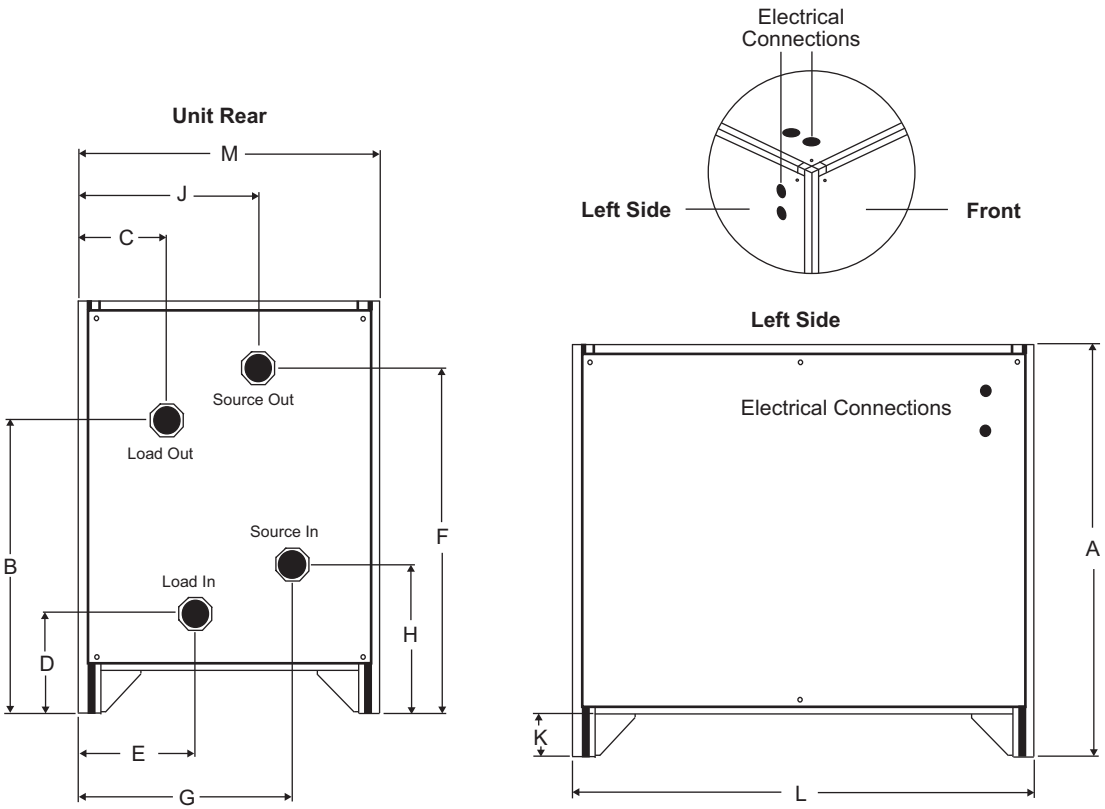
HRP — Heat Recovery Package

Dimensions (cont)

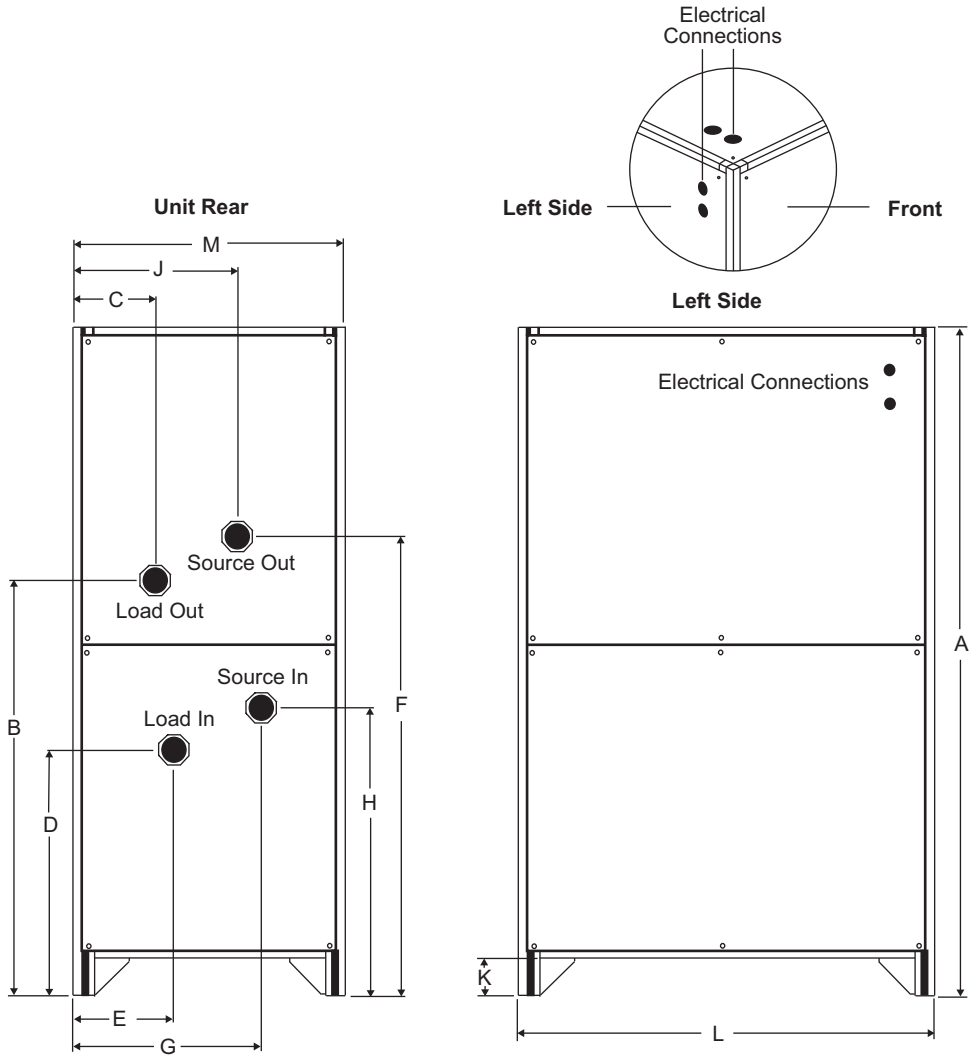
50PSW122-210 Unit



UNIT SIZE	DIMENSIONS (INCHES)												WATER CONN. (FPT)
	Height	Load Water Out Height	Right Side to Load	Load Water In Height	Right Side to Load Water In	Source Water Out Height	Right Side to Source Water In	Source Water In Height	Right Side to Source Water Out	Unit Leg Height	Depth	Width	
	A	B	C	D	E	F	G	H	J	K	L	M	
122	37.5	27.62	8.5	8.37	10.5	32.25	19.5	13.5	17.5	3.5	46	28	1-1/4
180	37.5	27.62	4.5	8.37	10.5	32.25	23.5	13.5	17.5	3.5	46	28	1-1/2
210	37.5	27.62	4.5	8.37	10.5	32.25	23.5	13.5	17.5	3.5	46	28	1-1/2

Dimensions (cont)

50PSW240-420 Unit



UNIT SIZE	DIMENSIONS (INCHES)												WATER CONN. (FPT)
	Height	Load Water Out Height	Right Side to Load	Load Water In Height	Right Side to Load Water In	Source Water Out Height	Right Side to Source Water In	Source Water In Height	Right Side to Source Water Out	Unit Leg Height	Depth	Width	
	A	B	C	D	E	F	G	H	J	K	L	M	
240	70	43.5	8.5	24.5	10.5	48.5	19.5	29.25	17.5	3.5	46	28	2
360	70	43.5	4.5	24.5	10.5	48.5	23.5	29.25	17.5	3.5	46	28	2
420	70	43.5	4.5	24.5	10.5	48.5	23.5	29.25	17.5	3.5	46	28	2

Performance data

Please see WSHP Builder for Performance Data.

Application data

Utilize Aquazone™ products to provide optimal energy efficient solutions in the most challenging design applications. Aquazone water source heat pump products are available in several models, which can be used in water loop, ground water, and ground loop systems.

ACQUAZONE™ Product Guide

50 SERIES	TYPE SIZE (tons)	APPLICATION
50HQP,VQP	Large Capacity 6-20 (HQP) 6-30 (VQP)	Environmentally balanced unit with Puron® refrigerant (R-410A) designed to handle large zoned areas for all geothermal and boiler/tower applications.
50PC	Compact 1/2-6	Compact WSHP with Puron refrigerant (R-410A) for boiler/tower, ground water, or ground loop systems.
50PS	Premium Efficiency 1/2-6	Premium, ultra efficient unit with Puron refrigerant (R-410A) for new boiler/tower, ground water, or ground loop systems.
50PEC	High Efficiency Console 3/4-1-1/2	Efficient console unit with Puron refrigerant (R-410A) and attractive design for finished interior, under-window installations.
50PT	Premium Efficiency 2-6	Premium, ultra efficient 2-stage unit with Puron refrigerant (R-410A) for new boiler/tower, ground water, or ground loop systems.
50PSW	Water-to-Water 2-35	Efficient unit with Puron refrigerant (R-410A) serves as an alternative to pre-heat or cool air. Unit can be used as a stand-alone or supplemental boiler/chiller in most hydronic heating applications. Also conditions process fluids, lubricants, and refrigerants.

Water loop system

Water loop (or boiler/tower) system applications typically include a number of units plumbed to a common piping system. For optimal performance, this system should be designed between 2.25 and 3 gpm per ton of cooling capacity. The system is comprised of highly efficient packaged reverse cycle heat pump units interconnected by a water loop. The water circuit serves as both a sink and source for heat absorption and rejection, and is designed for entering water temperatures between 60°F and 90°F. Within this temperature range, units can heat or cool as required from the same water source. Transferring heat from warm to cold spaces in the building conserves energy rather than creating new heat.

Refer to the Carrier Water Source Heat Pump System Design Guide for assistance with the design of water loop systems. The guide includes a practical approach for the latest and most current design recommendations including:

- Product application including horizontal, vertical, console, rooftop, and water-to-water applications.
- Ventilation methods and system design including energy recovery.
- Acoustical considerations for different product types.
- Addressing IAQ (indoor-air quality) issues such as condensate removal and humidity control.
- Air distribution design including diffuser selection/layout and ductwork design.
- Hydronic system design including pipe sizing/layout and boiler/tower sizing.
- Control configurations such as stand-alone, DDC (direct digital controls), DCV (demand controlled ventilation), and VVT® (variable volume and temperature).
- WSHP Efficiency/Operational Cost Comparison charts.
- System applications such as a system without a boiler, variable pumping, and VAV (variable air volume) for interior use.

Ground water systems

To utilize Aquazone units in ground water applications, extended range should be specified. This will provide factory-installed insulation on the coaxial coil to prevent condensate from dripping when entering-water temperatures are below 60°F. The standard copper coaxial coil on the Aquazone units may not be suitable for certain water conditions. Refer to the Water Conditioning section for proper coaxial coil material selection.

Surface water system

Surface water system is typically located near a lake or pond. In this application, the loop can be submerged in a series of coils beneath the water surface. The number of coils required depends on system load and design. This application requires minimum piping and excavation.

Open loop system

Open loop system is used where ground water is plentiful. In this application, ground water is pumped through supply piping from the well to the building. The water is then pumped back into the ground through a discharge well as it leaves the building. An additional heat exchanger is usually installed between the building water piping system and the ground water piping system. This design limits the amount of piping and excavation required.

Aquazone units are provided with a standard TXV (thermostatic expansion valve) and are rated to extremely low temperatures to self-adjust the refrigeration circuit, therefore water regulating valves are not required on open loop systems. To conserve water on this type of system, a slow opening/closing solenoid valve is recommended.

Ground loop systems

There are many commonly specified designs for ground loop applications. Typical designs include vertical loops and horizontal loops. In some applications, water is piped from the ground or lake directly to the water source heat pump. Piping is limited to the amount of pipe required to get the water from the source to the unit.

NOTE: When utilizing Aquazone water source heat pumps in ground loop systems, refer to design considerations in the ground water system section.

Horizontal ground loop

Horizontal ground loop is used when adequate space is available and trenching can be easily accomplished. A series of parallel pipes are laid out in trenches 3 to 6 feet below the ground surface and then back-filled. Multiple pipes are often used to maximize the heat transfer capability of each trench. The amount of pipe and the size of the ground loop field are based on ground conditions, heating, and cooling requirements of the application and system design.

Vertical ground loop

Vertical ground loop is used in vertical borehole applications. This design is well suited for retrofit applications

where there are space limitations or where landscaping is already complete and minimum disruption of the site is desired. The vertical ground loop system contains a single loop of pipe inserted into a hole. The hole is back-filled and grouted after the pipe is inserted. The completed loop is concealed below ground. The number of loops required depends on ground conditions, heating and cooling requirements, and the depth of each hole.

Hybrid systems

In some applications, hybrid systems may be beneficial to incorporate a cooling tower into the ground loop system to reduce the overall cost. A hybrid system discards excess heat into the air and increases the cooling performance of the ground loop.

Water conditioning

In some applications, maintaining proper water quality may require the use of higher corrosion protection for the water-to-refrigerant heat exchanger. Water quality varies from location to location and is unique for each job. Water characteristics such as pH value, alkalinity, hardness, and specific conductance are of importance when considering any WSHP application. Water typically includes impurities and hardness that must be removed. The required treatment will depend on the water quality as well as type of system. Water problems fall into the following three main categories.

1. Scale formation caused by hard water reduces the heat transfer rate and increases the water pressure drop through the heat exchanger. As water is heated, minerals and salts are precipitated from a solution and deposited on the inside surface of the pipe or tube.
2. Corrosion is caused by absorption of gases from the air coupled with water on exposed metal. Corrosion is also common in salt-water areas.
3. Organic growths such as algae can reduce the heat transfer rate by forming an insulating coating on the inside tube surface. Algae can also promote corrosion by pitting.

NOTE: In most commercial water loop applications, Aquazone™ WSHP units use a copper water-to-refrigerant heat exchanger. Units can also be equipped with a cupronickel heat exchanger for applications where water is outside the standard contaminant limits for a copper heat exchanger.

Application data (cont)

Water Quality Guidelines

CONDITION	HX MATERIAL[a]	CLOSED RECIRCULATING[b]	OPEN LOOP AND RECIRCULATING WELL[c]		
Scaling Potential — Primary Measurement Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below.					
pH/Calcium Hardness Method	All	N/A	**pH < 7.5 and Ca Hardness, <100 ppm**		
Index Limits for Probable Scaling Situations (Operation outside these limits is not recommended.)					
Scaling indexes should be calculated at 150°F for direct use and HWG applications, and at 90°F for indirect HX use. A monitoring plan should be implemented.					
Ryznar Stability Index	All	N/A	**6.0 - 7.5** If >7.5 minimize steel pipe use.		
Langelier Saturation Index	All	N/A	**–0.5 to +0.5** If <–0.5 minimize steel pipe use. Based upon 150 F HWG and direct well, 85 F indirect well HX.		
Iron Fouling					
Iron Fe^{2+} (Ferrous) (Bacterial Iron Potential)	All	N/A	**<0.2 ppm (Ferrous)** If Fe^{2+} (ferrous) >0.2 ppm with pH 6 - 8, O_2<5 ppm check for iron bacteria.		
Iron Fouling	All	N/A	**<0.5 ppm of Oxygen** Above this level deposition will occur.		
Corrosion Prevention[d]					
pH	All	6 - 8.5 Monitor/treat as needed.	**6 - 8.5** Minimize steel pipe below 7 and no open tanks with pH <8.		
Hydrogen Sulfide (H_2S)	All	N/A	**<0.5 ppm** At H_2S>0.2 ppm, avoid use of copper and cupronickel piping or HXs. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are okay to <0.5 ppm.		
Ammonia Ion as Hydroxide, Chloride, Nitrate and Sulfate Compounds	All	N/A	**<0.5 ppm**		
Maximum Chloride Levels			Maximum allowable at maximum water temperature.		
			50°F (10°C)	75°F (24°C)	100°F (38°C)
	Copper	N/A	<20 ppm	NR	NR
	Cupronickel	N/A	<150 ppm	NR	NR
	304 SS	N/A	<400 ppm	<250 ppm	<150 ppm
	316 SS	N/A	<1000 ppm	<550 ppm	<375 ppm
	Titanium	N/A	>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging					
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size.	<10 ppm (<1 ppm “sandfree” for reinjection) of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size. Any particulate that is not removed can potentially clog components.		
Brackish	All	N/A	Use cupronickel heat exchanger when concentrations of calcium or sodium chloride are greater than 125 ppm are present. (Seawater is approximately 25,000 ppm.)		

NOTE(S):

a. Heat exchanger materials considered are copper, cupronickel, 304 SS (stainless steel), 316 SS, titanium.
b. Closed recirculating system is identified by a closed pressurized piping system.
c. Recirculating open wells should observe the open recirculating design considerations.
d. If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists.
Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling. A low pH and high alkalinity can cause system problems, even when both values are within ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water registers a pH of 7.0.
To convert ppm to grains per gallon, divide by 17. Hardness in mg/l is equivalent to ppm.

LEGEND

HWG — Hot Water Generator
HX — Heat Exchanger
N/A — Design Limits Not Applicable Considering Recirculating Potable Water
NR — Application Not Recommended
SS — Stainless Steel

Application data (cont)

Coaxial Heat Exchanger Corrosion Resistance

The resistance guide below is an attempt to give a picture of the corrosion resistance of stainless steel of type **AISI 316** and **pure Copper** (99.9%) in water to a number of important chemical factors. The actual corrosion is, however, a very complex process influenced by many different factors in combination. This table is a considerable simplification and should not be overvalued.

CHEMICAL FACTORS	CONCENTRATION (mg/l or ppm)	TIME LIMITS ANALYZE	AISI 316 STAINLESS STEEL	COPPER	CUPRONICKEL
Alkalinity (HCO_3^-)	<70	Within 24 hours	+	0	+
	70-300		+	+	+
	>300		+	0/+	+
Sulfate (SO_4^{2-})	<70	No limit	+	+	+
	70-300		+	0/–	+
	>300		0	–	+
HCO_3^-/ SO_4^{2-}	>1.0	No limit	+	+	+
	<1.0		+	0/–	+
Electrical Conductivity	<10 mS/cm	No limit	+	0	+
	10 - 500 mS/cm		+	+	+
	>500 mS/cm		+	0	+
pH	<6.0	Within 24 hours	0	0	+
	6.0-7.5		+	0	+
	7.5-8.5		+	+	+
	>8.5		+	0	+
Ammonium (NH_4^+)	<2	Within 24 hours	+	+	+
	2-20		+	0	+
	>20		+	–	+
Chlorides (Cl) **Please see Chloride Content table.**	<20	No limit	+	+	+
	>20		+	0/+	+
Free Chlorine (Cl_2)	<1	Within 5 hours	+	+	+
	1-5		+	0	+
	>5		+	0/–	+
Hydrogen Sulfide (H_2S)	<0.5	No limit	+	+	+
	>0.5		+	0/–	+
Free (aggressive) Carbon Dioxide (CO_2)	<5	No limit	+	+	+
	5-20		+	0	+
	>20		+	–	+
Total Hardness (°dH)	4.0 - 8.5	No limit	+	+	+
Nitrate (NO_3)	<100	No limit	+	+	+
	>100		+	0	+
Iron (Fe)	<0.2	No limit	+	+	+
	>0.2		+	0	+
Aluminum (Al)	<0.2	No limit	+	+	+
	>0.2		+	0	+
Manganese (Mn)	<0.1	No limit	+	+	+
	>0.1		+	0	+

LEGEND

AISI — American Iron and Steel Institute
+ — Good resistance under normal conditions
0 — Corrosion problems may occur especially when more factors are valued 0
– — Use is not recommended

Chloride Content

CHLORIDE CONTENT	MAXIMUM TEMPERATURE OF WATER LOOP			
	60°C	80°C	120°C	130°C
= 10 ppm	SS 304	SS 304	SS 304	SS 316
= 25 ppm	SS 304	SS 304	SS 316	SS 316
= 50 ppm	SS 304	SS 316	SS 316	Ti/SS 316
= 80 ppm	SS 316	SS 316	SS 316	Ti/SS 316
= 150 ppm	SS 316	SS 316	Ti/SS 316	Ti/SS 316
= 300 ppm	SS 316	Ti/SS 316	Ti/SS 316	Ti/SS 316
> 300 ppm	Ti/SS 316	Ti/SS 316	Ti/SS 316	Ti/SS 316

LEGEND

SS — Stainless Steel
Ti — Titanium

NOTE: Titanium is not an available option for the 50PSW unit. It is shown here for comparative purposes.

Application data (cont)

Solenoid valves

In applications using variable flow pumping, solenoid valves can be field installed and operated from the control board in the Aquazone™ WSHP unit.

Freeze protection

Application systems exposed to outdoor temperatures below freezing (32°F) must be protected from freezing. The most common method of protecting water systems from freezing is adding glycol concentrations into the water. Design care should be used when selecting both the type and concentrations of glycol utilized due to the following:

- Equipment and performance may suffer with high concentrations of glycol and other antifreeze solutions.
- Loss of piping pressure may increase greatly, resulting in higher pumping costs.
- Higher viscosity of the mixture may cause excess corrosion and wear on the entire system.
- Acidity of the water may be greatly increased, promoting corrosion.
- Glycol promotes galvanic corrosion in systems of dissimilar metals. The result is corrosion of one metal by the other, causing leaks.

Antifreeze Correction Table

ANTIFREEZE TYPE	%	COOLING EWT 90°F			HEATING EWT 30°F		WPD EWT 30°F
		TC	SC	Power	HC	Power	
Water	0	1.000	1.000	1.000	1.000	1.000	1.000
Propylene Glycol	5	0.995	0.995	1.003	0.989	0.997	1.070
	15	0.986	0.986	1.009	0.968	0.990	1.210
	25	0.978	0.978	1.014	0.947	0.983	1.360
Methanol	5	0.997	0.997	1.002	0.989	0.997	1.070
	15	0.990	0.990	1.007	0.968	0.990	1.160
	25	0.982	0.982	1.012	0.949	0.984	1.220
Ethanol	5	0.998	0.998	1.002	0.981	0.994	1.140
	15	0.994	0.994	1.005	0.944	0.983	1.300
	25	0.986	0.986	1.009	0.917	0.974	1.360
Ethylene Glycol	5	0.998	0.998	1.002	0.993	0.998	1.040
	15	0.994	0.994	1.004	0.980	0.994	1.120
	25	0.988	0.988	1.008	0.966	0.990	1.200

LEGEND

EWT — Entering Water Temperature
HC — Heating Capacity
SC — Sensible Capacity
TC — Total Capacity
WPD — Water Pressure Drop

Source vs. load heat exchanger

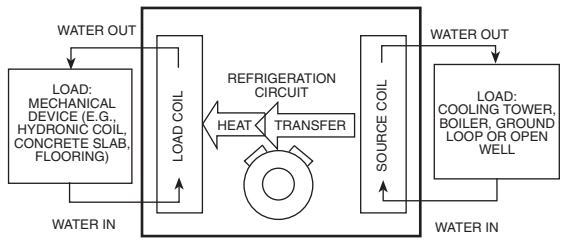
Both the load and source heat exchangers are water-to-refrigerant heat exchangers. The water for the source heat exchanger is supplied from a ground loop, open loop (well water), or water loop (boiler/tower) system. Heat from the refrigeration circuit is exchanged between the load and source heat exchangers. The water for the load heat exchanger can be used in many applications to provide chilled or hot water for air-handling units, fan coils, hydronic baseboards, radiant in-slab piping, or swimming pools.

Parallel operation

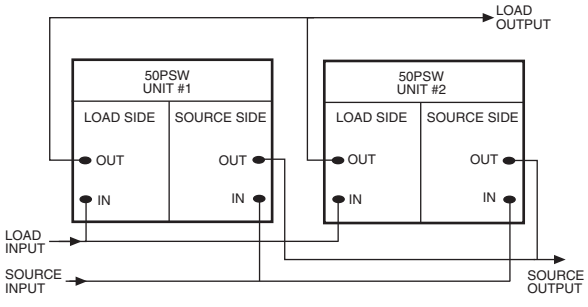
Multiple units can be piped in a parallel operation to satisfy heating and/or cooling loads that cannot be accomplished from a single 50PSW water-to-water unit.

Cycling one or more of the units on or off will provide capacity control through staging of multiple unit combinations. In a parallel operation, the total pressure drop through the load heat exchanger of multiple units is the same as the drop through a single unit.

Source vs. Load Heat Exchanger



Parallel Operation



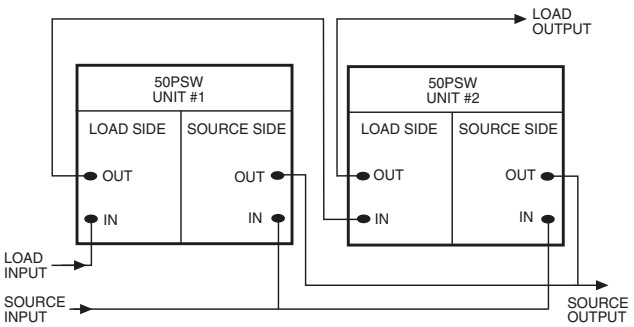
Series operation

Multiple units can be piped in a series type operation to satisfy lower cooling leaving water temperature.

In a series operation, the leaving load water temperature of the first unit becomes the load entering water temperature of the second unit. This arrangement provides an additional decrease in water temperature beyond the capability of a single unit. For example, a typical drop of 10°F to 15°F can be accomplished with one 50PSW unit. When 2 or more units are piped in series, the water temperature drop ranges between 20°F and 25°F. Capacity control is provided by cycling one or more of the units on or off to provide staging of the leaving water temperature from the units.

When the load coils are piped in series, the total water pressure drop through the load heat exchanger of the units should include both units. This is a consideration when sizing the overall system, since an increase in pump horsepower may be require.

Series Operation



Application data (cont)

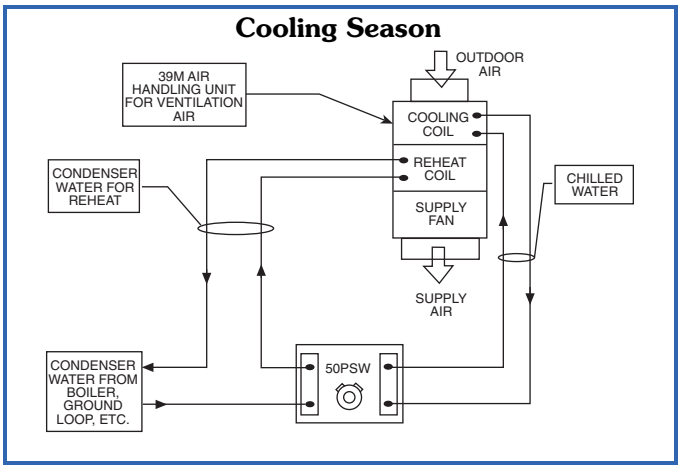
Tempering ventilation air in air handlers

The load heat exchanger in a water-to-water unit provides chilled water during the cooling season and hot water during the heating season. The source heat exchanger is used to provide warm water for ventilation air reheat during the cooling season. In the heating season, the source heat exchanger uses heat from building exhaust to efficiently produce hot water for heating ventilation air in the air-handling unit. The cooling and heating systems can be either piped together for tempering ventilation air as part of an overall integrated system with water-to-water units, or implemented separately depending on the particular design requirements for the ventilation air system.

NOTE: Depending on the system hydronic design, circulation pumps may be required for the source and load of the water-to-water heat pumps in both heating and cooling season operations.

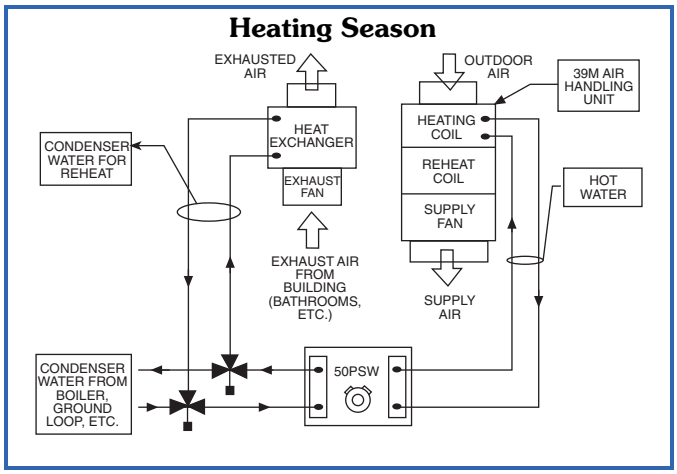
Cooling season

On the load side of the 50PSW unit, chilled water is circulated to the air-handling unit where it cools and dehumidifies ventilation air. The water absorbs heat from the ventilation air and returns to the 50PSW unit, where the heat is removed via the refrigeration circuit and then transferred to the source heat exchanger. Heated water from the source heat exchanger is used to reheat air in the ventilation unit. The heat is then absorbed from the water by the air in the reheat coil and, if necessary, is returned to the cooling tower, boiler, or ground loop for further heat rejection.



Heating season

Building exhaust heat is used by the water-to-water unit for hot water generation. On the load side of the heat exchanger, hot water is circulated to the air-handling unit for heating ventilation air. As the heat from the water is released to the air, the water is circulated back to the 50PSW unit. On the source side of the unit, water is circulated through the heat recovery coil, picks up heat from the exhaust air stream, and then circulates to the 50PSW unit. A pair of control valves is required to maximize the process of extracting the heat from the exhaust. Control valves on the source heat exchanger supply and return water from the main water loop to minimize (or possibly eliminate) the need for additional heat injection by system boilers.



Hydronic heating/cooling system with storage tank

In some cooling or heating applications, the addition of a storage tank may be necessary. The tank allows hot or chilled water temperatures to fluctuate, allowing the water-to-water heat pump to operate more consistently.

In heating applications, this prevents equipment short cycling and allows different flow rates through the water-to-water unit rather than through the hydronic heating delivery system.

A storage tank is also required for cooling applications if the water-to-water unit is 20% larger than the cooling load and/or multiple fan coil units in the same application.

NOTE: In cooling applications where only one fan coil is utilized, water-to-water units may be able to operate without a storage tank.

The size of the storage tank should be based upon the primary use of the application. For heating, storage tanks should be sized at one U.S. gallon per 1,000 Btuh of heating capacity at the maximum entering source water temperature and the minimum entering load water temperature. For cooling, storage tanks should be sized at one U.S. gallon per 1,000 Btuh of cooling capacity at the minimum entering source water temperature and the maximum entering load water temperature. The selection of the storage tank should be based upon the larger of the heating or cooling calculations.

NOTE: When the water-to-water units do not have sufficient capacity to handle the required heating load, supplementary heating such as electric heat or a boiler may be required.

Application data (cont)

Snow melting systems

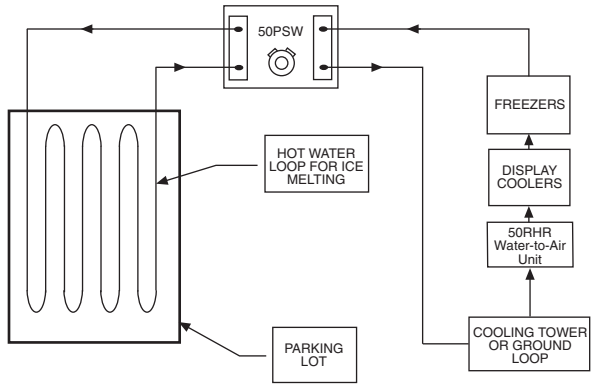
Snow melting systems use water-to-water heat pumps to melt snow and ice. The water-to-water heat pumps circulate hot water through a piping loop in a slab to melt ice and snow. This system is especially energy efficient when coupled with a geothermal ground loop for heat addition/rejection. The size of the water-to-water heat pumps is based on the amount of heat needed to melt the snow across the surface.

NOTE: Consult the ASHRAE HVAC Applications Handbook for slab piping design and temperature requirements.

The 50PSW units can be configured with a field-supplied control system for ice and snow melting. In commercial applications where fast ice removal is required, keeping the slab at a stationary temperature just below the freezing point and then gradually increasing the hot water temperature may reduce melting time.

NOTE: To prevent thermal expansion of the slab due to extreme temperature differences, hot water temperature should be slowly increased.

Snow Melting Systems



Water Temperature Change (°F) Through Heat Exchanger

WATER FLOW RATE (GPM)	RISE (°F) (Cooling)	DROP (°F) (Heating)
For Closed Loop: Ground Source or Cooler/Boiler Systems at 3 Gpm/Ton	9-12	4-8
For Open Loop: Ground Water Systems at 1.5 Gpm/Ton	20-26	10-17

Electrical data

50PSW UNIT SIZE	VOLTAGE (V-Ph-Hz)	COMPRESSOR			MCA	MAX FUSE
		QTY	RLA	LRA		
025	208/230-1-60	1	11.7	58.3	14.6	25
	265-1-60	1	9.1	54.0	11.4	20
	208/230-3-60	1	6.5	55.4	8.1	15
	460-3-60	1	3.5	28	4.4	15
035	208/230-1-60	1	15.6	83.0	19.5	35
	265-1-60	1	13.0	72.0	16.3	25
	208/230-3-60	1	11.6	73.0	14.5	25
	460-3-60	1	5.7	38.0	7.1	15
049	208/230-1-60	1	21.2	104.0	26.5	45
	208/230-3-60	1	14.0	83.1	17.5	30
	460-3-60	1	6.4	41.0	8.0	15
061	208/230-1-60	1	26.9	152.9	33.6	60
	208/230-3-60	1	16.5	110.0	20.6	35
	460-3-60	1	7.2	52.0	9.0	15
071	208/230-1-60	1	29.7	179.2	37.1	60
	208/230-3-60	1	17.6	136.0	22.0	35
	460-3-60	1	8.5	66.1	10.6	15
122	208/230-1-60	2	28.3	178.0	63.7	90
	208/230-3-60	2	19.2	136.0	43.2	60
	460-3-60	2	8.7	66.1	19.6	25
	575-3-60	2	6.9	55.3	15.5	20
180	208/230-3-60	1	48.1	245.0	60.1	100
	460-3-60	1	18.6	125.0	23.3	40
	575-3-60	1	14.7	100.0	18.4	30
210	208/230-3-60	1	55.8	340.0	69.8	125
	460-3-60	1	26.9	173.0	33.6	60
	575-3-60	1	23.7	132.0	29.6	50
240	208/230-3-60	2	33.3	239.0	74.9	100
	460-3-60	2	17.9	125.0	40.3	50
	575-3-60	2	12.8	80.0	28.8	40
360	208/230-3-60	2	48.1	245.0	108.2	150
	460-3-60	2	18.6	125.0	41.9	60
	575-3-60	2	14.7	100.0	33.1	45
420	208/230-3-60	2	55.8	340.0	125.6	175
	460-3-60	2	26.9	173.0	60.5	80
	575-3-60	2	23.7	132.0	53.3	70

LEGEND

LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
RLA — Rated Load Amps

Commercial Water-to-Water Heat Pump Unit with Puron® Refrigerant (R-410A)

HVAC Guide Specifications

Size Range: **2 to 35 Tons, Nominal**

Carrier Model Number: **50PSW**

Part 1 — General

1.01 SYSTEM DESCRIPTION

A. Heat pump units designed to operate with 25°F to 110°F entering water temperature range. Units shall consist of high-efficiency scroll compressors.

B. Units shall be individually packaged with wooden skid covered with protective corner posts and plastic stretch wrapping for maximum protection.

1.02 QUALITY ASSURANCE

A. Basic unit shall be rated in accordance with ISO/ASHRAE (International Organization for Standardization/American Society of Heating, Refrigerating, and Air-Conditioning Engineers) Standards and ETL (Engineering Testing Laboratory) listed.

B. Units shall have insulation and adhesive which meet NFPA (National Fire Protection Association) 90A requirements for flame spread and smoke generation, and assembled units shall be ETL listed to UL standard 1995.

C. Units shall be factory tested under normal operating conditions at nominal water flow rates to assure proper operation of all components and safety devices.

D. Units shall have AHRI (Air-Conditioning, Heating, and Refrigeration Institute)/ISO and ETL, US and Canada labels.

Part 2 — Product

2.01 EQUIPMENT

A. General:

1. Factory-tested and assembled single-piece water source heat pump units shall be factory wired, charged with HFC-410A, contain refrigerant-to-water heat exchanger, 4-way reversing valve, compressor, metering device, and all internal controls and safety devices.

B. Extended Range:

1. Unit shall operate at entering water temperature of 25 to 110°F.
2. Extended range adds closed cell insulation to internal water lines and provides insulation on suction side refrigeration tubing including refrigerant-to-water heat exchangers.

C. Unit Cabinet:

1. Unit shall be constructed of heavy gage, powder-painted, galvanized sheet metal with removable service panels (2).
2. Unit shall have separate entrances for high and low-voltage electrical supplies.
3. Supply and return water connections shall be copper FPT (female pipe thread) fittings, terminating out the top of the unit to facilitate heading on multiple units side-by-side.
4. All interior surfaces shall be lined with 1/2 in. thick, 1-3/4 lb per cu ft density acoustic type fiberglass insulation. All fiberglass shall be coated and all edges shall be tucked under flanges.

D. Compressors:

1. Unit shall have heat pump duty, scroll compressors with internal and external isolation.

E. Heat Exchangers:

1. Refrigerant-to-water heat exchanger shall be steel/copper tube-in-tube type rated for coaxial 625 psig refrigerant, 450 psig water-side pressures. Heat exchanger shall be powder coated for extra protection.
2. Optional steel/cupronickel refrigerant-to-water heat exchanger shall be used for open loop applications, or where water quality cannot be maintained as specified by manufacturer.

F. Refrigerant Components:

1. Refrigeration circuit components shall include liquid line service valve, suction line service valve, reversing valve, a full charge of compressor oil, and a holding charge of refrigerant.
2. Thermostatic expansion valves shall be provided for refrigerant metering. Reversing valve shall be 4-way solenoid activated that defaults to heating.

G. Unit Controls:

1. Solid-State Safety Circuit:

   All units shall have a Unit Protection Module (UPM) safety control circuit with the following features:

   a. Anti-short cycle time delay (5-minute delay on break).
   b. Random start time delay on initial power.
   c. Brownout/surge/power interruption protection.
   d. 120 second low pressure switch bypass timer.
   e. High refrigerant pressure shutdown.
   f. Low refrigerant pressure shutdown.
   g. Low water temperature shutdown (adjustable for closed loop systems).
   h. Air coil freeze protection shutdown.
   i. High condensate level shutdown.
   j. 24 vac alarm output for remote fault indication.

2. The UPM shall automatically reset after a safety shutdown. Restart the unit if the cause of the shutdown no longer exists (except for low temperature and high condensate level shutdowns). Should a fault re-occur within 60 minutes after reset, then a "hard" lockout will occur. A light-emitting diode (LED) shall annunciate the following alarms: brownout, high refrigerant pressure, low refrigerant pressure, low water temperature and a high level of condensate in the drain pan. The LED will display each fault condition as soon as the fault occurs. If a hard lockout occurs, then the fault LED will display the type of fault until the unit is reset.
3. The UPM shall feature the following field configurable adjustments:
   a. Lock out reset on thermostat interruption or power reset.
   b. Two or four restart attempts before a hard lockout.
   c. Test mode (reduces all time delays to 5 seconds for diagnostic work).
   d. Antifreeze setting for low water temperature sensor.
4. Safety devices include:
   a. Low pressure cutout set a 40 psig for loss of charge protection (freezestat and/or high discharge gas temperature sensor is not acceptable).
   b. High pressure cutout control set at 600 psig.
   c. Low supply water temperature sensor that detects drops in refrigerant temperature that could result in water coax heat exchanger freezing.
   d. Low air coil temperature sensor that detects drops in refrigerant temperature that could result in air heat exchanger freezing.
   e. High level condensate sensor that shuts off the compressor if the condensate drain pan fills with water.
   f. On board voltage detection that disables the compressor control circuit if there are extreme variations in supply voltage.

H. Electrical:
1. A control box shall be located within the unit compressor compartment and shall contain a 75 or 100 va transformer, 24 volt activated, 2 or 3 pole compressor contactor, terminal block for thermostat wiring and solid-state controller for complete unit operation. Electro-mechanical operation WILL NOT be accepted.
2. Units shall be name-plated for use with time-delay fuses or HACR circuit breakers.
3. Unit controls shall be 24 volt and provide heating or cooling as required by the remote thermostat.

I. Special Features:
1. The optional sound attenuation (mute package) will consist of compressor sound blankets.
2. Thermostat Controls:
   Accessory thermostat controls include:
   a. Edge Pro Thermostat offers 2-stage heat, 2-stage cool, remote sensor capability, manual/auto changeover, 5-minute compressor protection, 3 security levels, backlit LCD, with keypad lockout, and no batteries required.
3. Non-programmable thermostat with 2 heat stages, 2 cool stages, auto changeover, 5-minute built-in compressor protection, locking cover included.
4. Fire-rated hose kits come with a fixed MPT on one end and a swivel with an adapter on the other end. Hose kits can be either stainless steel or galvanized.
5. Ball valves (brass body) are for shutoff and balancing water flow. Valves are available with memory, memory stop, and pressure temperature ports.
6. Y Strainers (bronze body) are "Y" type configuration with a brass cap and a stainless steel strainer screen. Maximum operating pressure rating of strainers is 450 psig.
7. Solenoid valves (brass body) provide slow operation for quiet system application.
8. Hose kit assemblies include a ported ball valve with pressure temperature (P/T) plug ports, flexible stainless steel hose with swivel and nipple. Return hose includes a ball valve, preset measure flow (gpm) with two P/T ports, flexible stainless steel hose with a swivel and nipple.
9. Hot water generator coil and high temperature switch shall generate hot water within the unit.
10. The W2W Open controller continuously monitors and regulates heat pump operation reliably and precisely. This controller features a sophisticated, factory-engineered control program that provides optimum performance and energy efficiency. For added flexibility, the W2W Open controller is capable of stand-alone operation. It can also be integrated with any Building Automation System using the BACnet, Modbus, LonWorks, or N2 protocol.

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