

Versatec Ultra

NSKW

Geothermal Hydronic Heat Pump

Installation Information

Water Piping Connections

Electrical Data

Startup Procedures

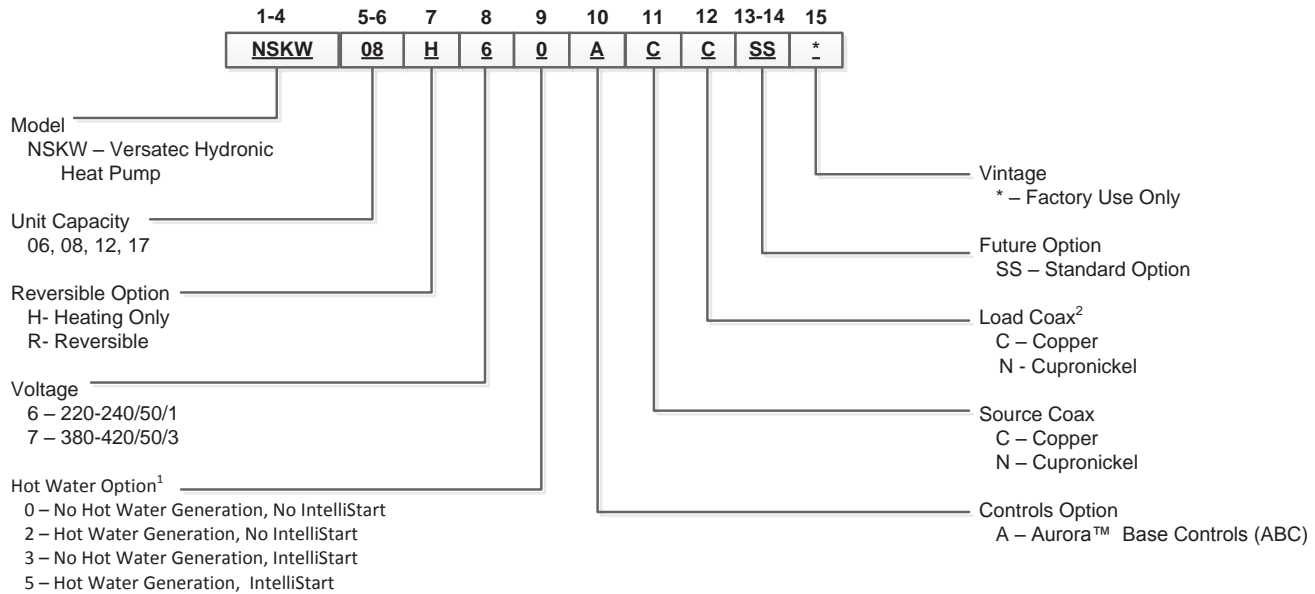
Preventive Maintenance



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Model Nomenclature



Rev.: 15 June 2016

NOTES: 1 – Available on 08, 12, 17 only. Hot water generator requires field installed external pump kit.
2 – NSKW06 heating only models are available only with copper double wall vented load coax for potable water, and are not designed to be converted to dedicated cooling units.

Energy Labelling

Supplier	WaterFurnace International, Inc.									
	NSKW06		NSKW08		NSKW12		NSKW17			
Model hot water heater	-									
Temperature application	°C 35 55		35 55		35 55		35 55		35 55	
Declared load profile for water heating	-									
Seasonal space heating energy efficiency class, average climate	A++ A++		A++ A++		A++ A++		A++ A++		A++ A++	
Water heating energy efficiency class, average climate	-									
Rated heat output (Pdesignh), average climate	kW 6		8		12		17			
Annual energy consumption space heating, average climate	kWh 2,860 3,432		3,689 4,543		4,920 6,343		7,985 9,656			
Annual energy consumption water heating, average climate	-									
Seasonal space heating energy efficiency, average climate	% 160 119		178 132		187 137		164 126			
Water heating energy efficiency, average climate	-									
Sound power level LWA indoors	dB 57		57		61		63			
Rated heat output (Pdesignh), cold climate	kW 6		8		12		17			
Rated heat output (Pdesignh), warm climate	kW 6		8		12		17			
Sound power level LWA outdoors dB	-									

3/18/2016



All Versatec Ultra NSKW product is safety tested to CE standards and performance tested in accordance with standard BS EN 14511-2.

General Installation Information

Safety Considerations

Installing and servicing air conditioning and heating equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair or service heating and air conditioning equipment. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available for all brazing operations.

NOTE: Before installing, check voltage of unit(s) to ensure proper voltage.



WARNING: Before performing service or maintenance operations on the system, turn off main power switches to the unit. Electrical shock could cause serious personal injury.

Process Water Applications

For process water applications, it is recommended that a secondary load heat exchanger be installed to prevent corrosion to the unit's primary coaxial coil. In situations where scaling could be heavy or where biological growth such as iron bacteria will be present, a closed loop system is recommended. Over a period of time, ground water unit heat exchanger coils may lose heat exchange capability due to a buildup of mineral deposits. These can be cleaned only by a qualified service mechanic as special pumping equipment and solutions are required. Never use flexible hoses with a smaller inside diameter than that of water connections.

Moving and Storage

Move units in the normal "Up" orientation as indicated by the labels on the unit packaging. When the equipment is received, all items should be carefully checked against the bill of lading to ensure that all crates and cartons have been received in good condition. Examine units for shipping damage, removing unit packaging if necessary to properly inspect unit. Units in question should also be internally inspected. If any damage is observed, the carrier should make the proper notation on delivery receipt acknowledging the damage. Units are to be stored in a location that provides adequate protection from dirt, debris and moisture.



WARNING: To avoid equipment damage, do not leave the system filled in a building without heat during cold weather, unless adequate freeze protection levels of antifreeze are used. Heat exchangers do not fully drain and will freeze unless protected, causing permanent damage.

Unit Location

Provide sufficient room to make water and electrical connections. If the unit is located in a confined space, provisions must be made for unit servicing. Locate the unit in an indoor area that allows easy removal of the access panels and has enough space for service personnel to perform maintenance or repair. These units are not approved for outdoor installation and, therefore, must be installed inside the structure being conditioned. Do not locate units in areas subject to freezing conditions.

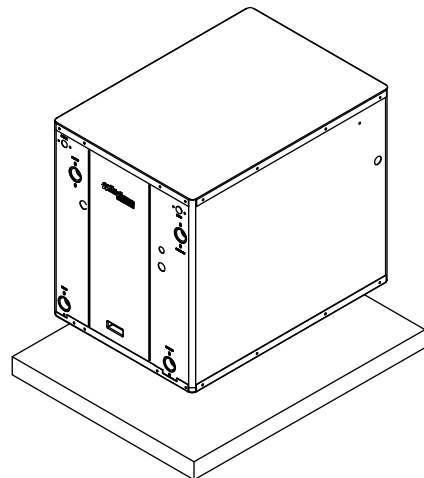


WARNING: Do not store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g. attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life.

Mounting Units

Prior to setting the unit in place, remove and discard the compressor hold down shipping bolt located at the front of the compressor mounting bracket.

Units should be mounted level on a vibration absorbing pad slightly larger than the base to provide isolation between the unit and the floor. It is not necessary to anchor the unit to the floor. Allow access to the front, back, and side access panels for servicing.



Vibration Pad Mounting

Water Quality

General

Water-to-water heat pumps may be successfully applied in a wide range of residential and light commercial applications. It is the responsibility of the system designer and installing contractor to ensure that acceptable water quality is present and that all applicable codes have been met in these installations. Failure to adhere to the guidelines in the water quality table could result in loss of warranty.

The heat exchangers and water lines in the units are copper or cupronickel tube. There may be other materials in the building's piping system that the designer may need to take into consideration when deciding the parameters of the water quality.

If an antifreeze or water treatment solution is to be used, the designer should confirm it does not have a detrimental effect on the materials in the system.

Application

These heat pumps are not intended for direct coupling to swimming pools and spas. If used for this type of application, a secondary heat exchanger must be used. Failure to supply a secondary heat exchanger for this application will result in warranty exclusion for primary heat exchanger corrosion or failure.

Contaminated Water

In applications where the water quality cannot be held to prescribed limits, the use of a secondary or intermediate heat exchanger is recommended to separate the unit from the contaminated water.

The following table outlines the water quality guidelines for unit heat exchangers. If these conditions are exceeded, a secondary heat exchanger is required. Failure to supply a secondary heat exchanger where needed will result in a warranty exclusion for primary heat exchanger corrosion or failure.

Water Treatment

Do not use untreated or improperly treated water. Equipment damage may occur. The use of improperly treated or untreated water in this equipment may result in scaling, erosion, corrosion, algae or slime. The services of a qualified water treatment specialist should be engaged to determine what treatment, if any, is required. The product warranty specifically excludes liability for corrosion, erosion or deterioration of equipment.



WARNING: Must have intermediate heat exchanger when used in pool and spa applications.

Water Quality Guidelines

Material		Copper	90/10 Cupronickel	316 Stainless Steel
pH	Acidity/Alkalinity	7 - 9	7 - 9	7 - 9
Scaling	Calcium and Magnesium Carbonate	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm
Corrosion	Hydrogen Sulfide	Less than 0.5 ppm (rotten egg smell appears at 0.5 ppm)	10 - 50 ppm	Less than 1 ppm
	Sulfates	Less than 125 ppm	Less than 125 ppm	Less than 200 ppm
	Chlorine	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Chlorides	Less than 20 ppm	Less than 125 ppm	Less than 300 ppm
	Carbon Dioxide	Less than 50 ppm	10 - 50 ppm	10 - 50 ppm
	Ammonia	Less than 2 ppm	Less than 2 ppm	Less than 20 ppm
	Ammonia Chloride	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Nitrate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Hydroxide	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Sulfate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Total Dissolved Solids (TDS)	Less than 1000 ppm	1000 - 1500 ppm	1000 - 1500 ppm
	LSI Index	+0.5 to -0.5	+0.5 to -0.5	+0.5 to -0.5
Iron Fouling (Biological Growth)	Iron, FE ²⁺ (Ferrous) Bacterial Iron Potential	< 0.2 ppm	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	Less than 1 ppm, above this level deposition will occur	Less than 1 ppm, above this level deposition will occur	Less than 1 ppm, above this level deposition will occur
Erosion	Suspended Solids	Less than 10 ppm and filtered for max. of 600 micron size	Less than 10 ppm and filtered for max. of 600 micron size	Less than 10 ppm and filtered for max. of 600 micron size
	Threshold Velocity (Fresh Water)	< 1.8 m/sec	< 1.8 m/sec	< 1.8 m/sec

NOTES: Grains = ppm divided by 17
mg/L is equivalent to ppm

2/22/12

Field Connected Water Piping

General

Each unit is equipped with captive FPT water connections to eliminate 'egg-shaping' from use of a backup wrench. For making the water connections to the unit, a Teflon tape thread sealant is recommended to minimize internal fouling of the piping. Do not over tighten connections. All supply and return water piping should be insulated to prevent excess condensation from forming on the water lines.

NOTES: 1) WaterFurnace recommends a male national pipe thread (NPT) to British standard pipe fitting (BSPF) to adapt to NSKW water connections. 2) Units are factory run-tested using propylene glycol. Prior to connecting piping to unit, thoroughly flush heat exchangers.

The piping installation should provide service personnel with the ability to measure water temperatures and pressures. The water lines should be routed so as not to interfere with access to the unit. The use of a short length of high pressure hose with a swivel type fitting may simplify the connections and prevent vibration. Optional stainless steel hose kits are available as an accessory item.

Before final connection to the unit, the supply and return hose kits must be connected, and the system flushed to remove dirt, piping chips and other foreign material. Normally, a combination balancing and close-off (ball) valve is installed at the return, and a rated gate or ball valve is installed at the supply. The return valve can be adjusted to obtain the proper water flow. The valves allow the unit to be removed for servicing.

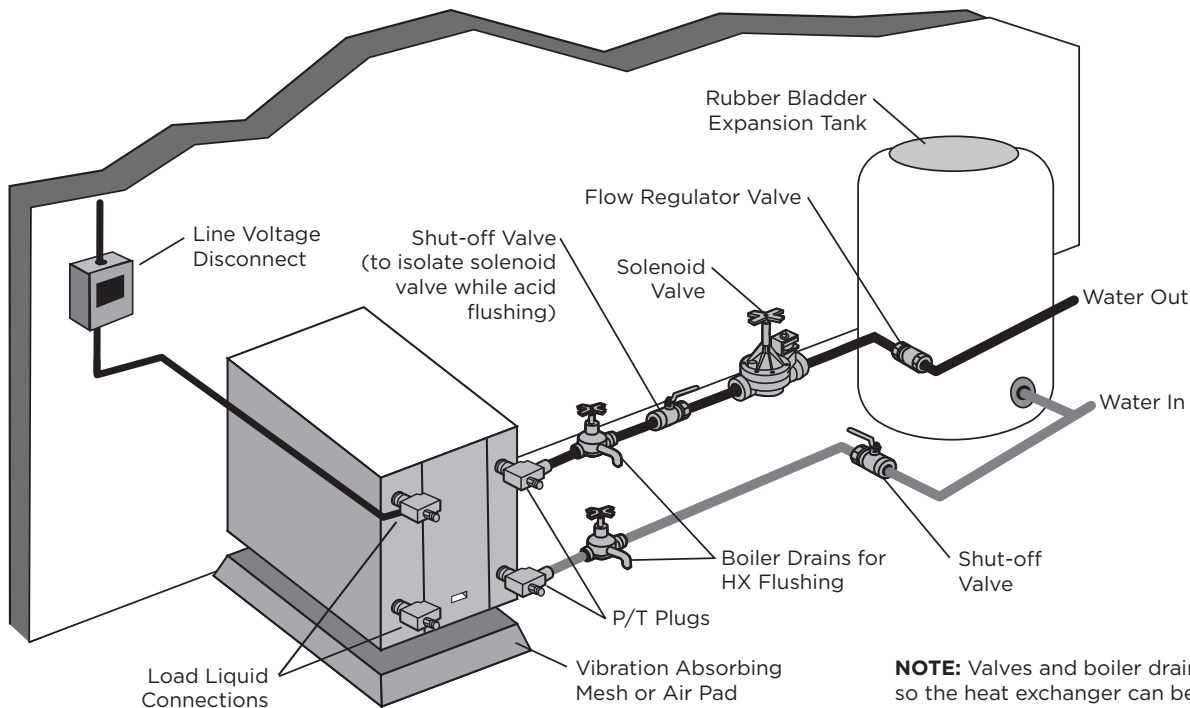
The proper water flow must be delivered to each unit whenever the unit heats or cools. To assure proper flow, the use of pressure/temperature ports is recommended to determine the flow rate. These ports should be located adjacent to the supply and return connections on the unit. The proper flow rate cannot be accurately set without measuring the water pressure drop through the refrigerant-to-water heat exchanger (See Pressure Drop Table for water flow and pressure drop information). Normally about 0.054 L/s flow rate per kw of cooling capacity (0.040 L/s per kw minimum) is needed. Both source as well as load fluid piping must be at least as large as the unit connections on the heat pump (larger on long runs).

Never use flexible hoses of a smaller inside diameter than that of the water connection on the unit and limit hose length to 3.05m per connection. Check carefully for water leaks.



CAUTION: Water piping exposed to outside temperature may be subject to freezing.

Typical Open Loop Installation



NOTE: Valves and boiler drains must be installed so the heat exchanger can be acid flushed.

Field Connected Water Piping cont.

Open Loop Well Water Systems

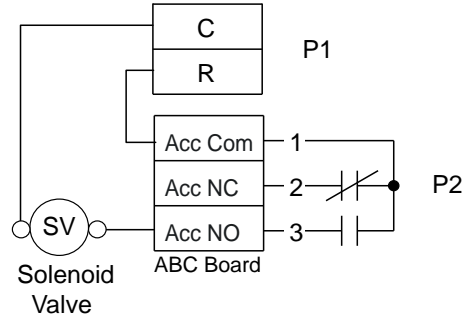
Always maintain water pressure in the heat exchanger by placing water control valves at the outlet of the unit. Use a closed bladder type expansion tank to minimize mineral deposits. Ensure proper water flow through the unit by checking pressure drop across the heat exchanger and comparing it to the figures in the pressure drop table. Normally, about 0.038 L/s per kW flow rate of cooling capacity is needed in open loop systems, 0.029 L/s per kW minimum if entering source temperature is above 10°C.

Some water control valves draw their power directly from the unit's 24V transformer and can overload and possibly burn out the transformer. Check total VA draw of the water valve(s) and ensure it is under 40 VA.

Discharge water from a heat pump can be disposed of in various ways depending on local building codes (i.e. recharge well, storm sewer, drain field, adjacent stream or pond, etc.). Most local codes restrict the use of sanitary sewer for disposal. Consult your local building and zoning departments to ensure compliance in your area.

Figure 9a: Open Loop Solenoid Valve Connection Option

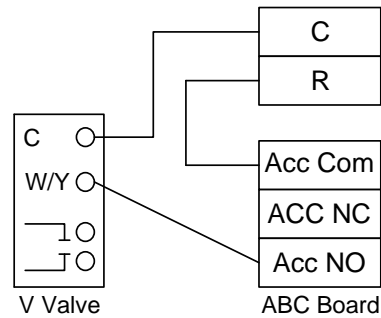
Typical quick operating external 24V water solenoid valve (type PPV100 or BPV100) wiring.



NOTE: SW2-4 and SW2-5 should be “OFF” to cycle with the compressor.

Figure 9b: Open Loop Solenoid Valve Connection Option

Typical slow operating external 24V water solenoid valve (type V100FPT) wiring.



NOTE: SW2-4 should be “ON” and SW2-5 should be “OFF” when using a slow opening (V100FPT) water valve.

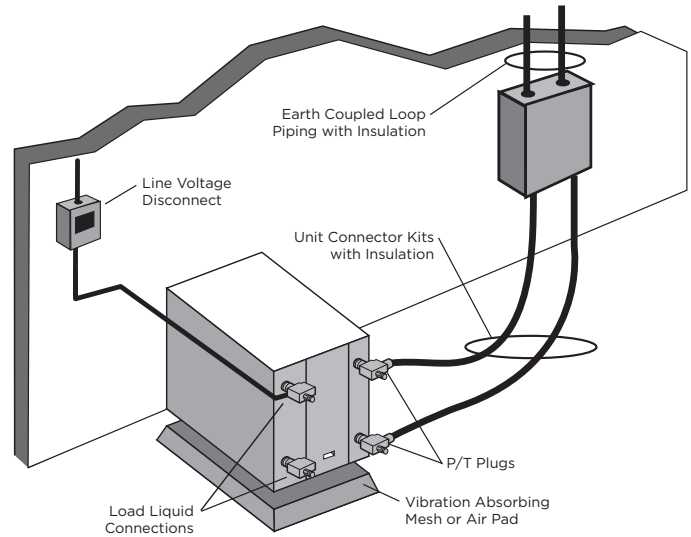
Field Connected Water Piping cont.

Earth Coupled Systems with Flow Center

Once piping is completed between the unit, flow center and the earth loop, final purging and charging of the loop is needed. A pump capable of 14 m³/hr @ 25 meters of head is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop itself. Antifreeze solution is used in most areas to prevent freezing. Maintain the pH in the 7.6-8.2 range for final charging.

Flush the system adequately to remove as much air as possible. Then, pressurize the loop to a static pressure of 345-517 kPa. This is normally adequate for good system operation. Ensure that the flow center provides adequate flow through the unit by checking pressure drop across the heat exchanger and by comparing it to the figures shown in the Pressure Drop tables. Usually, 0.054 L/s per kW or minimum 0.040 L/s per kW of cooling capacity is needed in closed loop earth-coupled applications.

Typical Closed Loop Earth Coupled Installation



Ground Loop Design and Installation

This instruction manual does not cover the design and installation of the ground loop system. WaterFurnace recommends that all ground loops are designed using GeoLink™ Design Studio (GDS) or another commercial software package. Installers shall follow the guidelines detailed in Microgeneration Certification Scheme (MCS) Installation Standard MIS 3005 for designing ground loop collectors. Additional guidance on ground collectors is provided by International Ground-Source Heat Pump Association (IGSHPA).

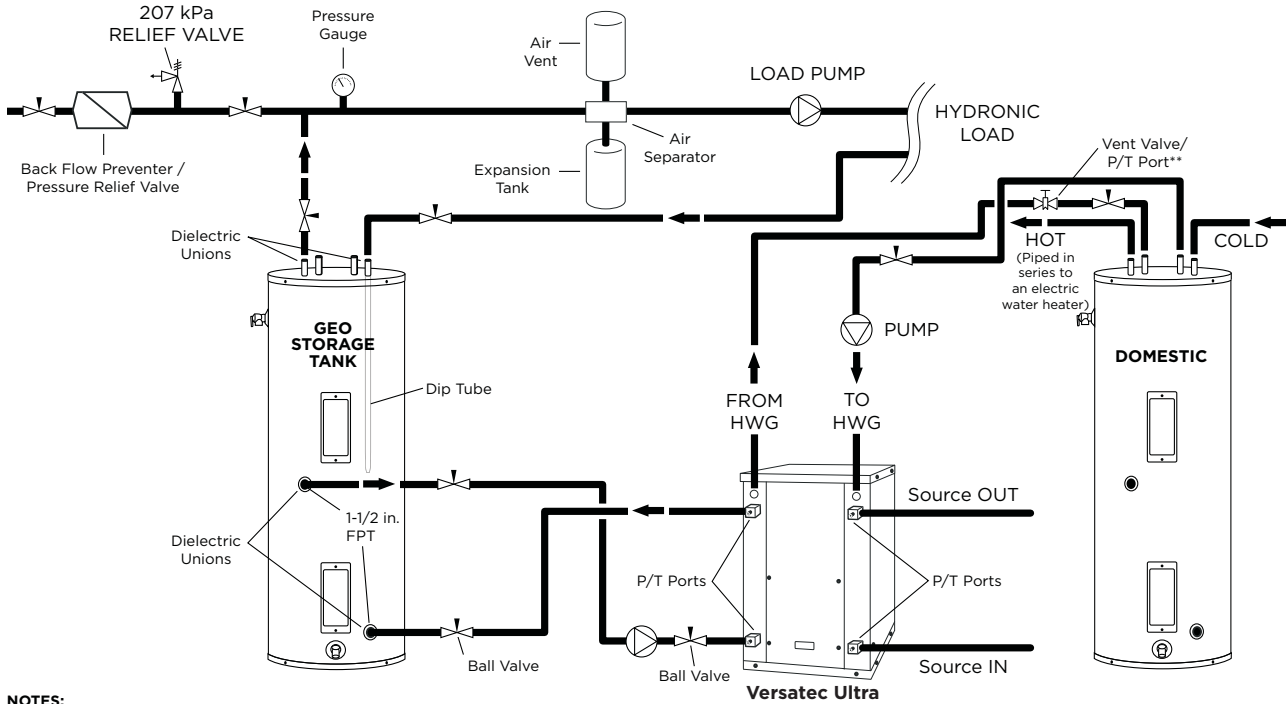
Potable Water Systems

TNSKW06 kW heat pumps can be equipped with a double-wall vented coaxial heat exchanger capable of hot water generation (HWG). An optional factory-installed hot water generator coil may be provided with NSKW08-17. The temperature of the hot water produced by the heat pump cannot be adjusted and will vary with the inlet temperature. WaterFurnace recommends the use of a properly sized buffer tank equipped with supplemental electric immersion heaters in conjunction with all NSKW models used in an HWG application. Immersion heaters must be capable of heating the water to 60°C at a regular time interval to prevent the build-up of bacteria such as Legionella. Installations must meet minimum requirements outlined in UK Domestic Heating Compliance Guide.



CAUTION: Hot water in excess of 60°C can cause scalding.

Suggested Domestic Water Heater Hookup



NOTES:

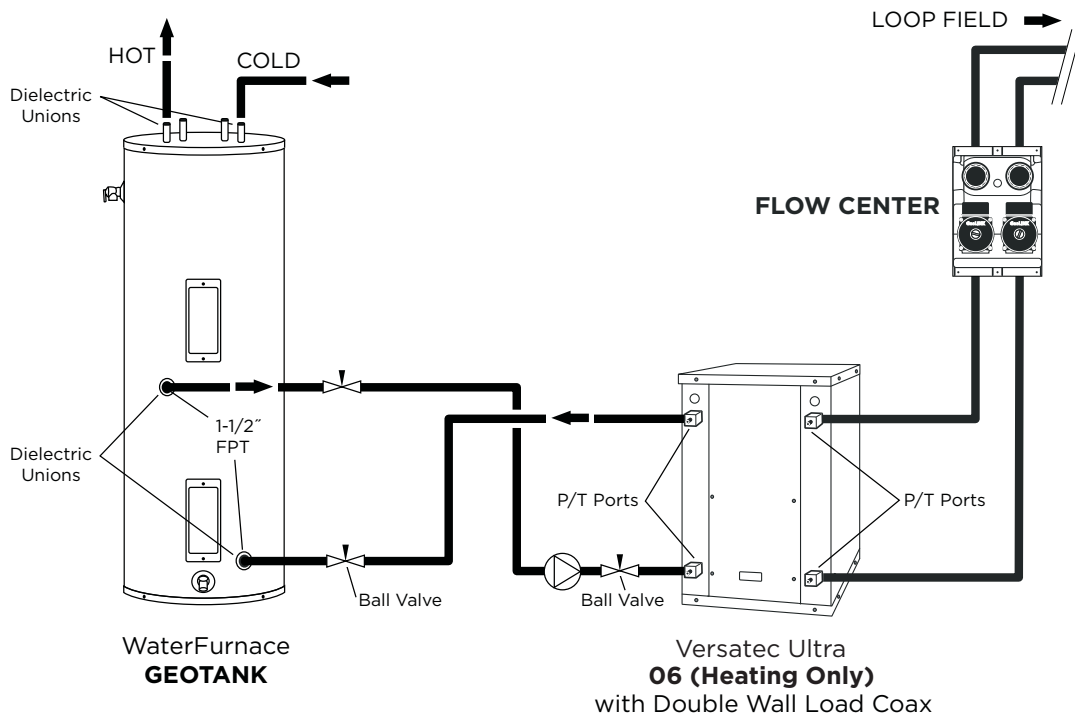
- * A 207 kPa pressure relief valve (Part No: SRV30) should be used in hydronic applications.
- ** Vent valve or P/T port at highest point in return line prior to ball valve.

Potable Water Systems cont.

Hot Water Generator Connections

The heat reclaiming hot water generator coil is vented double-wall copper construction and is suitable for potable water. To maximize the benefits of the hot water generator a minimum 50-gallon water heater is recommended. For higher demand applications, use an 80-gallon water heater as shown below or two 50-gallon water heaters connected in a series. A geo storage tank should not be used in this application unless it is plumbed in a series with an electric water heater. The geo storage tank is equipped with a single 4500 Watt element and will not be able to provide adequate water heating if used as a standalone water heater. Electric water heaters are recommended. Make sure all local electrical and plumbing codes are met for installing a hot water generator. The Versatec Ultra NSKW is not supplied with an internal circulator.

Alternate Hot Water Installation with Direct Coupling to a Double Wall Unit



NOTES:

- 1) Unions and valves must be installed so that acid flushing of the heat exchanger is possible.
- 2) Make sure there is not a check valve in the diptube of the tank.

Hydronic Section

General guidelines are shown below for component selection and design/installation criteria for the piping system. Local codes supersede any recommendations in this manual.

Shut Off/Flow Regulation Valves

Use full port ball valves or gate valves for component isolation. If valves are going to be used frequently, ball valves are recommended. Globe valves are designed for flow regulation. Always install globe valves in the correct direction (fluid should enter through the lower body chamber).

Check valves

Swing check valves must be installed in the horizontal position with the bonnet of the valve upright. Spring check valves can be mounted in any position. A flow check valve is required to prevent thermo-siphoning (or gravity flow) when the circulator pump is off or when there are two circulators on the same system.

Storage (Buffer) Tank

A buffer tank is required for all hydronic heating systems using Versatec Ultra heat pumps. The tank should be sized to provide 7.6 L of storage capacity for every 300 W of nominal heat pump capacity.

Pressure Relief Valve

Most codes require the use of a pressure relief valve if a closed loop heat source can be isolated by valves. Even if local code does not require this device, WaterFurnace recommends its installation. If the pressure relief valve in the buffer tank is not already rated at 207 kPa maximum pressure, one must be installed. The pressure relief valve should be tested at start up for operation. Note that the waste pipe must be at least the same diameter as the valve outlet (never reduce), and valves may not be added to this pipe. The bottom of the pipe must terminate at least 15 cm above the floor. If the piping is connected to a drain, there must be an air gap.

Backflow Prevention Check Valves

Most codes require backflow prevention check valves. Note that a single check valve is not equal to a backflow prevention check valve. Even if local code does not require this device, WaterFurnace recommends its installation. This is particularly important if the system will use antifreeze.

Pressure Reducing Valves or Feed Water Valves

This valve lowers the pressure from the make-up water line to the system. Most are adjustable and directional. A “fast fill” valve is required for initial filling of the system. Some have screens, which must be cleaned after the initial filling. If there is a restriction in the screen, the system could go to 0 kPa, potentially causing pumps(s) failure. A valve should be installed on each side of the pressure reducing valve for servicing. Both valves should have tags reading “Do not shut this valve under normal operation – service valve only.”

Expansion Tanks

Expansion tanks are required on hydronic systems to help absorb the pressure swings as the temperature in the system fluctuates.

Elbows/Tees

Long radius elbows or two 45° elbows will lower pressure drop. Standard tees have a greater restriction on the “T” portion than tees designed with angled outlet ports.

Antifreeze

Antifreeze is required if any of the piping system is located in areas subject to freezing.

Dielectric Unions

Dielectric unions are recommended whenever connecting two dissimilar metals to one and other to prevent electro-galvanic corrosion.

When using the various types of hydronic heat distribution systems, the temperature limits of the geothermal system must be a major consideration. In new construction, the distribution system can easily be designed with the temperature limits in mind. In retrofits, care must be taken to address the operating temperature limits of the existing distribution system. The maximum storage tank temperature for the Versatec Ultra NSKW is 54.4°C. Typical in floor radiant systems require much lower temperatures, typically 37.8°-46.1°C, which is ideal for the Versatec Ultra NSKW.

Hydronic Section cont.

If using a Geothermal Storage tank there will be two red wires exiting out of the top of the tank. These red wires extend internally down to the thermistor/tank thermostat section of the tank. Remove the bottom tank cover to expose the red wires as well as the yellow tank thermistor wires.

HydroZone

If using HydroZone control, connect the two red wires to the two yellow wires using wire nuts. Next, connect the two red wires from the top of the Geothermal Storage tank to "TS" and "GND" on the HydroZone. The "OAT" and "GND" terminals on the HydroZone are used for an outdoor air sensor.

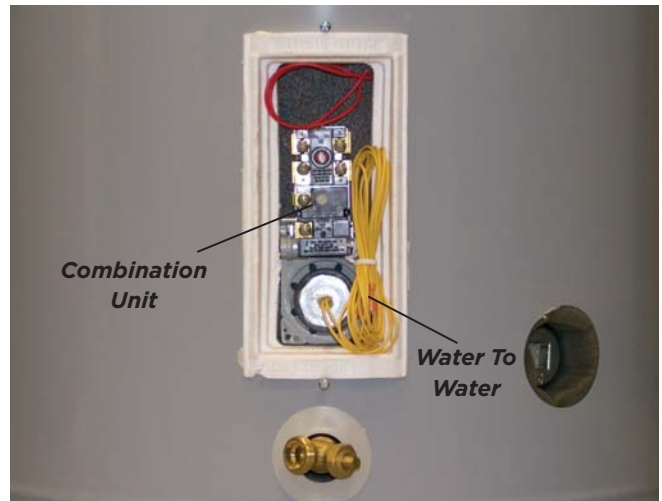
HydroStat

If using HydroStat control, connect the two red wires to the yellow wires using wire nuts. Next, connect the two red wires from the top of the Geothermal Storage tank to "TS" and "GND" on the HydroStat. The "OAT" and "GND" terminals on the HydroStat are used to connect the controller to the ELWT (Entering Load Water Temperature) well point sensor. This sensor is located on the load side entering water line inside the unit.

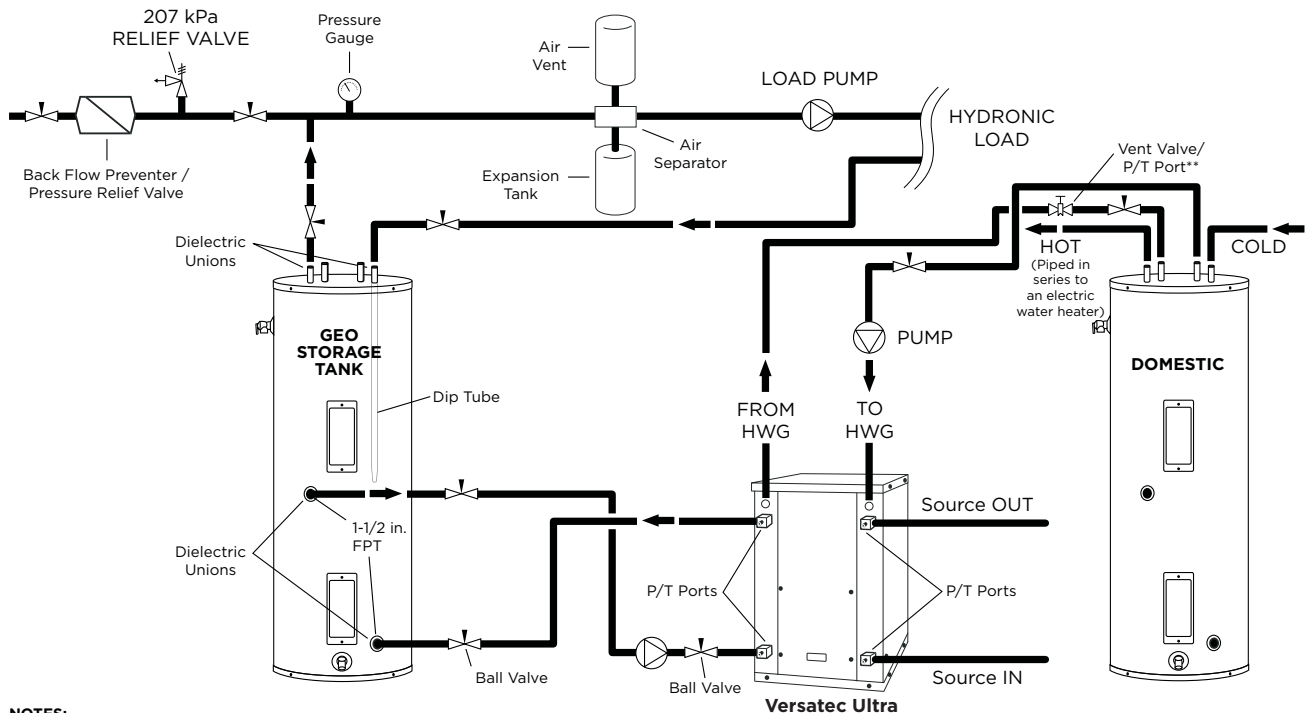
For other field installed controllers, these two red wires will need wired to the appropriate sensor input terminals. Another option for connection is to connect the thermostat on the Geothermal Storage tank directly to "R" and "Y1" on the ABC board.

Adequate rate of flow (L/s) is very important to system performance and long term reliability. Follow the guidelines for recommended flow in the recommendations table.

Geothermal Storage Tank Thermostat and Thermistor



Thermistor Wires Connected to TS and GND on HydroZone Controller.

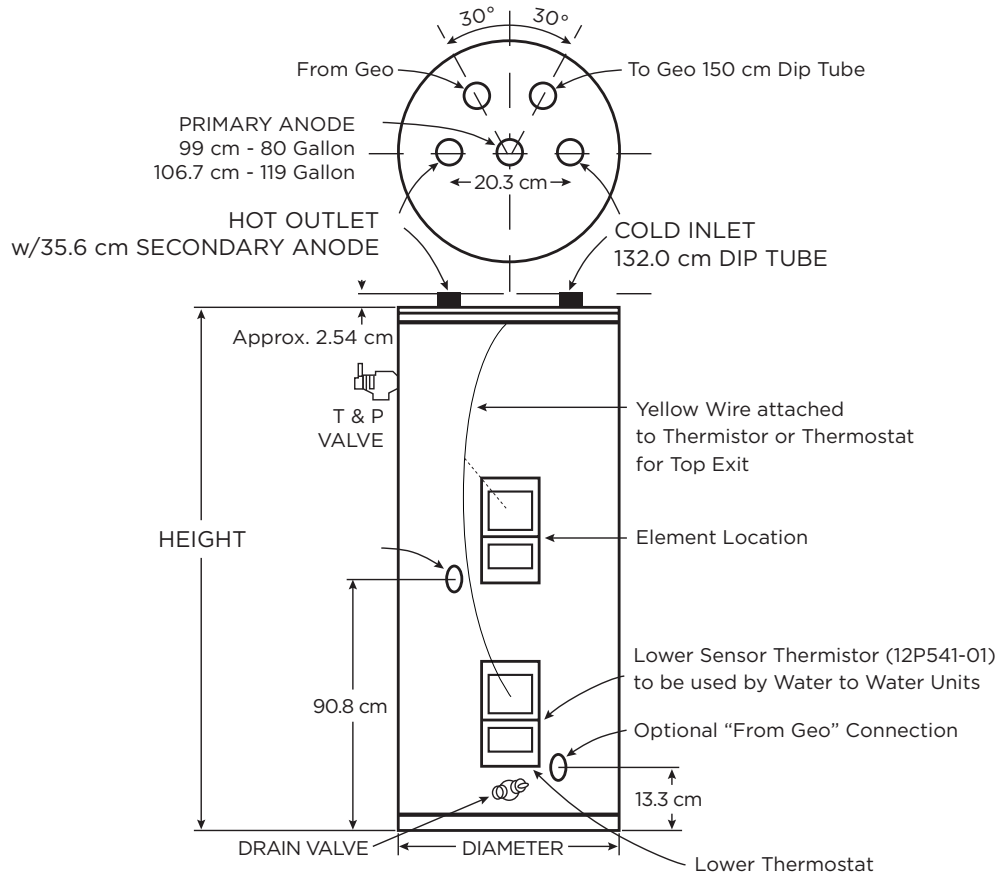


NOTES:

- * A 207 kPa pressure relief valve (Part No: SRV30) should be used in hydronic applications.
- ** Vent valve or P/T port at highest point in return line prior to ball valve.

Accessories and Options

Geo Storage Tank Dimensions



Model Number	Gallon [Liter] Capacity	Element Wattage (240 Volt)	Number of Elements	R Value	Dimensions in cm		Approx Shipping Weight kg
					Height	Diameter	
GEO-STORAGE-80	80 [303]	4500	1	16	160.6	61.0	92.5
GEO-STORAGE-120	119 [450]	4500	1	16	160.6	71.1	141.1

Electrical Data

Model	Rated Voltage	Voltage Min/Max	Compressor				Load Pump FLA	Source Pump FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR
			MCC	RLA	LRA	LRA*					
06	220-240/50/1	198/264	17.5	11.2	60.0	24.0	1.5	4.5	17.2	20.0	30
	380-420/50/3	342/462	6.5	4.2	28.0	16.8	-	-	4.2	5.3	6
08	220-240/50/1	198/264	27.0	17.3	97.0	34.0	1.5	4.5	23.3	27.6	40
	380-420/50/3	342/462	10.0	6.4	45.0	27.0	-	-	6.4	8.0	10
12	220-240/50/1	198/264	31.5	20.2	126.0	44.0	1.5	4.5	26.2	31.2	50
	380-420/50/3	342/462	12.1	7.8	51.5	31.0	-	-	7.8	9.8	15
17	220-240/50/1	198/264	45.0	29.0	130.0	46.0	1.5	4.5	35.0	42.3	70
	380-420/50/3	342/462	19.0	12.2	87.0	52.0	-	-	12.2	15.3	25

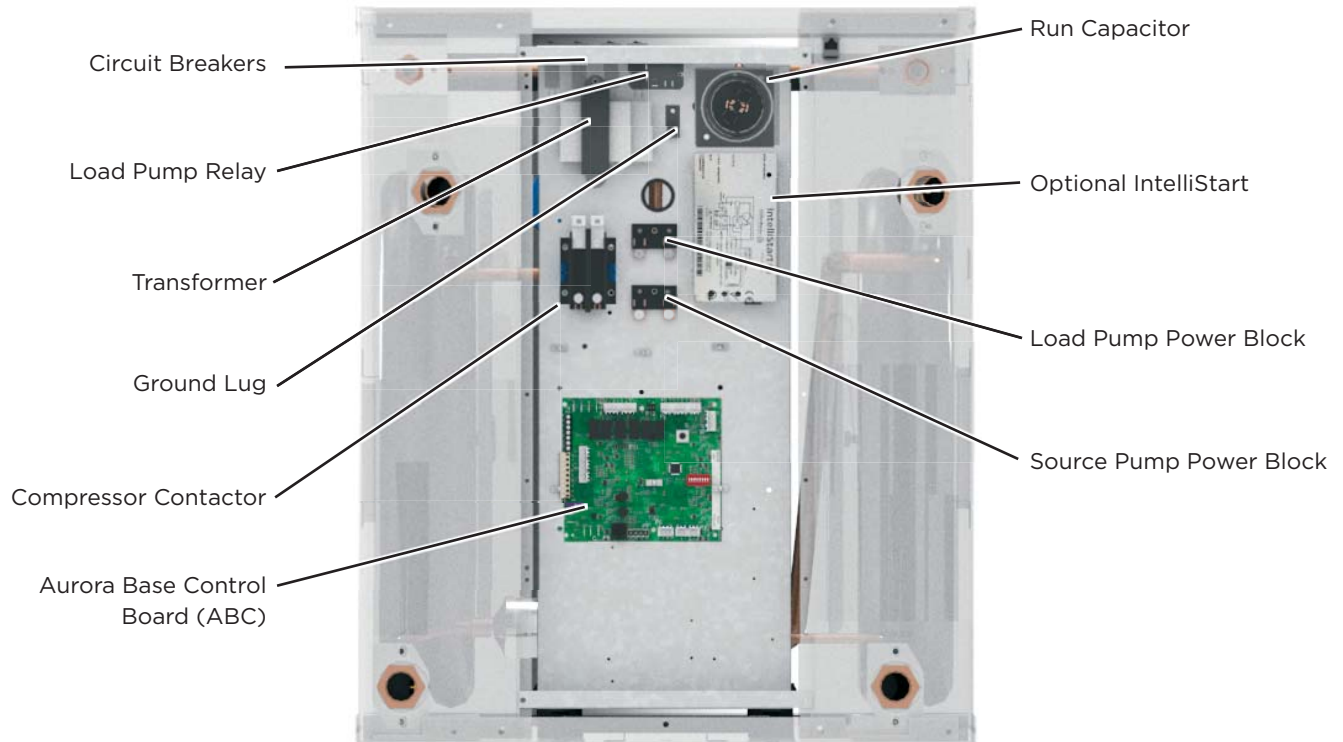
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Notes:

* - With optional IntelliStart, Type D MCB recommended

Electrical Data cont.

Control Box



Accessory Relay

A set of “dry” contacts has been provided to control accessory devices, such as water solenoid valves on open loop installations, electronic air cleaners, humidifiers, etc. This relay contact should be used only with 24 volt signals and not line voltage power. The relay has both normally open and normally closed contacts and can operate with either the fan or the compressor. Use DIP switch SW2-4 and 5 to cycle the relay with blower, compressor, or control a slow opening water valve. The relay contacts are available on terminals #1 and #3 for normally closed, and #2 and #3 for normally open on P2.

When powering high VA draw components, or V type open loop water valves, R should be taken ‘pre-fuse’ from the ‘R’ quick connect on the ABC board and not the ‘post-fuse’ ‘R’ terminal on the thermostat connection. If not, blown ABC fuses might result.

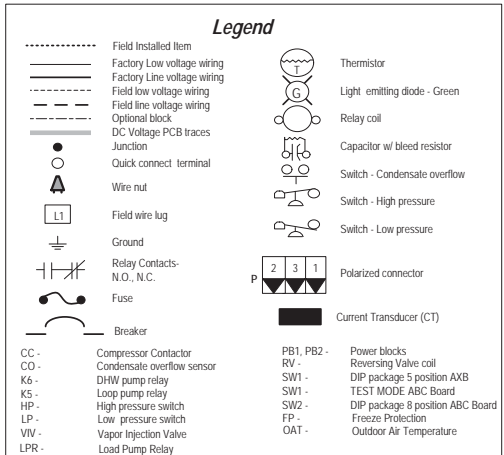
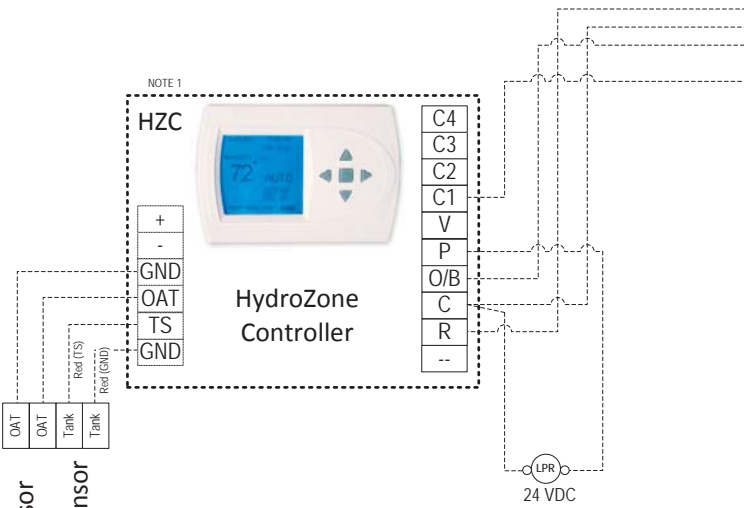
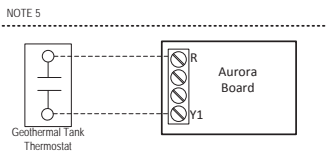
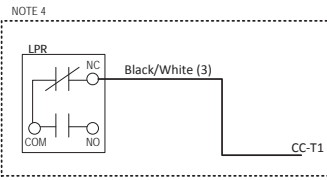
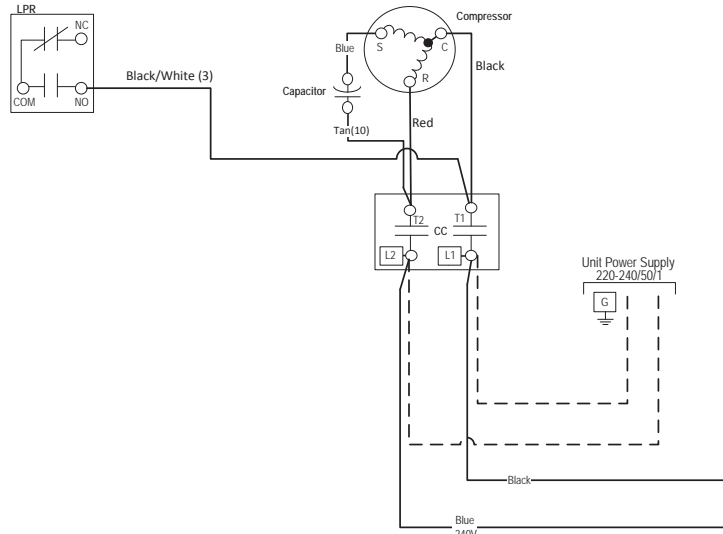
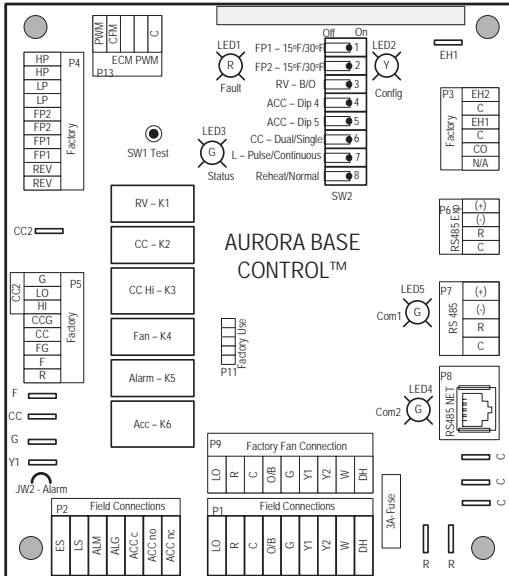
Control Box Relocation

The control box can be installed on the rear of the unit. To relocate the control box, follow the procedures below.

1. Remove all power sources to the unit.
2. Remove the unit’s top panel.
3. Cut all plastic wire ties to the following:
 - a) High pressure switch (black wires)
 - b) Low pressure switch (blue wires)
 - c) Freeze sensing and Thermistors
 - d) Compressor wires
4. Remove the four screws from the control box.
5. Relocate the control box to opposite end of the unit.
6. Using the screws removed in step 4 above, reattach the control box.
7. Move the RS485 Keystone Coupler to the opening on the back side of the unit.
8. Secure all wires so they do not come in contact with refrigerant lines.
9. Replace the top of the unit.
10. Replace both access panels.
11. Reapply power sources.

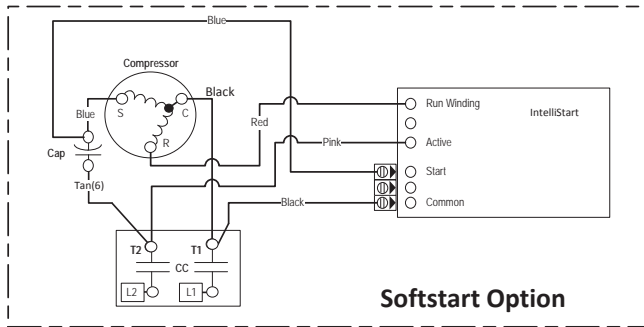
Wiring Schematics

Aurora Water-Water - 220-240/50/1

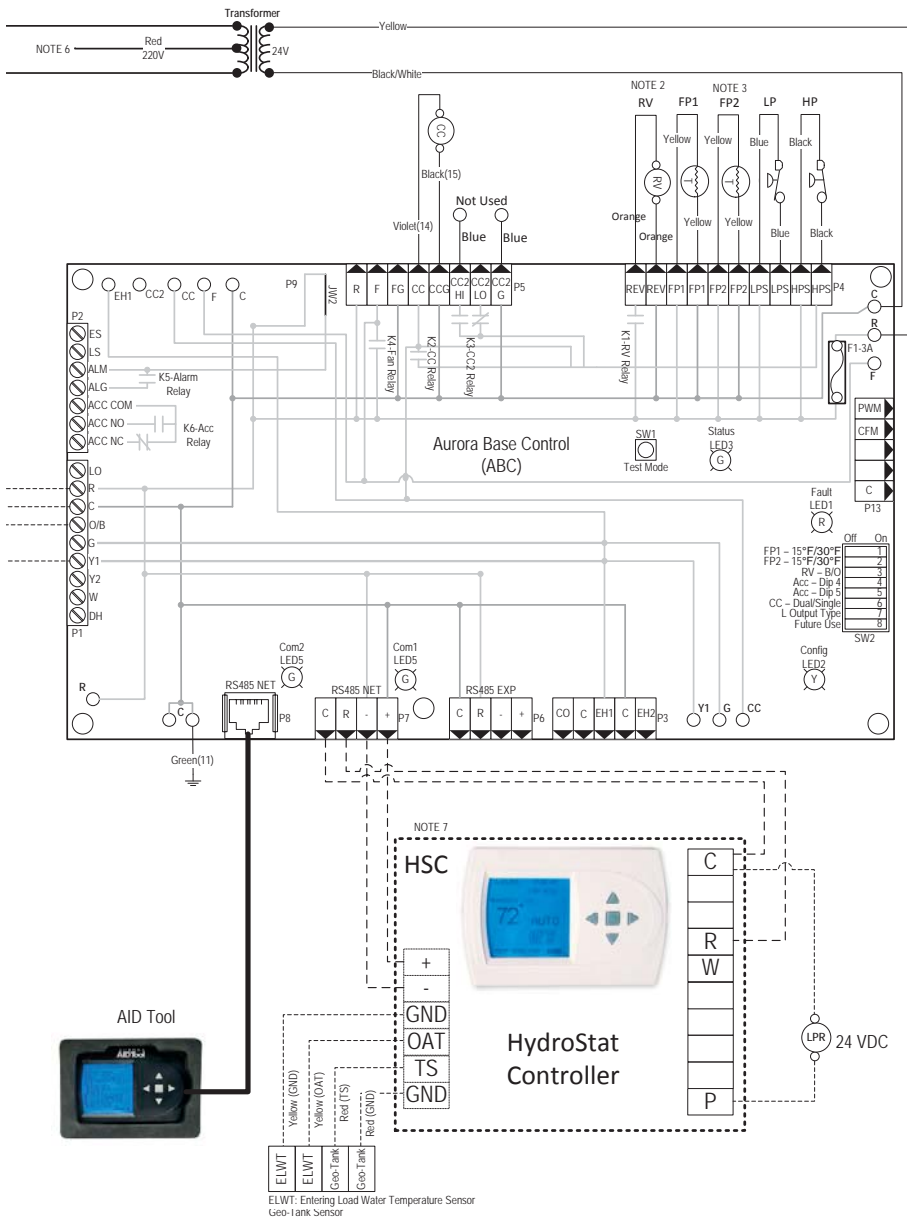


Wiring Schematics cont.

Aurora Water-Water - 220-240/50/1



- Notes**
- 1 - HydroZone controller is an optional field installed accessory.
 - 2 - Reversing Valve wires not installed on heating only option
 - 3 - FP2 is replaced with a resistor on heating only option
 - 4 - Move black/white(s) wire when HydroZone or HydroStat is not used for pump control to LPR-NC and CC-T1
 - 5 - When Geothermal Storage Tank is wired directly to the Aurora Board
 - 6 - Switch blue and red wire for 220V operation.
 - 7 - HydroStat communicating controller is an optional field installed accessory.



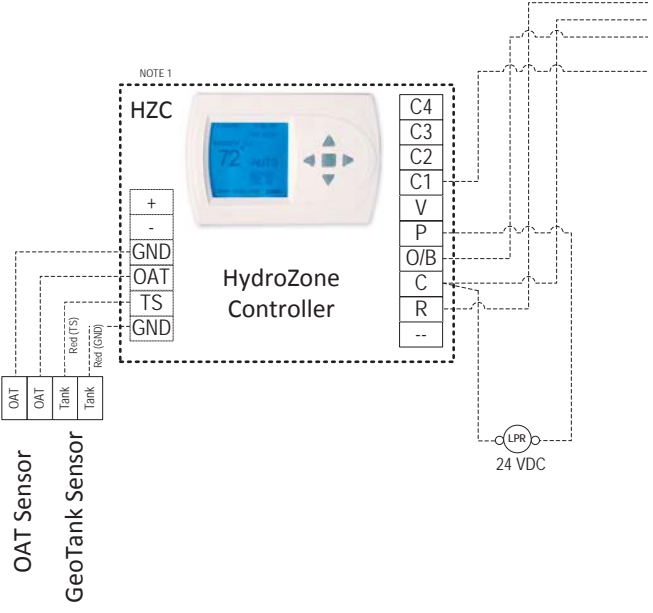
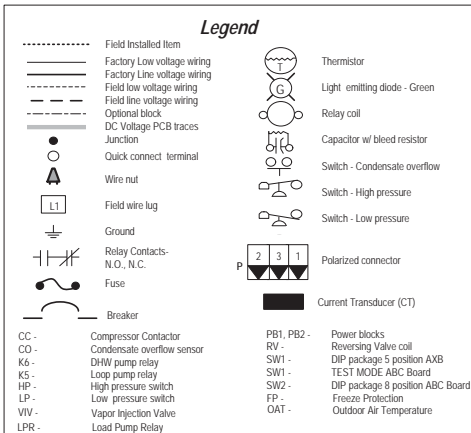
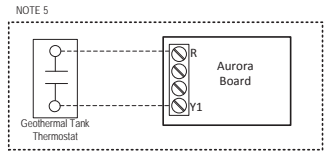
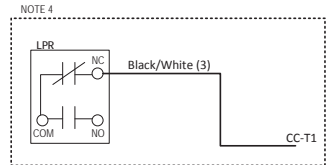
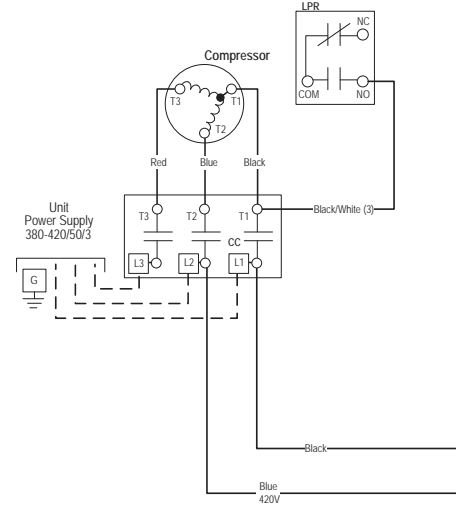
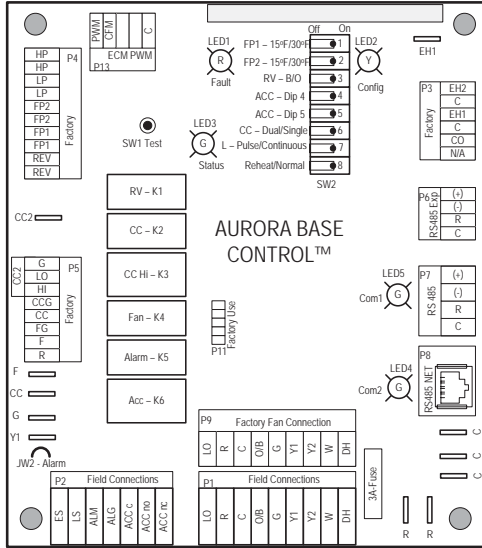
ABC SW2 Accessory Relay		
DESCRIPTION	SW2-4	SW2-5
Cycle with Blower	ON	ON
Cycle with Compressor	OFF	OFF
Water Valve Slow Opening	ON	OFF
Cycle with Comm. T-stat Hum Cmd	OFF	ON

Aurora Timing Events		
Event	Normal Mode	Test Mode
Random Start Delay	5 to 80 seconds	1 second
Compressor On Delay	5 seconds	< 1 second
Compressor Minimum On Time	2 minutes	5 seconds
Compressor Short Cycle Delay	4 minutes	15 seconds
Fault Recognition Delay - High Pressure	Less than 1 second	Less than 1 second
Start-Up Bypass - Low Pressure	2 minutes	30 seconds
Fault Recognition Delay - Low Pressure	30 seconds	30 seconds
Start-Up Bypass - Low Water Coil Limit	2 minutes	30 seconds
Fault Recognition Delay - Low Water Coil Limit	30 seconds	30 seconds
Fault Recognition Delay - Condensate Overflow	30 seconds	30 seconds
HydroZone Call Recognition Time	2 seconds	2 seconds
Water Valve Slow Open Delay	90 seconds	90 seconds

Aurora LED Flash Codes		
Flash Code	Description	Action
Slow Flash	1 second on and 1 second off	
Fast Flash	100 milliseconds on and 100 milliseconds off	
Flash Code	100 milliseconds on and 400 milliseconds off with a 2 second pause before repeating	
Random Start Delay (Alternating Colors)		Configuration LED (LED2, Yellow)
Status LED (LED1, Green)	Fast Flash	No Software Override
Configuration LED (LED2, Yellow)	Fast Flash	DIP Switch Override
Fault LED (LED3, Red)	Fast Flash	Fast Flash
Fault LED (LED1, Red)		Status LED (LED3, Green)
Normal Mode	OFF	Normal Mode
Input Fault Lockout	Flash Code 1	Control is Non-Functional
High Pressure Lockout	Flash Code 2	Test Mode
Low Pressure Lockout	Flash Code 3	Lockout Active
Future Use	Flash Code 4	Dehumidification Mode
Freeze Detection - FP1	Flash Code 5	Future Use
Reserved	Flash Code 6	Future Use
Condensate Overflow Lockout	Flash Code 7	Load Shed
Over/Under Voltage Shutdown	Flash Code 8	ESD
Future Use	Flash Code 9	Future Use
Future Use	Flash Code 10	Future Use
FP1 and FP2 Sensor Error	Flash Code 11	Flash Code 7

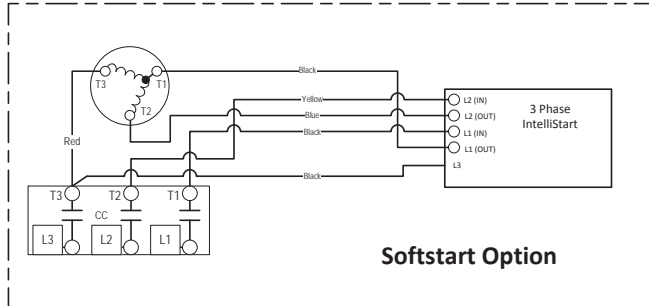
Wiring Schematics - Commercial

Aurora Water-Water - 380-420/50/3

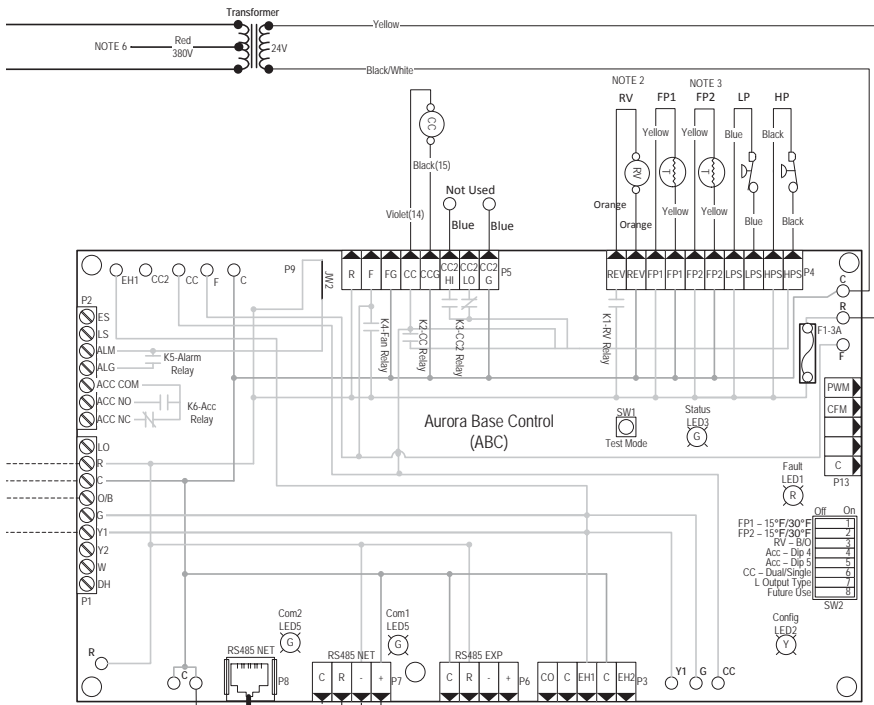


Wiring Schematics - Commercial cont.

Aurora Water-Water - 380-420/50/3



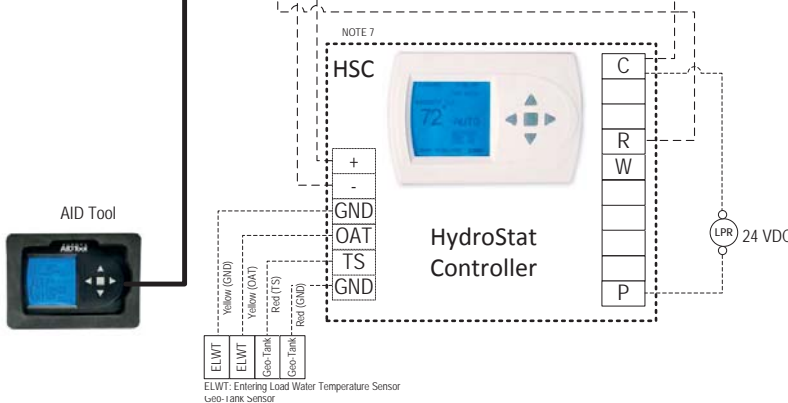
- Notes**
- 1 - HydroZone controller is an optional field installed accessory.
 - 2 - Reversing Valve wires not installed on heating only option
 - 3 - FP2 is replaced with a resistor on heating only option
 - 4 - Move black/white(3) wire when HydroZone or HydroStat is not used for pump control to LPR-NC and CC-T1
 - 5 - When Geothermal Storage Tank is wired directly to the Aurora Board
 - 6 - Switch blue and red wires for 380V operation
 - 7 - HydroStat communicating controller is an optional field installed accessory.



Aurora LED Flash Codes			
Slow Flash	1 second on and 1 second off		
Fast Flash	100 milliseconds on and 100 milliseconds off		
Flash Code	100 milliseconds on and 400 milliseconds off with a 2 second pause before repeating	Configuration LED (LED2, Yellow)	
Status LED (LED1, Green)	Fast Flash	No Software Override	OFF
Configuration LED (LED2, Yellow)	Fast Flash	DIP Switch Override	Slow Flash
Fault LED (LED3, Red)	Fast Flash		
Fault LED (LED1, Red)		Status LED (LED3, Green)	
Normal Mode	OFF	Normal Mode	ON
Input Fault Lockout	Flash Code 1	Control is Non-Functional	OFF
High Pressure Lockout	Flash Code 2	Test Mode	Slow Flash
Low Pressure Lockout	Flash Code 3	Lockout Active	Fast Flash
Future Use	Flash Code 4	Dehumidification Mode	Flash Code 2
Freeze Detection - FP1	Flash Code 5	Future Use	Flash Code 3
Reserved	Flash Code 6	Future Use	Flash Code 4
Condensate Overflow Lockout	Flash Code 7	Load Shed	Flash Code 5
Over/Under Voltage Shutdown	Flash Code 8	ESD	Flash Code 6
Future Use	Flash Code 9	Future Use	Flash Code 7
Future Use	Flash Code 10		
FP1 and FP2 Sensor Error	Flash Code 11		

ABC SW2 Accessory Relay			
DESCRIPTION	SW2-4	SW2-5	
Cycle with Blower	ON	ON	ON
Cycle with Compressor	OFF	OFF	OFF
Water Valve Slow Opening	ON	OFF	OFF
Cycle with Comm. T-stat Hum Cmd	OFF	ON	ON

Aurora Timing Events			
Event	Normal Mode	Test Mode	
Random Start Delay	5 to 80 seconds	1 second	
Compressor On Delay	5 seconds	< 1 second	
Compressor Minimum On Time	2 minutes	5 seconds	
Compressor Short Cycle Delay	4 minutes	15 seconds	
Fault Recognition Delay - High Pressure	Less than 1 second	Less than 1 second	
Start-Up Bypass - Low Pressure	2 minutes	30 seconds	
Fault Recognition Delay - Low Pressure	30 seconds	30 seconds	
Start-Up Bypass - Low Water Coil Limit	2 minutes	30 seconds	
Fault Recognition Delay - Low Water Coil Limit	30 seconds	30 seconds	
Fault Recognition Delay - Condensate Overflow	30 seconds	30 seconds	
HydroZone Call Recognition Time	2 seconds	2 seconds	
Water Valve Slow Open Delay	80 seconds	80 seconds	



External Control

An external controller is necessary for operation. For water storage tank set point control the HydroStat HZC, and HZO may be used. A field supplied aquastat may also be used as the external control to the heat pump. If zoning is required, the Hydrologic Zone Panels and Control system can provide up to eight zones of closed loop hydronic heating and cooling.

HydroStat features:

- Communicating Controller
- Pump Sampling
- 6.4 cm x 6.4cm LCD display and five push buttons serve as the human interface
- Controls and regulates water tank temperature
- Fahrenheit or Celsius
- Single Stage

HydroZone HZC features:

- 6.4 cm x 6.4cm LCD display and five push buttons serve as the human interface
- Controls and regulates water tank temperature
- Fahrenheit or Celsius
- Outdoor reset
- Warm weather shutdown
- Single Stage

HydroZone HZO features:

- HZC mounted on 19.0 cm x 19.0 cm x 8.3 cm electrical box
- HydroZone relay board
- 6.4 cm x 6.4cm LCD display and five push buttons serve as the human interface
- Controls and regulates water tank temperature
- Fahrenheit or Celsius
- Outdoor reset
- Warm weather shutdown
- Staging (up to 4 stages)
- Lead/Lag (when staging)

HydroLogic features:

- Operates radiant floor heating
- Operates hydronic fan coil heating and cooling
- 4 zones expandable to 8 zones
- Communicating 2 wire controls
- Controls 2 stages of compressors with rotation
- Controls backup heat source
- Intelligent heat/cool switchover
- Fahrenheit or Celsius
- Outdoor reset
- Indoor temperature feedback
- Warm weather shutdown

Converting to a Dedicated Cooling Unit

Procedure to Convert a Heating Only Unit to a Cooling Only Unit

All non-reversible units are built at the factory as dedicated heating units. Follow the procedures below to make the unit a dedicated cooling unit.

1. Shut off all power to the unit.
2. Remove the top and front access panel.
3. Refer to the labels on the unit for the location of ports and lines.
4. Connect the "Source Water-In" line to the port marked "Load Water-In." Then, connect the "Source Water-Out" line to the port marked "Load Water-Out."
5. Connect the "Load Water-In" line to the port marked "Source Water-In." Then, connect the "Load Water-Out" line to the port marked "Source Water-Out."
6. Flip flop locations for "FP1" and "FP2" thermistors. FP1 gets installed where FP2 is and FP2 installs where FP1 was.
7. Replace the top and front access panel.
8. Make sure all screws have been re-installed.
9. Turn on the power.

NOTE: A reversible unit **can not** be configured to heating only.

Unit Startup

Before Powering Unit, Check the Following:

NOTE: Remove and discard the compressor hold down shipping bolt located at the front of the compressor mounting bracket.

- **High voltage wiring is correct and matches the nameplate.**
- **Fuses, breakers and wire size are correct.**
- Piping is completed and water system has been cleaned and flushed.
- Air is purged from the closed loop system.
- Isolation valves are open and loop water control valves or loop pumps are wired.
- Service/access panels are in place.

Powering The Controls

Initial Configuration of the Unit

Before operating the unit, apply power and complete the following Aurora Startup procedure for the controls configuration. An AID Tool is recommended for setup, configuration and troubleshooting. AID Tool version 2.05 or greater is preferred.

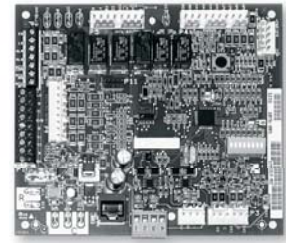
1. Configure Aurora Screen

- a. If HydroStat is installed, add 'TST' and ensure communication is present.

The Aurora Base Control System


Aurora 'Base' Control

The Aurora 'Base' Control (ABC) System is a complete residential and commercial comfort system that brings all aspects of the HVAC system into one cohesive module network. The ABC features microprocessor control and HP, LP, condensate and freeze detection, over/under voltage faults, along with communicating thermostat capability for complete fault detection text at the thermostat.



Aurora uses the Modbus communication protocol to communicate between modules. Each module contains the logic to control all features that are connected to the module. The Aurora 'Base' Control (ABC) has two Modbus channels. The first channel is configured as a master for connecting to devices such as a communicating thermostat, expansion board, or other slave devices. The second channel is configured as a slave for connecting the Aurora Interface Diagnostics Tool (AID Tool).

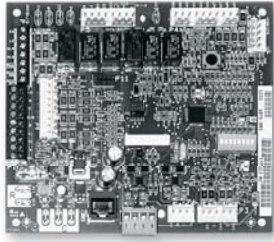
Aurora Control Features	Description	Aurora 'Base'
Microprocessor Compressor Control	Microprocessor control of compressor for timings with FPI, HP, LP, Condensate, assignable Acc relay	•
Base Hot Water Generator Operation	Compressor Contactor powers Hot Water Generator Pump with inline circuit breaker and thermostat limit.	•
Base Loop Pump Control	Compressor Contactor powers Loop Pump with inline circuit breaker and no loop pump linking capability.	•

Service Device	Description	Aurora 'Base'
 <p>Aurora Interface and Diagnostics (AID) Tool</p>	<p>Allows setup, monitoring and troubleshooting of any Aurora Control.</p> <p>NOTE: Although the ABC has basic compatibility with all Aurora, new product features may not be available on older AID Tools. To simplify the basic compatibility ensure the version of AID is at least the same or greater than the ABC software version.</p>	<p>For Service (Ver. 1.xx or greater)</p>

Add On Thermostats and Zoning	Description	Aurora 'Base'
HydroStat	Communicating controller for one hydronic heat pump.	Optional
HZO	Non-communicating controller for up to four heat pumps.	Optional
HZC	Non-communicating controller for one hydronic heat pump	Optional

The Aurora Base Control System cont.

Aurora 'Base' Control



NOTE: Refer to the Aurora Base Control Application and Troubleshooting Guide and the Instruction Guide: Aurora Interface and Diagnostics (AID) Tool for additional information.

Control Features

- Random start at power up
- Anti-short cycle protection
- High and low pressure cutouts
- Loss of charge
- Water coil freeze detection
- Over/under voltage protection
- Load shed
- Emergency shutdown
- Diagnostic LED
- Test mode push button switch
- Alarm output
- Accessory output with N.O. and N.C.
- Modbus communication (master)
- Modbus communication (slave)

Field Selectable Options via Hardware

DIP Switch (SW1) – Test/Configuration Button (See SW1 Operation Table)

Test Mode

The control is placed in the test mode by holding the push button switch SW1 for 2 - 5 seconds. In test mode most of the control timings will be shortened by a factor of sixteen (16). LED3 (green) will flash at 1 second on and 1 second off. Additionally, when entering test mode LED1 (red) will flash the last lockout one time. Test mode will automatically time out after 30 minutes. Test mode can be exited by pressing and holding the SW1 button for 2 to 5 seconds or by cycling the power. **NOTE:** Test mode will automatically be exited after 30 minutes.

Reset Configuration Mode

The control is placed in reset configuration mode by holding the push button switch SW1 for 50 to 60 seconds. This will reset all configuration settings and the EEPROM back to the factory default settings. LED3 (green) will turn off when entering reset configuration mode. Once LED3 (green) turns off, release SW1 and the control will reset.

DIP Switch (SW2)

SW2-1 (Source) FP1 Selection – Low water coil temperature limit setting for freeze detection. On = 30°F(-1.1°C); Off = 15°F(-9.4°C).

SW2-2 (Load) FP2 Selection – On = 30°F(-1.1°C); Off = 15°F(-9.4°C)

SW2-3 RV – O/B - thermostat type. Heat pump thermostats with “O” output in cooling or “B” output in Heating can be selected. On = O; Off = B.

SW2-4 Access Relay Operation (P2)
and 2-5

Access Relay Operation	SW2-4	SW2-5
Cycle with Blower	n/a	
Cycle with Compressor	OFF	OFF
Water Valve Slow Opening	ON	OFF
Cycle with Comm. T-stat Hum Cmd	n/a	

Cycle with Blower - (Not used on water-to-water)

Cycle with Compressor - The accessory relay will cycle with the compressor output.

Water Valve Slow Opening - The accessory relay will cycle and delay both the blower and compressor output for 90 seconds.

SW2-6 CC Operation – selection of single or dual capacity compressor. On = Single Stage; Off = Dual Capacity

SW2-7 Lockout and Alarm Outputs (P2) – selection of a continuous or pulsed output for both the LO and ALM Outputs. On = Continuous; Off = Pulsed

SW2-8 *Future Use*

Alarm Jumper Clip Selection

From the factory, ALM is connected to 24 VAC via JW2. By cutting JW2, ALM becomes a dry contact connected to ALG.

Field Selectable Options via Software

(Selectable via the Aurora AID Tool)

Safety Features

The following safety features are provided to protect the compressor, heat exchangers, wiring and other components from damage caused by operation outside of design conditions.

Fuse – a 3 amp automotive type plug-in fuse provides protection against short circuit or overload conditions.

Anti-Short Cycle Protection – 4 minute anti-short cycle protection for the compressor.

Random Start – 5 to 80 second random start upon power up.

The Aurora Base Control System cont.

Fault Retry - in the fault condition, the control will stage off the outputs and then “try again” to satisfy the thermostat Y input call. Once the thermostat input calls are satisfied, the control will continue on as if no fault occurred. If 3 consecutive faults occur without satisfying the thermostat Y input call, then the control will go to Lockout mode.

Lockout - The Alarm output (ALM) and Lockout output (L) will be turned on. The fault type identification display LED1 (Red) shall flash the fault code. To reset lockout conditions with SW2-8 On, thermostat inputs “Y1”, “Y2”, and “W” must be removed for at least 3 seconds. To reset lockout conditions with SW2-8 Off, thermostat inputs “Y1”, “Y2”, “W”, and “DH” must be removed for at least 3 seconds. Lockout may also be reset by turning power off for at least 30 seconds or by enabling the emergency shutdown input for at least 3 seconds.

High Pressure - fault is recognized when the Normally Closed High Pressure Switch, P4-9/10 opens, no matter how momentarily. The High Pressure Switch is electrically in series with the Compressor Contactor and serves as a hard-wired limit switch if an overpressure condition should occur.

Low Pressure - fault is recognized when the Normally Closed Low Pressure Switch, P4-7/8 is continuously open for 30 seconds. Closure of the LPS any time during the 30 second recognition time restarts the 30 second continuous open requirement. A continuously open LPS shall not be recognized during the 2 minute startup bypass time.

Loss of Charge - fault is recognized when the Normally Closed Low Pressure Switch, P4-7/8 is open prior to the compressor starting.

Freeze Detection (Source Coax) - set points shall be either 30°F(-1.1°C) or 15°F(-9.4°C). When the thermistor temperature drops below the selected set point, the control shall begin counting down the 30 seconds delay. If the thermistor value rises above the selected set point, then the count should reset. The resistance value must remain below the selected set point for the entire length of the appropriate delay to be recognized as a fault. This fault will be ignored for the initial 2 minutes of the compressor run time.

Freeze Detection (Load Coax) - uses the FP2 input to protect against ice formation on the coax. The FP2 input will operate exactly like FP1.

Over/Under Voltage Shutdown - An over/under voltage condition exists when the control voltage is outside the range of 18 VAC to 30 VAC. If the over/under voltage shutdown lasts for 15 minutes, the lockout and alarm relay will be energized. Over/under voltage shutdown is self-resetting in that if the voltage comes back within range of 18 VAC to 30 VAC for at least 0.5 seconds, then normal operation is restored.

Operation Description

Power Up - The unit will not operate until all the inputs and safety controls are checked for normal conditions. The unit has a 5 to 80 second random start delay at power up. Then the compressor has a 4 minute anti-short cycle delay after the random start delay.

Standby In standby mode, Y1, Y2, W, DH, and G are not active. Input O may be active. The blower and compressor will be off.

Heating Operation

Heating, 1st Stage (Y1) - The compressor is energized 10 seconds after the Y1 input is received.

Cooling Operation

In all cooling operations, the reversing valve directly tracks the O input. Thus, anytime the O input is present, the reversing valve will be energized.

Cooling, 1st Stage (Y1, O) - The compressor is energized 10 seconds after the Y1 input is received.

Emergency Shutdown - Four (4) seconds after a valid ES input, P2-7 is present, all control outputs will be turned off and remain off until the emergency shutdown input is no longer present. The first time that the compressor is started after the control exits the emergency shutdown mode, there will be an anti-short cycle delay followed by a random start delay. Input must be tied to common to activate.

Load Shed - The LS input disables all outputs with the exception of the blower output. When the LS input has been cleared, the anti-short cycle timer and random start timer will be initiated. Input must be tied to common to activate.

The Aurora Base Control System cont.

Aurora 'Base' Control LED Displays

These three LEDs display the status, configuration, and fault codes for the control. These can also be read in plain English via the Aurora AID Tool.

Status LED (LED3, Green)

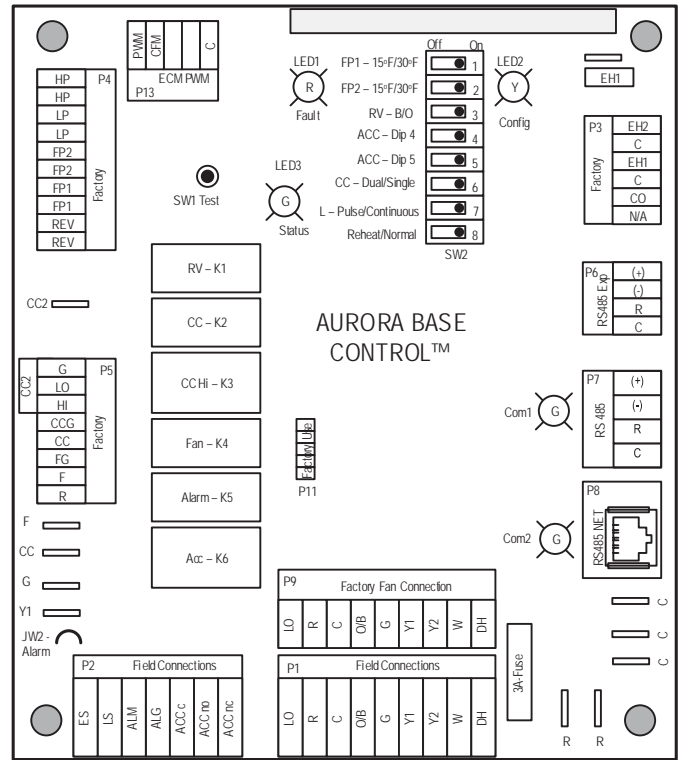
Description of Operation	Fault LED, Green
Normal Mode	ON
Control is Non-functional	OFF
Test Mode	Slow Flash
Lockout Active	Fast Flash
Dehumidification Mode	Flash Code 2
(Future Use)	Flash Code 3
(Future Use)	Flash Code 4
Load Shed	Flash Code 5
ESD	Flash Code 6
(Future Use)	Flash Code 7

Fault LED (LED1, Red)

Red Fault LED	LED Flash Code*	Lockout	Reset/Remove
Normal - No Faults	OFF	-	
Fault - Input	1	No	Auto
Fault - High Pressure	2	Yes	Hard or Soft
Fault - Low Pressure	3	Yes	Hard or Soft
Fault - Freeze Detection FP2	4	Yes	Hard or Soft
Fault - Freeze Detection FP1	5	Yes	Hard or Soft
Fault - Condensate Overflow	7	Yes	Hard or Soft
Fault - Over/Under Voltage	8	No	Auto
Fault - FP1 & FP2 Sensor Error	11	Yes	Hard or Soft

NOTE: All codes >11 use long flash for tens digit and short flash for the ones digit. 20, 30, 40, 50, etc. are skipped.

ABC Control Board Layout



Aurora Interface and Diagnostics (AID) Tool

The Aurora Interface and Diagnostics (AID) Tool is a device that is a member of the Aurora network. The AID Tool is used to troubleshoot equipment which uses the Aurora control via Modbus RTU communication. The AID Tool provides diagnostics, fault management, ECM setup, and system configuration capabilities to the Aurora family of controls. An AID Tool is recommended, although not required, for ECM airflow settings. The AID Tool simply plugs into the exterior of the cabinet in the AID Tool port.



Reference Calculations

Heating Calculations: $LWT = EWT - \frac{HE}{L/s \times 4.2^*}$	Cooling Calculations: $LWT = EWT + \frac{HR}{L/s \times 4.2^*}$
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NOTE: * When using water. Use 4.1 for 15% methanol/water or Environol solution.

Legend and Notes

ABBREVIATIONS AND DEFINITIONS:

COP = coefficient of performance
 EER = cooling energy efficiency (TC/kW)
 ELT = entering load fluid temperature
 EST = entering source fluid temperature to heat pump
 FLA = full load amps
 FtHd = pressure drop in feet of head
 gpm = US gallon per minute
 HC = heating capacity in kW
 HE = heat of extraction in kW
 HR = heat rejected in kW
 kPa = kilopascal
 kW = kilowatt

L/s = liters per second
 LLT = leaving load fluid temperature from heat pump
 LRA = locked rotor amps (starting current)
 LST = leaving source fluid temperature from heat pump
 LWPD = load heat exchanger water pressure drop
 MCC = maximum continuous current
 PD = pressure drop
 psi = pressure drop in pounds per square inch
 P/T = Pressure/Temperature
 RLA = rated load amps
 TC = total cooling capacity in kW
 W = Watt

CONVERSIONS:

$x^{\circ}F = (x - 32)/1.8^{\circ}C$
 1 bar = 100 kPa
 1 gpm = 0.0631 L/s

1 US Gallon = 3.785412 L
 1 Btu/h = 0.29037 W

Pressure Drop

Model	L/s	Pressure Drop (kPa)				
		0°C	15°C	25°C	35°C	50°C
06	0.25	6.2	4.8	4.1	3.4	2.8
	0.35	13.8	13.1	12.4	11.7	10.3
	0.45	22.1	20.7	20.0	19.3	17.9
	0.55	30.3	29.0	27.6	26.2	25.5
08	0.30	6.2	4.1	3.9	3.7	3.4
	0.45	15.9	14.1	13.4	12.8	12.1
	0.65	25.5	24.1	23.0	21.9	20.7
	0.80	34.5	32.4	30.3	29.0	27.6
12	0.50	11.7	9.7	9.4	9.2	9.0
	0.75	24.8	23.4	22.0	20.5	19.0
	1.00	38.6	37.2	34.5	31.7	29.0
	1.20	57.2	55.8	52.4	49.6	46.9
17	0.60	22.1	20.7	19.5	18.3	17.2
	0.90	37.9	36.5	35.2	33.5	32.1
	1.20	54.5	52.4	50.3	48.7	46.9
	1.50	79.3	77.9	75.8	74.5	72.4

2/14/12

Vented Only Load Side

Model	L/S	Pressure Drop (kPa)			
		15°C	25°C	35°C	50°C
06H	0.25	8.9	8.7	8.5	8.3
	0.35	20.3	19.6	18.9	18.3
	0.45	31.7	30.5	29.4	28.3
	0.55	46.1	44.8	44.1	42.7

NOTES: Temperatures are Entering Water Temperatures. 7/12/16
Double wall vented coax for heating potable water

Operating Limits

Operating Limits	Cooling	Heating
	°C	°C
Source Side Water Limits		
Minimum Entering Water	-1.1	-6.7
Normal Entering Water	29.4	15.6
Maximum Entering Water	43.3	32.2
Load Side Water Limits		
Minimum Entering Water	10.0	15.6
Normal Entering Water	15.6	37.8
Maximum Entering Water	32.2	48.9

NOTES: Minimum/maximum limits are only for startup conditions, and are meant for bringing the space up to occupancy temperature. Units are not designed to operate at the minimum/maximum conditions on a regular basis. The operating limits are dependent upon three primary factors: 1) entering source temperature, 2) entering load temperature, and 3) flow rate L/s. When any of the factors are at the minimum or maximum levels, the other two factors must be at the normal level for proper and reliable unit operation. Consult the Performance Tables for each model to determine allowable normal operating conditions. Units are not designed for outdoor installation.

Physical Data

Model	06	08	12	17
Compressor (1 each)	Scroll			
Factory Charge R410A, oz [kg]	58 [1.64]	70 [1.98]	68 [1.93]	110 [3.12]
Coax & Piping Water Volume - gal [l]*	0.89 [3.38]	1.0 [3.94]	1.4 [5.25]	1.6 [6.13]
Weight - Operating, lb [kg]	225 [102.1]	290 [131.5]	325 [147.4]	345 [156.5]
Weight - Packaged, lb [kg]	247 [112.0]	305 [138.3]	340 [154.2]	360 [163.3]

Note: * Source or load side only

3/25/15

Flow Rates

Model	Source Flow Rates (L/S)				Load Flow Rates (L/S)		
	Minimum Open Loop	Minimum Closed Loop	Normal	Maximum	Minimum	Normal	Maximum
06	0.25	0.30	0.45	0.60	0.25	0.45	0.60
08	0.30	0.50	0.65	0.75	0.30	0.65	0.75
12	0.50	0.75	1.00	1.10	0.50	1.00	1.10
17	0.65	0.90	1.20	1.30	0.60	1.20	1.30

2/14/12

Thermistor Resistance

Thermistor Table

Thermistor Temperature (°C)	Resistance (Ohms)
26.0	9,230 - 10,007
25.3	9,460 - 10,032
24.7	9,690 - 10,580
24.2	9,930 - 10,840
0.8	30,490 - 32,080
0.3	31,370 - 33,010
-0.3	32,270 - 33,690
-0.8	33,190 - 34,940
-16.9	79,110 - 83,750
-17.5	81,860 - 86,460
-17.8	82,960 - 87,860

Operating Parameters

Heating Mode

Entering Load Temp (°C)	Entering Source Temp (°C)	Suction Pressure (kPa)	Discharge Pressure (kPa)	Superheat (°C)	Subcooling (°C)
15	-15	358-462	1344-1565	4-9	3-8
	0	462-565	1434-1620	4-8	3-8
	10	655-779	1489-1689	4-8	3-7
	20	855-993	1551-1758	4-11	3-8
	30	986-1151	1586-1896	8-14	4-7
25	-15	372-476	1951-2179	4-9	4-8
	0	476-579	2020-2227	6-7	4-10
	10	676-862	2082-2310	7-8	4-9
	20	834-1020	2144-2386	8-10	4-9
	30	993-1234	2199-2503	8-14	4-9
35	-15	386-490	2544-2792	4-6	3-8
	0	531-586	2606-2834	6-7	4-8
	10	441-869	2675-2930	7-8	4-8
	20	848-359	2744-3020	8-10	2-7
	30	1020-1317	2813-3116	8-12	2-7
50	-15	407-510	3137-3413	4-10	2-9
	0	510-600	3199-3447	3-9	3-9
	10	731-883	3268-3551	3-9	3-8
	20	862-1076	3344-3654	3-9	2-8
	30	operation not recommended			

9/26/11

Cooling Mode

Entering Load Temp (°C)	Entering Source Temp (°C)	Suction Pressure (kPa)	Discharge Pressure (kPa)	Superheat (°C)	Subcooling (°C)
10	0	593-683	931-1103	7-12	1-8
	10	634-738	1317-1475	6-11	2-8
	20	676-793	1710-1848	3-8	3-9
	30	696-820	2310-2530	3-8	4-9
	45	724-841	2930-3206	4-9	6-11
20	0	614-731	903-1124	8-11	2-3
	10	710-862	1338-1538	6-8	3-5
	20	814-986	1772-1882	6-8	5-7
	30	862-1041	2372-2627	4-7	7-8
30	0	634-779	883-1145	8-11	2-3
	10	793-986	1358-1606	6-8	3-5
	20	889-1089	1834-2027	6-8	5-7
	30	1034-1158	2441-2723	4-7	7-8
45	0	662-834	862-1172	31-36	1-11
	10	876-1110	1379-1675	23-29	2-4
	20	1089-1379	1896-2172	12-21	4-11
	30	operation not recommended			

9/26/11

NOTE: Operating parameters based on normal conditions with 0.19 L/s per kW output for the load and source.

Antifreeze Correction

Catalog performance can be corrected for antifreeze use. Please use the following table and note the example given.

Antifreeze Type	Antifreeze % by wt	Heating		Cooling		Pressure Drop
		Load	Source	Load	Source	
EWT - °C		26.7	-1.1	10.0	32.2	-1.1
Water	0	1.000	1.000	1.000	1.000	1.000
Ethylene Glycol	10	0.990	0.973	0.976	0.991	1.075
	20	0.978	0.943	0.947	0.979	1.163
	30	0.964	0.917	0.921	0.965	1.225
	40	0.953	0.890	0.897	0.955	1.324
	50	0.942	0.865	0.872	0.943	1.419
Propylene Glycol	10	0.981	0.958	0.959	0.981	1.130
	20	0.967	0.913	0.921	0.969	1.270
	30	0.946	0.854	0.869	0.950	1.433
	40	0.932	0.813	0.834	0.937	1.614
	50	0.915	0.770	0.796	0.922	1.816
Ethanol	10	0.986	0.927	0.945	0.991	1.242
	20	0.967	0.887	0.906	0.972	1.343
	30	0.944	0.856	0.869	0.947	1.383
	40	0.926	0.815	0.830	0.930	1.523
	50	0.907	0.779	0.795	0.911	1.639
Methanol	10	0.985	0.957	0.962	0.986	1.127
	20	0.969	0.924	0.929	0.970	1.197
	30	0.950	0.895	0.897	0.951	1.235
	40	0.935	0.863	0.866	0.936	1.323
	50	0.919	0.833	0.836	0.920	1.399



WARNING: Gray area represents antifreeze concentrations greater than 35% by weight and should be avoided due to the extreme performance penalty they represent.

Troubleshooting Guideline for Refrigerant Circuit

The chart below will assist in determining if measurements taken at the unit are within factory specifications and aid in accurate diagnosis (SYMPTOM) and repair. The chart is general in nature and represents whether a symptom would result in normal, high, or low readings from the typical operating range.

Symptom	Head Pressure	Suction Pressure	Compressor Amp Draw	Superheat	Subcooling	Water Temp. Differential
Under Charged System (Possible Leak)	Low	Low	Low	High	Low	Low
Over Charged System	High	High	High	Normal	High	Normal
Low Water Flow Evaporator	Low/Normal	Low/Normal	Low	Low	High	High
Low Water Flow Condensor	High	High	High	High	Low	High
High Water Flow Evaporator	Normal	Low	Normal	High	Normal	Low
High Water Flow Condensor	Low	Low	Low	Low	High	Low
Restricted TXV (Check Service Advisory)	High	Low	Normal/Low	High	High	Low
Insufficient Compressor (Possible Bad Valves)	Low	High	Low	High	Normal/High	Low
TXV - Bulb Loss of Charge	Low	Low	Low	High	High	Low
Scaled Coaxial Heat Exchanger Evaporator	Low	Low	Low	Normal/Low	High	Low
Scaled Coaxial Heat Exchanger Condensor	High	High	High	Normal/Low	Low	Low
Restricted Filter Drier	Check temperature difference (delta T) across filter drier.					

7/8/14

HR Data

Heat of Rejection (kW) Table															
Source EST °C	Source L/s	Load Flow-0.25 L/s				Load Flow-0.35 L/s				Load Flow-0.45 L/s					
		ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C		
06	0	0.25	8.56	9.17	9.79	10.43	8.79	9.32	9.88	10.40	9.03	9.47	9.94	10.40	
		0.35	8.38	8.88	9.35	9.85	8.59	9.00	9.44	9.85	8.82	9.14	9.50	9.85	
		0.45	8.21	8.56	8.91	9.26	8.41	8.70	8.97	9.26	8.62	8.82	9.06	9.26	
	10	0.25	8.44	9.55	10.67	11.78	8.68	9.76	10.84	11.93	8.91	9.96	11.02	12.08	
		0.35	8.32	9.35	10.38	11.40	8.56	9.55	10.52	11.52	8.79	9.76	10.70	11.66	
		0.45	8.21	9.14	10.05	10.99	8.44	9.35	10.23	11.11	8.68	9.53	10.38	11.23	
	20	0.25	8.32	9.94	11.55		8.56	10.20	11.81		8.79	10.46	12.10		
		0.35	8.26	9.82	11.37		8.53	10.08	11.64		8.79	10.35	11.93		
		0.45	8.21	9.70	11.20	12.69	8.50	9.99	11.46	12.95	8.76	10.26	11.72	13.19	
	30	0.25	8.03	9.76			8.24	9.99			8.44	10.26			
		0.35	8.00	9.70			8.21	9.96			8.44	10.20			
		0.45	7.97	9.67			8.21	9.91			8.41	10.14			
	45	0.25	7.77	9.58			7.94	9.82			8.12	10.08			
		0.35	7.74	9.61			7.91	9.82			8.09	10.05			
		0.45	7.71	9.61			7.88	9.82			8.06	10.02			
	08	0	0.30	12.72	12.25	11.78	11.31	13.04	12.40	11.72	11.08	13.36	12.54	11.69	10.84
			0.50	12.37	11.84	11.31	10.76	12.63	11.96	11.28	10.61	12.87	12.08	11.28	10.46
			0.65	12.02	11.40	10.81	10.20	12.19	11.52	10.84	10.17	12.37	11.61	10.87	10.11
10		0.30	12.22	13.51	14.83	16.15	12.72	13.89	15.06	16.21	13.25	14.24	15.27	16.30	
		0.50	12.02	13.13	14.24	15.33	12.49	13.45	14.42	15.39	12.95	13.80	14.62	15.45	
		0.65	11.84	12.75	13.63	14.54	12.28	13.04	13.80	14.57	12.69	13.34	13.98	14.62	
20		0.30	11.69	14.80	17.88		12.40	15.39	18.38		13.10	15.97	18.85		
		0.50	11.66	14.42	17.17		12.37	14.98	17.56		13.04	15.50	17.97		
		0.65	11.66	14.07	16.44	18.85	12.34	14.57	16.76	18.99	13.01	15.06	17.09	19.14	
30		0.30	11.25	14.30	17.32		11.81	14.86	17.91		12.37	15.42	18.49		
		0.50	11.23	14.10	16.97		11.75	14.62	17.50		12.31	15.18	18.05		
		0.65	11.17	13.89	16.59		11.72	14.42	17.12		12.28	14.95	17.61		
45		0.30	10.81	13.80			11.23	14.33			11.61	14.89			
		0.50	10.76	13.75			11.17	14.30			11.58	14.86			
		0.65	10.67	13.72			11.11	14.27			11.55	14.83			

NOTE: Operation not recommended in shaded areas

6/28/2016

HR Data cont.

Heat of Rejection (kW) Table															
Source EST °C	Source L/s	Load Flow-0.25 L/s				Load Flow-0.35 L/s				Load Flow-0.45 L/s					
		ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C		
12	0	0.50	18.14	19.52	20.90	22.25	18.70	19.87	21.07	22.25	19.26	20.25	21.25	22.25	
		0.75	17.91	18.93	19.96	20.98	18.41	19.26	20.11	20.96	18.90	19.61	20.28	20.96	
		1.00	17.67	18.35	19.02	19.70	18.11	18.64	19.17	19.70	18.58	18.93	19.31	19.67	
	10	0.50	17.64	20.13	22.66	25.18	18.23	20.63	23.01	25.41	18.82	21.10	23.39	25.64	
		0.75	17.56	19.75	21.92	24.12	18.08	20.16	22.22	24.30	18.64	20.57	22.54	24.47	
		1.00	17.50	19.34	21.19	23.04	17.97	19.70	21.42	22.30	18.46	20.08	21.69	23.30	
	20	0.50	17.12	20.78	24.44		17.73	21.37	24.97		18.38	21.95	25.50		
		0.75	17.20	20.55	23.89		17.76	21.04	24.36		18.35	21.57	24.79		
		1.00	17.29	20.31	23.36	26.38	17.82	20.75	23.71	26.67	18.32	21.19	24.06	26.93	
	30	0.50	16.53	19.99	23.45		17.03	20.52	24.00		17.56	21.04	24.53		
		0.75	16.59	19.90	23.24		17.06	20.40	23.74		17.53	20.87	24.24		
		1.00	16.65	19.84	23.04		17.06	20.28	23.48		17.50	20.72	23.92		
	45	0.50	15.91	19.20			16.32	19.67			16.74	20.13			
		0.75	15.94	19.28			16.32	19.72			16.71	20.19			
		1.00	15.97	19.37			16.32	19.78			16.68	20.22			
	17	0	Load Flow-0.30 L/s				Load Flow-0.50 L/s				Load Flow-0.65 L/s				
			Source L/s	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C
			0.60	24.82	28.25	31.65	35.08	26.00	29.10	32.24	35.38	27.17	29.98	32.83	35.64
10		0.90	24.74	27.49	3.02	33.00	25.85	28.31	30.77	33.24	26.93	29.13	31.30	33.47	
		1.20	24.62	26.73	28.84	30.95	25.67	27.49	29.31	31.10	26.73	28.25	29.78	31.27	
		0.60	24.12	28.49	32.83	37.16	25.18	29.37	33.56	37.75	26.20	30.22	34.26	38.31	
20		0.90	24.09	27.90	31.71	35.52	25.09	28.72	32.39	36.02	26.08	29.57	33.03	36.52	
		1.20	24.03	27.32	30.60	33.88	25.03	28.11	31.21	34.29	26.00	28.90	31.83	34.73	
		0.60	23.45	28.72	33.97		24.33	29.60	34.85		25.23	30.48	35.73		
30		0.90	23.45	28.31	33.18		24.36	29.16	34.00		25.23	30.01	34.79		
		1.20	23.45	27.90	32.36	36.81	24.36	28.75	33.12	37.49	25.26	29.57	33.88	38.19	
		0.60	22.68	27.78	32.88		23.42	28.52	33.65		24.15	29.28	34.41		
45		0.90	22.68	27.52	32.36		23.42	28.25	33.09		24.15	28.99	33.79		
		1.20	22.57	27.26	31.83		23.42	27.96	32.50		24.18	28.69	33.21		
		0.60	21.95	26.85			22.51	27.46			23.07	28.08			
45		0.90	21.92	26.73			22.48	27.34			23.07	27.93			
		1.20	21.89	26.61			22.48	27.20			23.07	27.81			

NOTE: Operation not recommended in shaded areas

6/28/2016

HE Data

Heat of Extraction (kW) Table														
Source EST °C	Source L/s	Load Flow-0.25 L/s				Load Flow-0.35 L/s				Load Flow-0.45 L/s				
		ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	
06	0	0.25	2.29	4.57	3.93	3.25	5.30	4.66	3.99	3.34	5.39	4.75	4.07	3.43
		0.35	5.39	4.72	4.02	3.34	5.48	4.81	4.13	3.43	5.57	4.89	4.22	3.55
		0.45	5.60	4.87	4.13	3.40	5.66	4.95	4.25	3.55	5.74	5.04	4.34	3.66
	10	0.25	7.30	6.54	5.74	4.98	7.36	6.59	5.83	5.07	7.42	6.65	5.89	5.13
		0.35	7.59	6.80	5.98	5.16	7.65	6.86	6.04	5.25	7.71	6.92	6.13	5.33
		0.45	7.91	7.03	6.18	5.30	7.94	7.09	6.24	5.39	7.97	7.15	6.33	5.51
	20	0.25	9.41	8.50	7.59	6.71	9.41	8.53	7.65	6.77	9.44	8.59	7.71	6.86
		0.35	9.79	8.85	7.91	6.95	9.82	8.88	7.97	7.03	9.82	8.91	8.00	7.12
		0.45	10.20	9.20	8.21	7.21	10.20	9.23	8.26	7.27	10.20	9.26	8.29	7.36
	30	0.25	11.52	10.46			11.49	10.49			11.46	10.52		
		0.35	11.96	10.84			11.81	10.79			11.66	10.76		
		0.45	12.40	11.23			12.13	11.11			11.87	10.99		
08	0	Load Flow-0.30 L/s				Load Flow-0.50 L/s				Load Flow-0.65 L/s				
		ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	
		0.30	7.21	6.39	5.57	4.72	7.24	6.42	5.60	4.78	7.27	6.45	5.66	4.84
	10	0.50	7.62	6.65	5.72	4.78	7.65	6.74	5.83	4.89	7.71	6.80	5.92	5.01
		0.65	8.00	6.95	5.89	4.84	8.06	7.06	6.04	5.01	8.12	7.15	6.18	5.22
		0.30	10.17	9.11	8.03	6.98	10.17	9.11	8.09	7.06	10.14	9.14	8.15	7.15
	20	0.50	10.73	9.58	8.41	7.24	10.70	9.58	8.50	7.39	10.67	9.61	8.56	7.50
		0.65	11.31	10.05	8.79	7.50	11.25	10.05	8.88	7.71	11.20	10.08	8.97	7.88
		0.30	13.10	11.81	10.52	9.23	13.07	11.84	10.58	9.35	13.04	11.84	10.67	9.47
	30	0.50	13.86	12.49	11.11	9.73	13.75	12.46	11.17	9.85	13.63	12.43	11.23	9.99
		0.65	14.60	13.13	11.66	10.20	14.42	13.07	11.72	10.38	14.24	13.01	11.78	10.55
		0.30	16.03	14.86			15.39	14.16			14.77	13.48		
	30	0.50	16.65	15.56	14.45		15.80	14.62	13.45		14.95	13.72	12.49	
		0.65	17.26	16.24	15.21		16.21	15.09	14.01		15.15	13.95	12.78	

NOTE: Operation not recommended in shaded areas

6/28/2016

HE Data cont.

Heat of Extraction (kW) Table														
Source EST °C	Source L/s	Load Flow-0.25 L/s				Load Flow-0.35 L/s				Load Flow-0.45 L/s				
		ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	
12	0	0.50	11.02	9.70	8.35	7.00	10.99	9.67	8.38	7.06	10.93	9.67	8.41	7.15
		0.75	11.31	9.94	8.56	7.18	11.34	9.99	8.62	7.27	11.37	10.02	8.68	7.33
		1.00	11.61	10.20	8.76	7.36	11.72	10.29	8.85	7.44	11.84	10.40	8.97	7.53
	10	0.50	14.65	13.01	11.40	9.76	14.65	13.07	11.49	9.88	14.62	13.10	11.55	10.02
		0.75	15.24	13.51	11.78	10.05	15.24	13.54	11.84	10.14	15.21	13.57	11.90	10.26
		1.00	15.83	13.98	12.16	10.32	15.83	14.01	12.22	10.40	15.80	14.04	12.28	10.49
	20	0.50	18.29	16.35	14.45	12.51	18.32	16.44	14.57	12.72	18.32	16.50	14.71	12.90
		0.75	19.17	17.09	15.01	12.90	19.11	17.09	15.06	13.04	19.05	17.09	15.12	13.19
		1.00	20.05	17.79	15.53	13.28	19.90	17.73	15.56	13.39	19.78	17.67	15.56	13.48
	30	0.50	22.04	19.75	17.47		20.75	18.99	17.20		19.49	18.23	16.94	
		0.75	22.54	20.22	17.94		21.54	19.67	17.79		20.55	19.08	17.61	
		1.00	23.01	20.72	18.41		22.30	20.31	18.35		21.60	19.93	18.26	
17	0	Load Flow-0.30 L/s				Load Flow-0.50 L/s				Load Flow-0.65 L/s				
		ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	ELT 10°C	ELT 20°C	ELT 30°C	ELT 45 °C	
		0.60	14.01	12.40	10.76	9.14	14.16	12.54	10.93	9.32	14.27	12.69	11.11	9.50
	10	0.90	14.68	12.92	11.17	9.41	14.80	13.07	11.34	9.61	14.95	13.25	11.55	9.82
		1.20	15.33	13.45	11.58	9.70	15.47	13.63	11.78	9.94	15.62	13.80	11.96	10.14
		0.60	19.55	17.47	15.39	13.31	19.72	17.67	15.62	13.60	19.87	17.88	15.89	13.86
	20	0.90	20.55	18.29	16.06	13.83	20.66	18.49	16.32	14.13	20.81	18.67	16.56	14.45
		1.20	21.51	19.11	16.74	14.33	21.63	19.31	17.00	14.68	21.72	19.49	17.26	15.01
		0.60	25.09	22.57	20.02	17.50	25.29	22.80	20.34	17.85	25.47	23.07	20.63	18.23
	30	0.90	26.38	23.68	20.96	18.23	26.52	23.89	21.28	18.64	26.67	24.12	21.60	19.05
		1.20	27.70	24.79	21.89	18.99	27.75	24.97	22.22	19.43	27.84	25.18	22.54	19.87
		0.60	30.45	27.67			29.95	27.46			29.43	27.29		
	30	0.90	31.21	28.37	25.56		30.54	28.08	25.62		29.84	27.75	25.70	
		1.20	31.98	29.10	26.23		31.10	28.69	26.26		30.25	28.25	26.29	

NOTE: Operation not recommended in shaded areas

6/28/2016

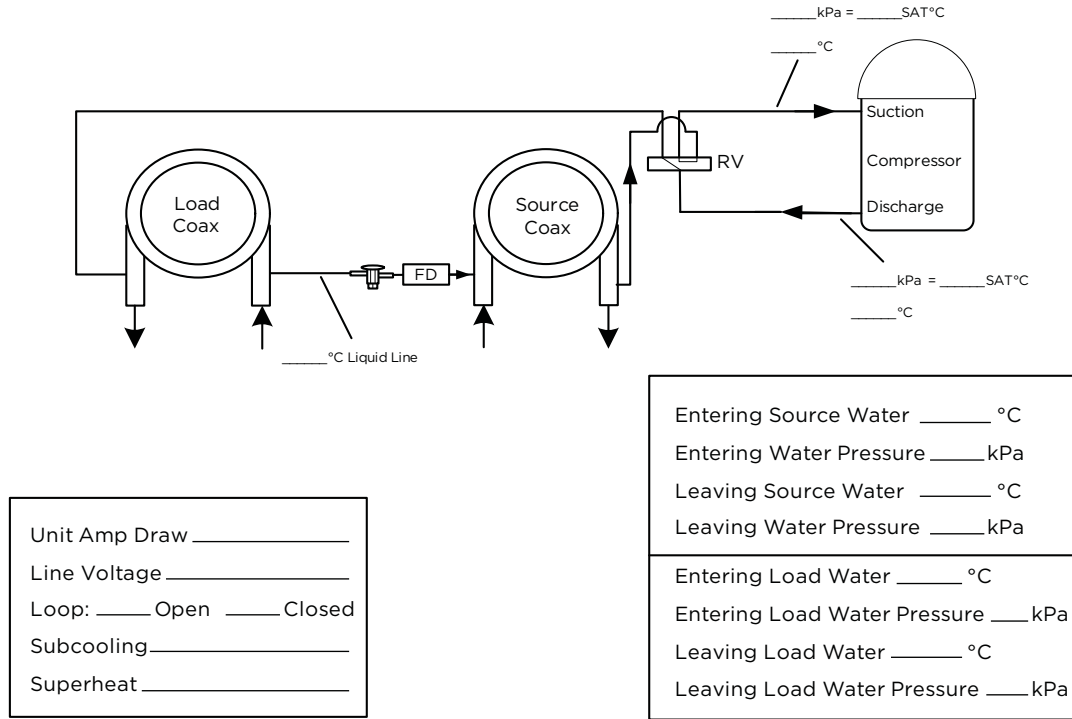
DHW HE cont.

06 DHW Heat of Extraction (kW) Table														
Source EST °C	Source L/s	Load Flow-0.25 L/s				Load Flow-0.35 L/s				Load Flow-0.45 L/s				
		ELT 15°C	ELT 25°C	ELT 40°C	ELT 50°C	ELT 15°C	ELT 25°C	ELT 40°C	ELT 50°C	ELT 15°C	ELT 25°C	ELT 40°C	ELT 50°C	
06	0	0.25	5.25	4.60	3.96	3.34	5.28	4.72	4.13	3.58	5.33	4.81	4.31	3.78
		0.35	5.39	4.75	4.07	3.43	5.45	4.84	4.19	3.58	5.51	4.92	4.34	3.72
		0.45	5.57	4.87	4.19	3.49	5.63	4.95	4.25	3.58	5.69	5.01	4.34	3.66
	10	0.25	7.15	6.36	5.57	4.75	7.24	6.48	5.72	4.95	7.30	6.57	5.86	5.16
		0.35	7.42	6.57	5.74	4.89	7.47	6.68	5.86	5.07	7.53	6.77	6.01	5.22
		0.45	7.65	6.80	5.92	5.04	7.74	6.89	6.04	5.19	7.80	6.98	6.15	5.30
	20	0.25	9.09	8.12	7.15	6.21	9.17	8.24	7.27	6.33	9.23	8.32	7.42	6.51
		0.35	9.44	8.41	7.39	6.39	9.50	8.53	7.53	6.57	9.58	8.65	7.68	6.74
		0.45	9.76	8.70	7.65	6.57	9.85	8.82	7.80	6.77	9.94	8.94	7.94	6.95
	30	0.25	10.96	9.85			11.11	10.02			11.28	10.20		
		0.35												
		0.45												

NOTE: Operation not recommended in shaded areas

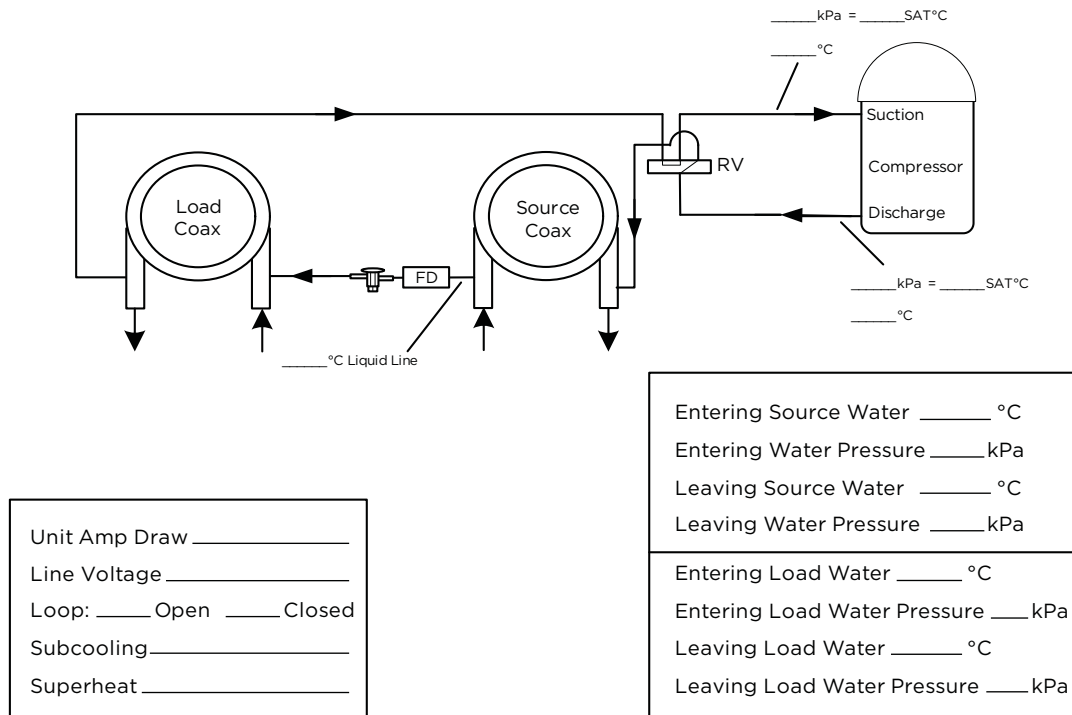
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Heating Cycle Analysis



NOTE: Do not attach refrigerant gauges unless a problem is suspected!

Cooling Cycle Analysis



NOTE: Do not attach refrigerant gauges unless a problem is suspected!

Startup and Troubleshooting Form

Company Name: _____ Company Phone No: _____
 Technician Name: _____ Date: _____
 Model No: _____ Serial No: _____
 Owner's Name: _____ Open or Closed Loop: _____
 Installation Address: _____ Installation Date: _____

Check One

Start up/Check-out for new installation Troubleshooting Problem: _____

1. FLOW RATE IN L/s (SOURCE SIDE HEAT EXCHANGER)

Water In Pressure: a. _____ kPa
 Water Out Pressure: b. _____ kPa
 Pressure Drop = a - b c. _____ kPa
 Convert Pressure Drop to Flow Rate
 (refer to *Pressure Drop* table) d. _____ L/s

2. TEMPERATURE RISE OR DROP ACROSS SOURCE SIDE HEAT EXCHANGER

	COOLING	HEATING
Water In Temperature:	e. _____ °C	e. _____ °C
Water Out Temperature:	f. _____ °C	f. _____ °C
Temperature Difference:	g. _____ °C	g. _____ °C

3. TEMPERATURE RISE OR DROP ACROSS LOAD SIDE HEAT EXCHANGER

	COOLING	HEATING
Water In Temperature:	h. _____ °C	h. _____ °C
Water Out Temperature:	i. _____ °C	i. _____ °C
Temperature Difference:	j. _____ °C	j. _____ °C

4. HEAT OF REJECTION (HR) / HEAT OF EXTRACTION (HE) CALCULATION

HR or HE = Flow Rate x Temperature Difference x Brine Factor*
 d. (above) x g. (above) x 4.1 for Methanol or Environol, 4.2 for water*
 Heat of Extraction (Heating Mode) = _____ kW/hr
 Heat of Rejection (Cooling Mode) = _____ kW/hr
 Compare results to Capacity Data Tables

Note: Steps 5 through 8 need only be completed if a problem is suspected

5. WATTS

	COOLING	HEATING	HYDRONIC
Volts:	m. _____ VOLTS	m. _____ VOLTS	m. _____ VOLTS
Total Amps (Comp. + Fan):	n. _____ AMPS	n. _____ AMPS	n. _____ AMPS
Watts = m. x n. x 0.85	o. _____ WATTS	o. _____ WATTS	o. _____ WATTS

6. CAPACITY

Cooling Capacity = HR. - o. p. _____ kW/hr
 Heating Capacity= HE. + o. p. _____ kW/hr

7. EFFICIENCY

Cooling EER = p. / o. q. _____ COP
 Heating COP = p. / o. q. _____ COP

8. SUPERHEAT (S.H.) / SUBCOOLING (S.C.)

	COOLING	HEATING	HYDRONIC
Suction Pressure:	r. _____ kPa	r. _____ kPa	r. _____ kPa
Suction Saturation Temperature:	s. _____ °C	s. _____ °C	s. _____ °C
Suction Line Temperature:	t. _____ °C	t. _____ °C	t. _____ °C
Superheat = t. - s.	u. _____ °C	u. _____ °C	u. _____ °C
Head Pressure:	v. _____ kPa	v. _____ kPa	v. _____ kPa
High Pressure Saturation Temp.:	w. _____ °C	w. _____ °C	w. _____ °C
Liquid Line Temperature*:	x. _____ °C	x. _____ °C	x. _____ °C
Subcooling = w. - x.	y. _____ °C	y. _____ °C	y. _____ °C

* Note: Liquid line is between the source heat exchanger and the expansion valve in the cooling mode; between the load heat exchanger and the expansion valve in the heating mode.

Troubleshooting

Should a major problem develop, refer to the following information for possible causes and corrective steps:

Compressor Won't Run

1. The fuse may be blown or the circuit breaker is open. Check electrical circuits and motor windings for shorts or grounds. Investigate for possible overloading. Replace fuse or reset circuit breakers after the fault is corrected.
2. Supply voltage may be too low. Check voltage with a volt meter.
3. Remote control system may be faulty. Check aquastat for correct wiring, setting and calibration. Check 24-volt transformer for burnout.
4. Wires may be loose or broken. Replace or tighten.
5. The low pressure switch may have tripped due to one or more of the following:
 - a. Fouled or plugged coaxial heat exchangers
 - b. Low or no water flow (source side heating, load side cooling)
 - c. Water too cold (source side heating)
 - d. Low refrigerant
6. The high pressure switch may have tripped due to one or more of the following:
 - a. Fouled or plugged coaxial heat exchanger
 - b. Low or no water flow (source side cooling, load side heating)
 - c. Water too warm (source side cooling)
7. Check the capacitor.
8. The compressor overload protection may be open. If the compressor dome is extremely hot, the overload will not reset until cooled down. If the overload does not reset when cool, it may be defective. If so, replace the compressor.
9. The internal winding of the compressor motor may be grounded to the compressor shell. If so, replace the compressor.
10. The compressor winding may be open. Check continuity with an ohm meter. If the winding is open, replace the compressor.

Insufficient Cooling or Heating

1. Check for restriction in water flow.
2. Check subcooling for low refrigerant charge.
3. The reversing valve may be defective and creating a bypass of refrigerant. If the unit will not cool, check the reversing valve coil.
4. Check thermal expansion valve for possible restriction of refrigerant flow.

Noisy Unit Operation

1. Check compressor for loosened mounting bolts. Make sure compressor is floating free on its isolator mounts, and shipping bolt is removed from compressor plate.
2. Check for tubing contact with the compressor or other surfaces. Readjust it by bending slightly.
3. Check screws on all panels.
4. Check for chattering or humming in the contactor or relays due to low voltage or a defective holding coil. Replace the component.
5. Check for proper installation of vibration absorbing material under the unit. Unit must be fully supported, not just on corners.
6. Check for abnormally high discharge pressures.

Preventive Maintenance

1. Keep all air out of the water lines. An open loop system should be checked to ensure that the well head is not allowing air to infiltrate the water line. Lines should always be airtight.
2. Keep the system under pressure at all times. In open loop systems, it is recommended that a water control valve be placed in the discharge line to prevent loss of pressure during off cycles. Closed loop systems must have a positive static pressure.

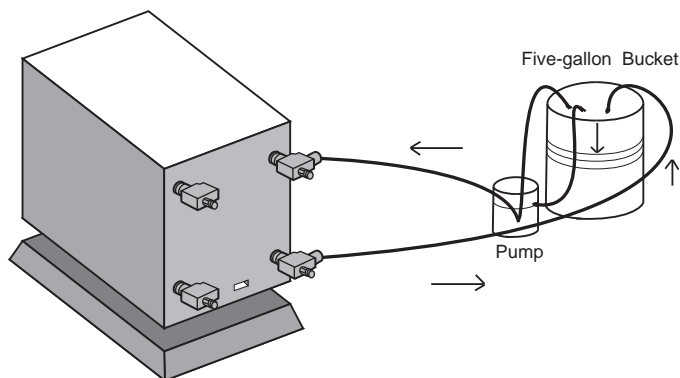
NOTES: If the installation is performed in an area with a known high mineral content in the water, it is best to establish a periodic maintenance schedule to check the water-to-refrigerant heat exchanger on a regular basis. Should periodic cleaning be necessary, use standard cleaning procedures which are compatible with either the cupronickel or copper water lines. Generally, the more water flowing through the unit, the less chance there is for scaling. Low flow rates produce higher temperatures through the coil. To avoid excessive pressure drop and the possibility of copper erosion, do not exceed flow rate as shown on the specification sheets for each unit.

Cleaning Procedure

1. Close the inlet and outlet water valves to isolate the heat pump from the well system, water heater or loop pumps.
2. Disconnect piping and remove solenoid valve, pumps, etc. from the inlet and outlet connections on the heat pump.
3. Connect plastic hoses from the circulating pump* to the outlet of the water-to-refrigerant heat exchanger to be de-limed (refer to the Cleaning Connections illustration).

4. Connect a plastic hose from the circulating pump inlet to the bottom of a plastic five (5) gallon pail (refer to the Cleaning Connections illustration).
5. Connect a plastic hose from the inlet line of the water-to-refrigerant heat exchanger to the plastic pail. Secure tightly to ensure that circulating solution does not spill (refer to the Cleaning Connections illustration).
6. Partially fill the plastic pail with clear water (about two-thirds full) and prime the circulating pump. Circulate until lines are full.
7. Start the circulating pump and slowly add a commercial scale remover** to the water as recommended by the scale remover manufacturer's directions.
8. Be sure the pump circulation is opposite to the normal water flow through the water-to-refrigerant heat exchanger.
9. Maintain re-circulation until all scale and other material has been dissolved and flushed from the heat exchanger.
10. Upon completion of the procedure. Safely dispose of the solution.
11. Rinse the pump and plastic pail. Refill with clear water.
12. Start the pump circulation and flush the system until all acid residue has been removed from the system. Refill the plastic pail until only clear water is circulated.
13. Turn off the circulating pump and disconnect all hoses and fittings.
14. Replace solenoid valves, pumps, hoses and other devices in their original locations. On closed loop systems, be sure to purge between the flow center and unit to avoid getting air into the loop.
15. Put the heat pump back into operation. Check for proper operating temperature.

Cleaning Connections



WARNING: This process involves a caustic solution and may be harmful to people and animals. Wear protective equipment (glasses, rubber gloves, apron, etc.)

NOTES: *Virginia Chemical Co. makes a Pump model H460.

* W.W. Granger Co. sells a Pump #2P-017 made by Little Giant.

**Virginia Chemical Co. makes a liquid ice machine cleaner which should be used on water-to-refrigerant heat exchangers serving a domestic hot water system. Calci-Solve by NYCO is available for use on other heat exchangers

Service Parts

Aurora Controls

Part Description		06	08	12	17
Refrigeration Components	Compressor 220-240/50/1	34P583-02	34P621-02	34P580-02	34P614-02
	380-420/50/3	34P583-04	34P621-04	34P580-04	34P614-04
	Compressor Capacitor 220-240/50/1	16P002D20	16P002D36	16P002D39	16P002D36
	Compressor Sound Jacket	92P504A05	92P519-01	92P519-02	92P519-02
	Thermal Expansion Valve	33P605-18	33P605-10	33P605-15	33P605-17
	Filter Drier for 'Reversible Models'	36P500B01	36P500B01	36P500B02	36P500B02
	Reversing Valve with Coil	33P506-04	33P503-05	33P526-04	33P526-04
	Hot Water Generator (Desuperheater)	n/a	62I516-03	62I516-03	62I516-03
	Source Coaxial Heat Exchanger (copper)	62I573-01	62I574-01	62I543-04	62I557-01
	Source Coaxial Heat Exchanger (cupronickel)	62I573-02	62I574-02	62I543-03	62I557-02
	Load Coaxial Heat Exchanger (copper)	62I573-01	62I574-01	62I543-04	62I557-01
	Load Coaxial Heat Exchanger (cupronickel)	62I573-02	62I574-02	62I543-03	62I557-02
	DHW Load Coax Vented Double Wall (copper)	62P549-01	n/a	n/a	n/a
Safeties/ Sensors	High Pressure Switch	35P506B02	35P506B02	35P506B02	35P506B02
	Low Pressure Switch	35P506B01	35P506B01	35P506B01	35P506B01
	Thermistor Freeze Protection	12P505-08	12P505-08	12P505-08	12P505-08
	Thermistor Well Port	12P541-01	12P541-01	12P541-01	12P541-01
Electrical	Compressor Contactor - Single Phase	13P004A03	13P004A03	13P004A03	13P004A03
	Compressor Contactor - Three Phase	13P537B03	13P537B03	13P537B03	13P537B03
	Transformer - 220-240v	15P501-02	15P501-02	15P501-02	15P501-02
	Transformer - 380-420v	15P511-02	15P511-02	15P511-02	15P511-02
	Relay 24 VDC SPDT	13P711-01	13P711-01	13P711-01	13P711-01
	Circuit Breaker 5 Amp	19P583-01	19P583-01	19P583-01	19P583-01
	Power Block 15 Amp 2 Pole	12P500A01	12P500A01	12P500A01	12P500A01
	Aurora Board Programmed (ABC)	17X553-10	17X553-10	17X553-10	17X553-10
	IntelliStart Soft Starter (220-240/50/1)	IS1B08-16SN	IS1B16-32SN	IS1B16-32SN	IS1B16-32SN
	IntelliStart Soft Starter (420/50/3)	IS5A04-27SN	IS5A04-27SN	IS5A04-27SN	IS5A04-27SN
Grounding Lug	12P004A	12P004A	12P004A	12P004A	
Cabinet	Front/Rear Access Panel	40P749-01W	40P749-01W	40P749-01W	40P749-01W
	Top Panel	42P557-01W	42C544-01	42C544-01	42C544-01

6/23/16

Technical Documentation

Model		NSKW06								
Type of heat pump		Air-water Exhaust-water Brine-water Water-water								
Low-temperature heat pump Yes No		Yes No								
Integrated immersion heater for additional heat		Yes No								
Heat pump combination heater Yes No		Yes No								
Climate		Average Cold Warm								
Temperature application		Average (55°C) Low (35°C)								
Applied standards		EN-14825								
Rated heat output		Prated	5.27	kW	Seasonal space heating energy efficiency			η_c	119	%
Declared capacity for space heating at part load and at outdoor temperature T_j					Declared coefficient of performance for space heating at part load and at outdoor temperature T_j					
$T_j = -7\text{ °C}$	Pdh	5.34	kW	$T_j = -7\text{ °C}$	COPd	2.66				
$T_j = +2\text{ °C}$	Pdh	5.55	kW	$T_j = +2\text{ °C}$	COPd	3.16				
$T_j = +7\text{ °C}$	Pdh	5.68	kW	$T_j = +7\text{ °C}$	COPd	3.54				
$T_j = +12\text{ °C}$	Pdh	5.81	kW	$T_j = +12\text{ °C}$	COPd	4.01				
$T_j = \text{biv}$	Pdh	5.27	kW	$T_j = \text{biv}$	COPd	2.50				
$T_j = \text{TOL}$	Pdh	5.27	kW	$T_j = \text{TOL}$	COPd	2.50				
$T_j = -15\text{ °C}$ (if TOL < -20 °C)	Pdh	-	kW	$T_j = -15\text{ °C}$ (if TOL < -20 °C)	COPd	-				
Bivalent temperature					Min. outdoor air temperature					
	T_{biv}	-10	°C		TOL	-10	°C			
Cycling interval capacity					Cycling interval efficiency					
	Pcych	-	kW		COPcyc	-	-			
Degradation coefficient					Max supply temperature					
	Cdh	1.00	-		WTOL	55.0	°C			
Power consumption in modes other than active mode Additional heat					Additional heat					
Off mode		POFF	0.010	kW	Rated heat output		Psup	-	kW	
Thermostat-off mode		P_{TO}	0.005	kW						
Standby mode		P_{SB}	0.002	kW	Type of energy input		Electric			
Crankcase heater mode		P_{CK}	-	kW						
Other items										
Capacity control		Fixed			Rated airflow (air-water)			-	m ³ /h	
Sound power level, indoors/outdoors		L_{WA}	57/0	dB	Nominal heating medium flow			1.26	m ³ /h	
Annual energy consumption		Q_{HE}	3432	kWh	Brine flow brine-water or water-water heat pumps			1.62	m ³ /h	

3/18/2016

Technical Documentation cont.

Model		NSKW08								
Type of heat pump		Air-water Exhaust-water Brine-water Water-water								
Low-temperature heat pump Yes No		Yes		No						
Integrated immersion heater for additional heat		Yes		No						
Heat pump combination heater Yes No		Yes		No						
Climate		Average		Cold		Warm				
Temperature application		Average (55°C)		Low (35°C)						
Applied standards		EN-14825								
Rated heat output		Prated	7.71	kW	Seasonal space heating energy efficiency			nc	132	%
Declared capacity for space heating at part load and at outdoor temperature Tj					Declared coefficient of performance for space heating at part load and at outdoor temperature Tj					
Tj = -7 °C	Pdh	7.81	kW	Tj = -7 °C	COPd	2.92				
Tj = +2 °C	Pdh	8.13	kW	Tj = +2 °C	COPd	3.48				
Tj = +7 °C	Pdh	8.33	kW	Tj = +7 °C	COPd	3.90				
Tj = +12 °C	Pdh	8.52	kW	Tj = +12 °C	COPd	4.42				
Tj = biv	Pdh	7.71	kW	Tj = biv	COPd	2.75				
Tj = TOL	Pdh	7.71	kW	Tj = TOL	COPd	2.75				
Tj = -15 °C (if TOL < -20 °C)	Pdh	-	kW	Tj = -15 °C (if TOL < -20 °C)	COPd	-				
Bivalent temperature					Tbiv	-10	°C	Min. outdoor air temperature		
Cycling interval capacity					Pcyh	-	kW	Cycling interval efficiency		
Degradation coefficient					Cdh	1.00	-	Max supply temperature		
Power consumption in modes other than active mode Additional heat					Additional heat					
Off mode		P _{OFF}	0.010	kW	Rated heat output		Psup	-	kW	
Thermostat-off mode		P _{TO}	0.005	kW						
Standby mode		P _{SB}	0.007	kW	Type of energy input					
Crankcase heater mode		P _{CK}	-	kW						
Other items										
Capacity control		Fixed			Rated airflow (air-water)				-	m ³ /h
Sound power level, indoors/outdoors		L _{WA}	57/0	dB	Nominal heating medium flow				1.80	m ³ /h
Annual energy consumption		Q _{HE}	4543	kWh	Brine flow brine-water or water-water heat pumps				2.34	m ³ /h

3/18/2016

Technical Documentation cont.

Model		NSKW12					
Type of heat pump		Air-water Exhaust-water Brine-water Water-water					
Low-temperature heat pump Yes No		Yes	No				
Integrated immersion heater for additional heat		Yes	No				
Heat pump combination heater Yes No		Yes	No				
Climate		Average	Cold	Warm			
Temperature application		Average (55°C)	Low (35°C)				
Applied standards		EN-14825					
Rated heat output	Prated	11.14	kW	Seasonal space heating energy efficiency	n_c	137	%
Declared capacity for space heating at part load and at outdoor temperature T_j				Declared coefficient of performance for space heating at part load and at outdoor temperature T_j			
$T_j = -7\text{ °C}$	P _{dH}	11.22	kW	$T_j = -7\text{ °C}$	COP _d	3.01	
$T_j = +2\text{ °C}$	P _{dH}	11.46	kW	$T_j = +2\text{ °C}$	COP _d	3.58	
$T_j = +7\text{ °C}$	P _{dH}	11.60	kW	$T_j = +7\text{ °C}$	COP _d	4.03	
$T_j = +12\text{ °C}$	P _{dH}	11.74	kW	$T_j = +12\text{ °C}$	COP _d	4.60	
$T_j = \text{biv}$	P _{dH}	11.14	kW	$T_j = \text{biv}$	COP _d	2.86	
$T_j = \text{TOL}$	P _{dH}	11.14	kW	$T_j = \text{TOL}$	COP _d	2.86	
$T_j = -15\text{ °C}$ (if $\text{TOL} < -20\text{ °C}$)	P _{dH}	-	kW	$T_j = -15\text{ °C}$ (if $\text{TOL} < -20\text{ °C}$)	COP _d	-	
Bivalent temperature	T_{biv}	-10	°C	Min. outdoor air temperature	TOL	-10	°C
Cycling interval capacity	P _{cyCh}	-	kW	Cycling interval efficiency	COP _{cyC}	-	-
Degradation coefficient	C _{dH}	1.00	-	Max supply temperature	WTOL	55.0	°C
Power consumption in modes other than active mode Additional heat				Additional heat			
Off mode	P _{OFF}	0.010	kW	Rated heat output	P _{sup}	-	kW
Thermostat-off mode	P _{TO}	0.005	kW				
Standby mode	P _{SB}	0.007	kW	Type of energy input		-	
Crankcase heater mode	P _{CK}	-	kW				
Other items							
Capacity control		Fixed		Rated airflow (air-water)		-	m ³ /h
Sound power level, indoors/outdoors	L _{WA}	57/0	dB	Nominal heating medium flow		2.70	m ³ /h
Annual energy consumption	Q _{HE}	6343	kWh	Brine flow brine-water or water-water heat pumps		3.60	m ³ /h

3/18/2016

Technical Documentation cont.

Model		NSKW17							
Type of heat pump		Air-water Exhaust-water Brine-water Water-water							
Low-temperature heat pump Yes No		Yes No							
Integrated immersion heater for additional heat		Yes No							
Heat pump combination heater Yes No		Yes No							
Climate		Average Cold Warm							
Temperature application		Average (55°C) Low (35°C)							
Applied standards		EN-14825							
Rated heat output		Prated	15.62	kW	Seasonal space heating energy efficiency	η_c	126	%	
<i>Declared capacity for space heating at part load and at outdoor temperature Tj</i>		<i>Declared coefficient of performance for space heating at part load and at outdoor temperature Tj</i>							
Tj = -7 °C	Pdh	16.06	kW	Tj = -7 °C	COPd	2.82			
Tj = +2 °C	Pdh	16.52	kW	Tj = +2 °C	COPd	3.30			
Tj = +7 °C	Pdh	16.80	kW	Tj = +7 °C	COPd	3.66			
Tj = +12 °C	Pdh	17.08	kW	Tj = +12 °C	COPd	4.09			
Tj = biv	Pdh	15.93	kW	Tj = biv	COPd	2.70			
Tj = TOL	Pdh	15.93	kW	Tj = TOL	COPd	2.70			
Tj = -15 °C (if TOL < -20 °C)	Pdh	-	kW	Tj = -15 °C (if TOL < -20 °C)	COPd	-			
Bivalent temperature		T _{biv}	-10	°C	Min. outdoor air temperature		TOL	-10	°C
Cycling interval capacity		P _{cyh}	-	kW	Cycling interval efficiency		COP _{cyh}	-	-
Degradation coefficient		Cdh	1.00	-	Max supply temperature		WTOL	55.0	°C
Power consumption in modes other than active mode Additional heat					Additional heat				
Off mode		P _{OFF}	0.010	kW	Rated heat output		P _{sup}	-	kW
Thermostat-off mode		P _{TO}	0.005	kW					
Standby mode		P _{SB}	0.007	kW	Type of energy input		-		
Crankcase heater mode		P _{CK}	-	kW					
Other items									
Capacity control		Fixed			Rated airflow (air-water)			-	m ³ /h
Sound power level, indoors/outdoors		L _{WA}	63/0	dB	Nominal heating medium flow			3.24	m ³ /h
Annual energy consumption		Q _{HE}	9656	kWh	Brine flow brine-water or water-water heat pumps			4.32	m ³ /h

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Notes

Revision Guide

Pages:	Description:	Date:	By:
All	NSKW Commercial Guide Creation	28 June 2016	JM



Manufactured by
WaterFurnace International, Inc.
9000 Conservation Way
Fort Wayne, IN 46809
www.waterfurnace.com

Product: **Versatec Ultra NSKW**
Type: Geothermal Hydronic Heat Pump
Size: 1.5-6 Tons
Document: Installation Manual

IM2566WN 7/16