

Versatec Ultra

UCV - Geothermal Military Unit
Geothermal/Water Source Heat Pump
Commercial 1.5 to 3.5 Tons

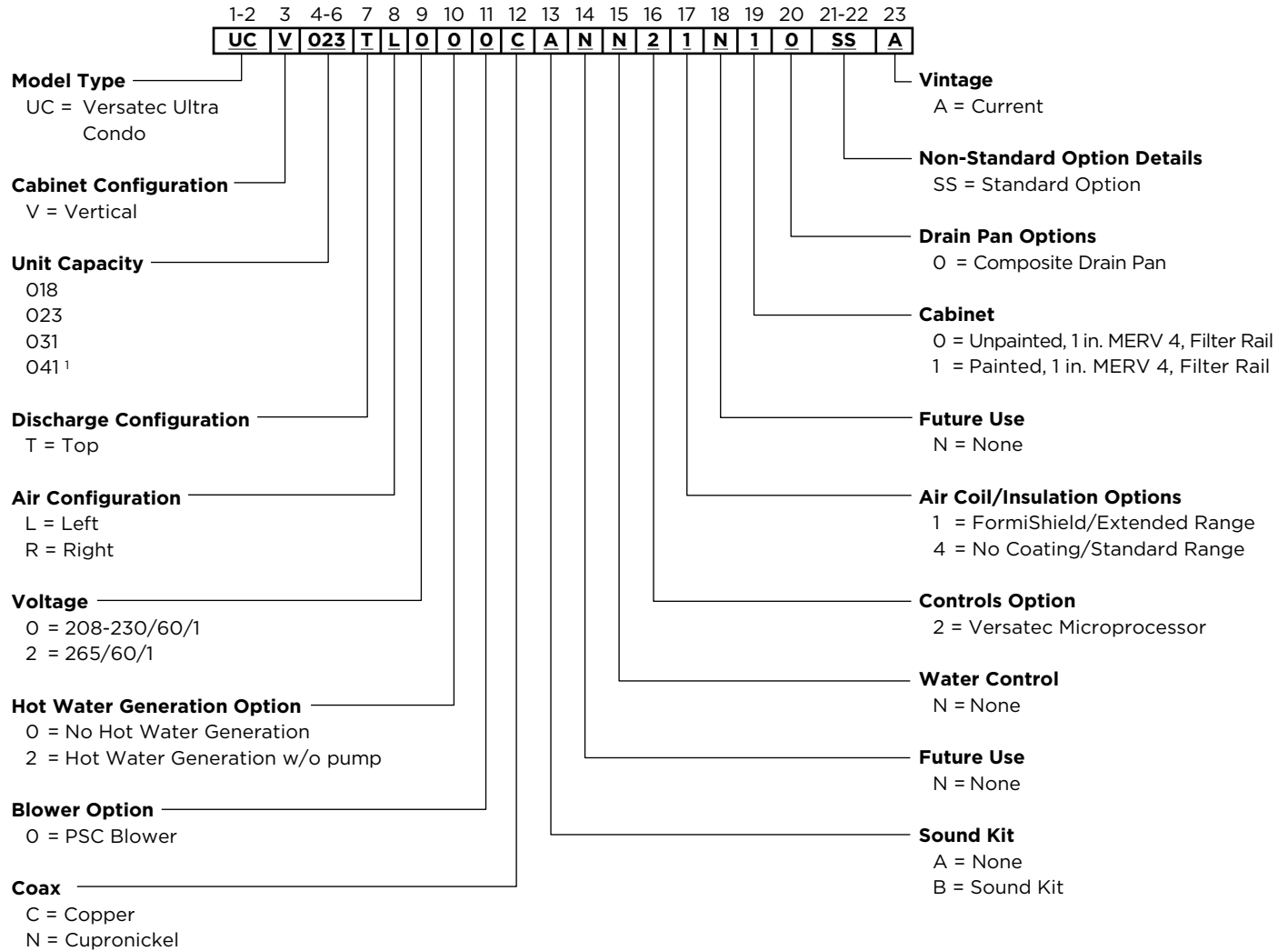
- Installation Information
- Water Piping Connections
- Hot Water Connections
- Electrical
- Startup Procedures
- Troubleshooting
- Preventive Maintenance



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Model Nomenclature



NOTE: ¹ UCV041 not available in 265/60/1

General Installation Information

Safety Considerations



WARNING: Before performing service or maintenance operations on a system, turn off main power switches to the indoor unit. If applicable, turn off the accessory heater power switch. Electrical shock could cause personal injury.

Installing and servicing heating and air conditioning 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. Untrained personnel can perform the basic maintenance functions of cleaning coils and cleaning and replacing filters. All other operations should be performed by trained service personnel. 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 a quenching cloth for brazing operations and have a fire extinguisher available.

Moving and Storage

Move units in the normal “up” orientation. Vertical units may be stored one upon another to a maximum height of two units. Do not attempt to move units while stacked. When the equipment is received, all items should be carefully checked against the bill of lading to be sure all crates and cartons have been received. Examine units for shipping damage, removing the units from the packaging if necessary. Units in question should also be internally inspected. If any damage is noted, the carrier should make the proper notation on the delivery receipt, acknowledging the damage.

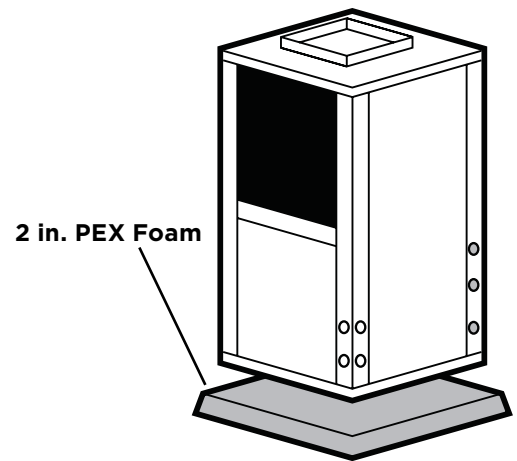
Unit Location

Locate the unit in an indoor area that allows for easy removal of the filter and access panels. Location should have enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water, electrical and duct connection(s). If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. **NOTE: Units should not be located in unconditioned spaces.**

Installing Vertical Units

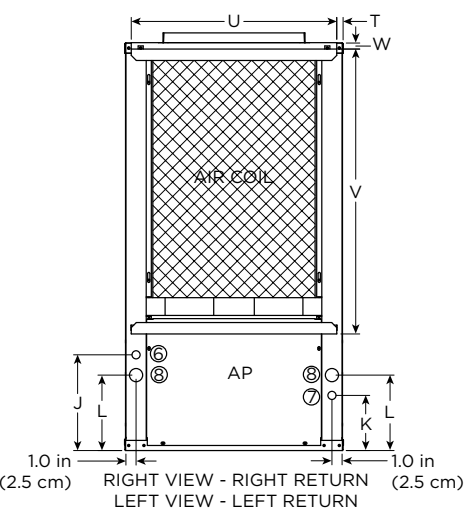
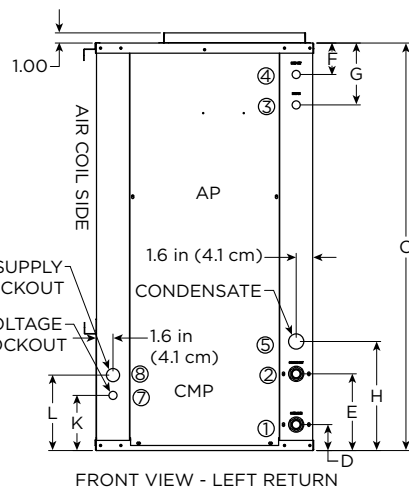
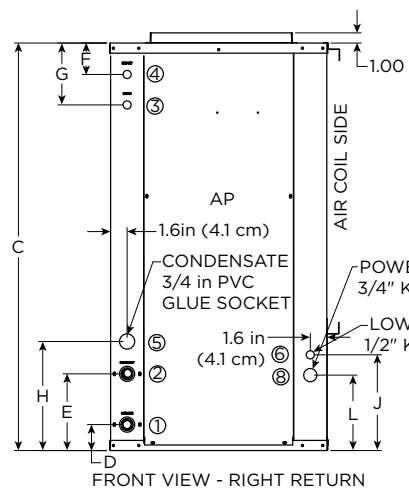
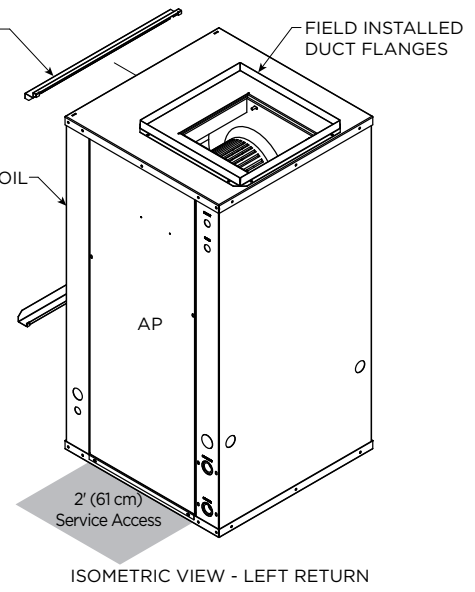
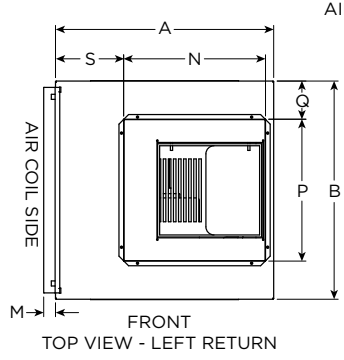
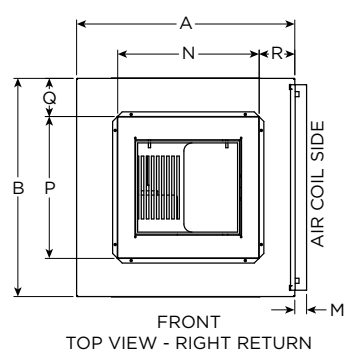
Vertical units are available in left or right air return configurations. Top flow vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to provide isolation between the unit and the floor. It is not necessary to anchor the unit to the floor (see figure below).

Vertical Unit Mounting



Dimensional Data

Legend
 AP = Alternate Service Panel
 BP = Blower Service Panel
 CP = Control Access Panel
 CMP = Compressor Service Panel



| Vertical Models | Overall Cabinet | | | Water Connections | | | | | | | Electrical Knockouts | | | |
|-----------------|-----------------|-------|----------|-------------------|-----|--------|---------|------------|-----------|----------------|----------------------|--------------|------------|------|
| | A | B | C | 1 | 2 | 3 | 4 | 5 | Loop | Knock-out | 6 | 7 | 8 | |
| | Width | Depth | Height** | In | Out | HWG In | HWG Out | Condensate | Water FPT | HWG Provisions | 1/2 in. cond | 1/2 in. cond | 1 in. cond | |
| 018-031 | in. | 21.5 | 21.5 | 36.2 | 2.6 | 7.6 | 3.1 | 6.1 | 10.8 | 3/4" | 0.875 | 9.4 | 5.4 | 7.4 |
| | cm. | 54.6 | 54.6 | 91.9 | 6.6 | 19.3 | 7.9 | 15.5 | 27.4 | 19.1 mm | 22.2 mm | 23.9 | 13.7 | 18.8 |
| 041 | in. | 21.5 | 21.5 | 40.2 | 2.6 | 7.6 | 3.1 | 6.1 | 10.8 | 3/4" | 0.875 | 9.4 | 5.4 | 7.4 |
| | cm. | 54.6 | 54.6 | 102.1 | 6.6 | 19.3 | 7.9 | 15.5 | 27.4 | 19.1 mm | 22.2 mm | 23.9 | 13.7 | 18.8 |

| Vertical Models | Discharge Connection | | | | | | | Return Connection* | | | |
|-----------------|----------------------------------|-----|------|------|-----|-----|------|-------------------------------------|------|------|-----|
| | duct flange installed (±0.10 in) | | | | | | | using deluxe filter rack (±0.10 in) | | | |
| | M | N | P | Q | R | S | T | U | V | W | |
| 018-031 | in. | 1.2 | 14.0 | 14.0 | 3.8 | 3.5 | 6.7 | 0.6 | 20.2 | 24.0 | 0.6 |
| | cm. | 3.0 | 35.6 | 35.6 | 9.7 | 8.9 | 17.0 | 1.5 | 51.3 | 61.0 | 1.5 |
| 041 | in. | 1.2 | 14.0 | 14.0 | 3.8 | 3.5 | 6.7 | 0.6 | 20.2 | 28.0 | 0.6 |
| | cm. | 3.0 | 35.6 | 35.6 | 9.7 | 8.9 | 17.0 | 1.5 | 51.3 | 71.1 | 1.5 |

Condensate is 3/4 in. PVC female glue socket and is switchable from side to front.
 *Dimensions for return connections are for a standard rail design with open return application only.
 The open filter rail, used in non-ducted returns, extends 1.2 in. [3.11 cm] from the unit.
 **Discharge flange is field installed and extends 1 in. (25.4 mm) from top of cabinet.

Duct System

An air outlet collar is provided on vertical top flow units to facilitate a duct connection. A flexible connector is recommended for discharge duct connections on metal duct systems. The return air filter rails are designed for open return applications and not intended for use with ductwork. The filter rail is designed to be easily installed without using a screw.

Uninsulated duct should be insulated with a minimum of 1-inch duct insulation. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended as the unit's performance will be adversely affected. If the unit is connected to existing ductwork, check the duct system to ensure that it has the capacity to accommodate the air required for the unit application. If the duct is too small, as in the replacement of heating only systems, larger ductwork

should be installed. All existing ductwork should be checked for leaks and repaired if necessary.

The duct system should be sized to handle the design airflow quietly and efficiently. To maximize sound attenuation of the unit blower, the supply plenum should include an internal duct liner of fiberglass or constructed of ductboard for the first few feet. On systems employing a sheet metal duct system, canvas connectors should be used between the unit and the ductwork. If air noise or excessive airflow is a problem, the blower speed can be changed.



CAUTION: Be sure to remove the shipping material from the blower discharge before connecting ductwork.

Water Piping

The proper water flow must be provided to each unit whenever the unit operates. To assure proper flow, use pressure/temperature ports to determine the flow rate. These ports should be located at the supply and return water 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.

All source water connections on commercial units are fittings that accept a male pipe thread (MPT). Insert the connectors by hand, then tighten the fitting with a wrench to provide a leakproof joint. When connecting to an open loop (groundwater) system, thread any copper MPT fitting into the connector and tighten in the same manner as described above.

Water Quality

In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, a closed loop system is recommended. The heat exchanger coils in ground water systems may, over a period of time, lose heat exchange capabilities due to a buildup of mineral deposits inside. These can be cleaned, but only by a qualified service mechanic, as special solutions and pumping equipment are required. Hot water generator coils can likewise become scaled and possibly plugged. In areas

with extremely hard water, the owner should be informed that the heat exchanger may require occasional flushing.

Units with cupronickel heat exchangers are recommended for open loop applications due to the increased resistance to build-up and corrosion, along with reduced wear caused by acid cleaning. Failure to adhere to the guidelines in the water quality table could result in loss of warranty.

| Material | | Copper | 90/10 Cupro-Nickel | 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 .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 .5 ppm | Less than .5 ppm | Less than .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 .5 ppm | Less than .5 ppm | Less than .5 ppm |
| | Ammonia Nitrate | Less than .5 ppm | Less than .5 ppm | Less than .5 ppm |
| | Ammonia Hydroxide | Less than .5 ppm | Less than .5 ppm | Less than .5 ppm |
| | Ammonia Sulfate | Less than .5 ppm | Less than .5 ppm | Less than .5 ppm |
| | Total Dissolved Solids (TDS) | Less than 1000 ppm | 1000-1500 ppm | 1000-1500 ppm |
| | LSI Index | ˆ0.5 to ˆ.05 | ˆ0.5 to ˆ.05 | ˆ0.5 to ˆ.05 |
| Iron Fouling | Iron, Fe ²⁺ (Ferrous) Bacterial Iron Potential | < .2ppm | < .2 ppm | < .2 ppm |
| (Biological Growth) | 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) | < 6 ft/sec | < 6 ft/sec | < 6 ft/sec |

Note:
Grains = PPM divided by 17
mg/l is equivalent to PPM

Condensate Drain

The internal condensate drain assembly consists of a drain tube which is connected to the drain pan, a 3/4 in. PVC female adapter and a flexible connecting hose. The female adapter may exit either the front or the side of the cabinet. The adapter should be glued to the field-installed PVC condensate piping. A condensate hose is inside all cabinets as a trapping loop; therefore, an external trap is not necessary.

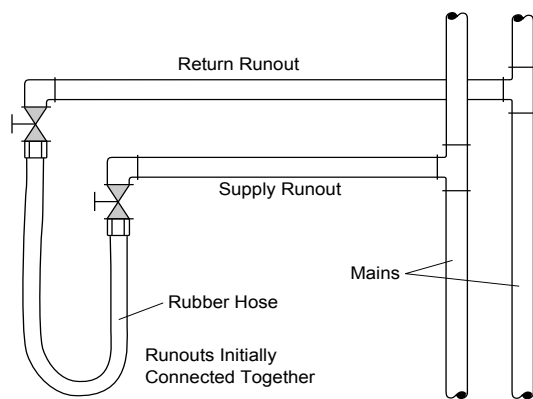
System Cleaning and Flushing

Cleaning and Flushing

Prior to start up of any heat pump, the water circulating system must be cleaned and flushed of all dirt and debris.

If the system is equipped with water shutoff valves, the supply and return runouts must be connected together at each unit location (This will prevent the introduction of dirt into the unit, see Flushing with Water Shutoff Valve Equipped Systems illustration). The system should be filled at the water make-up connection with all air vents open. After filling, vents should be closed.

Flushing with Water Shutoff Valve Equipped Systems



The contractor should start the main circulator with the pressure reducing valve makeup open. Vents should be checked in sequence to bleed off any trapped air and to verify circulation through all components of the system.

As water circulates through the system, the contractor should check and repair any leaks found in the piping system. Drain(s) at the lowest point(s) in the system should be opened for initial flush and blowdown, making sure water fill valves are set at the same rate. Check the pressure gauge at the pump suction and manually adjust the make-up water valve to hold the same positive pressure both before and after opening the drain valves. Flushing should continue for at least two hours, or longer if required, until drain water is clean and clear.

The supplemental heater and/or circulator pump, if used, should be shut off. All drains and vents should be opened to completely drain the system. Short-circuited supply and return runouts should now be connected to the unit supply and return connections.

Refill the system with clean water. Test the system water for acidity and treat as required to leave the water slightly alkaline (pH 7.5 to 8.5). The specified percentage of antifreeze may also be added at this time. Use commercial grade antifreeze designed for HVAC systems only. Environol™ brand antifreeze is recommended.

Once the system has been filled with clean water and antifreeze (if used), precautions should be taken to protect the system from dirty water conditions. Dirty water will result in system-wide degradation of performance, and solids may clog valves, strainers, flow regulators, etc. Additionally, the heat exchanger may become clogged which reduces compressor service life and can cause premature unit failure.

In boiler/tower application, set the loop control panel set points to desired temperatures. Supply power to all motors and start the circulating pumps. After full flow has been established through all components including the heat rejector (regardless of season), air vented and loop temperatures stabilized, each of the units will be ready for check, test and start up and for air and water balancing.

Ground Source Loop System Checkout

Once piping is completed between the unit pumping system and ground loop, final purging and charging of the loop is needed. A high pressure pump 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. Flush the system adequately to remove as much air as possible; then pressurize the loop to a static pressure of 40-50 PSI (summer) or 50-75 PSI (winter). This is normally adequate for good system operation. Loop static pressure may decrease soon after initial installation, due to pipe expansion and loop temperature change. Running the unit for at least 30 minutes after the system has been completely purged of air will allow for the “break-in” period. It may be necessary to adjust static loop pressure (by adding water) after the unit has run for the first time. Loop static pressure will also fluctuate with the seasons. Pressures will be higher in the winter months than during the cooling season. This fluctuation is normal and should be considered when charging the system initially.

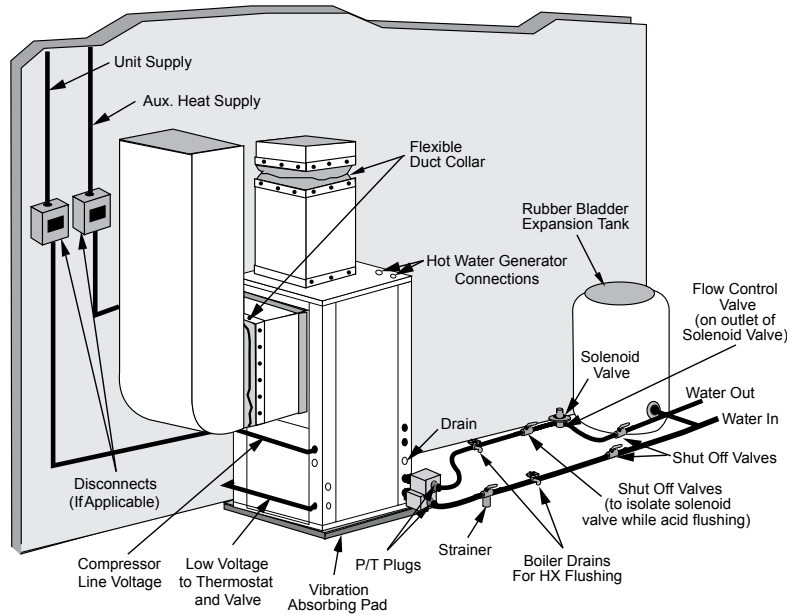
Ensure the pump provides adequate flow through the unit by checking pressure drop across the heat exchanger. Usually 2.25-3.0 GPM of flow per ton of cooling capacity is recommended in earth loop applications.

Open Loop Ground Water Systems

Typical open loop piping is shown below. Always maintain water pressure in the heat exchanger by placing water control valves at the outlet of the unit to prevent mineral precipitation. Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. Ensure proper water flow through the unit by checking pressure drop across the heat exchanger and comparing it to the figures in unit capacity data tables in the specification catalog. 1.5-2 GPM of flow per ton of cooling capacity is recommended in open loop applications. Due to only minor differences in flow rate from low to high, only one solenoid valve should be used. The valve should be sized for full flow.

Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways, depending on local codes, i.e. recharge well, storm sewer, drain field, adjacent stream or pond, etc. Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning departments to assure compliance in your area.

Open System - Groundwater Application



Hot Water Generator Connections

The heat reclaiming hot water generator coil is of 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 or two 50-gallon water heaters connected in a series as shown below. Electric water heaters are recommended. Make sure all local electrical and plumbing codes are met for installing a hot water generator. A water softener is recommended with hard water (greater than 10 grains or 170 total hardness).

NOTE: Refer to the hot water generation pump kit (DPK5) for further instructions.

Water Tank Preparation

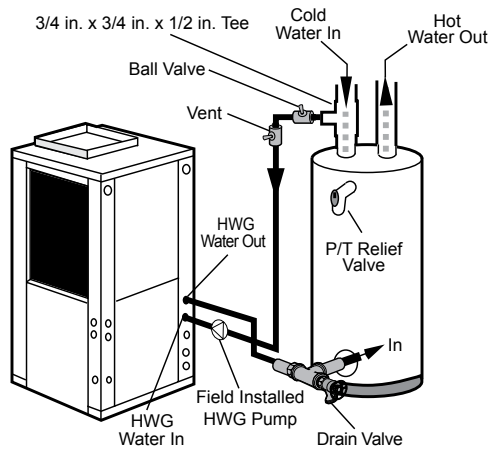
To install a unit with a hot water generator, follow these installation guidelines.

1. Turn off the power to the water heater.
2. Attach a water hose to the water tank drain connection and run the other end of the hose to an open drain or outdoors.
3. Close the cold water inlet valve to the water heater tank.
4. Drain the tank by opening the valve on the bottom of the tank, then open the pressure relief valve or hot water faucet.
5. Flush the tank by opening the cold water inlet valve to the water heater to free the tank of sediments. Close when draining water is clear.
6. Disconnect the garden hose and remove the drain valve from the water heater.
7. Refer to Plumbing Installation and Hot Water Generator Startup.

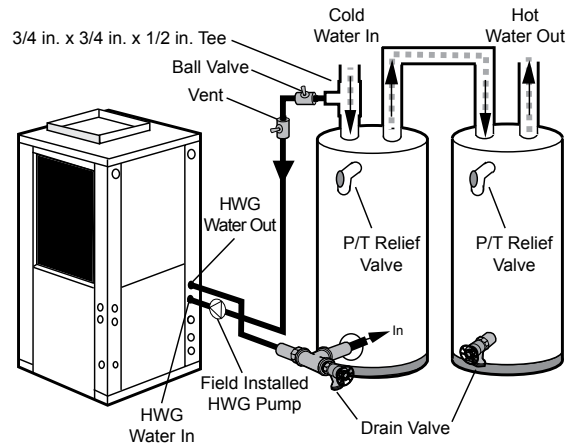


CAUTION: Elements will burn out if energized dry.

Typical Hot Water Generator Installation



Hot Water Generator Installation In Preheat Tank



NOTE: This configuration maximizes hot water generator capability.

Hot Water Generator Connections cont.

Plumbing Installation

1. Inspect the dip tube in the water heater cold inlet for a check valve. If a check valve is present it must be removed or damage to the hot water generator circulator will occur.
2. Remove drain valve and fitting.
3. Thread the 3/4-inch NPT x 3-1/2-inch brass nipple into the water heater drain port.
4. Attach the center port of the 3/4-inch FPT tee to the opposite end of the brass nipple.
5. Attach the 1/2-inch copper to 3/4-inch NPT adaptor to the side of the tee closest to the unit.
6. Install the drain valve on the tee opposite the adaptor.
7. Run interconnecting tubing from the tee to HWG water out.
8. Cut the cold water "IN" line going to the water heater.
9. Insert the reducing solder tee in line with cold water "IN" line as shown.
10. Run interconnecting copper tubing between the unit DHW water "IN" and the tee (1/2-inch nominal). The recommended maximum distance is 50 feet.
11. To prevent air entrapment in the system, install a vent coupling at the highest point of the interconnecting lines.
12. Insulate all exposed surfaces of both connecting water lines with 3/8-inch wall closed cell insulation.

NOTE: All plumbing and piping connections must comply with local plumbing codes.

Hot Water Generator Startup

1. Make sure the power is off to the heat pump. Connect the wire from the hot water generator pump to T1 on the contactor.
2. Close the drain valve to the water heater.
3. Open the cold water supply to the tank.
4. Open a hot water faucet in the building to bleed air from the system. Close when full.
5. Open the pressure relief valve to bleed any remaining air from the tank, then close.
6. If so equipped, turn the venting (burping) screw in the center of the pump two (2) turns open (water will drip out), wait until all air is purged from the pump, then tighten the plug. Use vent couplings to bleed air from the lines.
7. Carefully inspect all plumbing for water leaks and correct as required.
8. Before restoring electrical supply to the water heater, adjust the temperature setting on the tank.
 - On tanks with both upper and lower elements, the lower element should be turned down to the lowest setting, approximately 100°F. The upper element should be adjusted to 120°F to 130°F. Depending upon the specific needs of the customer, you may want to adjust the upper element differently.
 - On tanks with a single element, lower the thermostat setting to 120°F.
9. After the thermostat(s) is adjusted, replace the access cover and restore electrical supply to the water heater.
10. Make sure that any valves in the hot water generator circuit are open.
11. Turn on the unit to heating.
12. The HWG pump should be running. When the pump is first started, turn the venting (burping) screw (if equipped) in the center of the pump two (2) turns open until water dribbles out, then replace. Allow the pump to run for at least five minutes to ensure that water has filled the circulator properly.
13. The temperature difference between the water entering and leaving the hot water generator should be 5°F to 15°F. The water flow should be approximately 0.4 GPM per ton of nominal cooling.
14. Allow the unit to heat water for 15 to 20 minutes to be sure operation is normal.



CAUTION: Never operate the HWG circulating pump while dry. If the unit is placed in operation before the hot water generator piping is connected, be sure that the pump wires are disconnected from the contactor.

Electrical Connections

General

Be sure the available power is the same voltage and phase as that shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

208 Volt Operation

All Versatec Ultra Series UCV 208/230 units are factory wired for 230 volt operation. For 208 volt operation, the red and blue transformer wires must be switched on terminal strip PS.

Unit Power Connection

Connect the incoming line voltage wires to L1 and L2 of the contactor for single-phase unit. Consult the Unit Electrical Data for correct fuse sizes.

Control Box

Remove the two screws on the side of the control board. These screws are only required for shipping.



Electrical Data

PSC Motor

| Model | Rated Voltage | Voltage Min/Max | Compressor | | | Blower Motor FLA | Total Unit FLA | Min Circ Amp | Max Fuse/HACR |
|-------|---------------|-----------------|------------|------|-------|------------------|----------------|--------------|---------------|
| | | | MCC | RLA | LRA | | | | |
| 018 | 208-230/60/1 | 187/253 | 10.4 | 6.7 | 33.5 | 1.1 | 7.8 | 9.5 | 15 |
| | 265/60/1 | 238/292 | 8.7 | 5.6 | 28.0 | 1.0 | 6.6 | 8.0 | 10 |
| 023 | 208-230/60/1 | 187/253 | 21.0 | 13.5 | 58.3 | 1.2 | 14.7 | 18.1 | 30 |
| | 265/60/1 | 238/292 | 14.0 | 9.0 | 54.0 | 1.1 | 10.1 | 12.4 | 20 |
| 031 | 208-230/60/1 | 187/253 | 22.0 | 14.1 | 73.0 | 1.5 | 15.6 | 19.1 | 30 |
| | 265/60/1 | 238/292 | 17.5 | 11.2 | 60.0 | 1.5 | 12.7 | 15.5 | 25 |
| 041 | 208-230/60/1 | 187/253 | 31.0 | 20.0 | 115.0 | 3.5 | 23.5 | 28.5 | 45 |

HACR circuit breaker in USA only

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Blower Performance Data

Standard PSC Motor

| Model | Blower Spd | Blower Size | Motor HP | Airflow (cfm) at External Static Pressure (in. wg) | | | | | | | | | | | | | | | |
|------------|------------|-------------|----------|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | | | 0 | 0.05 | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.35 | 0.40 | 0.45 | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 1.00 |
| 018 | H | 9 x 7 | 1/6 | 875 | 860 | 845 | 830 | 820 | 805 | 790 | 770 | 750 | 725 | 700 | - | - | - | - | - |
| | M | | | 760 | 750 | 740 | 730 | 720 | 710 | 700 | 680 | 660 | 640 | 620 | - | - | - | - | - |
| | L | | | 630 | 620 | 610 | 600 | 590 | 580 | 570 | 560 | 550 | 520 | 490 | - | - | - | - | - |
| 023 | H | 9 x 7 | 1/5 | 995 | 975 | 950 | 925 | 895 | 865 | 835 | 795 | 750 | 715 | 680 | 595 | - | - | - | - |
| | M | | | 860 | 840 | 820 | 805 | 785 | 755 | 725 | 690 | 655 | 620 | 580 | - | - | - | - | - |
| | L | | | 790 | 775 | 760 | 745 | 725 | 690 | 655 | 635 | 610 | 575 | 535 | - | - | - | - | - |
| 031 | H | 9 x 7 | 1/3 | 1160 | 1135 | 1110 | 1085 | 1055 | 1025 | 995 | 965 | 930 | 890 | 850 | 765 | 650 | - | - | - |
| | M | | | 1035 | 1015 | 1000 | 975 | 955 | 930 | 905 | 875 | 845 | 810 | 780 | 685 | - | - | - | - |
| | L | | | 855 | 845 | 840 | 830 | 820 | 800 | 785 | 760 | 740 | 710 | 685 | 610 | - | - | - | - |
| 041 | H | 9 x 7 | 1/2 | 1200 | 1170 | 1145 | 1115 | 1080 | 1035 | 995 | 955 | 915 | 875 | 835 | 765 | 640 | - | - | - |
| | M | | | 1110 | 1085 | 1065 | 1035 | 1010 | 975 | 940 | 900 | 860 | 825 | 795 | 715 | 585 | - | - | - |
| | L | | | 1040 | 1020 | 1000 | 975 | 950 | 920 | 890 | 860 | 830 | 795 | 765 | 683 | 560 | - | - | - |

Factory settings are in **Bold**

9/2/10

Air flow values are with dry coil and standard filter

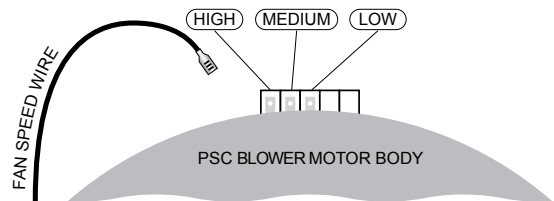
For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12in. wg. and 500 fpm by 0.16 in. wg.

Setting Blower Speed - PSC

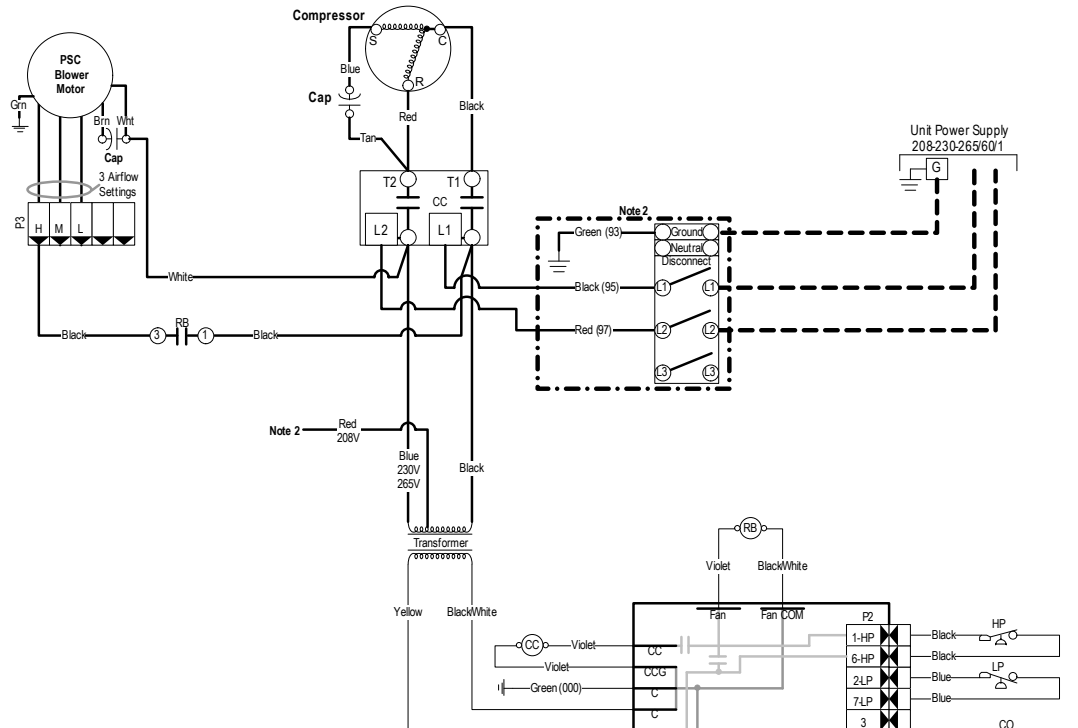


CAUTION: Disconnect all power before performing this operation.



Wiring Schematic

Versatec Microprocessor 208-230/60/1 PSC



Legend

| | | | |
|--|-----------------------------|--|------------------------------|
| | Factory Low Voltage Wiring | | Thermistor |
| | Factory Line Voltage Wiring | | Relay Coil |
| | Field Low Voltage Wiring | | Switch - Condensate Overflow |
| | Field Line Voltage Wiring | | Switch - High pressure |
| | Optional Block | | Switch - Low pressure |
| | DC Voltage PCB Traces | | Polarized connector |
| | Field Zone Sensor Wiring | | Capacitor |
| | Internal Junction | | |
| | Quick Connect Terminal | | |
| | Field Wiring Lug | | |
| | Ground | | |
| | Relay Contacts—N.O., N.C. | | |

CC – Compressor Contactor
 CO – Condensate Overflow Sensor
 ES – Emergency Shutdown
 HP – High Pressure Switch
 LP – Low Pressure Switch
 FD – Freeze Detection Sensor
 RB – Blower Relay
 RV – Reversing Valve Coil

Notes:

1 – Optional, factory installed unit mounted disconnect.
 2 – Swap blue and red leads for 208V operation

| Event | Normal Mode | Test Mode |
|---|--------------------|--------------------|
| Power On Delay | 5 minutes | 15 seconds |
| Compressor On Delay | 10 seconds | 2 seconds |
| Compressor Minimum On Time | 2 minutes | 5 seconds |
| Compressor Short Cycle Delay | 5 minutes | 15 seconds |
| Blower Off Delay | 30 seconds | 5 seconds |
| Fault Recognition Delay – High Pressure | Less than 1 second | Less than 1 second |
| StartUp Bypass – Low Pressure | 2 minutes | 0 seconds |
| Fault Recognition Delay – Low Pressure | 30 seconds | 30 seconds |
| StartUp Bypass – Freeze Detection | 2 minutes | 0 seconds |
| Fault Recognition Delay – Freeze Detection | 30 seconds | 30 seconds |
| Fault Recognition Delay – Condensate Overflow | 30 seconds | 30 seconds |

| Single-Speed | | | | |
|--------------|--------|--------|------|-----|
| Mode | Inputs | Blower | Comp | RV |
| Hg | Y | Auto | ON | OFF |
| Cg | Y/D | Auto | ON | ON |
| Blower Only | G | ON | OFF | OFF |

| Status Display Mode | |
|---------------------|---|
| LED | SW1-4 On, SW2 Off |
| Drain | Drain Pan Overflow Lockout |
| Water Flow | Freeze Detection Lockout (Loop <= 15°F, Well <= 30°F) |
| High Press | High Pressure Lockout |
| Low Press | Low Pressure Lockout |
| Air Flow | Not Used |
| Status | Microprocessor Malfunction |
| DHW Limit | Not Used |
| DHW | SW2 Status (Off = Down Position On-Up Position) |

| LED | Current Fault Display Mode | Inputs Display Mode | Outputs Display Mode |
|------------|----------------------------|---------------------|----------------------|
| LED | SW1-4 On, SW2 On | SW1-4 Off, SW2 Off | SW1-4 Off, SW2 On |
| Drain | Drain Pan Overflow Lockout | Y | Compressor |
| Water Flow | Freeze Detection Lockout | G | Blower |
| High Press | High Pressure Lockout | O | Reversing Valve |
| Low Press | Low Pressure Lockout | ES | ES |
| Air Flow | Not Used | NS | NS |
| Status | Not Used | LS | LS |
| DHW Limit | Not Used | Not Used | Not Used |
| DHW | SW2 = On | SW2 = Off | SW2 = On |

| DIP Switch Number | Description | "OFF" Position | "ON" Position |
|-------------------|--|-------------------------------|--------------------------------------|
| SW1-1 | Service Test Mode On the control allows field selection of "NORMAL" or "TEST" operational modes. Test mode accelerates most timing functions 6 times to allow faster troubleshooting. Test mode also allows viewing the "CURRENT" status of the fault inputs on the LED display. | Test Mode | Normal Speed Operation |
| SW1-2 | Freeze Detection Setting This DIP switch allows field selection of low source water thermistor fault sensing for "WELL" water (30°F) or "LOOP" (15°F) for antifreeze protected earth loops | "LOOP" (15°F) | "WELL" (30°F) |
| SW1-3 | Not Available | N/A | Normal Operation |
| SW1-4 | I/O Display Mode This DIP switch enables Input/Output Display or Status/Current Fault on LED Board. Refer to SW2 for operation and positioning. | Input/Output Display Mode | Status/Current Fault Display Mode |
| SW1-5 | Not Available | N/A | Normal Operation |
| SW2 | LED Display (On LED Board) This DIP switch enables Normal Status or Input display mode in the "OFF" position and Current Fault or Output display mode in the "ON" position. | Status or Inputs Display Mode | Current Fault or Output Display Mode |

* Flashing Status Light Indicates the Board is Functioning Properly
 A Solid "On" Indicates a Board Malfunction

Controls - Versatec Microprocessor

Standard Versatec Microprocessor



Flexible Control Options

The Versatec Ultra Series - Military control system is a microprocessor-based printed circuit board, (PCB), conveniently located in the unit control box for accessibility. The microprocessor control is specifically designed for water source heat pumps to integrate compressors and advanced features needed in water source heat pump applications. The microprocessor provides control of the entire unit as well as outputs for status modes, faults, and diagnostics. Low voltage thermostat terminal strips provide convenient field connections. LEDs are located on the control box to assist the technician when servicing the unit.

Startup

The unit will not operate until all the inputs and safety controls are checked for normal conditions. At first powerup, a four minute delay is employed before the compressor is energized.

Component Sequencing Delays

Components are sequenced and delayed for optimum space conditioning performance.

Short Cycle Protection

The control allows a minimum on time of 2 minutes and a minimum off time of 5 minutes for short cycle protection.

Condensate Overflow Protection

The Versatec control board incorporates an impedance sensing liquid sensor at the top of the drain pan. Upon a continuous 30-second sensing of the condensate, compressor operation is suspended (see Fault Retry), and the condensate overflow lockout LED begins flashing.

Safety Controls

The Versatec control receives separate signals for a high pressure switch for safety, a low pressure switch to prevent

loss of charge damage, and a low suction temperature thermistor for freeze sensing. Upon a continuous 30-second measurement of the fault (immediate for high pressure), compressor operation is suspended, the appropriate lockout LED begins flashing. (Refer to the "Fault Retry" section below).

Testing

The Versatec control allows service personnel to shorten most timing delays for faster diagnostics.

Fault Retry

All faults are retried twice before finally locking the unit out. An output signal is made available for a fault LED at the thermostat. The "Fault Retry" feature is designed to prevent nuisance service calls.

Diagnostics

The Versatec control board allows all inputs and outputs to be displayed on the LEDs for fast and simple control board diagnosis.

Emergency Shutdown

A grounded signal to common or connecting 24 VAC to the ES terminal places the controller into the emergency shutdown mode. The compressor and blower operation are suspended while in the emergency shutdown mode.

Heating Operation

Heating (Y1)

The blower motor is started immediately after the "Y1" input is received, and the compressor is energized 10 seconds after the "Y1" input.

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 (Y1,O)

The blower motor is started immediately after the "Y1" input is received, and the compressor is energized 10 seconds after the "Y1" input.

Blower (G only)

The blower motor is started immediately after the "G" input is received; and it will remain on for 30 seconds at the end of each heating or cooling cycle.

Controls - Versatec Microprocessor cont.

Lockout Conditions

During lockout mode, the appropriate unit and thermostat lockout LEDs will illuminate. The compressor, and accessory outputs are de-energized. If the thermostat calls for heating, emergency heat operation will occur. All other lockout modes can be reset at the thermostat after turning the unit off, and then on, which restores normal operation but keeps the unit lockout LED illuminated. Interruption of power to the unit will reset lockout without a waiting period and clear all lockout LEDs.

High Pressure

This lockout mode occurs when the normally closed safety switch is opened momentarily (set at 600 PSI).

Low Pressure

This lockout mode occurs when the normally closed low pressure switch is opened for 30 continuous seconds (set at 40 PSI).

Freeze Detection (Water Flow)

This lockout mode occurs when the freeze thermistor temperature is at or below the selected freeze detection point (well 30°F or loop 15°F) for 30 continuous seconds.

DIP Switch Settings

Prior to powering unit, ensure that all DIP switches on SW1 are set properly according to the table below.

| FACTORY SETUP DIP SWITCHES (SW1) | | | | |
|----------------------------------|---|--|-------------------------------|--------------------------------------|
| Dip Switch Number | | Description | "OFF" Position | "ON" Position |
| SW1- | 1 | Service Test Mode On the control, allows field selection of "NORMAL" or "TEST" operational modes, Test mode accelerates most timing functions 16 times to allow faster troubleshooting. Test mode also allows viewing the "CURRENT" status of the fault inputs on the LED display. | Test Mode | Normal Speed Operation |
| SW1- | 2 | Freeze Detection Setting This DIP switch allows field selection of low source water thermistor fault sensing for "WELL" water (30°F) or "LOOP" (15°F) for antifreeze protected earth loops. | "LOOP" (15°F) | "WELL" (30°F) |
| SW1- | 3 | Not Available | N/A | Normal Operation |
| SW1- | 4 | I/O Display Mode This DIP switch enables Input/Output Display or Status/Current Fault on LED Board. Refer to SW2 for operation and positioning. | Input/Output Display Mode | Status/Current Fault Display Mode |
| SW1- | 5 | Not Available | N/A | Normal Operation |
| SW2- | | LED Display (On LED Board) This DIP switch enables Normal Status or Input display mode in the "OFF" position and Current Fault or Output display mode in the "ON" position. | Status or Inputs Display Mode | Current Fault or Output Display Mode |

Operation Logic Data Table

| Mode | Inputs | Blower | Comp | RV |
|-------------|--------|--------|------|-----|
| Htg | Y | Auto | ON | OFF |
| Clg | Y, O | Auto | ON | ON |
| Blower Only | G/Y2 | ON | OFF | OFF |

Controls - Versatec Microprocessor cont.

Standard Microprocessor Controls

To check the unit control board for proper operation:

- 1) Disconnect thermostat wires at the control board.
- 2) Jumper the desired test input (Y1, W, O or G) to the R terminal to simulate a thermostat signal.
- 3) If control functions properly:
 - Check for thermostat and field control wiring (use the diagnostic inputs mode).
- 4) If control responds improperly:
 - Ensure that component being controlled is functioning (compressor, blower, reversing valve, etc.).
 - Ensure that wiring from control to the component is functioning (refer to the LED Definition table below and use the diagnostic outputs mode).
 - If steps above check properly, replace unit control.

LED Definitions and Diagnostics

Versatec Microprocessor

Status Display Mode

| | |
|----------------------|--|
| LED | SW1-4 On, SW2 Off |
| Drain | Drain Pan Overflow Lockout |
| Water Flow | Freeze Detection (Loop <= 15°F, Well <= 30°F) |
| High Pressure | High Pressure Lockout |
| Low Pressure | Low Pressure Lockout |
| Air Flow | Not Used |
| Status | Microprocessor Malfunction* |
| DHW Limit | Not Used |
| DHW | SW2 Status (Off=Down Position, On=Up Position) |

Diagnostic Display Modes

| | Current Fault Display Mode | Inputs Display Mode | Outputs Display Mode |
|--------------------|----------------------------|---------------------|----------------------|
| LED | SW1-4 On, SW2 On | SW1-4 Off, SP2 Off | SW1-4 Off, SW2 On |
| Drain | Drain Pan Overflow Lockout | Y | Compressor |
| Water Flow | Freeze Detection Lockout | G | Blower |
| High Press. | High Pressure Lockout | O | Reversing Valve |
| Low Press. | Low Pressure Lockout | ES | ES |
| Air Flow | Not Used | NS | NS |
| Status | Not Used | LS | LS |
| DHW Limit | Not Used | Not Used | Not Used |
| DHW | SW2 = On | SW2 = Off | SW2 = On |

* Flashing Status Light Indicates the Board is Functioning Properly.

A Solid "On" Indicates a Board Malfunction.

Refrigerant Systems

To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Compare the change in temperature on the air side as well as the water side to the Unit Operating Parameters tables. If the unit's performance is not within the ranges listed, and the airflow and water flow are known to be correct, gauges should then be installed and superheat and subcooling numbers calculated. If superheat and subcooling are outside recommended ranges, an adjustment to the refrigerant charge may be necessary.

NOTE: Refrigerant tests must be made with hot water generator turned "OFF". Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

Unit Startup

Before Powering Unit, Check The Following:

NOTE: Remove and discard the compressor shipping bolts. The bolts can then be discarded.

- High voltage is correct and matches nameplate.
- Fuses, breakers and wire size correct.
- Low voltage wiring complete.
- Piping completed and water system cleaned and flushed.
- Air is purged from closed loop system.
- Isolation valves are open, water control valves or loop pumps wired.
- Condensate line open and correctly pitched.
- Transformer switched to 208V if applicable.
- Dip switches are set correctly.
- Blower rotates freely – foam shipping support has been removed.
- Blower speed correct.
- Air filter/cleaner is clean and in position.
- Service/access panels are in place.
- Return air temperature is between 50-80°F heating and 60-95°F cooling.
- Check air coil cleanliness to ensure optimum performance. Clean as needed according to maintenance guidelines. To obtain maximum performance the air coil should be cleaned before startup. A 10-percent solution of dishwasher detergent and water is recommended for both sides of coil, a thorough water rinse should follow.

Startup Steps

NOTE: Complete the Equipment Start-Up/Commissioning Check Sheet during this procedure. Refer to thermostat operating instructions and complete the startup procedure.

1. Initiate a control signal to energize the blower motor. Check blower operation.
2. Initiate a control signal to place the unit in the cooling mode. Cooling setpoint must be set below room temperature.
3. Cooling will energize after a time delay. Check for correct rotation of scroll compressors in 3 phase applications. Incorrect rotation will cause low refrigerant pressures and possibly unusual noise. Switch any two power leads at the compressor or contactor to reverse rotation.
4. Be sure that the compressor and water control valve or loop pump(s) are activated.
5. Verify that the water flow rate is correct by measuring the pressure drop through the heat exchanger using the P/T plugs and comparing to the pressure drop table.
6. Check the temperature of both the supply and discharge water (Refer to Unit Operating Parameters tables).
7. Check for an air temperature drop of 15°F to 25°F across the air coil, depending on the blower speed and entering water temperature.
8. Decrease the cooling set point several degrees and verify high-speed blower operation (ECM2.3 only).
9. Adjust the cooling setpoint above the room temperature and verify that the compressor and water valve or loop pumps deactivate.
10. Initiate a control signal to place the unit in the heating mode. Heating set point must be set above room temperature.
11. Heating will energize after a time delay.
12. Check the temperature of both the supply and discharge water (Refer to Unit Operating Parameters tables).
13. Check for an air temperature rise of 20°F to 35°F across the air coil, depending on the blower speed and entering water temperature.
14. If auxiliary electric heaters are installed, increase the heating setpoint until the electric heat banks are sequenced on. All stages of the auxiliary heater should be sequenced on when the thermostat is in the Emergency Heat mode. Check amperage of each element.
15. Adjust the heating setpoint below room temperature and verify that the compressor and water valve or loop pumps deactivate.
16. During all testing, check for excessive vibration, noise or water leaks. Correct or repair as required.
17. Set system to desired normal operating mode and set temperature to maintain desired comfort level.
18. Instruct the owner/operator in the proper operation of the thermostat and system maintenance.

NOTE: Be certain to fill out and forward all warranty registration papers.

Operating Parameters

| Entering Water Temp °F | Water Flow GPM/Ton | Cooling -- No Hot Water Generation | | | | | |
|------------------------|--------------------|------------------------------------|-------------------------|-----------|------------|--------------------|---------------------|
| | | Suction Pressure PSIG | Discharge Pressure PSIG | Superheat | Subcooling | Water Temp Rise °F | Air Temp Drop °F DB |
| 30 | 1.5 | 100-115 | 170-190 | 17 - 26 | 10 - 14 | 18 - 22 | 18 - 22 |
| | 3.0 | 95-110 | 150-170 | 20 - 29 | 7 - 11 | 8 - 10 | 18 - 22 |
| 50 | 1.5 | 133 - 148 | 205 - 225 | 17 - 26 | 10 - 14 | 18 - 22 | 18 - 22 |
| | 3.0 | 129 - 144 | 185 - 205 | 20 - 29 | 7 - 11 | 8 - 10 | 18 - 22 |
| 70 | 1.5 | 139 - 154 | 280 - 300 | 8 - 11 | 8 - 12 | 18 - 22 | 18 - 22 |
| | 3.0 | 137 - 152 | 250 - 270 | 9 - 12 | 7 - 11 | 8 - 10 | 18 - 22 |
| 90 | 1.5 | 143 - 158 | 360 - 380 | 8 - 11 | 9 - 13 | 18 - 22 | 16 - 20 |
| | 3.0 | 141 - 156 | 330 - 350 | 9 - 12 | 8 - 12 | 8 - 10 | 16 - 20 |
| 110 | 2.3 | 143 - 158 | 360 - 380 | 8 - 11 | 9 - 13 | 18 - 22 | 16 - 20 |
| | 3.0 | 141 - 156 | 440-460 | 9 - 12 | 8 - 12 | 8 - 10 | 16 - 20 |

| Entering Water Temp °F | Water Flow GPM/Ton | Heating -- No Hot Water Generation | | | | | |
|------------------------|--------------------|------------------------------------|-------------------------|-----------|------------|--------------------|---------------------|
| | | Suction Pressure PSIG | Discharge Pressure PSIG | Superheat | Subcooling | Water Temp Drop °F | Air Temp Rise °F DB |
| 30 | 1.5 | 73 - 79 | 279 - 304 | 7 - 13 | 2 - 6 | 7 - 10 | 18 - 24 |
| | 3.0 | 79 - 85 | 285 - 310 | 8 - 14 | 2 - 6 | 3 - 6 | 20 - 26 |
| 50 | 1.5 | 103 - 109 | 308 - 333 | 8 - 12 | 4 - 8 | 8 - 11 | 20 - 26 |
| | 3.0 | 110 - 116 | 315 - 340 | 9 - 13 | 4 - 8 | 4 - 7 | 22 - 28 |
| 70 | 1.5 | 140 - 146 | 330 - 365 | 10 - 14 | 7 - 11 | 11 - 14 | 26 - 32 |
| | 3.0 | 146 - 153 | 340 - 375 | 10 - 14 | 7 - 11 | 7 - 10 | 28 - 34 |
| 90 | 1.5 | 170-177 | 425-460 | 14-18 | 12-16 | 8-11 | 42-50 |
| | 3.0 | 174-181 | 435-470 | 14-18 | 12-16 | 8-11 | 42-50 |
| 110 | 2.3 | | | | | | |
| | 3.0 | | | | | | |

NOTES: Cooling performance based on entering air temperatures of 80°F DB, 67°F WB.
 Heating performance based on entering air temperature of 70°F DB.

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Operating Limits

| Operating Limits | Cooling | | Heating | |
|--------------------------|-----------|---------|---------|------|
| | (°F) | (°C) | (°F) | (°C) |
| Air Limits | | | | |
| Min. Ambient Air | 45 | 7.2 | 45 | 7.2 |
| Rated Ambient Air | 80 | 26.7 | 70 | 21.1 |
| Max. Ambient Air | 100 | 37.8 | 85 | 29.4 |
| Min. Entering Air | 50 | 10.0 | 40 | 4.4 |
| Rated Entering Air db/wb | 80.6/66.2 | 27/19 | 68 | 20.0 |
| Max. Entering Air db/wb | 110/83 | 43/28.3 | 80 | 26.7 |
| Water Limits | | | | |
| Min. Entering Water | 30 | -1.1 | 20 | -6.7 |
| Normal Entering Water | 50-110 | 10-43.3 | 30-70 | -1.1 |
| Max. Entering Water | 120 | 48.9 | 90 | 32.2 |

NOTE: Minimum/maximum limits are only for start-up 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 dependant upon three primary factors: 1) water temperature, 2) return air temperature, and 3) ambient temperature. 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.

Pressure Drop

| Model | GPM | Pressure Drop (psi) | | | | |
|-------|------|---------------------|------|------|------|-------|
| | | 30°F | 50°F | 70°F | 90°F | 110°F |
| 018 | 3.0 | 1.1 | 1.0 | 0.8 | 0.7 | 0.5 |
| | 4.0 | 1.9 | 1.8 | 1.6 | 1.5 | 1.3 |
| | 5.0 | 3.3 | 3.2 | 3.0 | 2.9 | 2.7 |
| | 6.0 | 4.5 | 4.4 | 4.3 | 4.1 | 4.0 |
| 023 | 3.0 | 1.1 | 1.0 | 0.9 | 0.8 | 0.6 |
| | 4.5 | 2.4 | 2.2 | 2.1 | 2.0 | 1.9 |
| | 6.0 | 4.5 | 4.4 | 4.3 | 4.1 | 4.0 |
| | 8.0 | 6.7 | 6.6 | 6.5 | 6.3 | 6.2 |
| 031 | 4.0 | 0.9 | 0.8 | 0.7 | 0.6 | 0.5 |
| | 6.0 | 1.9 | 1.8 | 1.7 | 1.6 | 1.5 |
| | 8.0 | 3.7 | 3.6 | 3.5 | 3.4 | 3.3 |
| | 10.0 | 4.8 | 4.7 | 4.6 | 4.5 | 4.4 |
| 041 | 5.0 | 1.5 | 1.2 | 0.9 | 0.5 | 0.4 |
| | 8.0 | 3.4 | 3.1 | 2.8 | 2.5 | 2.1 |
| | 11.0 | 7.9 | 7.5 | 7.2 | 6.9 | 6.6 |
| | 14.0 | 9.1 | 8.8 | 8.5 | 8.2 | 7.9 |

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Compressor and Thermistor Resistance

Compressor Resistance Chart

| Model | 208-230/60/1 | | 265/60/1 | |
|-------|--------------|-------------|-------------|-------------|
| | Run | Start | Run | Start |
| 018 | 2.24 - 2.58 | 2.84 - 3.26 | 3.03 - 3.49 | 2.39 - 2.75 |
| 023 | 1.14 - 1.32 | 1.37 - 1.57 | 1.38 - 1.58 | 2.02 - 2.32 |
| 031 | 0.95 - 1.09 | 1.81 - 2.09 | 1.24 - 1.42 | 2.42 - 2.78 |
| 041 | 0.49 - 1.03 | 1.29 - 1.49 | n/a | |

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Thermistor Resistance Chart

| Thermistor Temperature (°F) | Microprocessor Resistance (Ohms) |
|-----------------------------|----------------------------------|
| 5 | 75757-70117 |
| 14 | 57392-53234 |
| 23 | 43865-40771 |
| 32 | 33809-31487 |
| 41 | 26269-24513 |
| 50 | 20570-19230 |
| 59 | 16226-15196 |
| 68 | 12889-12093 |
| 77 | 10310-9688 |
| 86 | 8300-7812 |
| 95 | 6723-6337 |
| 104 | 5480-5172 |
| 113 | 4490-4246 |
| 122 | 3700-3504 |
| 131 | 3067-2907 |
| 140 | 2554-2424 |
| 149 | 2149-2019 |

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Heat of Extraction/Rejection Data

| Model | GPM | Heat Of Extraction (HE) | | | | Heat of Rejection (HR) | | | | |
|-------|------|-------------------------|------|------|------|------------------------|------|------|------|-------|
| | | 30°F | 50°F | 70°F | 90°F | 30°F | 50°F | 70°F | 90°F | 110°F |
| 018 | 3.0 | | 11.4 | 13.9 | 19.1 | | 23.0 | 21.6 | 20.5 | |
| | 4.0 | 10.1 | 12.2 | 14.8 | 19.5 | 21.1 | 23.3 | 21.7 | 20.5 | 20.1 |
| | 5.0 | 10.4 | 13.1 | 15.8 | 19.8 | 21.2 | 23.6 | 21.9 | 20.7 | 20.1 |
| 023 | 3.0 | | 14.7 | 18.8 | 24.1 | | 31.1 | 30.7 | 29.6 | |
| | 4.5 | 11.9 | 15.4 | 19.6 | 24.5 | 30.1 | 31.1 | 30.6 | 29.6 | 29.2 |
| | 6.0 | 12.2 | 16.0 | 20.4 | 24.9 | 30.2 | 31.1 | 30.6 | 29.8 | 29.3 |
| 031 | 4.0 | | 21.5 | 27.6 | 34.2 | | 38.4 | 37.0 | 34.7 | |
| | 6.0 | 17.4 | 22.4 | 28.7 | 34.7 | 34.6 | 38.6 | 37.5 | 35.2 | 33.8 |
| | 8.0 | 16.8 | 23.4 | 29.8 | 35.3 | 34.8 | 38.9 | 37.9 | 35.6 | 34.0 |
| 041 | 5.0 | | 27.3 | 34.8 | 45.6 | | 53.2 | 52.1 | 48.4 | |
| | 8.0 | 22.1 | 28.5 | 36.6 | 46.3 | 49.5 | 53.3 | 51.8 | 49.1 | 47.8 |
| | 11.0 | 22.1 | 29.8 | 38.3 | 47.1 | 49.7 | 53.4 | 51.4 | 49.5 | 48.1 |

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Refrigerant Circuit Guideline

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

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Reference Calculations

| Heating Calculations: | Cooling Calculations: |
|--|--|
| $LWT = EWT - \frac{HE}{GPM \times 500}$ | $LWT = EWT + \frac{HR}{GPM \times 500}$ |
| $LAT = EAT + \frac{HC}{CFM \times 1.08}$ | $LAT(DB) = EAT(DB) - \frac{SC}{CFM \times 1.08}$ |
| $TH = HC + HWC$ | $LC = TC - SC$ |
| | $S/T = \frac{SC}{TC}$ |

Legend

ABBREVIATIONS AND DEFINITIONS:

- CFM = airflow, cubic feet/minute
- EWT = entering water temperature, Fahrenheit
- GPM = water flow in gallons/minute
- WPD = water pressure drop, PSI and feet of water
- EAT = entering air temperature, Fahrenheit (dry bulb/wet bulb)
- HC = air heating capacity, MBTUH
- TC = total cooling capacity, MBTUH
- SC = sensible cooling capacity, MBTUH
- KW = total power unit input, kilowatts
- HR = total heat of rejection, MBTUH
- HE = total heat of extraction, MBTUH
- HWC = hot water generator capacity, MBTUH
- EER = Energy Efficient Ratio
= BTU output/Watt input
- COP = Coefficient of Performance
= BTU output/BTU input
- LWT = leaving water temperature, °F
- LAT = leaving air temperature, °F
- TH = total heating capacity, MBTUH
- LC = latent cooling capacity, MBTUH
- S/T = sensible to total cooling ratio

Startup and Troubleshooting Form

Company Name: _____
 Technician Name: _____
 Model No: _____
 Owner's Name: _____
 Installation Address: _____

Company Phone No: _____
 Date: _____
 Serial No: _____
 Open or Closed Loop: _____
 Installation Date: _____

Check One

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

1. FLOW RATE IN GPM (COAXIAL HEAT EXCHANGER)

Water In Pressure: a. _____ PSI
 Water Out Pressure: b. _____ PSI
 Pressure Drop = a - b c. _____ PSI
 Convert Pressure Drop to Flow Rate
 (refer to *Pressure Drop* table) d. _____ GPM

2. TEMPERATURE RISE OR DROP ACROSS COAXIAL HEAT EXCHANGER

| | COOLING | HEATING |
|-------------------------|-------------|-------------|
| Water In Temperature: | e. _____ °F | e. _____ °F |
| Water Out Temperature: | f. _____ °F | f. _____ °F |
| Temperature Difference: | g. _____ °F | g. _____ °F |

3. TEMPERATURE RISE OR DROP ACROSS AIR COIL

| | COOLING | HEATING |
|-------------------------|-------------|-------------|
| Air In Temperature: | h. _____ °F | h. _____ °F |
| Air Out Temperature: | i. _____ °F | i. _____ °F |
| Temperature Difference: | j. _____ °F | j. _____ °F |

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 485 for Methanol or Environol, 500 for water*
 Heat of Extraction (Heating Mode) = _____ btu/hr
 Heat of Rejection (Cooling Mode) = _____ btu/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 |
|---------------------------|----------------|----------------|
| Volts: | m. _____ VOLTS | m. _____ VOLTS |
| Total Amps (Comp. + Fan): | n. _____ AMPS | n. _____ AMPS |
| Watts = m. x n. x 0.85 | o. _____ WATTS | o. _____ WATTS |

6. CAPACITY

Cooling Capacity = HR. - (o. x 3.413) p. _____ btu/hr
 Heating Capacity = HE. + (o. x 3.413) p. _____ btu/hr

7. EFFICIENCY

Cooling EER = p. / o. q. _____ EER
 Heating COP = p. / (o. x 3.413) q. _____ COP

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

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

* Note: Liquid line is between the coaxial heat exchanger and the expansion valve in the cooling mode; between the air coil 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.

If compressor won't run:

1. The fuse may be open or the circuit breaker is tripped. Check electrical circuits and motor windings for shorts or grounds. Investigate for possible overloading. Replace fuse or reset circuit breakers after fault is corrected.
2. Supply voltage may be too low. Check it with a volt meter.
3. Control system may be faulty. Check control for correct wiring of thermostat or aquastat and check the 24 volt transformer for proper voltage.
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) Heating
 - 1) Plugged heat exchanger on source side
 - 2) Water flow source side - (Low)
 - 3) Water too cold source side
 - 4) Low refrigerant
 - b) Cooling
 - 1) Plugged heat exchanger on load side
 - 2) Water flow load side - (Low)
 - 3) Water too cold load side
 - 4) Low refrigerant
6. The high pressure switch may have tripped due to one or more of the following:
 - a) Heating
 - 1) Plugged heat exchanger on load side
 - 2) Low water flow load side
 - 3) Water too warm load side
 - b) Cooling
 - 1) Plugged heat exchanger on source side
 - 2) Low water flow on source side
 - 3) Water too warm source side
7. The compressor overload protection may be open.
8. The internal winding of the compressor motor may be grounded to the compressor shell. If so, replace the compressor.
9. The compressor winding may be open or shorted. Disconnect power. Check continuity with ohm meter. If the winding is open, replace the compressor.

If sufficient cooling or heating is not obtained:

1. Check control for improper location or setting.
2. Check for restriction in water flow.
3. Check refrigerant subcooling and superheat for proper refrigerant charge and expansion valve operation.
4. The reversing valve may be defective and creating a bypass of refrigerant. If the unit will not heat, check the reversing valve coil.

If the unit operation is noisy:

1. Check compressor for loosened mounting bolts. Make sure compressor is floating free on its isolator mounts. Check for tubing contact with the compressor or other surfaces. Readjust it by bending slightly.
2. Check screws on all panels.
3. Check for chattering or humming in the contactor or relays due to low voltage or a defective holding coil. Replace the component.
4. Check for proper installation of vibration absorbing material under the unit.
5. Check for abnormally high discharge pressures.
6. Compressor rotation incorrect

Refrigerant Systems

To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Compare the change in temperature on the air side as well as the water side to the Unit Operating Parameters tables. If the unit's performance is not within the ranges listed, and the airflow and water flow are known to be correct, gauges should then be installed and superheat and subcooling numbers calculated. If superheat and subcooling are outside recommended ranges, an adjustment to the refrigerant charge may be necessary.

NOTE: Refrigerant tests must be made with hot water generator turned "OFF". Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

Preventive Maintenance

Water Coil Maintenance

1. Keep all air out of the water. 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. It is recommended in open loop systems that the water control valve be placed in the discharge line to prevent loss of pressure during off cycles. Closed loop systems must have positive static pressure.

NOTE: On open loop systems, if the installation is in an area with a known high mineral content (125 PPM or greater) in the water, it is best to establish with the owner a periodic maintenance schedule so the coil can be checked regularly. Should periodic coil cleaning be necessary, use standard coil cleaning procedures which are compatible with either the cupronickel or copper water lines. Generally, the more water flowing through the unit the less chance for scaling.

Other Maintenance

Filters

Filters must be clean to obtain maximum performance. They should be inspected monthly under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

Condensate Drain

In areas where airborne bacteria produce a slime in the drain pan, it may be necessary to treat chemically to minimize the problem. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect twice a year to avoid the possibility of overflow.

Blower Motors

Blower motors are equipped with sealed ball bearings and require no periodic oiling.

Hot Water Generator Coil

See Water Coil Maintenance section above.

Air Coil

The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum (with a brush attachment) clean. Care must be taken not to damage the aluminum fins while cleaning.



CAUTION: Fin edges are sharp.

Replacement Procedures

Obtaining Parts

When ordering service or replacement parts, refer to the model number and serial number of the unit as stamped on the serial plate attached to the unit. If replacement parts are required, mention the date of installation of the unit and the date of failure, along with an explanation of the malfunctions and a description of the replacement parts required.

In-Warranty Material Return

Material may not be returned except by permission of authorized warranty personnel. Contact your local distributor for warranty return authorization and assistance.

Service Parts

| Part Description | | 018 | 023 | 031 | 041 |
|--------------------------|---|----------------|----------------|----------------|-----------|
| Compressor | Compressor 208-230/60/1 | 34P593-01(-02) | 34P624-01(-02) | 34P583-01(-02) | 34P621-01 |
| | Compressor 265/60/1 | 34P593-02 | 34P624-02 | 34P583-02 | N/A |
| | Run Capacitor 208-230/60/1 | 16P002D19 | 16P002D19 | 16P002D20 | 16P002D36 |
| | Run Capacitor 265/60/1 | 16P002D30 | 16P002D20 | 16P002D20 | N/A |
| | Sound Jacket | 92P504A01 | 92P504A05 | | |
| PSC Motor & Blower | PSC Motor 208-230/60/1 Capacitor | 14P507B01 | 14P508B01 | 14P509B01 | 14P510B01 |
| | PSC Motor 265/60/1 Capacitor | 14P507B02 | 14P508B02 | 14P509B02 | N/A |
| Refrigeration Components | Air Coil | 61P569-01 | 61S569-01 | 61S569-01 | 61P575-01 |
| | Coax | 62P572-01 | 62P572-01 | 62P566-01 | 62P568-01 |
| | TXV | 33P605-16 | 33P605-16 | 33P605-02 | 33P605-10 |
| | Reversing Valve | 33P505-04 | 33P505-04 | 33P506-04 | 33P506-04 |
| | Filter Dryer | 36P500B01 | 36P500B01 | 36P500B01 | 36P500B01 |
| Hot Water Generation | Hot Water Generation Pump | 62P516-05 | | | |
| Control | Transformer 208-230/60/1 Microprocessor | 15P501B01 | | | |
| Sensors & Safeties | High Pressure Switch | 35P506B02 | | | |
| | Low Pressure Switch | 35P506B01 | | | |

NOTE: Part numbers subject to change.

9/2/10



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

Product: **Versatec Ultra Series UCV**
Type: Geothermal/Water Source Heat Pump
Size: Commercial 1.5 - 3.5 Tons
Document: Installation Manual

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