The Whalen Company

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INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR SERIES VI WATER SOURCE HEAT PUMPS

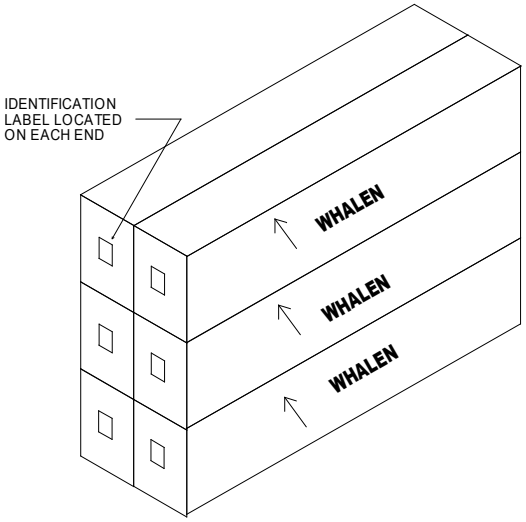
Models VI-A-20x–VI-A-120x, VI-B-20x – VI-B-120x
Models VP-A-20x–VP-A-120x, VP-B-20x – VP-B-120x

RECEIVING

Whalen Series VI heat pumps are either shipped individually packaged in corrugated shipping containers (with internal reinforcement for the tube extensions) or palletized (multiple unboxed units strapped to a shipping skid). Palletized shipments will require a fork lift to unload the units from the truck. For ease of handling and distribution, each unit is individually tagged with a label in three places containing information found on the approved unit schedule. This tagging is located on each end of the carton and directly on the unit.

JOB #	:	20110
MODEL #	:	VI-A-400-BO
FLOOR	:	12
RISER #	:	21B
HAND		RH
SUP	:	1 1/2
RET	:	1 1/4
DISCH	:	12 X 12 F

Typical label information includes job number, unit model, riser number, floor, LH, RH or REAR riser location, riser sizing, and other information specific to the project. This identification allows units to be delivered to a particular location in a protected unopened carton.



The Whalen Series VI units are made up of four separate parts.

1. *Unit Cabinet:* Unit cabinets are normally shipped first and are complete with integral supply, return, and condensate risers, supply and return water hoses, fan motor, electric coils (on electric heat units) and with complete factory internal wiring, requiring only field connection of main power supply to unit junction box. Cabinets with "VI" in the model number are provided with internal condensate risers and the standard Whalen drain pan (which is also the bottom of the cabinet). In this configuration the condensate drains from the pan through a hole located below the condensate riser. Cabinets with "VP" in the model number are provided with external condensate risers, a separate internal drain pan and a rubber "P-Trap" drain line that connects to the condensate riser. The condensate drains from the pan through a hole in the center of the drain pan into the "P-trap" which is located below the pan and then drains to the condensate riser.
2. *Unit Heat Pump Chassis:* Heat Pump Chassis are normally shipped after grilles and thermostats have been installed and all plumbing and wiring has been completed. The chassis is complete and ready for installation.
3. *Grilles:* Supply grilles, return air acoustic panels and filters are normally shipped after unit cabinets, and are installed on cabinets after cabinets have been installed and all finishing and painting has been completed.
4. *Thermostat:* Thermostats are normally shipped separately and are to be installed only after all finishing and painting has been completed.

Upon receipt, each shipment should be inspected for signs of damage. Visible damage should be noted on the freight bill at the time of delivery. All shipments are F.O.B. factory; the customer or consignee must report any claim for damages, visible or concealed, directly to the freight carrier.

IMPORTANT: THE RISERS ARE NOT HANDLES! DO NOT SUPPORT OR LIFT THE UNIT BY THE PIPE EXTENSIONS.

Units may be stored in a horizontal position limiting stacking to no more than six (6) units high.

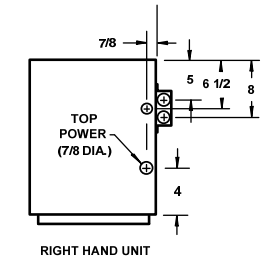
Each unit undergoes a quality control inspection and is factory tested for proper operation. It is the customer's responsibility to provide protection for the units upon arrival at the "ship to"

destination. This protection includes but is not limited to vandalism and weather deterioration. The units must be protected from the elements. It is solely the customer's responsibility to protect equipment from adverse weather conditions and to take security measures against theft and vandalism on the jobsite.

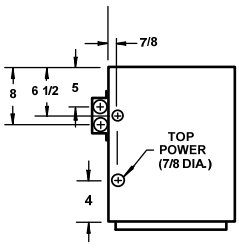
INSTALLATION

It is recommended that the installation of the heat pumps begin on the lowest floor of a riser and proceed floor by floor to the top of a riser. After removing the unit from the carton it should be placed on the floor in a horizontal position. On Water Loop installations the risers are anchored to the cabinet in two places with copper straps to allow for normal expansion and contraction. On Geothermal installations the risers are temporarily anchored to the cabinet with a removable bracket that is accessible through the return air opening of the cabinet (this bracket MUST be removed after the unit is installed). It is critical to align the units so that the proper risers match up when the units are installed. Sample riser piping diagrams are shown below.

SIDE RISERS:

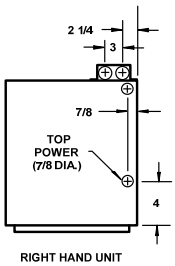


RIGHT HAND UNIT

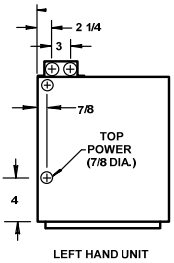


LEFT HAND UNIT

REAR RISERS:

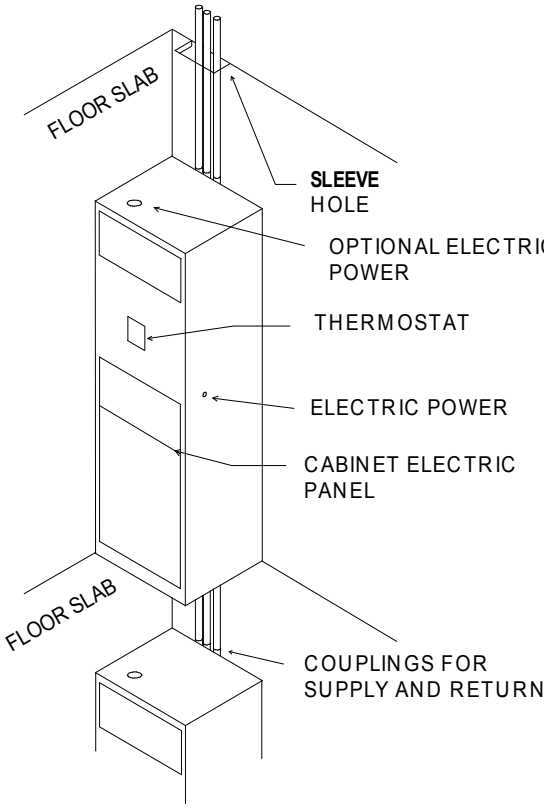


RIGHT HAND UNIT



LEFT HAND UNIT

Supply and return riser piping should extend 2" out the top of the casing. The supply riser is normally the riser closest to the front of the unit cabinet, or if the risers are on the back, the supply is the farthest from the unit center line. Although not required for proper operation of the unit, it is recommended that an isolation pad of about 3/8" thickness, non decomposing isolation material be positioned under the unit when installed to eliminate any vibration transmission between floors. Position the pipes as necessary by gently tapping the ends with a soft wood block. With tubes positioned, measure the distance from the bottom of the drain pan (floor level) to the swaged female connections on the unit below (allow for the vibration pad). Allow a minimum of 1" insertion depth into the swaged connection. If swaged connections are not provided, measure the risers allowing for couplings or reducing couplings, as required. The condensate line on the top of the unit below has a swedged portion permitting direct insertion of the unit condensate line into the unit below. When cutting the condensate line, it should be cut longer than the risers.



Cut measured riser pipes and the condensate drain line. It is not necessary to have piping inserted the full length of any swaged connection. Deburr and clean the ends of all piping. If the project requires riser extensions due to the floor-to-floor height, this is the time that they should be measured, cut and added to the unit risers. Modifications requiring the extension or shortening of risers are the responsibility of the installing contractor.

Insulation on risers between units is usually not necessary for standard water-loop systems since water temperature in these risers is normally 70° to 105°F. Ground-water and Ground-loop systems require the risers to be insulated as the cold water in those system designs may cause condensation on the risers. In coastal and humid areas, it is recommended that the condensate drain lines be insulated where pipes are in a non-air conditioned space.

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"VI" cabinets that are installed in positions where the area below the unit is not air conditioned or has high humidity conditions should have ¾" rigid insulation board affixed to the bottom of the cabinet before installation.

If risers are to be insulated, measure the distance between units when in place (from bottom of upper unit to top of lower unit). Cut Armaflex or other approved closed cell vapor seal insulation to measured lengths plus one inch (1"). Slide over tubes. Apply recommended sealant (Armstrong 520) to upper end of Armaflex and around pipes at drain pan. Press Armaflex end to pan, insure seal, apply additional ring of sealant around connections. Move Armaflex up around pipes, as far as possible, and clamp temporarily until soldering is complete.

Clean and apply flux to both male and female ends. Tip unit upright and guide pipes through sleeve hole in floor (requires two (2) men plus third man on floor below to guide upper male tubes into wedged female tubes of lower unit) - (an appliance hand truck has been found helpful in maneuvering and positioning unit in place). **Units must be level and vertically aligned in two planes to assure proper condensate drainage.**

Carefully position the unit so it is centered in the sleeve hole and insert the bottom of the risers into the swaged connections of the unit below. Riser piping and drain connections are soldered from floor below.

Riser joints must be made with 95-5 solder. If high temperature solder is used, the top and bottom of the units should be shielded and protected from excessive heat. Soft solders or other low temperature alloys are not suitable for this application.

After piping/riser systems has been hydrostatically tested for leaks, clean piping and top of unit, remove clamps on insulation. Apply sealant around pipe at unit top and Armaflex ends, press firmly to insure bond and vapor seal, apply additional ring of sealant around joint. (If insulation is installed after soldering extreme care must be used in application to insure proper sealing of all joints. Proper adhesives must be used and vapor barrier insured).

Pipe chases may be further insulated with approved insulating material or foam sealed with a vapor barrier sealant.

Risers are designed to handle up to 1/2 inch of vertical expansion in each direction. If the total calculated riser expansion exceeds these limits, the installing contractor must provide additional means of handling expansion compensation on the riser.

Whalen units may be set and piped as soon as floors are in place, thereby allowing installation prior to other interior work. It is recommended that the grille openings be covered during construction.

IMPORTANT: All joints should be hydrostatically tested for leaks before furring-in the unit.

The shipping carton can be utilized as a protective shield by cutting the ends off the carton.
If the riser floor sleeve hole extends beyond the bottom of the unit, a sub-plate can be provided to extend beyond the unit base and cover the hole to prevent air circulation.

After the units are installed, the riser system should be thoroughly leak checked with unit cabinet water valves closed. All risers, supply and return, should be supplied with blow down valves at the bottom, and the risers are to be flushed clean of all debris before individual unit valves are opened. After the water system has been cleaned, the hose supplied in each unit cabinet is to be temporarily connected to the supply and return valves, valves opened and the water system is to be run for a minimum of 24 hours. After the 24 hours, check each cabinet for full water flow through the hoses and sample the water to assure removal of dirt, scale and debris from the piping system. Close the supply and return ball valves to prepare for chassis installation. This is also a good time to check the condensate drain system when opening the supply and return cabinet hoses.

WARNING

The condenser water system must be clean and contain minimum oxygen levels to prevent corrosion. Condenser water pH, total dissolved solids and total suspended solids must be maintained within proper limits to prevent equipment failure. Total dissolved solids should not exceed 300 ppm. Total suspended solids should not exceed 75 ppm. PH should be between 6.8 and 8.4.

Closed loop condenser water systems must include an air separator. Water pumps, cooling towers or boilers and condenser water temperature control systems must be fully operational before Series VI heat pump chassis are installed.

Failure* to *do* so *VOIDS ALL WHALEN GUARANTEES OR WARRANTIES STATED OR IMPLIED.

The Whalen Company cannot overemphasize the importance of insuring the condenser water system is clean and fully operational before installation of heat pump chassis. Almost 100% of installation problems with Heat Pump units are directly related to condenser water systems being dirty or not operating properly.

It is recommended that all water system checks be completed before building drywalls and ceiling are installed.

The installing contractor is responsible for complying with all applicable building codes.

ELECTRICAL

A complete internal electrical wiring harness has been installed at the factory requiring only field connection of main power supply to the unit junction box, installation of the chassis and installation of the thermostat. All wires and thermostat wiring are color coded. All field electrical wiring should be performed in accordance with the National Electrical Code and any applicable local codes.

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Electrical data can be found within the approved submittal drawings or by referencing the wiring diagram and electrical label attached to the sheet metal inner panel that holds the refrigeration chassis in place, located behind the return air grille or acoustic panel.

Standard unit power connection is made to a unit-mounted electrical junction box, through a 7/8" diameter opening located on either the left or right side of unit. Standard connections and clamps per local building codes should be used. Power supply need only be brought to the junction box inside the unit's control cabinet.

The power wiring configuration of the unit varies depending on the incoming voltage. The ground wire should be firmly secured to the junction box. For 115 and 265 Volt incoming power, the white line wire (Neutral) connects to the white wire in the box and the black line wire (L1) connects to the black wire in the box. For 208 / 230 Volt incoming power, the white line wire (L2) connects to the red wire(s) in the box and the black line wire (L1) connects to the black wire in the box. Connections should be secured and insulated as per local codes and ordinances. For 115 and 265 Volt units provided with a disconnect switch, connect the white line wire (Neutral) to the white wire in the control box and the black line wire (L1) connects to the open terminal on the disconnect switch. For 208 / 230 Volt units provided with a disconnect switch, connect the white line wire (L2) to the open red terminal on the disconnect switch and connect the black line wire (L1) to the open black terminal on the disconnect switch.

A wiring diagram is affixed to the inner panel of each unit. Units are factory wired and require only field installation of the main power supply and remote thermostat wiring (if thermostat is mounted remotely from unit).

DO NOT OPERATE THE UNIT WITHOUT THE THERMOSTAT OR RETURN AIR FILTER - TO DO SO VOIDS WARRANTY.

FINISHING

The Whalen Unit is designed for drywall to be applied directly to the unit. Screws used to fasten the drywall to the cabinet can not penetrate more than ¼" into the unit. (For 1/2" wallboard the maximum screw length is 3/4"). Areas of the cabinet where screws might damage wiring, piping or coils are clearly marked. **WHERE DRYWALL IS STUDDED OFF THE UNIT, DO NOT ATTACH STUDS TO THE UNIT.**

Clean all drywall dust and debris from the unit after drywall installation and cutting of appropriate air and thermostat openings. **Be sure not to damage thermostat wiring or plug located in recessed junction box during this process.** All cabinet openings should be covered to keep out materials that may be harmful to unit components. Unit components showing signs of foreign material such as water, dust, dirt or paint will not be covered under the equipment warranty.

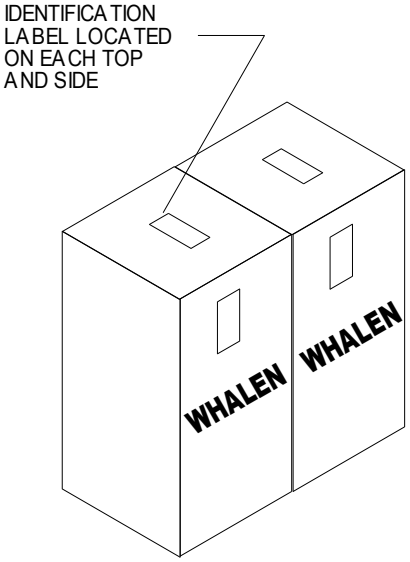
If wallboard, drywall or plaster is not applied directly to the unit casing, sheet metal sleeves or ducts should be used at supply and return air openings to prevent air leakage and facilitate attachment of grilles.

INSTALLING HEAT PUMP CHASSIS

Whalen Series WA, WB and WG heat pump chassis are shipped individually packaged in a corrugated shipping container banded on a shipping pallet. For ease of handling and distribution, each unit is individually tagged with a label in three places containing information found on the approved unit schedule. This tagging is located on the top and one side of the carton and directly on the unit.

JOB #	:	20110
MODEL #	:	WA-403BLY
VOLTAGE	:	208
CONTROL VOLTS #	:	24
OPTIONS		VALVE

Typical label information includes job number, unit model, power voltage, control voltage and options included. This identification allows units to be delivered to a particular location in a protected unopened carton.



In addition, each chassis has an electrical label that lists the chassis Model number, Serial number, Compressor RLA and FLA, Refrigerant Charge, Test Pressure, Power Voltage, Minimum Voltage and other information. This label is located on the sheetmetal facing the air coil.

Upon receipt, each shipment should be inspected for signs of damage. Visible damage should be noted on the freight bill at the time of delivery. All shipments are F.O.B. factory; the customer or consignee must report any claim for damages, visible or concealed, directly to the freight carrier.

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IMPORTANT: THE CHASSIS MUST BE KEPT IN AN UPRIGHT POSITION AT ALL TIMES.

Units may be stacked 2 high for storage.

Each unit undergoes a quality control inspection and is factory tested for proper operation. It is the customer's responsibility to provide protection for the units upon arrival at the "ship to" destination. This protection includes but is not limited to vandalism and weather deterioration. The units must be protected from the elements. It is solely the customer's responsibility to protect equipment from adverse weather conditions and to take security measures against theft and vandalism on the jobsite.

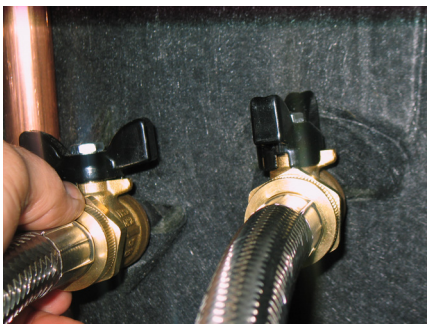
INSTALLATION

Each chassis is designed and manufactured to fit into the corresponding cabinet of that size. Chassis are available from 200 cfm to 1200 cfm and match cabinets of the same cfm (200, 300, 400, 600, 800, 1000 and 1200 cfm). The chassis will fit into the cabinet and match up to the inlet air opening cut out of the sheetmetal inner panel that fixes the chassis into position.

Installation of the chassis is performed in steps.

1) Remove the cabinet acoustic panel from the wall at the return air opening of the unit (chassis accessible panels need not be removed, just open the front panel and secure it out of the way).
2) Remove the sheet metal inner panel from the cabinet. This is accomplished by removing the four flathead screws from the cabinet and pulling the inner panel out of the cabinet.

3) Open the lid of the new chassis box and lift the chassis straight up out of the box (if you do not need to reuse the box, it can be cut off of the new chassis without lifting the chassis).
4) Set the chassis on the galvanized steel rails in the bottom of the unit and slide it back a few inches, keeping the chassis centered from left to right.
5) Connect both hoses to the chassis. KEEP THE HOSES ORIENTED TO LEFT – RIGHT POSITION. DO NOT OPEN THE SHUT-OFF VALVES AT THIS TIME.
6) The right hose on the chassis is the water supply hose and must be connected to the supply riser. The supply riser is the closest riser to the return air opening on side riser units and is the riser adjacent to the condensate drain riser in rear riser units.
7) Place your hand on the left hose at the chassis and follow it up into the cabinet where it connects to the shut-off valve and loosen the connection at the valve (**DO NOT REMOVE THE HOSE ALL THE WAY**).



8) Open the shut-off valve on the right hose slowly, letting the water into the chassis to force the air out of the chassis and hoses. On units provided with electric shut-off valves, manually open the electric shut-off valve while venting the chassis. When venting is completed, release manual override of electric shut-off valve.

9) When a steady stream of water is flowing out of the left hose, tighten the hose onto the shut-off valve.
10) Check for leaks and tighten hoses until leaks are stopped. Open both shut-off valves fully.
11) Plug the chassis power cord into the cabinet control panel (the control panel has a female connector to accept the power cord plug).
12) Slide the chassis into the cabinet. Push the chassis into the cabinet so that the leading edge of the air coil is flush with the leading edge of the cabinet electrical panel. Make sure the chassis is centered left to right and is sitting level on the galvanized steel rails.
13) Reinstall the inner panel, making sure the inner panel gasket is sealing tight against the chassis coil face. Fasten the inner panel to the cabinet with the four (4) machine screws provided which fit into factory installed inserts on the unit. Turn on electric disconnect switch.
14) Install the return air filter.
15) Replace the acoustic panel.

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On units equipped with single riser configuration and integral circulating pump, see SINGLE RISER UNITS section below.

SINGLE RISER UNITS:

On single riser units equipped with integral circulating pump, the supply hose is connected to the inlet of the pump and the return hose is connected to the chassis. The installer must determine if the riser is upflow or downflow configuration. The supply connection on the riser is always upstream of the return connection. Connect the supply and return hoses to the ball valves at the appropriate location on the riser.

Disconnect two-pin quick-connect on pump and plug pump into temporary pump purging cord (supplied with the chassis). With electric disconnect switches off, connect the other end of of temporary cord into the chassis power cord receptacle in control box.

Open both supply and return valves and check for any water leaks. Close supply valve and open coin-air vent in pump piping. Once air has stopped coming out, close return water valve and open supply water valve and turn on disconnect to energize pump. Once air has stopped coming out of coin air vent, close vent and turn off disconnect, open return water valve, remove temporary cord from cabinet and pump and re-connect two-pin plug to pump. Plug chassis power cord into control box receptacle.

Reinstall the inner panel, making sure the inner panel gasket is sealing tight against the chassis face. The inner panel is held in place with four (4) machine screws (provided) which fit into factory installed inserts on the unit. Turn on electric disconnect switch.

GRILLES, ACOUSTIC PANELS and FILTERS

Supply grilles, return air acoustic panels and filters are shipped separately and are normally installed after finishing is complete, and the unit is cleaned of all dust and debris.

Supply grilles are attached with sheet metal screws provided.

The return air acoustic panel is furnished with two machine screws (6/32 x 1-1/4" nom) which fit into factory installed inserts on the unit.

Check the following prior to installation of the return air grille.

1. Verify that the condensate drain pan and drain line are clear from debris on all heating/cooling units.

2. A clean and properly sized return air filter is installed within the return air grille.

3. Service disconnect switch, when included, is set to "ON."

IMPORTANT: DO NOT USE SHEET METAL SCREWS TO ATTACH THE RETURN AIR GRILLE

THERMOSTAT

The thermostat is normally located on the front (return air side) of cabinet. Standard units include a recessed junction box with polarized plug for connection and unit mounting of the thermostat. Units that utilize a field wired remote mounted thermostat will have field wiring connection made to color-coded control wiring through 7/8" diameter opening in top of cabinet, or through the left or right side of cabinet, as specified in submittal drawings.

Check to see that the thermostat provided has the model number that matches the one referenced on the wiring diagram. Attach the thermostat to the unit wiring with the polarized plug or color-coded wiring, using the connectors provided. Attach the thermostat to the unit or junction box with the screws provided.

Thermostats are shipped separately, individually packaged in a box that has been designed to serve as a dust cover to protect the thermostat during finishing and cleaning. Thermostats should be protected until the space is ready for occupancy.

DO NOT OPERATE THE UNIT WITHOUT THE THERMOSTAT OR RETURN AIR FILTER - TO DO SO VOIDS THE WARRANTY.

OPERATIONAL SYSTEMS CHECK

1. Verify that all disconnect switches are on.

2. Turn system switch ON and select "HIGH" fan speed.

3. Turn temperature control knob to full cool setting and listen for heat pump chassis to come on. Open grille, pull back filter and feel the chassis coil face to see if it is getting cooler.

4. Let the chassis run in cooling for about 10 minutes. If unit should cut off, see "Trouble Diagnosis" section

5a. If unit has electric heat (type B unit) or if the unit is a reverse cycle heat pump (type A unit), turn the temperature control to full heat setting and determine if the unit is heating by feeling the air at the supply register. If not, see "Trouble Diagnosis" section.

5b When complete, set temperature control to the mid or normal position and turn system switch to off.

Once the unit has been checked out and the installer insures that thermostat and fan motor(s) are functioning properly and the unit is operating satisfactorily, the tenant should be advised of the following operational procedures for satisfactory performance of the Whalen units.

OPERATING INSTRUCTIONS

Place Thermostat System switch to Auto.

Place Thermostat fan speed switch to High

If you desire a cooler temperature, move dial to Cooler.

If you desire a warmer temperature, move dial to Warmer.

For best results, find a position on the thermostat that you are comfortable at and leave in that position.

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Hi-Off-Low switch must be in Low or High to operate. Unit will not work in Off position.

Doors and windows should be closed when system is on to prevent excess humidity in the room.

MAINTENANCE and SERVICE

The Whalen Series VI heat pump units have been designed to be as maintenance-free as possible. All replaceable parts are readily accessible via the access grilles. No special tools are necessary. It is recommended that filters be checked quarterly and replaced as required. Inspect condensate drain pan and drain line prior to and during cooling season. Remove any debris.

Replacement parts are available through your local Whalen factory representative. When ordering, state the part number directly from the component in need of being replaced. Should the part number be physically absent or is otherwise unidentifiable, locate the Unit / Electrical Data Nameplate found on the sheet metal inner panel behind the return grille and take note of the unit Model Number and Serial Number. Then contact your local Whalen representative for assistance.

MOISTURE – CONDENSATE

Properly installed and insulated Whalen units present no moisture or condensate problems. Moisture evident at the outlet grille is a temporary condition caused by excessive moisture in the room (typically caused by the room being opened to outside air). The condensation will cease when the room is closed and the relative humidity in the room brought to normal conditions.

If moisture becomes evident at the base of the unit, remove the return grille and inspect the drain pan. A clogged condensate drain line may be cleared with a flexible plumber's snake from the unit or from the top or bottom of the riser.

MAINTENANCE RECOMMENDATIONS
Semi-Annual

1. Inspect Unit.
2. Run system through operation check.
3. Remove return air grille and check filter; replace filter if required. (Filters may require more frequent changing in certain environments). Clean return grille as necessary.
4. Disconnect power and remove inner panel.
5. Inspect fan and motor assembly for dirt, etc. Clean fan housing and blower wheel if required. (Whalen Units utilize permanently lubricated motors that do not require special care or maintenance when suitable air filters are installed and properly maintained).
6. Inspect drain pan, clean if necessary. Check condensate drain line to insure it is open and clear.
7. Replace inner panel. Restore power and replace return air grille with clean filter installed.
8. Remove and clean supply air grilles if required.

DRAIN PANS

The drain pan should be inspected before summer operation with the removal of all debris to allow the proper flow of condensate. Periodic inspection of the drain pan should be performed during the cooling operation to prevent any possibility of it becoming clogged with foreign matter.

FILTER

The filter can be accessed for changing or cleaning by removing or opening the acoustic panel door. In cases where the filter cannot be removed through the opening of the acoustic panel, remove the panel from the wall.

Throwaway	The filter should be changed regularly with periodic inspections made to prevent the accumulation of dirt and particulate matter that can negatively affect the free flow of air. If the application or frequency of operation causes excessive dirt to accumulate, the filter should be changed more frequently.
Permanent	The filter should be cleaned regularly with periodic inspections made to prevent the accumulation of dirt and particulate matter that can negatively affect the free flow of air. If the application or frequency of operation causes excessive dirt to accumulate, the filter should be cleaned more frequently.

SYSTEM DESCRIPTION

The Whalen Series VI –A heat pump is a water cooled, reverse cycle cooling / heating unit with a removable refrigeration chassis. The cabinet contains the supply fan and motor, the control panel and electric heat (if provided). The refrigeration chassis consists of a copper tube / aluminum finned air to refrigerant coil located at the air inlet of the chassis, a water to refrigerant coaxial coil located inside the chassis sheet metal box, a hermetic compressor located inside the sheet metal compressor box and a refrigerant reversing valve also located in the compressor box.

In the cooling mode, the air coil is used as the evaporator coil and provides the cooling of the room air. The compressor rejects the heat absorbed by the evaporator coil to the condenser coil which is the coaxial water coil.

In the heating mode, the coaxial water coil is used as the evaporator coil that pulls heat from the water. This heat is rejected by the compressor to the condenser coil which is now the air coil to heat the room air.

The unit is switched between the cooling and heating modes by energizing the reversing valve.

The Whalen Series VI-B is a cooling only unit and operates the same as the heat pump in the cooling mode. Cooling only units do not include a reversing valve.

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TYPICAL OPERATING PARAMETERS

The Whalen Company Series VI heat pump chassis model number indicates the nominal cfm of the unit (example, in the model number WA3-BLY, the 3 signifies 300 cfm). Divide this cfm by 400 to determine the nominal cooling capacity of the unit in tons.

Typical operating parameters of The Series VI water loop source heat pumps are (contact factory for ground source or ground loop application parameters).

Capillary or distributor tube temperature at coil	54^0F
Evaporator saturated suction temperature	50^0F
Suction line temperature (with superheat)	65^0F
Superheat at compressor	15^0F
Discharge line temperature	140 - 150^0F
Condensing temperature Cooling	105^0F
Condensing temperature Heating	110^0F
Subcooling	10^0F

Air temperature to Evap coil:

80^0F db / 67^0F wb Cooling, 68^0F Heating

Air temperature off Evap coil:

58 to 65^0F Cooling, 95 – 100^0F Heating

Entering water temperature Cooling:

95^0F max, 85^0F preferred, 75^0F min

Leaving water temperature Cooling:

8 to 12^0F higher than entering water temperature

Entering water temperature Heating:

75^0F max, 70^0F preferred, 60^0F min

Leaving water temperature Heating:

8 to 10^0F lower than entering water temperature

Water flow rate:

3 gpm / ton nominal, 2 gpm / ton minimum

TROUBLE DIAGNOSIS

Trouble diagnosis should only be attempted by qualified maintenance personnel.

Fan Motor Fails to Start:

1. Verify that all main power and circuit breakers are on and fuses (if provided) are not blown.
2. Turn system switch on and select HI or LO fan speed.
3. Remove grille and front panel and carefully remove cover to electrical control panel in cabinet.
4. Refer to wiring diagram on front panel, identify incoming power black and red or black and white wires and determine if unit is being supplied with correct voltage with Volt Ohm-meter (VOM).
5. If fan will not run on either LO or HI, verify 24 Volt transformer is operating correctly by checking voltage with VOM between black and white with green stripe wires in the thermostat plug. If 24 volts is not present, check low voltage output from transformer by checking with VOM at blue and yellow wires on transformer. If 24 volts is not present, replace transformer. If 24 volts is present, check continuity of the black or red wire connecting transformer to thermostat.
6. If transformer is ok, disconnect power at either the building breaker panel or unit disconnect switch. Remove thermostat cover and inspect for visible indications of system ground or short. Also check for proper wiring connections between thermostat and unit, to assure colors match per wiring diagram and that insulation is intact. Check "pin" terminals for good contact on thermostats equipped with polarized quick-connect plugs.
7. Determine if fan motor is being supplied correct voltage. If not, check the 24 volt relays that connect power to the fan motor. If relay normally open contacts do not close when thermostat is calling for fan and relay is energized, replace relay.
8. If fan has power and hums, turn off power and make sure fan rotates freely.
9. Remove fan and motor and inspect fan motor and fan motor capacitor wiring. If capacitor wiring or shield is burned, replace wires. Check capacitor by removing wires from capacitor and measure capacitance with meter. Capacitance should measure within 6% of capacitor rating. If not, replace capacitor.
10. If fan motor is hot, it may be off on internal overload. Let cool and attempt to re-start. If fan runs, start and stop several times to determine if a starting problem. If fan continues to run, reinstall fan in cabinet and run for at least 10 minutes.
11. If fan will not run or cuts out on internal overload, replace motor.

Heat Pump Chassis Fails to Start

1. Complete steps 1 -·3 of Fan Motor Fails to Start.
2. If Circuit Breakers are tripping when Heat Pump Chassis is turned on, unplug heat pump chassis. If circuit breakers continue to trip, check control box wiring and field connections and verify unit is wired in accordance with wiring diagram.
3. If chassis caused circuit breakers to trip, identify red and black wires from heat pump chassis plug and determine if red or black lead is shorted to ground with VOM. If wires are shorted, service is required by a qualified HVAC service technician.
4. Feel compressor in heat pump chassis. If hot, allow to cool and attempt to restart. If the compressor starts, see the appropriate section below. If heat pump fails to restart, open heat pump chassis control box and check for loose connections or burnt wiring. If none found, unplug chassis and check compressor resistance with VOM between the red and black wires at the chassis plug. Infinite ohms means that the overload is probably still open and compressor needs more time to cool. 2-5 ohms is the normal compressor winding resistance and indicates the compressor is O.K., but the capacitor may be bad or there may be a faulty

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connection at the control box plug or a starter problem in the control box.

5. If capacitor wiring or shield is burned, replace wires. Check capacitor by removing wires from capacitor and measure capacitance with meter. Capacitance should measure with 6% of capacitor rating. If not, replace capacitor.

Heat Pump Chassis Starts but Cuts Off
Cooling Only Units:

1. After unit cuts off, determine if there is ice formation on the evaporator coil or if the condenser coil is extremely hot.
2. If there is ice formation on the coil, check for poor seal between inner panel and coil. Check for proper air flow. Check for discharge grilles closed, blocked filters, etc. Is the room too cool (below 68°F)? If the supply water is 75°F or less, there may be premature freezing of the evaporator coil. If air flow and water temperatures are O.K., unit may be low on charge. If so, service is required by a qualified HVAC service technician.
3. If condenser water coil is hot, check for proper water supply with flow meter, if available. Check water temperatures. With proper water flow, there should be a temperature rise of about 10°F from supply to return, and the supply water should be 95°F or less. If no water flow, check electric water control valve for proper operation (if provided). The control valve is energized by the compressor contactor and is normally closed, power to open. If the control valve is operating properly, shut unit off and perform air venting procedure described in INSTALLING HEAT PUMP CHASSIS on page 4.
4. Inspect safety lock-out circuit. The chassis is provided with a high pressure switch that senses the refrigerant circuit condensing pressure and a low temperature switch that senses the refrigerant circuit suction temperature. These switches are normally open, fail to close and are automatic resetting devices. The switches are wired in series with a lock-out relay that energizes when either switch energizes on a failure condition. The lock-out relay interrupts the control voltage to the compressor contactor and prevents the compressor from running. The lock-out circuit will reset when the call for compressor (Y circuit from the thermostat) or power to the chassis is turned off and reset.

Heat Pump Chassis Starts but Cuts Off
Heating and Cooling (Reverse Cycle Units)

1. If problem occurs in cooling, see checks under cooling only units.
2. If in heating and the unit cuts out, determine if there is ice formation on the evaporator coil or if the condenser air coil is extremely hot.
3. If there is ice formation on the evaporator coil or it is extremely cold, check for proper water flow and entering water temperatures between 65°F and 75°F. With proper water flow, there should be a temperature decrease of about 8°F from supply to return. If no water flow, check electric water control valve for proper operation (if provided). The control valve is energized by compressor contactor and is normally closed, power to open. If the control valve is operating properly, shut unit off and perform air venting procedure described in INSTALLING HEAT PUMP CHASSIS on page 4. If water flow and temperature is O.K., unit may be low on charge. If so, service is required by a qualified HVAC service technician.
4. If condenser air coil is extremely hot and compressor is hot, check for proper air flow. Select HI fan speed if fan is on LO speed and check for poor air seal between inner panel and coil, discharge grilles closed, blocked filters, etc. Is the room too hot (above 80°F)?
5. Check the safety lock-out circuit as described for Cooling Only units.

Heat Pump Chassis Operating but not Cooling

1. Feel evaporator air coil and condenser water coil. If the air coil is not cool and condenser coil is not warm, system may not be properly charged or compressor is defective. Service is required by a qualified HVAC service technician.

Heat Pump Chassis Operating but not Heating (Reverse Cycle Only)

1. Feel condenser air coil and evaporator water coil. If the water coil is not cool and the condenser coil not warm, system may not be properly charged or compressor is defective. If so, service is required by a qualified HVAC service technician.
2. If chassis is cooling when heating is selected, verify that thermostat is set to correctly control the reversing valve. Refer to wiring diagram and locate blue (or orange) wire in control box and determine if it is supplying correct voltage to reversing valve solenoid coil. If correct voltage is supplied, shift unit rapidly from heating to cooling and listen for clicking sound in heat pump chassis. If no voltage, check wiring harness for proper connections (loose wires, etc). If valve is clicking but not reversing, the valve has malfunctioned and requires replacement by a qualified HVAC service technician.

Electric Heat Not Working

1. Complete steps 1-3 of Fan Motor Fails to Start. (Note electric heat is controlled by time delay relays and may take up to one minute before activated.)
2. Remove discharge grille and inner panel to access electric heat.
3. Inspect coil for foreign material, breaks in the coil or shorts to ground.
4. Disconnect power and remove heater cover. Check continuity across thermal high temperature cut-out and fusible link. Replace cut-outs and fusible links as necessary.

SOLID STATE CONTROLS

Units provided with the solid state control option are furnished with a solid state board in the cabinet control panel and a 10K Ohm thermistor that replaces the low temperature switch. The thermistor and high pressure switch are wired to the solid state board (these wires are run in the chassis power cord). The optional low pressure switch is also wired to the solid state board through the power cord. The high and low pressure switches used with the solid state board are normally closed, fail to open. The compressor lock-out relay is not provided on

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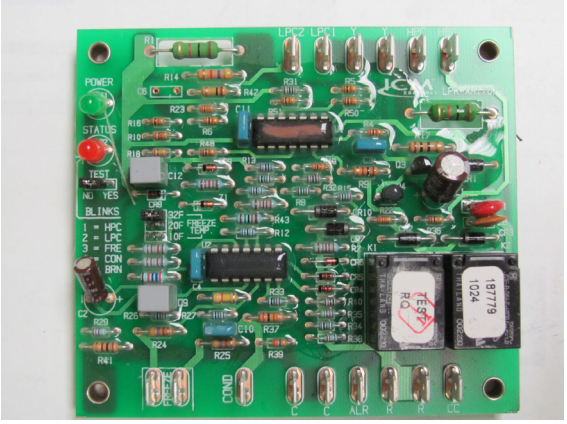
solid state units as that function is provided by the board.

The solid state board has been revised as of July 1, 2011. If your unit was built prior to July 1, 2011 the solid state board is configured as shown below. Units produced after July 1, 2011 will be configured as shown on page 12.

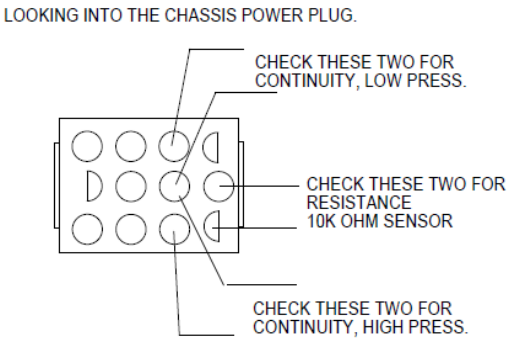
SOLID STATE BOARD CONFIGURATION PRIOR TO JULY 1, 2011:



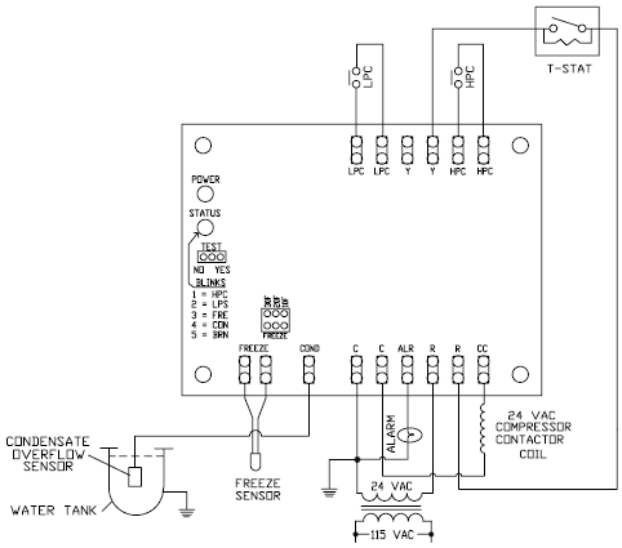
The solid state board starts and stops the compressor, and performs the safety functions of High pressure cut-out, optional Low pressure cut-out, Freeze protection cut-out (low suction temperature), Condensate pan overflow and Brown-out (under voltage). The board also has a built-in 5 minute time delay between compressor starts.

The Freeze protection circuitry includes a jumper on the board to select the freeze protection alarm temperature set-point. This jumper should be set on 32^0F for standard condenser water loop systems. Lower settings are available for ground loop systems that include anti-freeze solutions. This jumper is factory set and should not require adjustment.

The sensors can be checked for proper operation by using a VOM and testing the chassis wiring plug as shown below.



The solid state board has a green LED that indicates the board has power and is operating and a red LED that blinks from 1 to 5 times when a safety lock-out has occurred. The LED failure code and solid state board trouble shooting procedures are:



LOCK-OUT LED blinks 1 time.	High pressure Lockout circuit is energized. Check for high pressure switch failure by checking for continuity across pressure switch after system pressures have equalized. If no continuity, switch is defective. If so, service is required by a qualified HVAC service technician. To clear the alarm, turn power to unit OFF, then back ON.
LOCK-OUT LED blinks 2 times.	Low pressure Lockout circuit is energized. Check for low pressure switch failure by checking for continuity across pressure switch after system pressures have equalized. If no continuity, switch is defective. If so, service is required by a qualified HVAC service technician. To clear the alarm, turn power to unit OFF, then back ON.
LOCK-OUT LED blinks 3 times.	Freeze sensor Lockout circuit is energized. Check for sensor failure by checking resistance across sensor. Sensor is a 10K Ohm device. If the resistance is zero or infinite (shorted), sensor is defective. If so, replace the sensor. To clear the alarm, turn power to unit OFF, then back ON.
LOCK-OUT LED blinks 4 times.	Condensate overflow Lockout circuit is energized. Check that wire leads in drain pan are at equal height and are not touching or shorted to the cabinet. Clean drain and trap. Turn power to unit OFF, then back ON to clear alarm.
LOCK-OUT LED blinks 5 times.	Voltage brownout Lockout circuit is energized. Incorrect or missing main power voltage. Check incoming power, disconnect and fuses. Turn power to unit OFF, then back ON to clear alarm.

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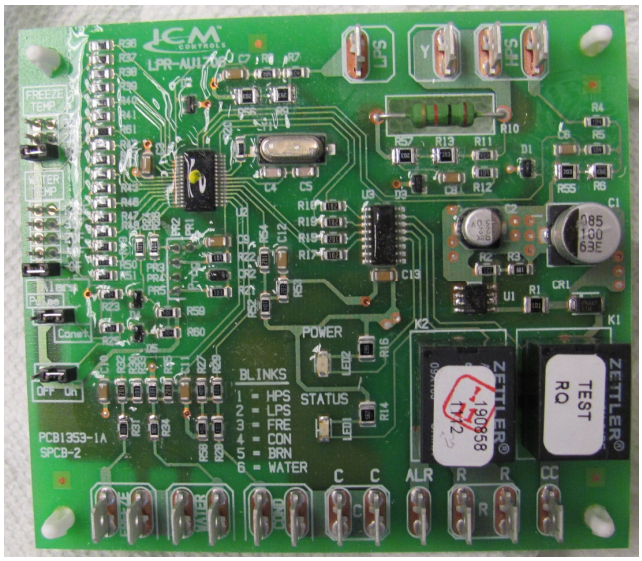
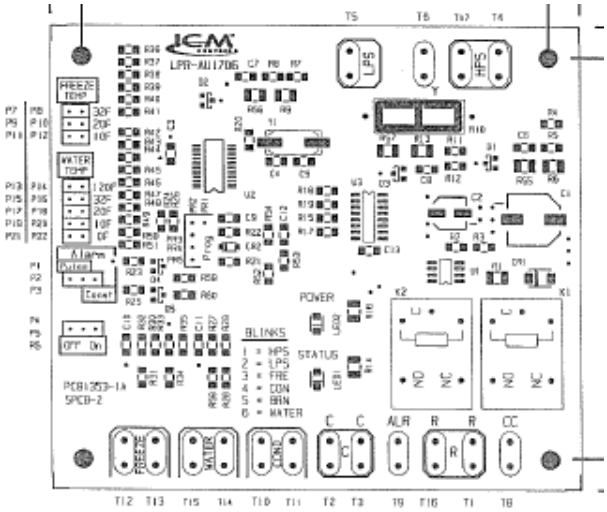
SOLID STATE BOARD CONFIGURATION AFTER JULY 1, 2011:





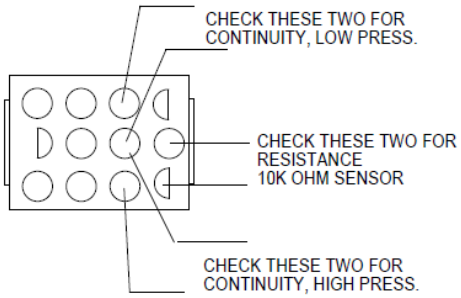
The solid state board starts and stops the compressor, and performs the safety functions of High pressure cut-out, optional Low pressure cut-out, Freeze protection cut-out (low suction temperature and optional low water temperature), Condensate pan overflow and Brown-out (under voltage). The board also has a built-in 5 minute time delay between compressor starts.

The Freeze protection circuitry includes two jumpers on the board to select the freeze protection alarm temperature set-points. The Freeze Temp jumper and the Water Temp jumpers should be set on 32^0F for standard condenser water loop systems. Lower settings are available for ground loop systems that include anti-freeze solutions. These jumpers are factory set and should not require adjustment.

The solid state board has a green LED that indicates the board has power and is operating and a red LED that blinks from 1 to 6 times when a safety lock-out has occurred. The LED failure code and solid state board trouble shooting procedures are:

The sensors can be checked for proper operation by using a VOM and testing the chassis wiring plug as shown below.

LOOKING INTO THE CHASSIS POWER PLUG.



LOCK-OUT LED blinks 1 time.	High pressure Lockout circuit is energized. Check for high pressure switch failure by checking for continuity across pressure switch after system pressures have equalized. If no continuity, switch is defective. If so, service is required by a qualified HVAC service technician. To clear the alarm, turn power to unit OFF, then back ON.
LOCK-OUT LED blinks 2 times.	Low pressure Lockout circuit is energized. Check for low pressure switch failure by checking for continuity across pressure switch after system pressures have equalized. If no continuity, switch is defective. If so, service is required by a qualified HVAC service technician. To clear the alarm, turn power to unit OFF, then back ON.
LOCK-OUT LED blinks 3 times.	Freeze sensor Lockout circuit is energized. Check for sensor failure by checking resistance across sensor. Sensor is a 10K Ohm device. If the resistance is zero or infinite (shorted), sensor is defective. If so, replace the sensor. To clear the alarm, turn power to unit OFF, then back ON.
LOCK-OUT LED blinks 4 times.	Condensate overflow Lockout circuit is energized. Check that wire leads in drain pan are at equal height and are not touching or shorted to the cabinet. Clean drain and trap. Turn power to unit OFF, then back ON to clear alarm.
LOCK-OUT LED blinks 5 times.	Voltage brownout Lockout circuit is energized. Incorrect or missing main power voltage. Check incoming power, disconnect and fuses. Turn power to unit OFF, then back ON to clear alarm.
LOCK-OUT LED blinks 6 times	Low Temperature sensor(s) is out of range or is in the Lock-out mode. Turn power to unit OFF, then back ON to clear alarm

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USING SERIES VI HEAT PUMPS WITH GEOTHERMAL GROUND LOOP PIPING SYSTEMS

Ground Loop Piping Systems utilize the ground as the heat source or heat sink for the systems rather than cooling towers or boilers. This has the impact of reducing the energy required to operate the system, but also changes the range of operation of the individual heat pumps. Additionally, the water temperatures in the loop vary more than standard water loop systems, and may require the use of additives to the water to prevent freezing.

The fluid temperatures in Ground Loop Piping Systems can vary from 20^0F to 120^0F (-6.7^0C to 48.9^0C). Any installation that will have water temperatures entering the heat pumps less than 45^0F (7.2^0C) must be protected with an anti-freeze solution. The most common anti-freeze additives are glycols or alcohols. The amount of these additives to be added to the water is based on the minimum temperature that the system will attain in any condition (the **Freeze Point Temperature**). This temperature will be the minimum supply temperature of the water / anti-freeze solution (determined by the design of the Ground Loop Piping System) less 15^0F (9.3^0C). This 15^0F difference accounts for the extraction of heat from the loop when the heat pumps are in the heating mode.

Special design considerations must be included when employing a low temperature system. The fluid flow rate delivered to each heat pump must be maintained between 2 to 3 gpm per nominal ton (i.e. at ARI rating conditions). Lower water temperatures and the addition of anti-freeze increases the viscosity of the fluid and the water side pressure drops will increase substantially. The exposed system piping and risers on the heat pumps should be insulated if the water temperature in the loop is expected to be below 60^0F (15.6^0C) or if the piping loop is exposed to outside conditions to prevent condensation.

For selection of the anti-freeze solution and the amount BY VOLUME of the anti-freeze, please reference Table 1 below. Determine the anti-freeze percentage based on the Freeze Point Temperature calculated above and the type of anti-freeze used in the system.

Table 1 **ANTI-FREEZE PERCENT by VOLUME**

FREEZE POINT TEMPERATURE	-5^0F -20.6^0C	0^0F -17.7^0C	5^0F -15.0^0C	10^0F -12.2^0C	15^0F -9.4^0C	20^0F -6.7^0C	25^0F -3.9^0C	30^0F -1.1^0C
ANTI-FREEZE TYPE	**ANTI-FREEZE PERCENT BY VOLUME**							
Ethylene Glycol	35%	32%	27%	23%	19%	13%	8%	2%
Propylene Glycol	38%	34%	31%	26%	22%	16%	11%	3%
Ethanol	37%	33%	30%	25%	20%	15%	10%	3%
Methanol	28%	24%	21%	19%	16%	13%	8%	2%

The required amount of anti-freeze and water solution should be mixed in a storage container before insertion into the Ground Loop Piping System (make sufficient amount to entirely fill the piping system and all units). Follow ALL safety precautions provided by the manufacturer of the anti-freeze additive. All handling of the anti-freeze and the finished solution should be done outdoors in a well ventilated area. Verify the solution freeze-point by using a hydrometer to measure the specific gravity of the anti-freeze solution (see Table 2 for specific gravity of various percentages and anti-freeze solutions).

Table 2 **SPECIFIC GRAVITY OF ANTI-FREEZE SOLUTION BY VOLUME**

ANTI-FREEZE PERCENT BY VOLUME	5%	10%	15%	20%	25%	30%	35%	40%
ANTI-FREEZE TYPE	**SPECIFIC GRAVITY OF ANTI-FREEZE SOLUTION BY VOLUME 60^0F solution temperature**							
Ethylene Glycol	1.010	1.020	1.029	1.038	1.044	1.053	1.059	1.065
Propylene Glycol	1.004	1.008	1.013	1.017	1.022	1.026	1.030	1.034
Ethanol	.990	.979	.969	.959	.949	.938	.928	.918
Methanol	.999	.978	.969	.959	.949	.939	.929	.918

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When cleaning and flushing of system is complete, fill the system with the pre-mixed solution of anti-freeze and water using a small pump designed for this application. Fill the piping system with the solution (carefully venting the air) until the system pressure is at 20 psig. When the system pressure achieves 20 psig, turn on the system circulating pump(s) and vent the system of any trapped air. Once the air is vented, make sure the system circulating pump is operating with a net positive suction head equal to or greater than it's specifications. If the net suction head is below the specified value, turn off the system pumps and add additional anti-freeze solution to reach the minimum requirement at the pump suction.

When using Whalen Series VI heat pumps in a Ground Loop Piping System, the units must be ordered as Extended Range Units. The units will be provided with our solid state control board and two low temperature sensors; a low water temperature sensor and a low refrigerant suction temperature sensor. The solid state board has jumper settings for both sensors and the jumper settings are determined by the entering fluid temperature of the Ground Loop Piping System. The jumper settings are listed in Table 3 below.

Table 3 **Jumper Set Points**

Low Water Temperature Sensor Jumper Setpoint	Low Refrigerant Suction Temperature Sensor Jumper Setpoint	Entering Fluid Temperature, ^{0}F
36^0F	32^0F	Greater than 46^0F
20^0F	20^0F	30^0F to 45^0F
10^0F	10^0F	20^0Fto 29^0F

Enter Table 3 with the Entering Fluid Temperature of the anti-freeze solution and read across table to left determine proper jumper setting for your system conditions.

Notes:
Do not use the 0^0F Jumper position of the Low Water Temperature Sensor Jumper.
Nuisance trips may be experienced if Entering Fluid Temperature of the anti-freeze solution falls below 20^0F.
Increasing the Entering Fluid Temperature of the anti-freeze solution will reduce nuisance trips.