The Whalen Company

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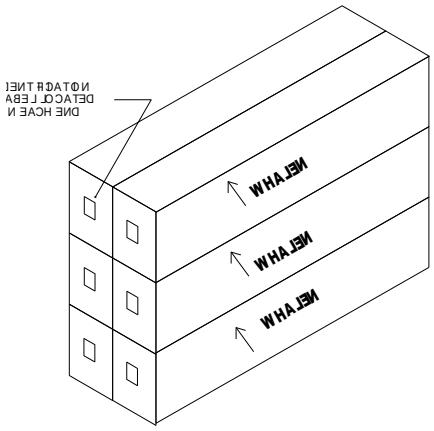
INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS for SERIES VT & VR WATER SOURCE HEAT PUMPS and AIR CONDITIONING UNITS with HYDRONIC or ELECTRIC HEATING with INTEGRAL ENERGY RECOVERY VENTILATOR (ERV)

Note: This revision of the IOM supersedes all previous versions

RECEIVING

Whalen units 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 #	:	VT-A-0404-BGB-
FLOOR	:	12
RISER #	:	21B
HAND		RH
SUP	:	1 1/2
RET	:	1 1/4
PANEL	:	TR4FL



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 V(T,R) units are made up of four separate parts that are typically shipped to the jobsite in this order:

1. *Unit Cabinet:* Unit cabinets are normally shipped first and are complete with the integral energy recovery ventilator (ERV), supply, return, and condensate risers, supply and return water hoses (connected to supply and return ball valves), fan and motor, electric coils (on electric heat units) and with complete factory internal wiring, requiring only field connection of the main power supply, the ERV power supply, the ERV intermittent high speed fan switch and the remote mounted thermostat. Cabinets are provided with an internal drain pan and a rubber "P-Trap" drain line that connects to the condensate riser.
2. *Flush Mount Panel & Grilles:* Supply grilles, flush mount panels and filters are normally shipped after unit cabinets and are installed after finishing and painting has been completed.
3. *Thermostat & ERV Intermittent High Speed Fan Switch:* Thermostats and ERV intermittent high speed fan switches are normally shipped separately and are to be installed only after all finishing and painting has been completed.
4. *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.

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.

Pub Date: April 10, 2017

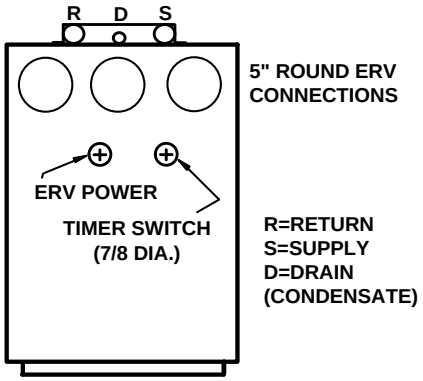
Units may be stored in a horizontal position limiting stacking to no more than six (6) units high.

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 and stored in above-freezing conditions. 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.

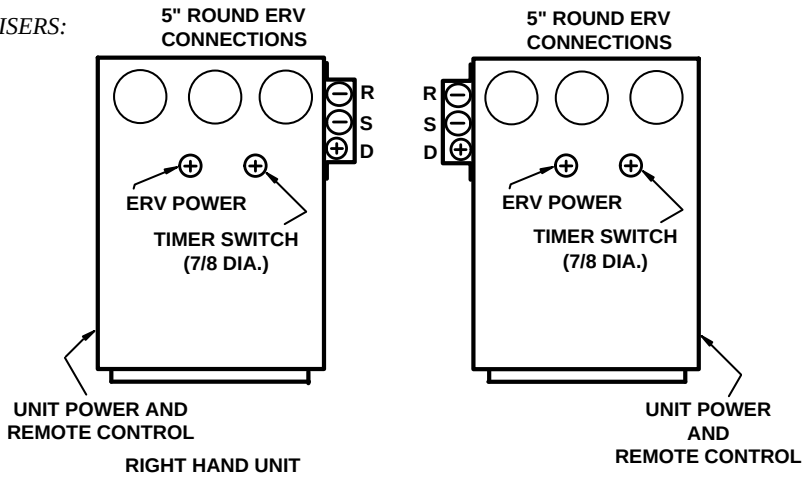
INSTALLATION

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 (reference the project submittal drawings for the actual dimensions of your project).

REAR RISERS:



SIDE RISERS:



PIPING

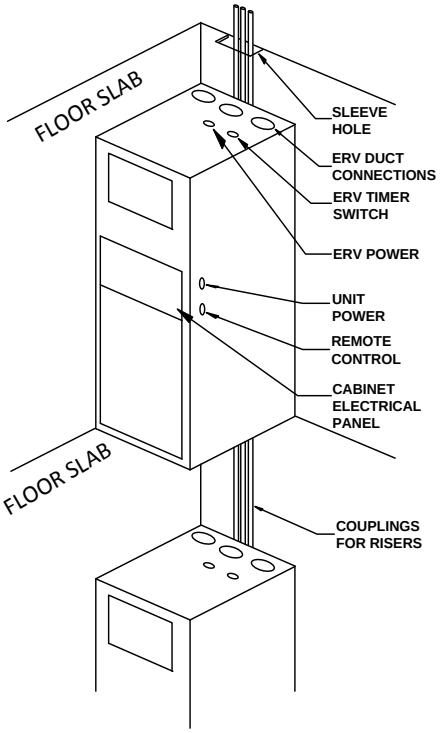
Any required piping not contained within the provided unit is the responsibility of the installing contractor. Any horizontal runs of the risers must follow local building code(s). Failure to do so will void any warranties. If the project requires riser extensions due to the floor-to-floor height, pipe should be measured, cut and added to the top of the unit's risers prior to installation of the cabinet.

Any riser diameter changes made in factory are done at the top of the unit. If the provided risers are too long, excess pipe can be cut from the bottom risers. **RISERS AT THE TOP OF THE UNIT ARE NOT TO BE ALTERED.**

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.

Once risers have been cut and appropriate insulation has been applied, clean and apply flux to both male and female ends of the risers. Tip unit upright and guide pipes through the sleeve hole in the floor (requires two (2) people plus third person on floor below to guide upper male tubes into swedged 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.** Riser piping and drain connections are soldered from floor below.

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. Units with hydronic heat "Series V(T,R)-C" may require riser insulation. Units will be provided with an insulated condensate riser. Units may have risers fully insulated in-factory or it may be added in the field by the installing contractor after soldering of the risers. If the unit has factory installed full length riser insulation, slide insulation away from riser ends and clamp out of the way during soldering of the risers.

Riser joints must be made with 95-5 solder. If high temperature solder is used, the top and bottom of the units must be shielded and protected from excessive heat. Soft solders or other low temperature alloys are not suitable for this application. All soldering will be done in a downward direction at the top of a unit. After soldering, the riser/piping system should be hydrostatically tested for leaks (with all riser ball valves closed).

After the system has been hydrostatically tested for leaks, units requiring riser insulation must have all exposed copper riser sections insulated and sealed. For units with factory installed full length riser insulation, the clamps should now be removed from the insulation and the tubes should be stretched over swedges until the both ends of the insulation butt together, then seal the seam. For units that need to have riser insulation installed in the field, lap-seal insulation can be added to the risers after soldering is complete. First, measure the distance between units when in place (from bottom of the upper unit to top of the lower unit). Cut approved closed cell vapor seal insulation to measured lengths plus one inch (1"). Wrap the tube around the riser, peel off adhesive backing, and squeeze insulation around the riser to create the longitudinal seal. All seams must then be sealed. Pipe chases may be further insulated with an approved insulating material or sealant.

Whalen units are designed to handle up to 1-1/4 inch of vertical riser 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 and duct openings be covered during construction. The shipping carton can be utilized as a protective shield by cutting the ends off the carton.

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

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.

The riser sleeve hole must be sealed with proper materials to meet all applicable fire ratings and building codes.

MASTER/SLAVE UNITS

Units configured in a Master/Slave arrangement are designed to share one set of risers between adjacent units (typically through a fire rated wall). The Master unit includes the risers and is installed as described above. The supply and return risers on the Master units are provided with female connections that accept 5/8" OD pipe (1/2" nominal pipe) on the opposite side of the riser from the Master unit for stub-out piping to the Slave unit.

The condensate riser on all Master units is provided with female connections that accept 7/8" OD pipe (3/4" nominal pipe) on the opposite side of the riser from the Master unit for stub-out piping to the Slave unit.

The Slave unit should be set in place and the length of the stub-out pipes measured from the swedged connection on the riser to a distance of no more than 3" insertion into the Slave cabinet. Install the stub-outs after the interceding wall has been constructed, drilling or cutting holes in the wall to allow the stub-outs to go through the wall. The stub-outs should be soldered to the swedged connections of the risers and the ball valves in the Slave cabinet with 95-5 solder. The holes cut into the wall for stub-outs must be sealed with proper materials to meet all applicable fire ratings and building codes.

RECOMMENDATIONS FOR CLEANING CLOSED LOOP WATER SYSTEMS BEFORE INSTALLING REFRIGERATION CHASSIS:

The building condenser water system for the Whalen heat pumps should include the items below at a minimum and should be installed in accordance with good design practice:

- **Riser isolation valves**
- **Means to accommodate riser expansion and contraction**
- **Means to drain and vent risers**
- **Means to fill and drain system components**
- **Air separator**
- **Expansion tank**
- **System strainer with coarse and fine screens and suitable means for inspecting and flushing**
- **Filtered and treated water supply and suitable pressure regulator**
- **Water pumps**
- **Cooling tower or closed circuit cooler**
- **Boilers**
- **Condenser water temperature control systems**

After the units are installed, the riser system should be thoroughly leak checked with Whalen riser water valves in each cabinet closed.

All risers (supply and return) should be supplied with blow down valves at the bottom and vent valves at the top.

The individual system components (risers, run-outs, closed circuit cooler, etc) should be filled and dumped as required to clear the system of dirt, solder, flux, weld slag, etc that may be present in the system PRIOR to running system pumps to avoid contamination of the whole system (it should be noted that repeated filling and draining of steel components in the system may cause corrosion of these items). The manufacturers of these components should be contacted for their specific cleaning recommendations.

DO NOT RUN THE SYSTEM WATER THROUGH THE WHALEN REFRIGERATION CHASSIS UNTIL A RUNNING FLUSH OF THE SYSTEM HAS BEEN COMPLETED.

Fill the system with treated and filtered water and run the system pumps. Water should be constantly bled off the system at or near the pump discharge. The water bleed off should be replaced by the normal treated and filtered make-up water. Strainers should be checked and cleaned as necessary. Water samples should be taken from all system drains. The system is clean when the water samples are clear of particulate matter. It may take as long as three days of running the system to clear the water.

When the system water is clear, close the supply and return ball valves in each Whalen cabinet 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.

A water treatment specialist should be called in to test the water condition and recommend proper water treatment. It is important that the water is the proper pH to prevent corrosion, at the acceptable level of hardness to prevent scaling, free of organic matter that could be a health hazard and free of particulate matter that could foul the system.

After the buildings water system has been cleaned, the unit ball valves, connections, and hose must be flushed. First, disconnect the hose from the return riser ball valve and place that end into the drain pan. Open the supply riser ball valve and flush the connection. After flushed, close the supply ball valve and reconnect the hose to the return riser ball valve. Then repeat these steps for the return connection. Disconnect the hose from the supply riser and place that end into the drain pan. Open the return riser ball valve and flush the connection. After flushed, close the return ball valve and reconnect the hose to the supply riser ball valve to prevent accidental water discharge.

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 1000 ppm for a glycol system and 300 ppm for a water-only system. Total suspended solids should not exceed 75 ppm. PH should be between 6.8 and 8.4. Failure to do so VOIDS ALL WHALEN GUARANTEES OR WARRANTYS STATED OR IMPLIED.

The Whalen Company cannot overemphasize the importance of insuring the condenser water system is clean and fully operational before installation of the refrigeration chassis. Almost 100% of installation problems with water source heat pump units are directly related to condenser water systems being dirty or not maintaining proper flow to each individual unit.

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.

DUCTWORK

The Whalen vertical stacked heat pumps are designed to accommodate a minimum amount of supply air ductwork to distribute the treated air. Care should be taken to follow good design, fabrication and installation practices of the ductwork. The ductwork must be sized within the static pressure capabilities of the unit supply fan.

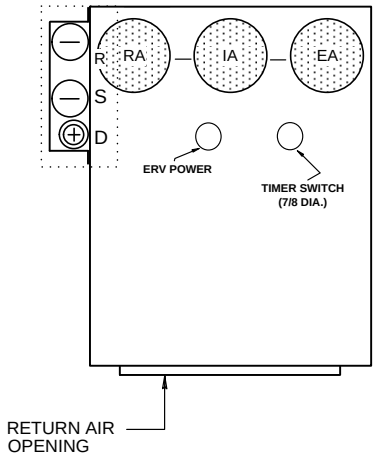
The supply ductwork should be installed so that a minimum gap of 1/2" is maintained between the ductwork and the unit duct flange. The ductwork should be suspended from the building ceiling and isolated from the Whalen unit with a suitable flexible connector.

In addition to the standard ventilation ductwork, Whalen Series V(T,R) units require exhaust, intake, and recovery air ductwork for the ERV. Recovery air is ducted from the washroom vent (or any non-contaminated ventilation source) to the unit, intake air is ducted from the outside to the unit, and exhaust air is ducted from the unit to the outside.

The exhaust, intake, and recovery ductwork connections are made at the top, back, or side of the unit (see configurations below) with 5" round connections. (Note: the return air connection must always be made through the top of the unit in the rear left corner). The ducts will be labeled. Seal connections using foil tape.

The exhaust and intake ductwork are connected to a modular ventilation wall box installed through an outer wall. Whalen wall boxes are available as separate intake and exhaust boxes or as a double box to accommodate both. It is important that vent and damper flaps are not obstructed – to do so voids any warranties.

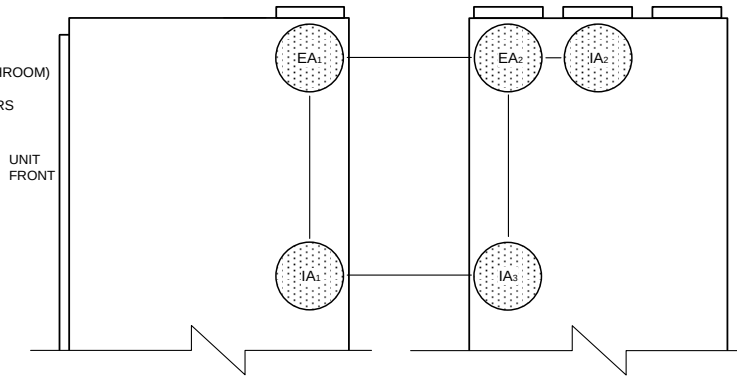
Standard ERV Duct Connections:



EA = EXHAUST AIR (TO OUTSIDE)
IA = INTAKE AIR (FROM OUTSIDE)
RA = RECOVERY AIR (FROM WASHROOM)

ALL WITH 5" ROUND DUCT COLLARS

Alternate ERV Duct Connections:



No ductwork should be attached to the unit's front return or supply air openings as all unit maintenance and service is done through these connections. The return air opening should be unblocked and uncluttered to provide maximum unit air flow and ease of service. Blocking off (or otherwise reducing the air flow of the unit) will result in nuisance safety trips and will eventually cause unit failure that is not covered by warranty.

ELECTRICAL

A complete internal electrical wiring harness has been installed at the factory, requiring only field connection of the main unit and ERV power supplies, as well as the remote mounted thermostat and ERV intermittent high speed fan switch control wiring. All wires are color coded. All field electrical wiring should be performed in accordance with the National Electrical Code and any applicable local codes.

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 access door of the flush mount panel.

All electrical connections are made in unit-mounted electrical boxes through 7/8" diameter openings in the case of the unit. The unit power and thermostat connections are located on either the left or right side of the unit (opposite riser side). The ERV power connection is located at the top left of the unit. The ERV intermittent high speed fan switch connection is located at the top right of the unit.

Standard connections and clamps per local building codes should be used. Power supply need only be brought to the junction boxes inside the unit's cabinet. A wiring diagram is affixed to the inner panel of each unit.

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.

The power connection for the ERV is made in the junction box located within the cabinet behind the top inner panel on the left-hand side of the unit. The ERV can only operate on 120 Volt incoming power. The ground wire should be firmly secured to the junction box. The white line wire (Neutral) connects to the white wire(s) in the box and the black line wire (L1) connects to the black(s) wire in the box. Connections should be secured and insulated as per local codes and ordinances.

Do NOT plug the ERV's power cord into the power receptacle until the unit is ready for operation. Once connected, the ERV fans will begin to run.

The ERV intermittent high speed fan switch connection is made in the junction box within the cabinet at the top right hand side. Run wires from each of the (2) blue wires in the junction box to a 2x4 electrical box located in the desired ventilation space. Multiple switches can be wired in parallel.

DO NOT OPERATE THE UNIT WITHOUT THE THERMOSTAT OR RETURN AIR FILTER – DOING SO WILL VOID ALL WARRANTIES.

VERIFY DRAIN PAN & FAN INSTALLATION

Whalen Series V(T,R) units are provided with an internal drain pan (stainless steel) that mounts on structural steel members in the unit cabinet. The drain pan is elevated approximately 4" above the cabinet floor, and is provided with a drain hole in the center of the pan. A copper nipple is soldered to the drain pan and a flexible rubber P-trap is fastened to the drain nipple with a squeeze-lock clip. The P-trap then passes through the side of the unit cabinet where it is connected to the condensate drain riser on a stub-out and secured with a squeeze-lock clip. These connections can be serviced through the removable plate directly beneath the return air opening. After the cabinet has been installed, these connections should be inspected. This plate will inaccessible after drywall has been installed. The condensate drain riser is secured to the outside of the unit cabinet and passes the condensate from the top unit to the bottom unit on the riser where the condensate can be properly disposed of according to building codes.

Also after the installation of the cabinet, the fan should be checked for proper installation. The fan is located behind the control panel, above the chassis and is held in place on the fan deck by two sheet metal straps that fasten together at the bottom of the fan housing with a machine screw. The fan should be held rigidly by the straps and should be positioned in the center of the cabinet, inside the flanges on the fan deck. The strap screw should be tightened fully so that the upper and lower straps make contact. The straps will have no slack when the fan is correctly installed.

FINISHING

Whalen Series V(T,R) Units are designed to be free standing units. **FOR OPTIMAL SOUND CHARISTERISTICS, BRACING DRYWALL, STUDS, WALL BOARD OR PLASTER MUST NOT TOUCH OR BE ATTACHED TO THE UNIT.**

Clean all drywall dust and debris from the unit after drywall installation and cutting of appropriate air, thermostat, and ERV intermittent high speed fan switch openings. 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, drywall dust, dirt or paint will not be covered under the equipment warranty.

GRILLES, FLUSH MOUNT PANELS and FILTERS

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

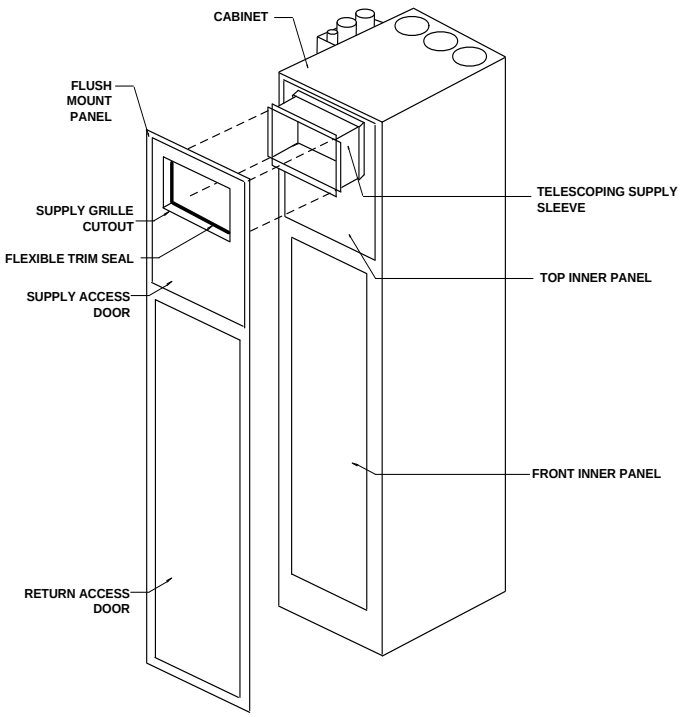
When installed, the flush mount panel should not come into contact with the unit. All flush mount panels are attached to the framed-out wall opening by the installer.

Flush mount panels, supply air ductwork or supply air grilles must not be attached to the unit casing for best sound performance. The supply air opening may require a sleeve to direct all of the air to the desired outlet location. Return air openings should be sleeved if necessary, to prevent unconditioned air from entering the unit. The sleeves must not have hard connection at both ends as maintenance is done through these openings. Use an appropriate flexible seal or foil tape.

A minimum of ¼" clearance is required between the back of the flush mount panel and the front of the cabinet. Insulation should be placed between the drywall and the unit front for sound attenuation without interfering with return or supply air flow. It is recommended to use foil tape to create a seal between flanges of the flush mount panel and return air inlet.

The front supply discharge seals to the flush mount panel with an adjustable telescoping sleeve. After the unit has been positioned and the flush mount panel has been installed, the supply sleeve must be adjusted to create this seal.

1. Remove the supply grille by pulling it horizontally from the supply access door. Remove the supply access door by opening it approximately halfway and lifting the door up off its hinges.
2. Confirm the placement of the trim seal over the flanges of the supply grille cutout in the supply access door.
3. With the supply access door removed, pull the supply sleeve out from the unit until it is approximately ½" behind the inner face of the flush mount panel behind the supply access door.
4. Replace the supply access door. Close the door and ensure that the trim seal makes firm contact with the telescoping supply sleeve. Adjust the position of the sleeve as required.
5. Once confirmed that a seal is made with the supply access door, run two (2) self-tapping screws through the sleeve into the flanges of the top inner panel to hold the supply sleeve in place. Open the supply access door and seal the outside of the sleeve to these flanges using foil tape. Close the supply access door and reinsert the supply grille.



IMPORTANT: FAILURE TO CREATE A SEAL BETWEEN THE SUPPLY DISCHARGE AND THE FLUSH MOUNT PANEL COULD RESULT IN AIR RECIRCULATION AND VOID ANY WARRANTIES.

IMPORTANT: DO NOT ALLOW FASTENERS TO PENETRATE OR TOUCH THE UNIT CASING.

THERMOSTAT & ERV INTERMITTENT HIGH SPEED FAN SWITCH

The Whalen Series V(T,R) u*nits utilize a field wired, remote mounted thermostat and ERV intermittent high speed fan switch that will have field wiring connections made to color-coded control wiring through 7/8" diameter openings in the unit 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 color-coded unit wiring, using the connectors provided. Attach the thermostat to the remote junction box with the screws provided.

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

The field wired ERV intermittent high speed fan is to be mounted in the desired ventilation space. Attach the field installed control wires located in the field mounted 2x4 electrical box to the terminals of the switch. The switch is non-polar, so terminal connections are not important. Attach the switch to the electrical box with screws provided and attach the cover plate.

CAUTION: Use with a thermostat other than those provided or approved by Whalen can void all warranties.

NOTE: All heat pump thermostats **MUST** include anti-short cycle protection to prevent rapid ON/OFF cycling of the compressor. A delay of at least 4 minutes is required. Verifying anti-short cycling delay is the responsibility of the installing contractor.

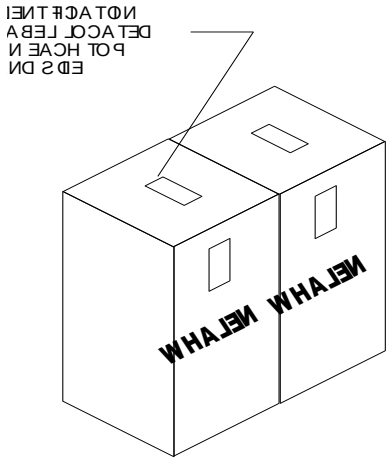
NOTE: The reversing valve must be energized during the applicable mode, and must remain energized until the opposite mode is engaged. Verification of this thermostat feature must be completed by the installing contractor.

NOTE: Many electronic, digital and programmable thermostats are designed to work on a variety of types of units (fan coils, heat pumps, cooling only units, gas furnace, etc.) and require programming to be performed to match the thermostat to the type of unit and type of installation in order to properly control the unit. The Whalen Company does not perform this programming as it requires knowledge of the installation and operating parameters of the system that Whalen does not possess. This programming must be performed by the installing contractor.

INSTALLING HEAT PUMP CHASSIS

Whalen 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 #	:	WG-0304
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 side of the compressor enclosure.

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

Chassis may be stacked 2 high for storage. Each unit undergoes a quality control inspection and is factory tested for leaks and 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.

Each chassis is designed and manufactured to fit into the corresponding cabinet of that size. Chassis are available from 200 CFM to 800 CFM and match cabinets of the same cfm (200, 300, 400, 500, 600, 800 CFM). The chassis will fit into the cabinet and match the inlet air opening cut out of the sheet metal inner panel that fixes the chassis into position

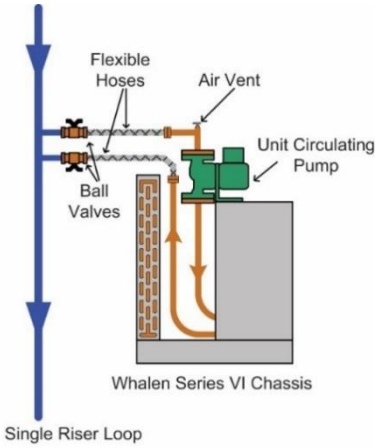
Follow these steps to install the refrigeration chassis:

1) Open the return access door (lower door) of the flush mount panel.
2) Remove the sheet metal inner panel from the cabinet by removing the four flathead screws from the cabinet and pulling the inner panel out.
3) Lift up and tilt the drain pan to verify rubber P-trap is properly attached to drain nipple and condensate riser. Set pan back on channels when proper installation is confirmed.
4) Inspect cabinet insulation before inserting chassis. Repair any tears with UL Listed foil tape. **MAKE SURE RISER VALVES ARE CLOSED**.
5) 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).
6) Disconnect the hose within the cabinet from the supply riser (the supply riser is the closest riser to the front of the unit for side riser units and on the right-hand side of the cabinet for rear riser units).
7) Remove both ends of the hose from the chassis and reconnect one end to the supply riser within the cabinet.
8) Set the chassis on the galvanized steel rails in the bottom of the unit. Position chassis just far enough into the cabinet for it to keep its balance.
9) Connect the hose from the return riser to the water pipe on the left side of the chassis labeled "Water Out" and the hose from the supply riser to the water pipe on the right side of the chassis labeled "Water In". **HAND TIGHTEN ONLY. DO NOT OPEN THE SHUT-OFF VALVES AT THIS TIME**.
10) Slightly loosen the left or rear hose at the return riser ball valve so air can be bled from the line.
11) Open the ball valve on the supply riser slowly, letting the water into the chassis to force the air out through the return hose connection. 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.
12) When a steady stream of water is flowing out of the return hose, tighten the return hose onto the riser ball valve (**HAND TIGHTEN ONLY**).
13) Open both ball valves slowly while visually inspecting for leaks. If small leaks are present, hose connection must be hand tightened until leaks stop (Never tighten hose connections with tools, as this may cause damage to the rubber gasket)
14) Plug the chassis power cord into the cabinet control panel (the control panel has a female connector to accept the power cord plug).

15) Slide the chassis into the cabinet, making sure that the hoses are not kinked or forced against the cabinet or fan to prevent noise transmission. 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. Move the chassis slightly to the right to match the air inlet cover hole location and make sure the chassis is sitting level on the galvanized steel rails.
16) Reinstall the inner panel, making sure the inner panel gasket is LIGHTLY sealing 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 (only tighten the screws until the gasket touches the evaporator coil – the gasket will not compress). Do not try to force the chassis back into the cabinet by over-tightening the screws.
17) Turn on electric disconnect switch.
18) Install the return air filter.
19) Close the flush mount panel's return access door.

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 up-flow or down-flow 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 temporary cord into the chassis power cord receptacle in control box.

All air must be removed from the system prior to operation. Open both supply and return ball valves and check for any water leaks. Close supply valve and open coin-air vent in pump piping. After all air is has been purged, close return ball valve, open supply ball valve, and turn on the unit disconnect to energize the pump. When all air has been purged from the vent, close vent and turn off the disconnect switch. Open the return ball 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.

On units equipped with Hydronic hot water coil for heating and cooling only air refrigeration chassis, see HYDRONIC HEAT UNITS section below.

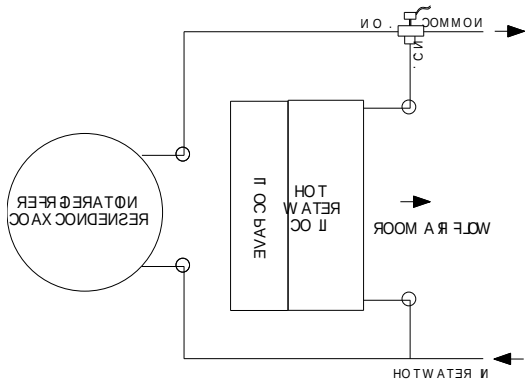
HYDRONIC HEAT UNITS:

Hydronic heat units are available in two configurations:

1) The hot water coil and the refrigeration coax condenser coil water circuits are piped in parallel with the water flow direction controlled by a 3-way electric control valve.

When air conditioning is required, the 3-way valve is positioned to allow water flow to the refrigeration coax condenser, where the water absorbs heat from the refrigeration chassis while air conditioning is performed by the compressor.

When heating is required, the 3-way valve is positioned to allow water flow to the hot water coil where the room air is heated. The compressor is not energized in this function. This configuration should be used on a constant flow pump system.

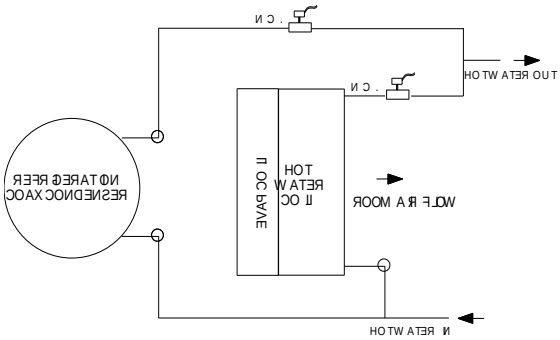


Configuration 1

2) The hot water coil and the refrigeration coax condenser coil are piped in parallel with the water flow supply controlled by two 2-way electric control valves (one valve allows flow to the coax and one valve allows flow to the hot water coil).

When air conditioning is required, the 2-way valve on the coax circuit is opened to allow water flow to the refrigeration coax condenser, where the water absorbs heat from the refrigeration chassis while air conditioning is performed by the compressor. The 2-way valve on the hot water coil remains closed.

When heating is required, the 2-way valve on the hot water coil is opened to allow water flow to the hot water coil where the room air is heated. The compressor is not energized in this function and the 2-way valve on that circuit remains closed. This configuration should be used on a variable flow pump system.



Configuration 2

For units with hydronic heat, follow the installation procedures described above, with these additional requirements:

For configuration 1, the chassis water circuit must be vented at the coin-air vent on top of the water coil manifold. Loosen the return water hose connection, open the coin-air vent, and put the 3-way valve in the normally closed position. Once only water is escaping the vent, manually over-ride the 3-way valve to the normally open position and continue to vent until only water is escaping from the return hose connection. Close the air vent, tighten the return hose, and release the 3-way valve.

For configuration 2, the chassis water circuit must be vented at the coin-air vent on top of the water coil manifold. Loosen the return water hose connection and open the coin-air vent. Manually set the 2-way valve to the hot water coil to the open position (while the other valve remains closed). Hold the 2-way valve open until only water is escaping from the vent. Release the valve over-ride. Then vent again with the 2-way valve to the refrigeration coax condenser coil manually over-ridden to the open position (while the other valve remains closed). Hold until only water is escaping from the return hose connection. Then close coin air vent, tighten the return hose and release the electric valves.

OPERATIONAL SYSTEMS CHECK

1. Verify that all disconnect switches are on and the ERV is connected.
2. ERV fans should run whenever the ERV power cable is connected. The unit fan will operate on ultra-low speed whenever the unit is powered (even when there is no call for heating or cooling).
3. Turn system switch ON and select "HIGH" fan speed.
4. Turn temperature control knob to full cool setting and listen for heat pump chassis to come on. Open return access door in the flush mount panel, pull back filter and feel the chassis coil face to see if it is getting cooler.
5. Let the chassis run in cooling for about 10 minutes. If the unit cuts off, see "Trouble Diagnosis" section.
6. If unit has electric heat (type B unit), Hydronic heat (type C unit) or if the unit is a reverse cycle heat pump (type A unit), turn the temperature control dial 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.
7. Depress the ERV intermittent high speed fan switch. Check to see if draw from the washroom exhaust vent is increased. (You should hear the ERV exhaust fan speed up within the unit). Depress the intermittent high speed fan switch again and make sure the draw from the washroom exhaust vent is decreased.
8. When complete, set the temperature control dial 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, ERV intermittent high speed fan switch, 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 unit.

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.

The unit will operate on ultra-low fan speed at all times, until there is a call for heating or cooling. Then the fan will operate at its high or low setting depending on the position of the fan speed switch when applicable.

When the ERV intermittent high speed fan switch is depressed the ERV fans will operate in exhaust mode for 20 minutes to ventilate the recovery vent's space (typically the washroom). Depressing the switch a second time will deactivate exhaust mode and resume normal ventilation.

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

CAUTION: operating the unit in COOLING while doors or windows are open may result in excess condensation from the unit and/or on the supply air grille.

MAINTENANCE and SERVICE

Whalen units have been designed to be as maintenance-free as possible. All replaceable parts are readily accessible via the flush mount panel and supply air grilles. No special tools are necessary. It is recommended that filters be replaced monthly. Inspect condensate drain pan and drain line prior to and during cooling season. Remove any debris. The ERV can be serviced through the supply access door in the flush mount panel.

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 air panel and take note of the unit Model Number and Serial Number. Then contact your local Whalen representative for assistance.

NOTE: THE WHALEN SERIES WA, WB, WC AND WG REFRIGERATION CHASSIS ARE CRITICALLY CHARGED WITH NON-OZONE DEPLETING REFRIGERANT AND ARE NOT PROVIDED WITH REFRIGERANT ACCESS PORTS IN ORDER TO PROTECT THE INTEGRITY OF THE REFRIGERANT CHARGE. FIELD INSTALLATION OF REFRIGERANT ACCESS PORTS OR OTHER MODIFICATION OR ALTERATION OF WHALEN EQUIPMENT VOIDS THE WARRANTY AND MAY RESULT IN DAMAGED EQUIPMENT AND/OR UNSAFE OPERATION.

PLEASE REVIEW THE WARRANTY STATEMENT PROVIDED WITH THE PROJECT ON YOUR WHALEN EQUIPMENT.

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 within the room has been brought to normal conditions.

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

For Whalen Series VR units, inspect the ERV condensate drain hose, clear it of any kinks or blockages, and ensure that it correctly terminates into the unit drain pan. Also, inspect drain pans within the ERV by removing the top inner panel and the ERV cover. Be sure there is no puddling in the drain pans and that the ERV drain hoses are securely attached.

SEMI-ANNUAL MAINTENANCE RECOMMENDATIONS

1. Inspect unit.
2. Run system through operation check.
3. Open the return access door in the flush mount panel and check filter; replace filter if required. (High efficiency filters require more frequent changing to maintain a cleaner environment). Clean panel as necessary.
4. Disconnect power and remove front inner panel.
5. Vacuum and clean the air coil fin surface. Using a hand sprayer, spray the face of the coil with a mixture of liquid dishwashing soap and water and rinse by spraying the face of the coil with water. Professional coil cleaning service may be required for coils with caked on dirt and grime.
6. 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).
7. Inspect chassis water hoses for cracks and/or leaks. Replace if damage or wear is evident. Replacement of hoses is recommended after approximately 5 years. Hoses should be hand tightened only – do not over-tighten.
8. Inspect drain pan, clean if necessary. Check condensate drain line to insure it is open and clear.
9. Remove the supply access door (top door) in the flush mount panel by opening the door approximately halfway and lifting it up off its hinges. Then remove the top inner panel, unplug the ERV and remove its cover.
10. Inspect filters and replace as required. Wash the filters in very mild soapy water and rinse. Allow the filters to dry before placing back into the unit.
11. Inspect the ERV core and fans for any damage or debris. Vacuum all surfaces of the core. If required, wash complete interior of the ERV with a non-abrasive mild soap and rinse with clean water.
12. For Series VR units, ensure that the ERV condensate drain pans and hoses are unobstructed and terminate correctly into the unit drain pan.
13. Replace the ERV cover and plug the ERV power cord back into its receptacle.
14. Replace inner panels. Restore power and close the flush mount panel doors after a clean filter has been installed.
15. 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. Use a bactericide or bacteriostat drain pan conditioner that is pH neutral. Follow directions of product used to assure proper bacteria control.

RETURN AIR FILTER

THE UNIT RETURN AIR FILTER IS THE MOST IMPORTANT PART OF THE SYSTEM. Proper system maintenance **MUST** include changing of the filter at regular, recommended intervals to assure the unit air coil remains free of dust and other materials. Upgrading the filter to a higher efficiency level (MERV Rating) will provide more filtration of particles in the air and will result in a longer life of the heat pump and a cleaner environment. Whalen strongly recommends the use of high efficiency filters.

The units are provided to the installing contractor with a "construction grade" filter. This filter should be replaced as described above as soon as possible after regular use begins. The filter can be accessed for changing or cleaning by opening the return access door in the flush mount panel. The filter should be inspected regularly with periodic replacement made to prevent the accumulation of dirt and particulate matter on the air coil 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.

Whalen offers four efficiency upgrades of filters that greatly exceed the MERV 4 construction grade filters. Each grade progressively increases the filtration performed. Table 1 to the right, compares the minimum particle size each filter can remove from the airstream and the percentage of those particles that the filter will remove. The filters are: MERV 4, MERV 7, MERV 8, MERV 11 and MERV 13.

MERV Rating	Particle Size (in microns)			Particle Examples
	0.3 - 1.0	1.0 – 3.0	3.0 – 10.0	
4	-	-	> 20 %	Pollen, Dust Mites, Sanding Dust
7	-	-	>50 %	Mold Spores
8	-	-	> 70 %	Mold Spores, Cement Dust
11	-	65 – 80 %	85 + %	Auto Emissions, Lead Dust
13	> 75 %	90 + %	90 + %	Tobacco Smoke, Bacteria

Table 1: FILTER SELECTIONS

Model	Size
200, 300, & 400[3]	13 x 24 x 1
500, 600 & 800[5]	15 x 28 x 1

Table 2: FILTER SIZES

The use of high efficiency filters increases the external static pressure on the fan and motor. The fan and motor must be sized properly to handle this extra static pressure. Upgrades to MERV 7 or MERV 8 filters usually will not deteriorate unit performance. Upgrades to MERV 11 or MERV 13 require analysis of the fan motor and any ductwork.

New Whalen units can be engineered and constructed with the proper fans and motors compatible with MERV 13 filters. Check with the factory.

ERV Filters

Before the unit is put into operation, the permanent filter should be checked and washed in a very mild soapy water and rinsed to remove any construction residue if required. Twice a year, or as needed, the filters should be washed. Replace filters every two years or as required.

ERV Core

The core should be inspected and cleaned once a year, and replaced if damaged or frozen due to unit malfunction. Handle the core carefully, as the membrane is easily damaged. If removing the core, gently pull the core horizontally out of the unit. We recommend wearing gloves.

WHALEN HEAT PUMP SYSTEM DESCRIPTION

The Whalen Series V(T,R)-A heat pump is a water cooled, reverse cycle cooling / heating unit with an integrated energy recovery ventilator (ERV) and removable refrigeration chassis. The cabinet contains the supply fan and motor, the control panel and electric heat (if provided) and the ERV. The ERV contains two smaller fans and a parallel plate cross flow air to air heat/energy exchanger. 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.

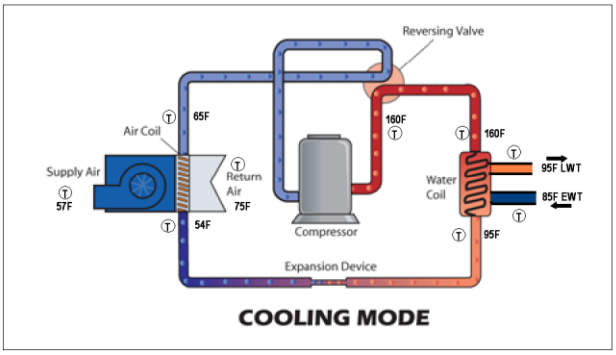
In the cooling mode, the air coil is used as the evaporator and provides the cooling of the room air. The compressor rejects the heat absorbed by the evaporator to the condenser coil which is the coaxial water coil.

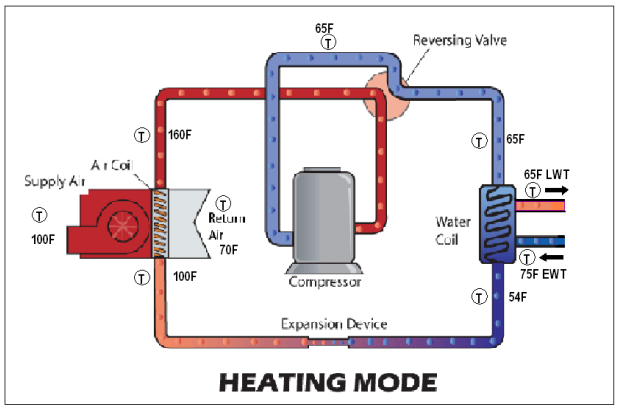
In the heating mode, the coaxial water coil is used as the evaporator that pulls heat from the water. This heat is rejected by the compressor to the condenser which is now the air coil to heat the room air.

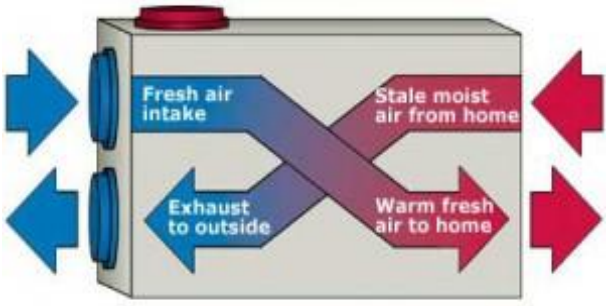
The unit is switched between the cooling and heating modes by energizing the reversing valve.

The ERV allows stale air to be exhausted from the space while recovering some of the energy used to condition it. Recovery air (from the washroom) is ducted into the unit and passes through the ERV. Fresh unconditioned intake air (from the outdoors) is also ducted into the unit and passes through the ERV. Within its core, heat is transferred between the two airstreams. In summer, the hot outdoor air is cooled by the exhaust air, and in winter it is warmed. This pre-conditioned air is ducted within the unit to the front of the air coil where it mixes with the unit return air. After its energy has been extracted, the exhaust air from the washroom is ducted to the outdoors.

The Whalen Series V(T,R)-B is a cooling only unit with electric heat and operates the same as the heat pump in the cooling mode.







Energy Recovery Ventilator
Basic Configuration

The Whalen Series V(T,R)-C is a cooling only unit with hydronic hot water heat and operates the same as the heat pump in the cooling mode. In the heating mode the unit provides heat through the hydronic hot water coil while the compressor is turned off.

TYPICAL OPERATING PARAMETERS

The Whalen Company Series V(T-R) model number indicates the nominal cfm of the unit (example, in the model number VT-A-0304, the 03 signifies 300 cfm). Divide this cfm by 400 to determine the nominal cooling capacity of the unit in tons.

Typical operating parameters of Whalen water loop source heat pumps are provided below (contact factory for ground source or ground loop application parameters). Whalen units can be tested with the unit in operation by placing thermocouples on the compressor suction, discharge and liquid lines (one at each end of the liquid line), one on a distributor tube at the entrance of the evaporator coil and one on each condenser water connection. A hand-held temperature gun can be used for the supply and return air temperature measurements. Run the unit under normal conditions and compare readings with the information below:

TYPICAL V(T,R)-(A,B) OPERATING TEMPERATURES

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	125-135^0F
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
Entering water temperature Cooling:
95^0F max, 75^0F min
Leaving water temperature Cooling:
8 to 12^0F higher than entering water temperature
Entering water temperature Heating:
75^0F max, 60^0F min
Leaving water temperature Heating:
8 to 10^0F lower than entering water temperature
Water flow rate 3 gpm / ton

Low pressure cut-out/cut-in	40 / 80 psig
Low temperature cut-out/cut-in	30 / 50 ^{0}F
High pressure cut-out / cut-in	600 / 500 psig

TYPICAL V(T,R)-C OPERATING TEMPERATURES

Typical operating parameters of The Series V(T,R)-C water loop source cooling only / Hydronic heat units are provided below. Whalen V(T,R)-C units can be tested with the unit in operation by placing thermocouples on the compressor suction, discharge and liquid lines, one on a distributor tube at the entrance of the evaporator coil and one on each condenser water connection. A hand-held temperature gun can be used for the supply and return air temperature measurements. Run the unit under normal conditions and compare readings with the information below:

Capillary or distributor tube temperature at coil	60^0F
Evaporator saturated suction temperature	56^0F
Suction line temperature (with superheat)	66^0F
Superheat at compressor	10^0F
Discharge line temperature	125-135^0F
Condensing temperature Cooling	133^0F
Subcooling	21^0F

Air temperature to Evap coil:
80^0F db / 67^0F wb Cooling
Air temperature off Evap coil:
63-65^0F Cooling
Entering water temperature Cooling: 75^0F min,
95^0F max
Leaving water temperature Cooling:
9-10^0F higher than entering water temperature
Entering water temperature Heating:
120^0F max
Leaving water temperature Heating:
8^0F lower than entering water temperature
Air temperature off Hot Water coil
95 – 100^0F Heating
Water flow rate 3 gpm / ton

Low pressure cut-out/cut-in	40 / 80 psig
Low temperature cut-out/cut-in	30 / 50 ^{0}F
High pressure cut-out / cut-in	600 / 500 psig

TROUBLE DIAGNOSIS

Trouble diagnosis should only be attempted by qualified maintenance personnel. Before any troubleshooting is performed, verify that the thermostat has been programmed as required for proper operation on the installation in question. The thermostat must include a minimum 4 minute compressor anti-cycle timer.

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. The fan should begin to run on ultra-low fan speed
3. Open return access door in the flush mount 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, verify the 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 VERIFY PINS ARE FULLY PRESSED INTO THE CONNECTOR PLUG
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 wiring; verify wiring is correct. If any wiring or shield is burned, replace wires.
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 it is 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, compressor replacement 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, check the compressor thermal overload for continuity (if no continuity, overload is defective). If overload is ok, unplug chassis and check compressor resistance with VOM between the red and black wires at the chassis plug. Infinite ohms means that the internal 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 there may be a faulty connection at the control box plug or a starter problem in the control box.

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 8.

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 8. 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 supply access door in the flush mount 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.

Hot Water Heat Not Working

1. Complete steps 1-3 of Fan Motor Fails to Start.
2. Open return access door in flush mount panel to access hot water heat coil.
3. Inspect coil for foreign material, breaks in the coil or shorted out control valve.
4. Check control valve for blockage

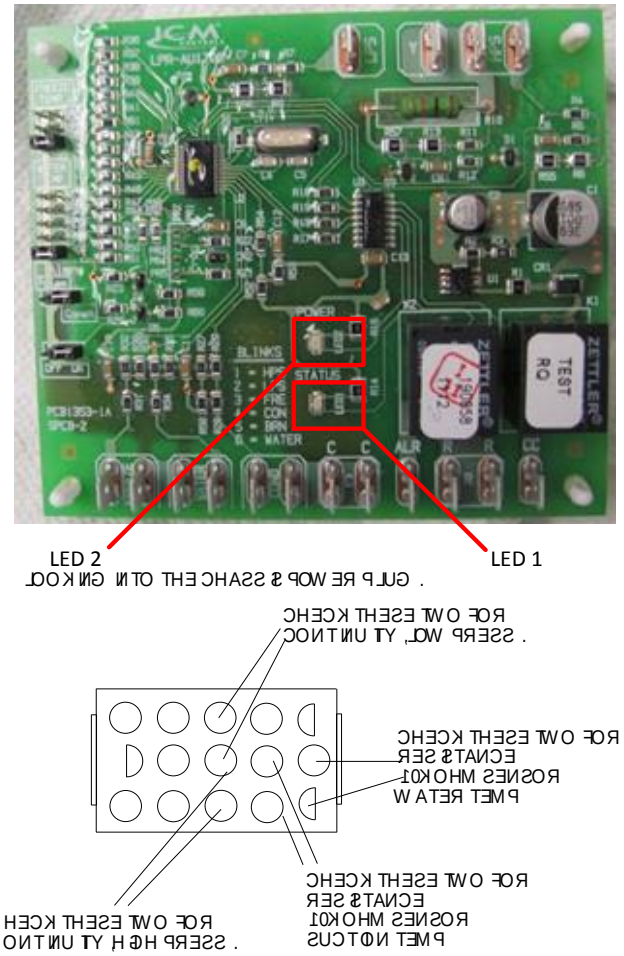
SOLID STATE CONTROLS

Whalen units are furnished with a solid state board located in the cabinet control panel, two 10K Ohm thermistors and a high and low pressure switch located in the chassis, and a condensate overflow switch located in the cabinet's drain pan. The thermistors and the high and low pressure switches are wired to the solid state board through the chassis power cord. The condensate overflow switch is directly wired to the solid state board through the cabinet. The high and low pressure switches used with the solid state board are normally closed, fail to open. The compressor lock-out function is provided by the board.

The solid state board starts and stops the compressor and performs the safety functions of high pressure cut-out, low pressure cut-out, freeze protection cut-out (low suction temperature and 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 temperature jumper should be set on 32^0F for standard condenser water loop systems and the Water Temp jumpers should be set on 36^0F 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 board is provided with a "TEST" jumper that is factory set on "OFF". This jumper is used for service testing and should be kept in the "OFF" position for normal operation.



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

The freeze protection sensor is located on the suction line of the compressor in the refrigeration chassis enclosure. The low water temperature sensor is located on the leaving water line of the refrigeration chassis.

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.
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

Table 3: Solid State Board LED Codes

ECM Control Board

Unit sizes 200-600 cfm are equipped with an ECM control board to provide modulation for the ECM motor. The board is mounted in the control box of the cabinet. If the unit is on but the unit fan fails to operate, check the control to ensure it is properly operating. The ECM control board LED codes are:

LED	Function	LED Status Indicator
LED1	24Vac Power Input	**ON** = UCB is powered on.
LED2/ LED3/ LED6/ LED7/ LED8	5 Taps	**ON** = Tap is Energized with signal voltage and Active. **OFF** = Tap is Inactive.
LED4	Communication with PC Parameter Software	**FLASHING** = UCB is communicating with PC Parameter Software.
LED5	Motor Control – PWM Signal Output (VR/0-10Vdc/5- Tap)	**ON** = PWM signal output is inactive and motor is not running. **FLASHING** = PWM signal output is active and motor is running.

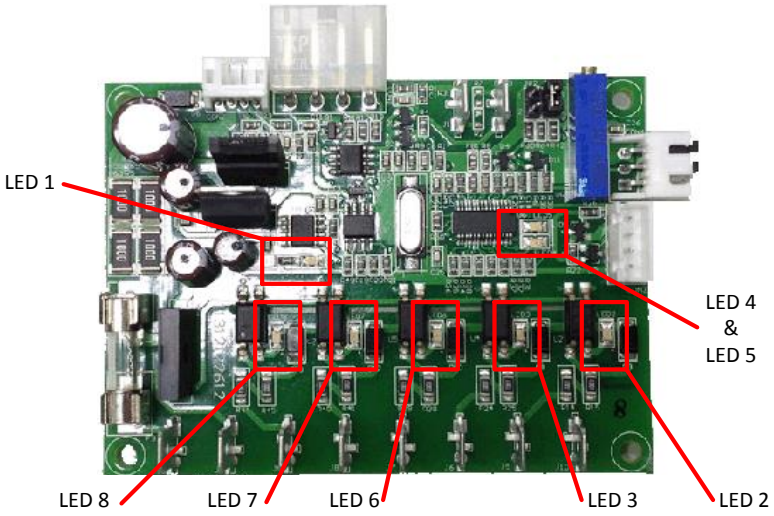


Table 4: ECM Control Board LED Codes

ERV Circuitry

The ERV is wired to run at a constant dedicated ventilation rate whenever the ERV is plugged in. Depressing the intermittent high speed fan switch initiates high speed exhaust for 20 minutes or until the switch is depressed again. The ERV contains its own freeze protection safety. "Polar Shield" prevents freezing air from reaching the unit coil by closing a spring actuated damper on the supply air stream and de-energizing the supply fan when the unit's internal temperature sensor detects freezing conditions. The exhaust fan will continue to circulate exhaust air until standard operating conditions are reached, and normal ventilation resumes.

USING SERIES V(T,R) HEAT PUMPS WITH GEOTHERMAL GROUND LOOP PIPING SYSTEMS

Ground-loop piping systems use the earth as the heat "source" or "sink" for the system rather than cooling towers and boilers. System energy consumption is reduced, however the heat pump operates over a wider range because the water temperature varies more than it does in the standard cooling tower and boiler loop. As a result, additives are usually required to prevent the water from freezing.

When applied in ground-loop systems, the Whalen heat pumps include factory-set protective devices. These devices sense temperature and de-energize the heat pump should temperatures fall below the set point. The set points, along with the required antifreeze mixture specification, were based upon the submitted design condition and must not be altered.

ALTERING FREEZE PROTECTION SET POINTS OR ANTIFREEZE MIX WILL RESULT IN PERMANENT DAMAGE TO EQUIPMENT AND VOIDS THE WARRANTY

The Whalen heat pump comes supplied with insulated risers. Prior to installing the Whalen heat pump, determine if the fluid in the loop will ever drop below 60 °F (15.6 °C) or if any system pipe is exposed to outdoor conditions. If so, all additional indoor piping must be insulated to prevent condensation.

Periodically verify the antifreeze and water mixture for the necessary freeze protection level. The Freeze Protection Point (°F) as determined from the submitted design condition must be known. Use a hydrometer to verify the specific gravity of your anti-freeze solution. The following tables may be useful.

READ AND FOLLOW DIRECTIONS ON THE MSDS SHEET FOR YOUR ANTI-FREEZE TYPE BEFORE HANDLING THE ANTI-FREEZE AND SOLUTION

Table 5 **ANTI-FREEZE PERCENT by VOLUME**

FREEZE PROTECTION POINT	-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%

Table 6 **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