



The Whalen Company

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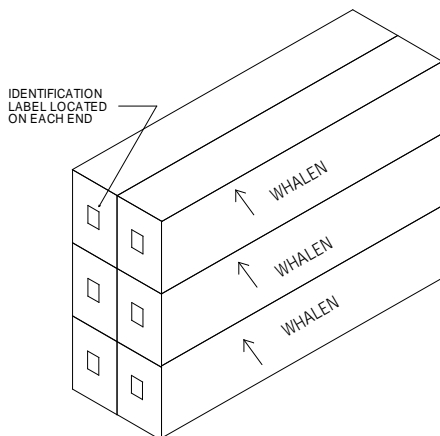
INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR 2-PIPE HEATING/COOLING, 2-PIPE HEATING ONLY, AND 50/50 4-PIPE RISER HEAT-EXCHANGER FAN-COIL UNITS Models W202–W802, W201 – W801, W2022 – W16022

RECEIVING

Whalen room fan coil 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 #	:	W402
FLOOR	:	12
RISER #	:	21B
HAND	:	RH
SUP	:	1 1/2
RET	:	1 1/2
DISCH	:	12 X 12 F

Typical label information includes job number, unit model, riser number, floor, LH or RH 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 unit consists of an outer casing, riser coils, an inner assembly, fan and motor. (Thermostats, grilles, and filters are normally shipped separately, subsequent to the units).

Upon receipt, the complete 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.

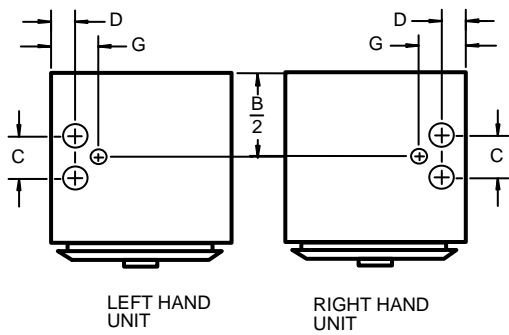
IMPORTANT: THE RISERS ARE NOT HANDLES! DO NOT SUPPORT OR LIFT THE UNIT BY THE PIPE EXTENSIONS.

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.

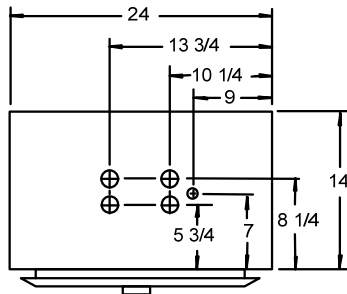
INSTALLATION

It is recommended that the installation of the fan coil unit 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. The riser heat-exchanger coil floats within the unit assembly to allow for normal expansion and contraction. It is critical to align the units so that the proper risers match up when the units are installed. The riser piping on 2 Pipe units is as shown below (reference the project submittal drawings for the actual dimensions of your project).

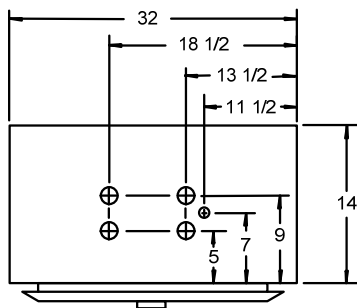


	W202	W302	W302X	W402	W502	W602	W802
B	14	14	14	14	14	16	16
C	2.5	2.5	4	4	4	4	4
D	1.5	1.5	2.75	2.75	2.75	2.75	2.75
G	2.75	2.75	4.5	4.5	4.5	4.5	4.5

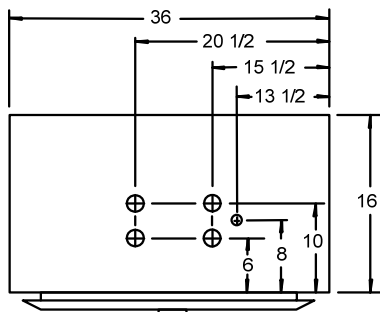
The riser piping on 50/50 4 Pipe units is as shown below.



300, 400, 500, & 600 CFM UNITS



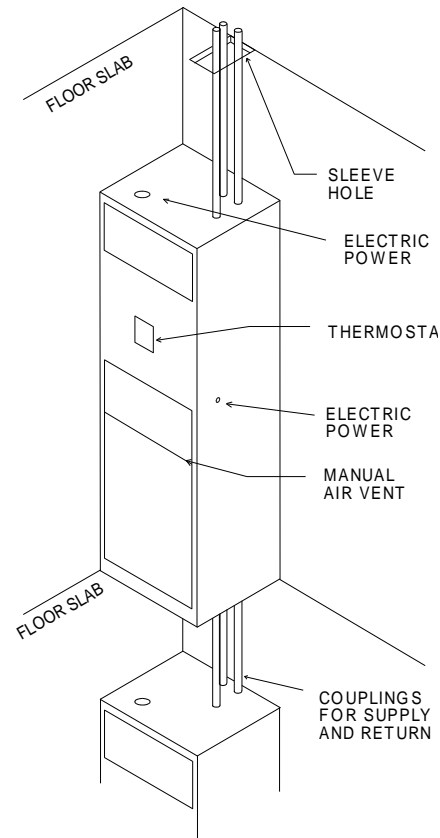
800 & 1000 CFM UNITS



1200 & 1600 CFM UNITS

Supply and return riser piping should extend 2" out the top of the casing (consult your project drawings for this dimension on your project). 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 a minimum of 1" insertion depth into the swaged connection.



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.

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). Unit must be 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 Sil-Fos or other high temperature alloy. 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).

(In coastal and humid areas, it is recommended that the condensate drain lines be insulated where pipes are in a non-air conditioned space. Drain pans are also recommended to be insulated with an approved 3/4" rigid insulation board in cases where area below unit is not air conditioned and exposed to excessively humid conditions).

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 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.

Units at the top of *upfeed* risers are provided with a manual air vent on the Top U-Bend assembly, which is normally accessed through the front supply grille or access panel. During testing and start-up, all "TUB" units must be vented to dislodge trapped air within the risers.

Units at the bottom of *downfeed* risers are provided with a manual drain on the Bottom U-Bend assembly, which is normally accessed through the front return grille. "BUB" units are used to drain the risers and are provided with a boiler drain and male hose bib connection.

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 and installation of the thermostat. All wires and thermostat wiring are color coded. Fan motor and all

field electrical wiring should be performed in accordance with the National Electrical Code and any applicable local codes. Aquastats are all easily accessible through the supply or return air openings.

Electrical data can be found within the approved submittal drawings or by referencing the wiring diagram and electrical label attached to the fan cover, located inside the return air opening.

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 return air opening.

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 fan cover of each unit. Units are all factory wired requiring only field installation of the main power supply and the thermostat.

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 1/4" 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.

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.

VERIFY FAN INSTALLATION AND OPERATION

Prior to operation of the fan coil, the fan should be checked for proper installation and operation. The fan is located in the return air opening next to the coil 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 to the rear of the cabinet, between 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.

GRILLES and FILTERS

Supply and return grilles 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 grille 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 a 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.

The unit is provided with an aquastat that senses the water temperature in the hydronic system. This aquastat works in conjunction with the thermostat to put the unit in the heating mode when the water in the coil is hot and into the cooling mode when the water is cold.

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.

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, oil burners, 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.

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

HYDRONIC PIPING SYSTEM CHECK

WARNING

The hydronic chilled water / hot water piping 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 chilled and hot water systems must each include an air separator. Water pumps, chillers or boilers and water temperature control systems must be fully operational before the units will operate correctly.

The Whalen Company cannot overemphasize the importance of insuring the chilled / hot water system is clean and fully operational before operation of the units. Almost 100% of installation problems are directly related to 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. After the units are installed, the riser system should be thoroughly leak checked. 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. This is also a good time to check the condensate drain system for leaks and proper drainage.

OPERATIONAL SYSTEMS CHECK

**RECOMMENDED
HOT WATER TEMPERATURE SETTINGS
for**

2-Pipe & 50/50 Riser Heat Exchanger Fan Coil Units

1. Place Thermostat Hi-Off-Low Fan Speed Switch to high position.
2. Set Warmer / Cooler Temperature Dial to Normal.
3. Check to see that fan is operating and air is flowing from the discharge grille. (If not, check main power supply).
4. Move Hi-Off-Low switch to Off, then low position. Check air flow.
5. [2-pipe system:] Depending upon the temperature of water in the hydronic system -- either chilled or warm -- the thermostat will cycle the fan off and on to satisfy the thermostat setting. If system is in cooling mode (chilled water in risers), set fan on low position and turn thermostat dial fully towards cooling position. Then move dial slowly to warmer position. Fan should shut off when thermostat setting reaches room temperature. During heating season reverse the procedure.

[50/50 4-pipe unit:] Depending upon temperature of water in the system, which may be two pipes for cooling and two pipes for heating, or four pipes for cooling or heating, the thermostat will cycle the fans on and off to satisfy the thermostat setting.

With four pipes for cooling, set fans on low position and turn dial fully toward cooling position. Then move dial slowly towards heating position. Both fans should shut off when thermostat setting reaches room temperature. With four pipes for heating, reverse the procedure.

With two pipes for cooling and two pipes for heating, one fan should run when calling for warmer and the other fan should run when calling for cooling. Both fans should be off when thermostat reaches room temperature setting.

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

OPERATING INSTRUCTIONS

Place: Fan Speed Switch on Low position.

Move: Warmer/Cooler Dial to Normal.

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

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

For a fast build-up of heat or cooling, put Fan Speed Switch on High.

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

Fan Speed Switch must be in Low or High to operate. Unit will not operate in Off position.

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

Outdoor Air Temperature	Water Temperature
0°F	140°F
10°F	130°F
20°F	120°F
30°F	110°F
40°F	100°F
50°F	90°F
60°F	80°F

The Whalen Two-Pipe Riser Heat Exchanger fan coil unit has been designed to provide a steady heating and cooling environment through the use of fan cycling control. Operation of the unit outside these parameters may affect performance.

The unit cycles on and off to maintain the selected setpoint of the thermostat. Water temperatures in excess of the recommended hot water temperature set-point schedule may result in room overheating and/or insufficient unit cycling.

SYSTEM DESIGN

Whalen 2-Pipe Riser Heat Exchanger fan coil unit is designed to operate at low hot water temperatures. To insure proper system control, it is important that auxiliary equipment on the Whalen fan coil hot water loop be capable of operating properly at the recommended hot water temperatures listed above. If a common boiler is utilized, system design should include the ability to provide the recommended water temperatures for each different type of equipment on the project

MAINTENANCE and SERVICE

The Whalen Fan-Coil unit has been designed to be as maintenance-free as possible. All replaceable parts are readily accessible via the access grilles. No special tools are necessary. Recommendation: check filter quarterly and replace as required. For heating/cooling units, also inspect condensate drain pan and drain line prior to and during cooling season, and assure they are clear of 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 fan access cover behind 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 by inserting a flexible plumber's snake into the drain connection at the bottom of the unit or by inserting the plumber's snake into the drain connection from the unit above to free any clogs in the condensate riser.

MAINTENANCE RECOMMENDATIONS

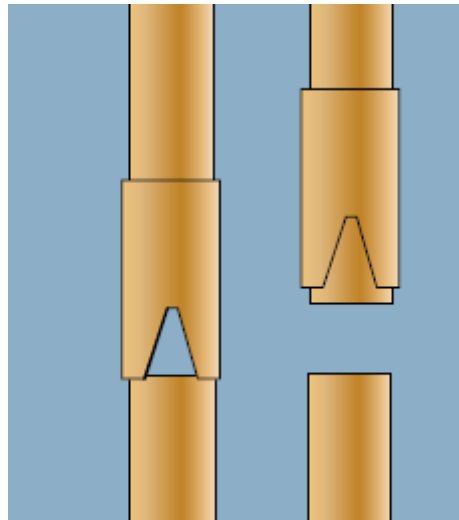
Semi-Annual

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 fan access cover.
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. Vacuum and clean the air coil fin surface accessible through the return air opening. 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.
8. Replace fan access cover. Restore power and replace return air grille with clean filter installed.
9. 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.

The condensate riser is provided with a slip coupling just above the drain pan outlet to facilitate cleaning of the drain. When cleaning the drain line, raise the coupling up about 1" to provide access to the drain line. Clean the drain with a plumber's snake. Push the slip coupling back down to the drain outlet when cleaning is finished to help prevent debris from falling into the drain outlet.



FILTER

The filter can be accessed for changing or cleaning by removing the return air grille. Standard return air grilles contain two screws located on the top and bottom of the grille. Hinged Core Return Air Grilles contain spring clips or thumb tabs located on the top corners of the grille. Removable Core Return Air Grilles contain spring clips or thumb tabs located on the top and bottom corners of the grille.

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.

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 unit and installation in question.

2-Pipe Fan Control heating/cooling units 2-Pipe Fan Control 50/50 heating/cooling units

Most problems can be promptly diagnosed at the thermostat without the necessity of removing grilles or registers. The fan motor and blower are accessible and removable through the return air opening, after removal of the return grille and fan access cover. 2-Pipe heating/cooling units are equipped with the standard 4-wire automatic changeover thermostat and a changeover aquastat mounted on the riser coil that is accessed

through the front discharge opening after removal of supply grille.

2 PIPE UNITS
IF FAN MOTOR FAILS TO START
4 WIRE THERMOSTAT
LINE VOLTAGE CONTROLS

1. Check main power supply, circuit breakers and panel box.
2. Set thermostat fan switch in low position. Rotate temperature setpoint dial through full range. Repeat on "HI" fan setting.
3. If fan will not run on either LO or HI, disconnect power at either the building breaker panel or unit disconnect switch.
4. 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.
5. Restore power and use volt-ohm meter to check for correct voltage from L1 through changeover aquastat (BLU *or* YEL wire, relative to temperature of water in risers*).

*Aquastat with blue, yellow and black wire leads closes for Heating at $85^{\circ}\pm 5^{\circ}$ through BLU; and Cooling at $65^{\circ}\pm 5^{\circ}$ through YEL. Aquastat with blue, yellow and white wire leads closes for Heating at $85^{\circ}\pm 5^{\circ}$ through YEL; and Cooling at $65^{\circ}\pm 5^{\circ}$ through BLU.

If no voltage is obtained through either BLU or YEL wires (relative to switch status within above tolerances) and L1 is powered, aquastat is defective and requires replacement.

6. If correct voltage is obtained through BLU *or* YEL unit wire, connect same -- using *jumper* if necessary -- to BRN (HI fan) unit wire. If motor runs at high speed, proceed to check low speed operation: BLU *or* YEL unit wire to RED (LO fan) unit wire.

Should motor run satisfactorily at both speeds and Steps 4 and 5 have been completed, problem is likely with thermostat. See Step 7.

If motor does not run on any speed, check at main junction box for incoming power at circuit breaker. If power is evident, remove power at circuit breaker and remove fan housing cover. Inspect fan, check for freedom of rotation within fan scroll. If fan is rubbing against side plate, loosen the set screw on the fan hub that tightens the fan to the motor shaft and move the fan slightly to a position that is free from rubbing. Re-tighten the fan set screw on the flat of motor shaft. Re-energize system and repeat motor test.

If motor fails to run on either HI or LO speed, it is defective and requires replacement. Should a PSC type fan motor fail to run on *both* speeds or hums on HI, first check capacitor and connecting wires for burn-out or burned/discholoring wiring or shielding. If found, replace capacitor and retest motor. If capacitor is OK, replace motor.

7. If thermostat is suspected of being defective, disconnect from unit and use Volt-ohm meter or test light to check for continuity through HI-Off-LO switch and Heat/Cool contacts. Set thermostat to *Coolst* and with fan switch set to HI, check for continuity through Brown and Yellow leads. Rotate dial towards "Warmer." Circuit should break when bimetal contact reaches ambient room temperature. If circuit is good, set switch to LO and check through Red lead. (With switch set to OFF, there should be no continuity). If this test is satisfactory, proceed to check in Heating mode: Set dial to *Warmest* and test HI-LO-Off functions through Blue lead; rotate dial towards "Cooler."

Should continuity or switching functions be impaired [or thermostat fails to satisfy at Warmer/Cooler settings], install replacement thermostat and check for proper operation.

50/50 UNITS

The Whalen 50/50 units employ two motors, two aquastats, two or four SPST relays, and are provided with 9 wire thermostats or 6 wire thermostats.

50/50 UNITS
IF FAN MOTORS FAIL TO START
9 WIRE THERMOSTATS
LINE VOLTAGE CONTROLS

For units where control wiring from the thermostat junction box consists of nine wires (normally terminated in a polarized plug), follow these steps to troubleshoot the fan motors:

1. Check main power supply, circuit breakers and panel box.
2. Set thermostat fan switch in LO position. Rotate temperature setpoint dial through full range. Repeat on "HI" fan setting.
3. If fans will not run on either LO or HI, disconnect power at either the building breaker panel or unit disconnect switch.
4. 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.
5. Restore power and use volt-ohm meter to check for correct voltage from L1 through changeover aquastats (BLU *or* YEL wire, relative to temperature of water in risers*).

*Aquastat with blue, yellow and black wire leads closes for Heating at $85^{\circ}\pm 5^{\circ}$ through BLU; and Cooling at $65^{\circ}\pm 5^{\circ}$ through YEL. Aquastat with blue, yellow and white wire leads closes for Heating at $85^{\circ}\pm 5^{\circ}$ through YEL; and Cooling at $65^{\circ}\pm 5^{\circ}$ through BLU.

If no voltage is obtained through either BLU or YEL wires (relative to switch status within above tolerances) and L1 is powered, aquastat is defective and requires replacement.

6. The 50/50 unit has two fans and motors. BRN and RED wires connect to left side fan motor's Hi and Lo speeds respectively. PUR and TAN connect to right side fan motor's Hi and Lo respectively.

YEL wire links both aquastats to thermostat's Call for Heating. LT. BLU links aquastats to thermostat's call for Cooling.

The aquastats sense the water temperature in the risers and allow the cooling function only when there is cold water in the risers and allow the heating function only when there is hot water in the risers by energizing relays R1 and R2.

Dark BLU wire links BLK [L1] via left side fan relay [R1] to power left motor, and ORG links BLK [L1] via right side fan relay [R2] to power right motor.

Connection of BLK to BRN and PUR unit control wiring should energize both left and right motors to run at high speed -- *provided both aquastats and fan relays are functioning properly.*

Connection of BLK to RED and TAN should power both fans to run at low speed -- *provided both aquastats and fan relays are functioning properly.*

7. Should motors run satisfactorily at all speeds and Steps 4 and 5 have been completed, problem is likely with thermostat. See Step 9.

If neither motor runs on HI or LO speed, check at main junction box for incoming power at circuit breaker. If power is evident, remove power at circuit breaker and remove fan housing covers. Inspect both fans, check for freedom of rotation within fan scrolls. If fan is rubbing against side plate, loosen the set screw on the fan hub that tightens the fan to the motor shaft and move the fan slightly to a position that is free from rubbing. Re-tighten the fan set screw on the flat of motor shaft. Re-energize system and repeat motor test.

8. Should either motor fail to run normally, it is recommended that the components be isolated and checked individually. See Steps a thru c below and consult unit wiring diagram.
 - a) Disconnect power at breaker or switch and open respective left or right power supply junction box, located inside return air opening. Remove BLK (or BLU) and RED motor leads from their terminal connections, but leave WHT (common) connection intact. Check power supply for correct voltage, then connect L1 to BLK (or BLU) motor lead. If motor runs at normal high speed, proceed to check low speed operation by connecting BLK to RED motor lead.
 - b) Aquastats may be tested as in Step 5 for 2-Pipe units, *but remember* aquastats' switching logic for 50/50 units: YEL+WHT = heating and BLU+WHT = cooling or YEL+BLK = cooling and BLU+BLK = heating.
 - c) Fan cycle relays R1 and R2 should energize and respective Normally Open contacts should close (verify continuity with volt-ohm meter). If any relay fails to energize or close contacts when energized, replace relay.
9. If motor fails to run on either HI or LO speeds, it is

defective and requires replacement. Should a PSC type fan motor fail to run on *all speeds* or hums on HI, first check capacitor and connecting wires for burn-out or burned/discholoring wiring or shielding. If found, replace capacitor and retest motor. If capacitor is OK, replace motor.

10. If thermostat is suspected of being defective, disconnect from unit and use Volt-ohm meter or test light to check for continuity through HI-Off-LO switch and Heat/Cool contacts. Set thermostat to *Cooler* and with fan switch set to HI, check for continuity through Brown and Yellow leads. Rotate dial towards "Warmer." Circuit should break when bimetal contact reaches ambient room temperature. If circuit is good, set switch to LO and check through Red lead. (With switch set to OFF, there should be no continuity). If this test is satisfactory, proceed to check in Heating mode: Set dial to *Warmest* and test HI-LO-Off functions through Blue lead; rotate dial towards "Cooler."

Should continuity or switching functions be impaired [or thermostat fails to satisfy at Warmer/Cooler settings], install replacement thermostat and check for proper operation.

50/50 UNITS IF FAN MOTORS FAIL TO START

6 WIRE THERMOSTATS 24 VOLT CONTROLS

For units where control wiring from the thermostat junction box consists of six wires (normally terminated in a polarized plug) and the unit has 24 Volt controls, follow these steps to troubleshoot the fan motors:

1. Check main power supply, circuit breakers and panel box.
2. Set thermostat fan switch in LO position. Rotate temperature setpoint dial through full range. Repeat on "HI" fan setting.
3. If fans 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 black wire connecting transformer to thermostat.
4. 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.
5. Restore power and use volt-ohm meter to check for correct voltage from L1 through changeover aquastats (BLU or YEL wire, relative to temperature of water in risers*).

*Aquastat with blue, yellow and black wire leads closes for Heating at $85^{\circ}\pm 5^{\circ}$ through BLU; and Cooling at $65^{\circ}\pm 5^{\circ}$ through YEL. Aquastat with blue, yellow and white wire leads closes for Heating at $85^{\circ}\pm 5^{\circ}$ through YEL; and Cooling at $65^{\circ}\pm 5^{\circ}$ through BLU.

If no voltage is obtained through either BLU or YEL wires (relative to switch status within above tolerances) and L1 is powered, aquastat is defective and requires replacement.

6. The 50/50 unit has two fans and motors. The BRN and RED wires connect to both fan motor's Hi and Lo speeds through relays FR1 and FR2.

YEL wire links both aquastats to thermostat's call for heating. BLU wire links both aquastats to thermostat's call for cooling.

The aquastats sense the water temperature in the risers and allow the cooling function only when there is cold water in the risers and allow the heating function only when there is hot water in the risers by energizing relays R1 and R2.

The left side fan starts when relay R1 is energized. The right side fan starts when R2 is energized.

Connection of BLK to BRN unit control wiring should energize both left and right motors to run at high speed -- *provided both aquastats and fan relays are functioning properly.*

Connection of BLK to RED should power both fans to run at low speed -- *provided both aquastats and fan relays are functioning properly.*

Should either motor fail to run normally, it is recommended that the components be checked for proper operation.

See Steps a thru c below and consult unit wiring diagram.

- a) Connect the BLK wire to YEL & BLU wires. Fan cycle relays R1 and R2 should energize and respective Normally Open contacts should close (verify continuity with volt-ohm meter). Connect BLK to BRN wire. Fan speed control relay FR1 should energize and Normally Open contact should close (verify continuity with volt-ohm meter). Connect BLK to RED wire. Fan speed control relay FR2 should energize and Normally Open contact should close (verify continuity with volt-ohm meter). If any relay fails to energize or close contacts when energized, replace relay.
 - b) Aquastats may be tested as in Step 5 for 2-Pipe units, *but remember aquastats' switching logic for 50/50 units: YEL+WHT = heating; BLU+WHT = cooling or YEL+BLK = cooling and BLU+BLK = heating.*
 - c) Connect the BLK wire to YEL & BLU and BRN wires. Both fan motors should run on high speed. Connect the BLK wire to YEL & BLU and RED wires. Both fan motors should run on low speed.
7. If a motor fails to run on either HI or LO speeds, it is defective and requires replacement. Should a PSC type fan motor fail to run on *all speeds* or hums on HI, first check

capacitor and connecting wires for burn-out or burned/discolored wiring or shielding. If found, replace capacitor and retest motor. If capacitor is OK, replace motor.

8. If thermostat is suspected of being defective, disconnect from unit and use Volt-ohm meter or test light to check for continuity through HI-Off-LO switch and Heat/Cool contacts. Set thermostat to *Coolest* and with fan switch set to HI, check for continuity through Brown and Yellow leads. Rotate dial towards "Warmer." Circuit should break when bimetal contact reaches ambient room temperature. If circuit is good, set switch to LO and check through Red lead. (With switch set to OFF, there should be no continuity). If this test is satisfactory, proceed to check in Heating mode: Set dial to *Warmest* and test HI-LO-Off functions through Blue lead; rotate dial towards "Cooler."

Should continuity or switching functions be impaired [or thermostat fails to satisfy at Warmer/Cooler settings], install replacement thermostat and check for proper operation.

50/50 UNITS IF FAN MOTORS FAIL TO START 6 WIRE THERMOSTATS LINE VOLTAGE CONTROLS

For units where control wiring from the thermostat junction box consists of six wires (normally terminated in a polarized plug) and the unit has line voltage controls, follow these steps to troubleshoot the fan motors:

1. Check main power supply, circuit breakers and panel box.
2. Set thermostat fan switch in LO position. Rotate temperature setpoint dial through full range. Repeat on "HI" fan setting.
3. If fans will not run on either LO or HI, disconnect power at either the building breaker panel or unit disconnect switch.
4. 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.
5. Restore power and use volt-ohm meter to check for correct voltage from L1 through changeover aquastats (BLU or YEL wire, relative to temperature of water in risers*).

*Aquastat with blue, yellow and black wire leads closes for Heating at $85^{\circ}\pm 5^{\circ}$ through BLU; and Cooling at $65^{\circ}\pm 5^{\circ}$ through YEL. Aquastat with blue, yellow and white wire leads closes for Heating at $85^{\circ}\pm 5^{\circ}$ through YEL; and Cooling at $65^{\circ}\pm 5^{\circ}$ through BLU.

If no voltage is obtained through either BLU or YEL wires (relative to switch status within above tolerances) and L1 is powered, aquastat is defective and requires replacement.

6. The 50/50 unit has two fans and motors. The BRN and

RED wires connect to both fan motor's Hi and Lo speeds respectively.

YEL wire links both aquastats to thermostat's call for heating. BLU wire links both aquastats to thermostat's call for cooling.

The aquastats sense the water temperature in the risers and allow the cooling function only when there is cold water in the risers and allow the heating function only when there is hot water in the risers by energizing relays R1 and R2.

The left side fan starts when relay R1 is energized. The right side fan starts when R2 is energized.

Connection of BLK to BRN unit control wiring should energize both left and right motors to run at high speed -- *provided both aquastats and fan relays are functioning properly.*

Connection of BLK to RED should power both fans to run at low speed -- *provided both aquastats and fan relays are functioning properly.*

Should motors run satisfactorily at all speeds and Steps 4 and 5 have been completed, problem is likely with thermostat. See Step 9.

7. If neither motor runs on HI or LO speed, check at main junction box for incoming power at circuit breaker. If power is evident, remove power at circuit breaker and remove fan housing covers. Inspect both fans, check for freedom of rotation within fan scrolls. If fan is rubbing against side plate, loosen the set screw on the fan hub that tightens the fan to the motor shaft and move the fan slightly to a position that is free from rubbing. Re-tighten the fan set screw on the flat of motor shaft. Re-energize system and repeat motor test.
8. Should either motor fail to run normally, it is recommended that the components be isolated and checked individually. See Steps a thru c below and consult unit wiring diagram.
 - a) Disconnect power at breaker or switch and open respective left or right power supply junction box, located inside return air opening. Remove BLK (or BLU) and RED motor leads from their terminal connections, but leave WHT (common) connection intact. Check power supply for correct voltage, then connect L1 to BLK (or BLU) motor lead. If motor runs at HI high speed, proceed to check low speed operation by connecting BLK to RED motor lead.
 - b) Aquastats may be tested as in Step 5 for 2-Pipe units, but remember aquastats' switching logic for 50/50 units:
YEL+WHT = heating and BLU+WHT = cooling or
YEL+BLK = cooling and BLU+BLK = heating.
 - c) Connect the BLK wire to YEL & BLU wires. Fan cycle relays R1 and R2 should energize and respective Normally Open contacts should close (verify continuity with volt-ohm meter). If any relay fails to energize or close contacts when energized, replace relay.
9. If motor fails to run on either HI or LO speeds, it is defective and requires replacement. Should a PSC type fan motor fail to run on all speeds or hums on HI, first check

capacitor and connecting wires for burn-out or burned/discolored wiring or shielding. If found, replace capacitor and retest motor. If capacitor is OK, replace motor.

10. If thermostat is suspected of being defective, disconnect from unit and use Volt-ohm meter or test light to check for continuity through HI-Off-LO switch and Heat/Cool contacts. Set thermostat to Coolest and with fan switch set to HI, check for continuity through Brown and Yellow leads. Rotate dial towards "Warmer." Circuit should break when bimetal contact reaches ambient room temperature. If circuit is good, set switch to LO and check through Red lead. (With switch set to OFF, there should be no continuity). If this test is satisfactory, proceed to check in Heating mode: Set dial to Warmest and test HI-LO-Off functions through Blue lead; rotate dial towards "Cooler."

Should continuity or switching functions be impaired [or thermostat fails to satisfy at Warmer/Cooler settings], install replacement thermostat and check for proper operation.