The Whalen Company

P.O. Box 1390 ▪ Easton, Maryland 21601 ▪ Tel. 410.822.9200 ▪ Fax 410.822.8926 ▪ www.whalencompany.com

INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR 2-PIPE, 2-PIPE ELECTRIC HEAT AND 4-PIPE HEATING/COOLING VALVE CONTROL FAN-COIL UNITS

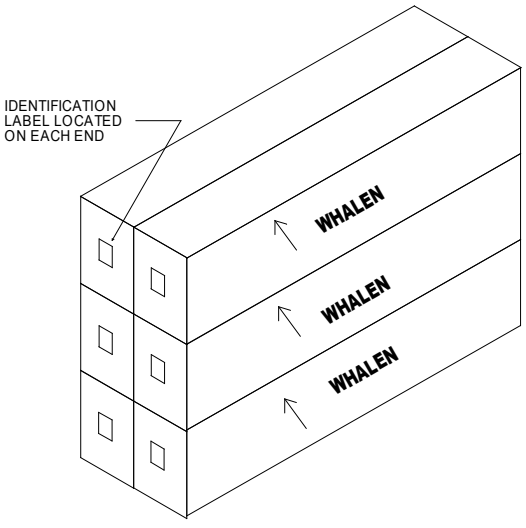
Models WFx-300-2P–WFx-1200-2P, WFx-300-2E–WFx-1200-2E, WFx-300-4P – WFx-1200-4P
Models WRx-300-2P–WRx-1200-2P, WRx-300-2E–WRx-1200-2E, WRx-300-4P – WRx-1200-4P

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 #	:	WFC-400-ET
FLOOR	:	12
RISER #	:	21B
HAND		RH
SUP	:	1 1/2
RET	:	1 1/4
DISCH	:	12 X 12 F

Typical label information includes job number, unit model, riser number, floor, 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 WFx and WRx units consist of an outer casing, chilled and/or hot water coils, water and condensate risers, control panel, fan and motor. (Thermostats, grilles, and filters are normally shipped separately, subsequent to the units).

Cabinets are available with two drain pan configurations:

1) The standard Whalen drain pan and internal condensate risers (the drain pan is the bottom of the cabinet). In this configuration the condensate drains from the pan through a hole located below the condensate riser.
2) The optional "P-Trap" drain pan and external condensate risers. In this configuration, the unit includes a separate internal drain pan and a rubber "P-Trap" drain line that connects to the condensate riser. The condensate drains from the pan through a hole in the center of the drain pan into the "P-trap" which is located below the pan and then drains to the condensate riser.

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

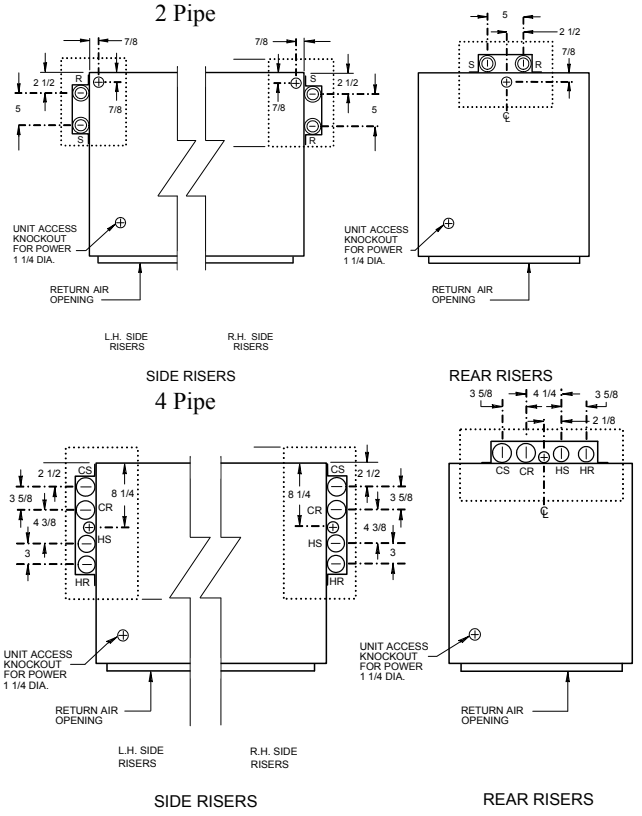
IMPORTANT: THE RISERS ARE NOT HANDLES! DO NOT SUPPORT OR LIFT THE UNIT BY THE PIPE EXTENSIONS.

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

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

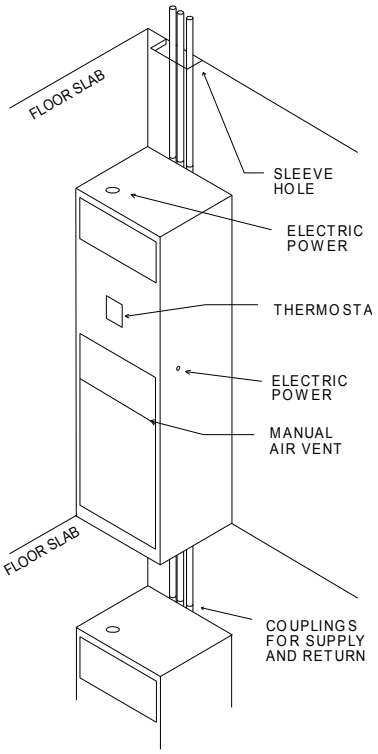
INSTALLATION

It is recommended that the installation of the 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 risers are anchored to the cabinet in two places with copper straps 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 and 4 Pipe units are as shown below (reference the project submittal drawings for the actual dimensions of your project).



Supply and return riser piping should extend 2" out the top of the casing. 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 or cut pipe connections on the unit below. Allow a minimum of 1" insertion depth into the swaged connection. If swaged connections are not provided, measure the risers allowing for couplings or reducing couplings, as required. The condensate line on the top of the unit below has a swedged portion permitting direct insertion of the unit condensate line into the unit below. When cutting the condensate line, it should be cut longer than the risers.

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



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 ¾" rigid insulation board in cases where area

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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.

Each unit is provided with an air vent at the coil connection. This vent is accessed through the front supply grille and unit access panel. During testing and start-up, all units must be vented to dislodge trapped air within the risers.

Units at the bottom of *downfeed* risers are provided with a manual drain and vent on the riser stub-out inside the cabinet. This vent is accessed through the front supply grille and unit access panel.

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 (used on 2-Pipe units and 2-Pipe auxiliary electric heat units) are accessible through the return air opening and unit access panel.

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 ¼" into the unit. (For 1/2" wallboard the maximum screw length is 3/4"). Areas of the cabinet where screws might damage wiring, piping or coils are clearly marked. 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.

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.

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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.

2-Pipe and 2-Pipe auxiliary electric heat units are provided with aquastats that sense the water temperature in the hydronic system. These aquastats 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.

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 with unit cabinet water valves closed. All risers, supply and return, should be supplied with blow down valves at the bottom, and the risers are to be flushed clean of all debris before individual unit ball valves are opened.

After the water system has been cleaned, the chilled water and hot water coils must be filled and vented. This is also a good time to check the condensate drain system when opening the supply and return ball valves on each coil. To purge the coils and vent trapped air pockets, open the supply riser ball valve and open the air vent located on the coil leaving water connection at the top of the coil. Vent this line until a steady stream of water is achieved. When vented, close the air vent and then open the return riser ball valve. On units provided with electric shut-off valves, manually open the electric shut-off valve while venting the coil. When venting is completed, release manual override of electric shut-off valve. Vent chilled water and hot water coils.

OPERATIONAL SYSTEMS CHECK

1. Place Thermostat Hi-Off-Low Fan Speed Switch to High position.

2. Set Warmer / Cooler Temperature Dial or electronic setting to 75^0F and set Thermostat Auto-On Switch (if provided) to On.

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 to Low position. Check air flow.

5a. (2-pipe units) - Depending upon the thermostat set-point, the thermostat will open or close the electric

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water control valve to satisfy the thermostat setting while the fan runs continuously. When running in cooling (chilled water less than 60^0F in the risers) the control valve opens and the chilled water flows through the coil and the air gets cooled. When the room temperature is cooled to the thermostat set-point, the electric control valve will close, stopping the chilled water flow through the coil so no cooling is performed.

When running in heating (hot water at least 90^0F in the risers) the control valve opens and the hot water flows through the coil and the air gets heated. When the room temperature is heated to the thermostat set-point, the electric control valve will close, stopping the hot water flow through the coil so no heating is performed.

When the Thermostat Auto-On switch is set to the Auto position, the fan will turn off and the control valve will close when the room temperature reaches the thermostat setting. With the system in the cooling mode, set fan on LO position, turn the thermostat dial to 60^0F and allow the unit to run for two minutes. Then move thermostat set-point slowly to warmer position until it reaches the room temperature. The fan will stop and the control valve will close.

With the system in the heating mode, set fan on LO position and turn thermostat dial to 85^0F and allow the unit to run for two minutes. Then move thermostat set-point slowly to cooler position until it reaches the room temperature. The fan will stop and the control valve will close.

5b (2-Pipe Auxiliary Electric Heat Units) - Follow the procedure outlined for the 2-pipe unit to insure proper control valve operation. With the unit in the heating mode (the thermostat dial is turned to 85^0F) and the water temperature in the risers is below 70^0F the control valve will close stopping water flow to the coil and the electric coil relay located in the heater control box will energize, turning on the heat strip located in the air stream (accessible through the return air opening).

When the water temperature increases above 115^0F in the risers, the electric heat will be de-energized, the control valve will open and the water will flow through the coil and the air will get heated.

5c (Total Electric Heat Units) - Follow the procedure outlined in 5b for the Auxiliary Electric Heat Unit. Turn the thermostat dial to 85^0F to place the unit in the heating mode. The control valve will close to stop the water flow and the electric heat is energized and the air is heated.

5d 4 Pipe Units – The 4 Pipe unit is provided with a hot water heating coil and a chilled water cooling coil, each with a control valve and the fan runs continuously. When running in cooling the chilled water coil control valve opens and the chilled water flows through the coil and the air gets cooled. When the room temperature is cooled to the thermostat set-point, the electric control valve will close, stopping the chilled water flow through the coil so no cooling is performed.

When running in heating the hot water coil control valve opens and the hot water flows through the coil and the air gets heated. When the room temperature is heated to the thermostat set-point, the electric control valve will close, stopping the hot water flow through the coil so no heating is performed.

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: Hi-Off-Low Switch in 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 Hi-Low switch in High.

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

Hi-Off-Low switch must be in Low or High to operate. Unit will not work in Off position.
Doors and windows should be closed when system is on to prevent excess humidity in the room.

MAINTENANCE and SERVICE

The Whalen 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. It is recommended that filters be checked quarterly and replaced 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 with a flexible plumber's snake from the unit or from the top or bottom of the riser.

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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. Check operation of the electric control valve.
7. Inspect drain pan, clean if necessary. Check condensate drain line to insure it is open and clear.
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.

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

2-Pipe Valve Control heating/cooling units
2-Pipe Valve Control heating/cooling units Auxiliary Heat
2-Pipe Valve Control heating/cooling units Total Electric
4-Pipe Valve Control 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 equipped with a two speed fan motor will be provided with a 5 or 6-wire automatic changeover thermostat (the 6th wire is a neutral). Units with optional three speed fan motors will be provided with a 6 or 7 wire automatic changeover thermostat (the 7th wire is a neutral). The 2 Pipe units are equipped with a changeover aquastat mounted on the riser that is accessed through the front return air opening after removal of supply grille and fan access panel. 2 Pipe units with Auxiliary Heat are provided with two changeover aquastats. 2 Pipe Total Electric and 4-Pipe units are not equipped with aquastats.

The thermostats may be line voltage or low voltage if the units are provided with 24 Volt controls.

IF FAN MOTOR FAILS TO START
LINE VOLTAGE CONTROLS

1. Check main power supply, circuit breakers and panel box are ON and confirm unit has power.
2. Set thermostat fan switch in LO position and the system switch to ON. 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 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°±5° through BLU; and Cooling at 65°±5° through YEL. Aquastat with blue, yellow and white wire leads closes for Heating at 85°±5° through YEL; and Cooling at 65°±5° 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 L1 unit wire, connect same -- using *jumper* if necessary -- to BRN (HI fan) unit wire. If motor runs at high speed, check low speed operation by connecting L1 unit wire to RED (LO fan) unit

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wire. For three speed motor applications, connect the L1 wire to the ORANGE (MED fan) for medium speed check. Should motor run satisfactorily at all 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, MED 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 for burned/discolored wiring or shield. 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 *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.

IF FAN MOTOR FAILS TO START
24 VOLT CONTROLS

1. Check main power supply, circuit breakers and panel box are ON and confirm unit has power.

2. Set thermostat fan switch in LO position and the system switch to ON. 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 strip 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°±5° through BLU; and Cooling at 65°±5° through YEL. Aquastat with blue, yellow and white wire leads closes for Heating at 85°±5° through YEL; and Cooling at 65°±5° 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 24 volts is obtained through power wire from the unit to the thermostat (typically BLACK wire), connect this wire to BRN (HI fan) unit wire. Fan relay R1 should energize and Normally Open contact should close (verify continuity with volt-ohm meter). If motor runs at high speed, proceed to check low speed operation by connecting the 24 volt power wire to the RED (LO fan) unit wire. Fan relay R2 (if unit has 3 speed fan, low speed relay is R3) should energize and Normally Open contact should close (verify continuity with volt-ohm meter).

   For three speed motor applications, connect the 24 volt power wire to the ORANGE (MED fan) for medium speed check. Fan relay R2 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.

   Should motor run satisfactorily at all 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, MED 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 for burned/discolored wiring or shield. 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 *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

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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 fail to satisfy at Warmer/Cooler settings], install replacement thermostat and check for proper operation.

SEQUENCE OF OPERATION

On 2 Pipe Heating/Cooling Units the control valve is activated by the Cool and Heat outputs from the thermostat which are connected to an aquastat.

On a call for cooling from the thermostat and the water temperature is less than 65^0F, the aquastat energizes the control valve, allowing the chilled water to flow through the coil, cooling the air. If the water temperature rises above 85^0F, the aquastat de-energizes the control valve and the air passes through the coil without getting cooled.

On a call for heating from the thermostat and the water temperature is greater than 85^0F, the aquastat energizes the control valve, allowing the hot water to flow through, heating the air. If the water temperature falls below 65^0F, the aquastat de-energizes the control valve and the air passes through the coil without getting heated.

This aquastat has blue, yellow and white wire leads. The switch closes for Heating at 85°±5° through YEL to WHI; and Cooling at 65°±5° through BLU to WHI.

On 2 Pipe Heating/Cooling Auxiliary Electric Units the control valve and the electric heat relay are activated by the Cool and Heat outputs from the thermostat which are connected to two aquastats labeled K1 and K2 in the wiring diagrams.

On a call for cooling from the thermostat and the water temperature is less than 65^0F, the K2 aquastat energizes the control valve and chilled water flows through the cooling coil and the air is cooled. If the water temperature rises above 85^0F, the aquastat de-energizes the control valve, stopping the chilled water flow to the coil.

On a call for heating from the thermostat and the water temperature is greater than 100^0F, the K1 aquastat energizes the control valve and hot water flows through the coil and the air is heated. If the water temperature falls below 75^0F, the aquastat de-energizes the control valve, stopping the water flow through the coil, and energizes the electric heat relay. The air is heated by the electric heat.

The K1 aquastats has blue, yellow and orange wire leads. The switch closes for Heating at 100°±5° through YEL to ORG; and Cooling at 75°±5° through YEL to BLU. The K2 aquastat has two red wire leads. The switch closes for Heating at 85°±5° and Cooling at 65°±5°.

On 2 Pipe Heating/Cooling Total Electric Units the control valve and the electric heat relay are activated by the Cool and Heat outputs from the thermostat. No aquastats are used.

On a call for cooling from the thermostat, the thermostat cool output energizes the control valve, allowing the chilled water to pass through the coil and cool the air. When the thermostat is satisfied, the control valve is de-energized and the chilled water stops flowing through the coil.

On a call for heating from the thermostat, the thermostat heat output energizes the electric heat relay and the air is heated by the electric heat. The control valve remains closed and no chilled water flows to the water coil.

On 4 Pipe Heating/Cooling Units the chilled water control valve and the hot water control valve are activated by the Cool and Heat outputs from the thermostat. No aquastats are used.

On a call for cooling from the thermostat, the thermostat cool output energizes the chilled water control valve, allowing the chilled water to pass through the coil and cool the air. When the thermostat is satisfied, the chilled water control valve is de-energized and the chilled water stops flowing through the coil.

On a call for heating from the thermostat, the thermostat heat output energizes the hot water control valve, allowing the hot water to pass through the hot water coil and heat the air. When the thermostat is satisfied, the hot water control valve is de-energized and the hot water stops flowing through the coil.

IF CONTROL VALVE FAILS TO OPERATE

If the control valve fails to operate, the air will not be heated or cooled as described above. Verify that the aquastats are functioning properly by placing the unit in cooling or heating (depending on the water temperature in the risers) and check for power at the control valve actuator (Line voltage if unit has line voltage controls or 24 volts if unit has 24 volt controls) using a Volt Ohm Meter (VOM). If voltage is present, aquastat is working and valve actuator does not actuate, replace the actuator. If no voltage is present, check the output from the thermostat and verify that correct voltage is present and that thermostat is working correctly. If the thermostat is ok, replace the aquastat.

IF ELECTRIC HEAT COIL FAILS TO OPERATE

The electric heat coil module consists of one or two control boxes in which a relay (operated by the unit control circuit and thermostat), a high temperature automatic limit control, a thermal cut off directly attached to the Ni-Chrome heating element and the heating coil element are all mounted. Both the thermal cut off and the high temperature limit control are in the heating coil power wiring circuit. The temperature limit control sensing element protrudes through the control box directly above the heating coil to sense over-heating of the coil for any reason, including fan failure. This is an automatic reset type device and will reset when the temperature drops below the pre-set limit. The thermal cut off is located below one of the coil terminals directly attached to the coil element. Both safety devices can be replaced easily in the field if continuity tests reveal an open circuit at room temperature. The thermal cut off can be replaced by loosening the nut and bolt terminals on the coil and control box and installing a replacement. The electric heaters are located above the unit supply fan and are accessible through the return air opening of the unit, behind the return grille.
To determine if the coil is broken or damaged, perform a continuity check. Care should be exercised in coil replacement to ensure the Ni-Chrome element is not stretched excessively and is not touching the side or bottom of the plenum.

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