Installation Manual *for*

VertiCool Aurora

AIR CONDITIONING UNITS

3 Ton – 35 Ton

Air-Cooled • Water-Cooled • Heat Pump

UNITED COOLAIR

CORPORATION

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GENERAL INFORMATION

INSPECTION OF EQUIPMENT

Upon receipt of the unit, inspect for visible or concealed damage. Report any damage to the carrier, and file a damage claim.

LOCATION

The VertiCool Aurora has been designed to be installed as a single package floor mounted unit.

Before the unit is installed, a thorough study should be made of the structure and proposed installation location. Careful consideration must be given to location of wiring, condensate disposal, ductwork and accessibility for maintenance or service. It is necessary that a minimum clearance of 36" be allowed on the front of the cabinet. Some air path configurations will also require side access to the evaporator section. Sufficient clearance must be provided to slide the air filter(s) out, either the left or right side (30" recommended).

Attention must be given to floor loading limitations.

Consideration must be made for condensate removal, either with a trap or condensate pump.

HANDLING

To facilitate handling, the unit is set on a wooden skid so that it may be picked up with a two-wheel hand truck or fork lift. Under no circumstances should the unit or the skid be “walked” on the corners. Use dolly trucks or pipe rollers to move the unit to its proper location.

! Discharge air from the condenser air outlet should be deflected away from the condenser air inlet, to prevent recirculation.

! CAUTION: Unit should not be located in space subject to freezing temperatures.

MOUNTING AND SETTING IN PLACE

The units might be shipped as a single package or they might be shipped split. Units that have been ordered with the optional re-sealable refrigerant fittings can be split in the field to accommodate moving into position. Sections are also bolted together.

When re-assembling the evaporator section to the condensing section, use a sling or other suitable means that is sufficient to hold the weight of the section. Use spreader bars to prevent structural damage to the cabinet during installation.

Make sure that the evaporator section is positioned correctly for the desired air pattern. Care must be taken when lowering the evaporator section that the refrigerant re-sealable fittings are lined up properly and that they are not damaged in this process. Re-install the fasteners if removed prior.

LOUVER AND DUCTING

Carefully choosing the right condensing section intake/exhaust louver(s) and determining the best location for them are critical components to a successful VertiCool installation.

1. Select a louver design that will safely separate the discharge from the intake air stream to ensure that air recirculation will not occur.
2. The intake louver should be designed to minimize and virtually eliminate water penetration at a reasonable face area velocity (fpm).
3. The discharge duct must be as short and straight as possible but of sufficient length to guarantee uniform airflow distribution through the louver for maximum velocity.
4. In most cases, the cross-sectional “free area” of the louver must be equal to or larger than the cross-sectional areas of the intake and/or discharge unit openings to allow for optimum velocity and reasonable pressure drop across the louver.

5. Ducts should be insulated if the unit is installed and operating in cold climates.
6. Adequate access to both the evaporator and condenser coils as well as the louver must be available for cleaning purposes.
7. All louver manufacturer instructions, local codes, and industry accepted guidelines must be followed for all installations.

The intake and discharge louver can be in separate frames or combined in one frame.

The combination intake/discharge louver design offers an advantage over separate louvers because it requires only one wall opening which decreases installation costs. However, the blades cannot be of uniform configuration (i.e. the same blade design and angle). The discharge louver blades should be angled to direct the airflow straight out horizontally from the unit and the intake blades should be angled down at approximately 45°.

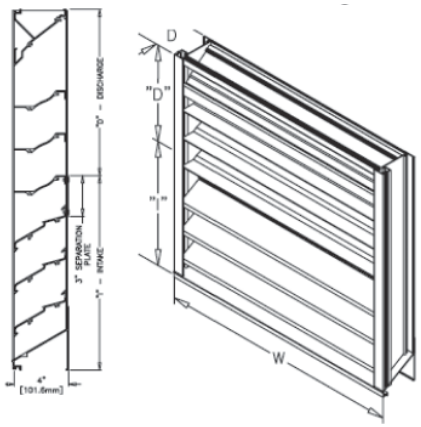


Figure 1: Combination Intake/Discharge

It is critical that the two air streams be directed in different directions so that no recirculation of discharge air is allowed to enter the inlet air stream. In some cases it may be necessary to provide a deflector vane or separator between the two air streams. If recirculation of the discharge air does occur, the unit will likely trip on high head pressure and continue to fail until the louver design is corrected.

Louvers may be manufactured of aluminum (14 gauge) or steel (18 gauge). Louver widths of 30 inches or more should have additional bracing midway along the blades to maintain proper blade separation. If the louvers are to be installed in a coastal application or any location with environmental concerns, then the louvers should be treated.

It is also beneficial to angle the bottom of the intake ductwork up from the louver toward the unit opening to minimize the possibility of water carryover reaching the unit and allow for proper drainage.

Louvers should be inspected and cleaned on a regular basis. A bird screen is required to deter animals and debris from entering the duct system.

GENERAL DUCTWORK RECOMMENDATIONS

All ductwork must be designed in accordance with industry accepted practices. Consult ASHRAE, AMCA or SMACNA guidelines or standards for details. Ducts should be insulated in accordance with ASHRAE Standard 90.1 or per local codes, particularly if the unit will be operated during cold weather. We recommend utilizing a suitable flexible duct connector to minimize or isolate any vibration transmission to the structure. The condensing unit intake duct should include a provision to access the inlet side of the coil for periodic cleaning. It is also best to design for sufficient clearances for servicing the blower motors, expansion valves, filters, and any additional accessories installed.

LENGTH OF CONDENSING SECTION DUCTWORK FOR DISCHARGE AIR

The VertiCool Aurora unit should be located a minimum distance from the louvered wall to maximize efficiency of the blower. Certain conditions and obstructions at the fan inlet and outlet adversely affect fan performance (i.e. elbows, guards, dampers, etc.). “System Effect” is a term used by the industry to describe these adverse conditions. It is best to design the inlet and discharge ductwork to provide minimum sufficient straight length of duct to reduce system effect and allow for uniform air discharge.

The figure below illustrates the discharge air velocity profile at various distances from the centrifugal blower. It is important to determine the 100% Effective Duct Length to ensure uniform air discharge.

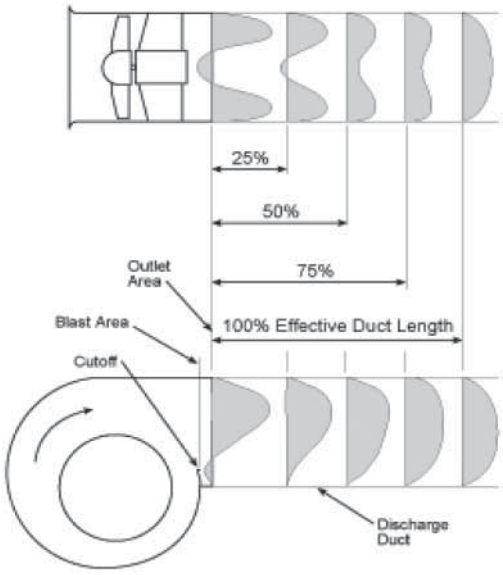


Figure 2: Air Velocity Profile

Based on formulas in ASHRAE Fundamentals – 2009 Duct Design, Chapter 21, the following minimum intake and discharge 100% Effective Duct Lengths (EDL) are recommended:

- 3 thru 6 tons = 3.5 feet
- 8 tons = 4.5 feet
- 10 tons = 5.5 feet
- 12 tons = 5 feet
- 15 tons = 5.5 feet
- 20 tons = 6.5 feet
- 25 thru 30 tons = 8 feet
- 35 tons = 9.5 feet

The VertiCool units are supplied with a standard motor and drive package which provides approximately 0.25" ESP. Upgrades (optional) are available that can raise this capability to 1" ESP. The drive packages have some ability to be adjusted in the field. You must know the overall duct design in order to determine what drive package will be required. Normal startup procedures should be followed including balancing the system following the completed unit installation.

LOCATION, LOCATION, LOCATION

Strategically located intake and discharge louvers help to prevent recirculation of discharge and contaminated air into the intake air stream. Airflow around a building and prevailing wind direction can adversely affect the potential for recirculation and should be factored into louver placement.

In some areas, local codes dictate louver location. Maximize the distance of intake louvers from any exhaust outlet and other contaminants, people, property lines, etc. Avoid placing intakes near idling vehicles.

The bottom of the intake louver should be raised a minimum of 12" from a horizontal surface (roof, sidewalk, etc.) to prevent blockage from debris. If snow accumulations are expected to be greater than 12", raise the bottom of the louver above the average snowfall depth.

If more than one VertiCool unit will be installed in the same area, then the minimum separation of one unit adjacent to another should be 6 feet. A 10 foot separation distance should be maintained where two units are installed one above the other. It is best to direct discharge air up and away from pedestrian walkways as well.

We do not recommend multiple installations between closely situated buildings where discharge air could collect and be directed back to the intake. Again, recirculation will cause the unit to trip on high head pressure.

Avoid locating any inlet louver where vehicles will be idling.

INSTALLATION

The VertiCool Aurora units can be shipped as a single package or as a split package which is assembled in the field.

AIR-COOLED SINGLE PACKAGE

1. Move the unit to the desired installation location.
2. Unit contains a full charge of R-410a refrigerant.
3. Install the unit so that controls and access panels are accessible to the operator and maintenance personnel.
4. Install the condensing section ductwork following the guidelines and industry accepted practices for the condenser air inlet and discharge.
5. Install ductwork on the evaporator as required. If the unit was provided with a discharge plenum having grilles, no ductwork would be required.

CONDENSATE DRAIN CONNECTION

Install a condensate trap or a condensate pump as required. Route the condensate disposal tubing to a suitable location.

Units are equipped with two evaporator drain connections. The 3 through 15-ton units are 1" IPS while the 20 through 35-ton units are 1-1/4" IPS. It is only necessary that one drain connection be utilized. Make sure that the drain connection not being used is plugged.

The drain line must be trapped because the coils are located on the negative side of the blower(s). The purpose of the condensate trap is to neutralize the negative pressure created within the cabinet by the blower.

This negative pressure can vary from less than 1" up to 2" water column. The condensate trap must be of sufficient depth in water column to permit the condensate to flow from the drain pan.

The “A” dimension must equal or exceed the negative static pressure developed by the supply air blower. If it does not, the condensate will not drain properly and may overflow the drain pan. The trap must be at least 2-1/2" deep to maintain a water seal under all operating conditions, especially during blower start-up.

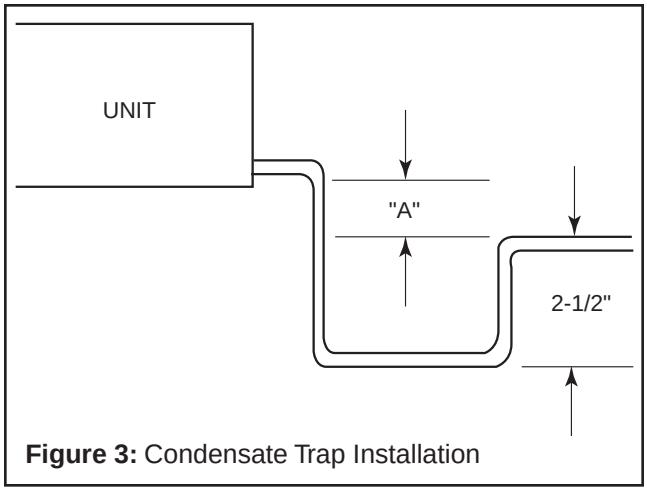


Figure 3: Condensate Trap Installation

ELECTRICAL WIRING

1. Refer to the wiring diagram that was included with the unit.
2. Units are completely internally wired at the factory.
3. All units are provided with terminal blocks.
4. Check the unit data tag for the required voltage, minimum circuit ampacity and maximum fuse size.
5. Route the power wiring through one of the holes provided in the front corner posts.
6. Power wiring must comply with all National and Local codes. The power supply must be suitably fused for wire protection.
7. Use copper conductors only. The unit must be earth grounded using the ground lug provided in the electrical box.

! NOTE: Metal conduit is not an acceptable ground.

8. Specific codes require that each unit must have a field provided method to disconnect main power installed within sight of the unit.

Wire Size[1] AWG. Gauge				
22	20	19	18	16
40	120	150	190	305
Maximum Wire Length[2] Feet				

Notes:
1. Solid, Class II copper wire
2. Based on a voltage drop of 1.2 volts per wire.
3. Total wire length is from unit to room thermostat, and back to unit.

FIGURE 4: Control Wire Sizes

9. Select a location to install the thermostat to avoid vibration, drafts, sun exposure or internal heat sources. Use an inside wall.
10. Route the correct low voltage wire type and size back to the unit and through one of the holes provided in the front corner posts. Connect to the low voltage terminal block per the wiring diagram supplied.

AIR-COOLED UNITS SHIPPED SPLIT OR SPLIT IN THE FIELD UNIT INSTALLATION

1. Move the unit to the desired installation location.
2. Unit contains a full charge of R-410a refrigerant.
3. Install the unit so that controls and access panels are accessible to the operator and maintenance personnel.
4. Install the condensing section ductwork following the guidelines and industry accepted practices for the condenser air inlet and discharge.
5. When re-assembling the evaporator section to the condensing section, use a sling or other suitable means that is sufficient to hold the weight of the section. Use spreader bars to prevent structural damage to the cabinet during installation.
6. Make sure that the evaporator section is positioned correctly for the desired air pattern. Care must be taken when lowering the evaporator section that the refrigerant re-sealable fittings are lined up properly and that they are not damaged in this process. Re-install the fasteners if removed prior.
7. Install ductwork on the evaporator as required. If the unit was provided with a discharge plenum having grilles, no ductwork would be required.
8. Install the condensate trap as outlined above.
9. Wire the unit as outlined above.

PLENUM INSTALLATION

The plenum is typically installed at the factory. However, it may need to be removed to move the unit into position. The plenum is held in position with sheet metal screws.

If the plenum has discharge grilles, the grilles will have to be removed to take the plenum off for re-installation on the evaporator section.

ELECTRIC HEAT

Electric heat is typically located in the return air stream. It is located between the filters and the evaporator coil.

On larger units having 80 kW or more of electric heat, a second power supply is required. Run the second power supply to the connections located with the heater. Follow all National Electrical Codes and Local Codes as required. Make sure to run a ground wire to the supplied lug.

Route the low voltage wiring for the heater control to the low voltage terminal block located with the heater.

AUXILIARY COILS (HOT WATER OR STEAM)

A hot water coil or steam coil when used as heat will be located in the return air stream between the filters and the evaporator coil. Hot water coils may also be located after the evaporator coil. These are typically installed at the factory.

Some units will include Jack Stands to support the auxiliary coil / filter box. If the unit is shipped as a single package the jack stands will be attached. Care should be taken when moving the unit from

the skid to the installation location so as not to tear or loosen the jack stand where it is attached to the cabinet.

If the evaporator section is shipped loose the auxiliary coil section will be attached to the evaporator. The jack stands, if required, will be placed inside the auxiliary coil section. The mounting hardware will be attached to the jack stand flange.

If an optional hot water valve is ordered, this will be shipped loose for installation in the field.

Control wiring will need to be installed from the hot water valve back to the unit control panel. Follow all National Electrical Codes and Local Codes as required.

Any steam valves and other adjunct steam components will be field supplied and installed by others.

Control wiring will need to be installed from the steam valve back to the unit control panel. Follow all National Electrical Codes and Local Codes as required.

A pan is included under any hot water coil or steam coil. A condensate trap will need to be installed for this drain pan. A trap will need to be installed since this line is in a negative air stream. Follow the same procedures for this line as for the unit condensate drain line outlined on page 7.

Pipe the hot water coil or steam coil per industry accepted practices.

WATER SIDE ECONOMIZER (FREE COOLING COIL)

A water side economizer coil will be located in the return air stream between the filters and the evaporator coil. These are typically installed at the factory.

Some units will include Jack Stands to support the water side economizer / filter box. If the unit is shipped as a single package the jack stands will be attached. Care should be taken when moving the unit from the skid to the installation location so as not to tear or loosen the jack stand where it is attached to the cabinet.

If the evaporator section is shipped loose the water side economizer section may or may not be attached to the evaporator. The jack stands, if required, will be placed inside the water side economizer section. The mounting hardware will be attached to the jack stand flange.

If the unit is shipped as a single package, the water piping from the unit to water side economizer coil will be factory installed.

If the water side economizer is shipped as a separate section or if the unit comes with the evaporator and water side economizer as a section, the water piping will be shipped loose for field attachment.

A condensate pan is included under the water side economizer coil. A condensate trap will need to be installed for this drain pan. A trap will need to be installed since this line is in a negative air stream. Follow the same procedures for this line as for the unit condensate drain line on page 7.

AIR SIDE ECONOMIZER

The air side economizer option is installed on the rear of the cabinet.

Some units will include Jack Stands to support the air side economizer / filter box. If the unit is shipped as a single package the jack stands will be attached. Care should be taken when moving the unit from the skid to the installation location so as not to tear or loosen the jack stand where it is attached to the cabinet.

If the evaporator section is shipped loose the air side economizer section may or may not be attached to the evaporator. The jack stands, if required, will be placed inside the air side economizer section. The mounting hardware will be attached to the jack stand flange.

The enthalpy sensors for the return air and the outside air are shipped loose for field mounting.

Follow the instructions with each sensor for the proper location and mounting.

Field supplied low voltage wiring must be installed between the two sensors and the terminal blocks located in the unit control panel. Make sure to use the correct type and wire gauge size.

When ducting to the air side economizer, flexible duct collars should be utilized to avoid any transmission of vibration into the duct work.

CLEARANCE

Clearance of 36" is required on the front side of all units for service and maintenance access.

If a unit has front return, 30" clearance on each side of the unit must be provided for access to the motor and / or refrigerant circuit components, such as the thermostatic expansion valve(s).

Filters can be accessed from either side of the unit. Sufficient space must be provided for removal and replacement of all the filters. This can be from one side only or from both sides.

PRESSURE SWITCHES

High Pressure
This switch shuts the compressor it is connected to down in the event of excessive high pressure in the discharge line. A manual reset is required at the high pressure switch.

Low Pressure
This switch shuts the compressor it is connected to down in the event of excessive low pressure in the suction line.

NOTE: The low pressure switch(es) are connected to lock out relay(s). If a compressor goes off on low pressure, the lock out relay(s) must be reset by switching the thermostat to the "OFF" position and then back to the "COOL" position.

WATER-COOLED UNITS

Water-Cooled Condenser
The condenser is a tube-in-tube, chemically cleanable configuration. The inner tube carries the water and the outer tube the refrigerant.

Water Piping and Connections
Do not reduce the water pipe sizes from the factory connections on the unit. Both the water inlet and outlet of the condensing section should be equipped with field supplied shut off valves. This is needed for shutdown of water supply during long periods of unit shutdown and/or condenser removal, if required.

The condensate drain line should not be connected to the condenser outlet, as flooding will occur.

Provisions should be made for ease of pipe cleaning by using plugged tees at all turns, rather than ordinary elbows.

Hook Up
Each refrigerant circuit requires 3 gallons per minute (GPM) of water per ton of refrigeration. If the unit does not have water regulating valves or head pressure control valves, field supplied balancing valves may be required. For future reference when cleaning is needed, record details on temperatures entering and leaving the heat exchanger and the pressure drop as a new installation during the initial unit start-up. See "Cleaning The Water-Cooled Condenser" on page 14.

Water Connection
Install and connect a fresh water strainer (field supplied) to the water inlet line. Strainer should be readily accessible for periodic cleaning. Shut off valves on both strainer inlet and outlet are recommended to facilitate cleaning.

CAUTION: High inlet water temperature or low water flow rate may result in nuisance tripping of the high pressure switch.

CAUTION: Water-cooled units with a glycol cooling fluid will require a higher GPM / Ton flow rate. Contact the factory for details.

NOTE: Optional Head Pressure Control Valve(s) should be incorporated into the unit circuit(s) if the cooling fluid will be less than 65° F.

WARNING: Water-cooled units are for use with fresh water applications only. Do not use for brackish water or salt water unless appropriate condensers have been installed as an option.

SPLIT SYSTEMS

Evaporator Mounting

In some situations it is necessary to install the system split. The evaporator section may be supplied with the lower section for floor mounting. The evaporator can also be supplied as a stand-alone section.

When being used as a stand-alone evaporator section care must be taken to properly support the section if suspended. It is advisable to provide a full perimeter frame to assure that the sheet metal does not buckle.

Provide field supplied and installed vibration isolation as required.

Care must be taken when mounting the evaporator to assure that adequate service clearance is provided for access to the components. Make sure that the access panels can be removed. Confirm that no items, such as electrical lines/conduit or water piping, are routed in front of removable access panels.

The evaporator section will have a control panel. Dependent upon the system components this control panel may be located internal to the evaporator or externally. Wire high and low voltage to this section as required following National Electrical Codes and Local Codes.

NOTE: Make sure to use the appropriate gauge of low voltage wire based on the total wire length so that no more than a 1.2 volt drop is experienced.

On larger units having 80 kW or more of electric heat, a second power supply is required. Run the second power supply to the connections located with the heater. Follow all National Electrical Codes and Local Codes as required. Make sure to run a ground wire to the supplied lug.

CHILLED WATER SECTIONS

The chilled water section may be supplied with the lower section for floor mounting. The chilled water section can also be supplied as a standalone section.

When being used as a standalone chilled water section, care must be taken to properly support the section if suspended. It is advisable to provide a full perimeter frame to assure that the sheet metal does not buckle.

Provide field supplied and installed vibration isolation as required.

Care must be taken when mounting the chilled water section to assure that adequate service clearance is provided for access to the components. Make sure that the access panels can be removed.

The chilled water section will have a control panel. Dependent upon the system components, this control panel may be located internal to the evaporator or externally. Wire high and low voltage to this section as required following National Electrical Codes and Local Codes.

NOTE: Make sure to use the appropriate gauge of low voltage wire based on the total wire length so that no more than a 1.2 volt drop is experienced.

On larger units having 80 kW or more of electric heat, a second power supply is required. Run the second power supply to the connections located with the heater. Follow all National Electrical Codes and Local Codes as required. Make sure to run a ground wire to the supplied lug.

Install the chilled water valve per industry accepted practices.

MAINTENANCE PROCEDURES

FILTERS

Do NOT run unit without filters.

Throwaway filters are supplied which are pleated extended surface type. Filters should be checked monthly for dirt accumulation and changed when necessary. Replacement filters must be the same type as originally supplied.

NOTE: Unit must be shut off at the disconnect switch before the filters are serviced. Be sure to check that the air flow direction arrows on the filters point in the correct direction of air flow.

CLEANING THE WATER-COOLED CONDENSER

Refer to document "Cleaning a Water-Cooled Condenser (Maintenance Procedure)", which can be found on the web site at www.unitedcoolair.com in the Miscellaneous section of the DOWNLOAD category.

BLOWERS

Disconnect power and lockout service before doing any service or maintenance.

Air-cooled units are provided with adjustable belt drive blower packages for both the evaporator and condensing sections. Check that the blower wheel is tight on the shaft and does not contact the housing. Bearings are permanently sealed, but should be checked periodically for signs of wear. Check for restrictions or foreign material in the air circuit.
The drive may be adjusted for different static pressures. If such an adjustment is made, check that the motor current draw does not exceed the motor nameplate current by more than 10%.

On units with three-phase fan motors, check for proper blower rotation at start-up. If they run backwards, interchange two of the incoming power leads.

BLOWER MOTORS

All blower motors are equipped with thermal overload protectors, either built-in the motor or in the control box.

CAUTION: Open disconnects to unit, as motor will start when automatic thermal overload resets.

BLOWER SPEED ADJUSTMENT

Blower speed may be changed by adjusting the variable diameter sheave provided on the blower drive motor. Sheave may be adjusted by removing the belt and loosening the setscrew located in the hub of the outer flange. With the setscrew loosened, the flange may be turned clockwise to increase blower speed or counter-clockwise to reduce blower speed.

Typically the motor and drive packages have been sized and designed for the specific CFM and external static pressure (ESP) of the application. Before making any changes confirm what the performance was designed for and what the actual performance is.

CAUTION: Setscrew must be positioned directly above the flat section of the threaded sheave shaft before tightening to hold adjustment.

CAUTION: reduction of airflow through excessive external air friction losses, lowered blower speed, operation with dirty filters, or obstructed air flow may result in excessive condensation at air outlets, short cycling, or total unit shutdown due to evaporator coil icing.

NOTE: Verify that the motor current draw does not exceed the motor nameplate current by more than 10%.

BLOWER MOTOR LUBRICATION

Motor manufacturers indicate that motors never need relubrication, but if units run continuously,

it is recommended that they be re-lubricated every 5500 hours for 3600 RPM motors and 10,000 hours for 1800 RPM motors. If unit motors are run in a cyclical manner, lubrication is recommended every 5 years.

If the unit has been inactive or in storage for over a year, relubricate before starting.

Use Polyrex EM, Texaco Polystar, Pennzoil Penn #2 or Chevron SRI #2 lubricant or equivalent in the following quantities: 0.6 cu. in. or 2 teaspoons, approximately 1 1/2 to 2 handle pumps using a standard grease gun. Keep grease clean, and do not mix dissimilar greases.

Clean area around fitting. Remove purge plug (only on larger motors) for greasing, and replace after at least 20 minutes of operation after greasing. For safety, we recommend relubricating while the motor is stopped.

Rotate the motor by hand as the grease is being applied to avoid air pockets. Over greasing, either in quantity or speed of injection, can cause premature bearing failure. Apply the recommended quantity of grease gradually.

! CAUTION: Disconnect power and lockout service before doing any service or maintenance to the unit.

BLOWER BEARING LUBRICATION

Bearings on the smaller units are permanently sealed, but should be checked periodically for signs of wear.

Larger units have pillow block bearings. Bearings will need to be lubricated based on the use of the equipment.

DUTY	GREASE INTERVAL
Low Usage	12 Months
Periodic	6 Months
Continuous	1 – 2 Months

Use a high quality lithium grease for blower pillow block bearings. Wipe off the “Zerk” fitting with a rag before adding grease so as not to introduce dirt into the bearing.

Slowly rotate the shaft while pumping it in. Pump the grease in slowly so as not to blow out the bearing seal. When the grease starts to “seep” out of the bearing you have put in enough new lubricant. Over lubricating can cause a bearing to fail from overheating or it can blow out the seal.

Wipe off the “Zerk” fitting with a rag after adding grease.

BELTS

Drive belts should be examined periodically for wear and for correct tension. Belts that are too tight cause bearing wear while belts that are too loose cause slippage. If the midpoint (midway between the blower and motor shaft) of the belt is pressed inward, there should be about 1/2” to a 1” of deflection when the belt is properly tensioned. Belt tension can be adjusted by means of the adjusting bolt, which requires loosening of a nut to move the motor and change belt position.

REFRIGERANT SYSTEMS

All refrigerant circuits contain a liquid line sight glass. If bubbles appear in the sight glass, the system is either undercharged with refrigerant or there may be a restriction in the liquid line upstream of the sight glass. However, bubbles will appear every now and then in units with the hot gas bypass option. Bubbles will also appear upon compressor start up, but normally clear to pure liquid after a few minutes of operation.

! It should be noted that systems using R-410a refrigerant may not run clear and may have a “washed look”.

The sight glass contains a moisture indicator which changes color when moisture is present in the refrigerant circuit. This indicator is the circular dot in the center of the sight glass. If the color of this

indication is “DRY”, the refrigerant is okay. When the indication is “WET”, an abnormal condition exists, servicing is required.

NOTE: After installation and during equipment start up, the sight glass may indicate a “WET” condition. This occurs during prolonged periods of non-operation and should indicate “DRY” after several hours (up to 12) of operation.

EVAPORATOR AND AIR-COOLED CONDENSER COILS

Check semi-monthly the condition of the face of both the evaporator and condenser coils.

A dirty condenser coil will cause high condensing pressures, resulting in higher power consumption and possibly system shut-down by high-pressure safety control. A dirty evaporator coil will reduce unit capacity and eventually will cause shut-down by the low pressure safety control.

HARD START KIT

A start assist device is utilized on all single-phase units. The purpose of this device is to assist the compressor in starting under low voltage conditions.

A capacitor in conjunction with a Positive Temperature Coefficient (PTC) relay is installed across the run and start windings of the motor. The PTC device utilizes a ceramic element with a predictable thermal response to the introduction of electric current. When the compressor is called upon to start, the start capacitor provides a voltage boost to the start winding of the motor and causes the motor to turn. As the starting current is introduced across the start windings, the PTC element begins to warm. When the PTC device reaches approximately 250°F (corresponding to 0.6-0.8 seconds), the resistance in the element increases and creates an open switch that releases the start winding from the circuit and the motor continues to run. If the compressor does not start before the device heats to 250°F, it will not start until the PTC device cycles through a cool-down period (usually 2-3 minutes). A compressor off-cycle timer is included in the electrical circuit for this purpose.

The time delay relay also helps the refrigerant system pressures to equalize at the end of the run cycle. This helps the compressor during the starting process in that it is not attempting to start against a high discharge pressure.

The installer should verify that this timer is set for 3 or more minutes.

SEQUENCE OF OPERATION

COOLING SEQUENCE OF OPERATION

1. Before starting the unit, make sure electrical power has been turned on for a minimum of 24 hours. This assures that any liquid refrigerant is "driven" out of the crankcase (crankcase heater is optional).
2. For water-cooled units, make sure condenser water is available. Open all shut off valves and make sure all air is purged from the water circuit. Verify that the cooling tower is functioning, if this is the source of condensing water supply. Start circulating the water to the water condenser.
3. The following sequence is based on the unit being controlled by a room thermostat. If another control type is being utilized, reference the instructions for that device.
   a. Raise thermostat setpoint to highest level.
   b. Set System switch to "OFF" position.
   c. Set Fan switch to the "AUTO" position.
   d. Moving the Fan switch to the "ON" position should cause the evaporator blower motor to run. Moving the Fan Switch back to "AUTO" should stop the blower.
   e. Move the System switch to the "COOL" position. Slowly lower the thermostat setting to call for cooling. The evaporator blower should start (assuming the Fan switch is set to "AUTO") and the System No. 1 compressor should start.
   f. On those units with multiple compressors, if the thermostat setpoint continues to be lowered, the second compressor should then start.
   g. Set room thermostat at desired space temperature and the Fan switch to "AUTO" or "ON". The unit will cycle as required to maintain conditions.
4. Chilled water sequence is the same as above, except compressor activation is replaced by the chilled water valve function.
5. Heat pump cooling sequence is the same as above, except the reversing valve will also be activated when the compressor cycle is started.

HEATING SEQUENCE OF OPERATION (OTHER THAN HEAT PUMP)

1. The following sequence is based on the unit being controlled by a room thermostat. If another control type is being utilized, reference the instructions for that device.
   a. Lower thermostat setpoint to the lowest level.
   b. Set System switch to "OFF" position.
   c. Set Fan switch to "AUTO" position.
   d. Moving the Fan switch to the "ON" position should cause the evaporator blower motor to run. Moving the Fan switch back to "AUTO" should stop the blower.
   e. Move the System switch to the "HEAT" position. Slowly raise the thermostat setting to call for heating. The evaporator blower should start (assuming the Fan switch is set to "AUTO") and the electric heating element will be activated.
   f. On those units with a second stage of electric heat, if the thermostat setpoint continues to be raised, the second stage of electric heat should then be activated.

! NOTE: Units with more than one stage of electric heat require a two stage heat thermostat.

   g. Set room thermostat at desired space temperature and set the Fan switch to "AUTO" or "ON". The unit will cycle as required to maintain conditions.

HEAT PUMP HEATING SEQUENCE OF OPERATION

NOTE: Confirm that a heat pump thermostat has been used for this application.

1. Before starting the unit, make sure electrical power has been turned on for a minimum of 24 hours. This assures that any liquid refrigerant is "driven" out of the crankcase (crankcase heater is optional).
2. For water-cooled units, make sure condenser water is available. Open all shut off valves and make sure all air is purged from the water circuit. Verify that cooling tower is functioning, if this is the source of condensing water supply. Start circulating the water to the water condenser.
3. The following sequence is based on the unit being controlled by a room thermostat. If another control type is being utilized, reference the instructions for that device.

a. Lower thermostat setpoint to the lowest level.

b. Set System switch to "OFF" position.

c. Set Fan switch to "AUTO" position.

d. Moving the Fan switch to the "ON" position should cause the evaporator blower motor to run. Moving the Fan switch back to "AUTO" should stop the blower.

e. Move the System switch to the "HEAT" position. Slowly raise the thermostat setting to call for heating. The evaporator blower should start (assumes Fan switch set to "AUTO") and the System No. 1 compressor will start.

f. On those units with multiple compressors, if the thermostat setpoint continues to be raised, the second compressor should then start.

g. Set room thermostat at desired space temperature. Set the Fan switch to "AUTO" or "ON". The unit will cycle as required to maintain conditions.

OPTIONS

CONDENSATE PUMP

If the unit includes the External Condensate Pump option, please refer to Form EXT PUMP IOM (0410) for Installation and Operation.

THERMOSTAT

Standard units (no heating) with one compressor require single stage thermostats, cool only. Units with two require dual stage thermostats, cool only.

When a programmable thermostat is used, three connections must be made from "c". . . ① to the programmable thermostat, ② to a ground and ③ to the 24 volt coil of the evaporator fan motor contactor. See Figure 5.

Heat pump units and units with auxiliary electric heat (either integral in unit or in duct) require single stage, cool/heat heat pump thermostats if units have only one compressor. Units with two compressors require dual stage heat pump thermostats with cool/heat functions.

CHECKING HOT GAS BYPASS

1. Using a calibrated meter, connect a thermocouple lead to the outlet line at the hot gas bypass valve. Tie wrap and insulate the lead.
2. Connect a low pressure refrigerant gauge to the suction line service port.
3. Connect a high pressure refrigerant gauge to the liquid line service port.
4. Operate air conditioner in the cooling mode until system is stabilized. (Approximately 15 minutes)
5. If the high side pressure is not at or above 420 psig, block off the condenser inlet air stream until the pressure is above this threshold. This will simulate a system performance level close to the design condition of 95° F ambient.
6. The hot gas bypass valve setting is 104 psig.
   a. If the suction pressure is 104 psig the thermocouple reading should be approximately 117° F or higher. Please note that it may be necessary to block off some of the evaporator air in order to check this condition.
   b. If the suction pressure is above 104 psig the thermocouple reading should be less than 117° F.
   c. If the suction pressure is below 104 psig the hot gas bypass valve should be adjusted to raise the pressure.

ADJUSTMENT OF HOT GAS BYPASS VALVE

The function of the hot gas bypass valve is to prevent the suction pressure from falling below a predetermined set point, thereby balancing the system. The set point is typically 104 psig (R-410a).

Refer to the procedure below for Checking the Hot Gas Bypass Valve before proceeding. This will help to establish where the valve is currently set.

1. Connect a low pressure refrigerant gauge to the suction line.
2. Operate air conditioner in the cooling mode until system is stabilized. (Approximately 15 minutes)
3. Remove the seal cap that covers the adjustment screw of the hot gas bypass valve.
4. Adjust the valve by turning the stem. A

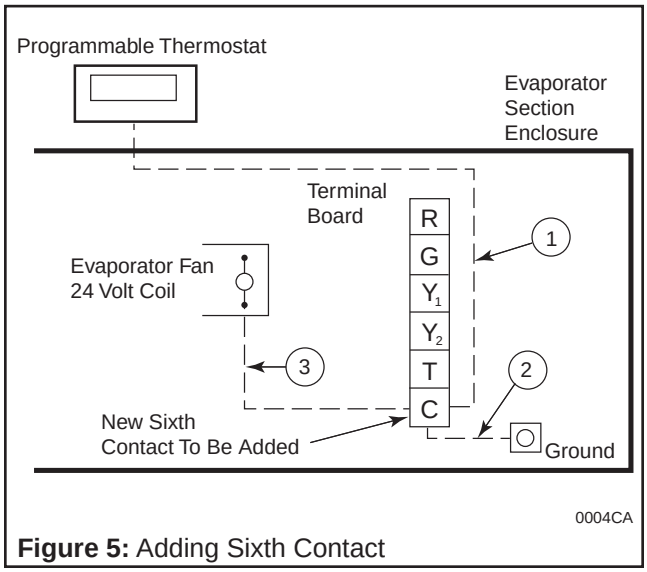


Figure 5: Adding Sixth Contact

CLOCKWISE turn will increase the pressure setting. A COUNTERCLOCKWISE turn will decrease the pressure setting. One complete turn is equal to approximately a 4 psi change.

Adjustments should be made in small increments, allowing the system to stabilize after each turn.

5. Vary the evaporator load to test at various conditions that the suction pressure does not fall below the set point (104 psig for R-410a).
6. Replace the seal cap on the hot gas bypass valve.

NOTE:
a. On split system applications the hot gas bypass line to the evaporator should be insulated to prevent condensation.

b. Use a wet rag around the hot gas bypass valve when doing any brazing

STEAM COIL

The steam coil is located in the return air. The coil is copper tube/aluminum fin. Connections exit the cabinet at the coil location. Standard steam coils and non-freeze steam coils are available. Controls and valves for steam coils are supplied by others. (See also the section on Steam Coils in the Installation Section, Page 8)

HOT WATER COIL

The hot water coil is located in the return air, either before or after the evaporator. The coil is copper tube/aluminum fin. Connections exit the cabinet at the coil location. Controls and valves for hot water coils are typically supplied by others. (See also the section on Hot Water Coils in the Installation Section, Page 8).

CHILLED WATER VALVE OR HOT WATER VALVE

Chilled water or hot water valves, if supplied by United CoolAir, are typically 2-way. The valve would be shipped loose for installation in the field. The valve is to be mounted in the outlet line of the coil.

FLOODED CONDENSER

When the outdoor ambient temperature falls, the condensing pressure falls. This causes the discharge pressure to fall. Since the pressure differential across the thermostatic expansion valve port affects the rate of refrigerant flow, low discharge pressure generally causes insufficient refrigerant to be fed to the evaporator. Failure to have sufficient head pressure will result in low suction pressure and/or iced evaporator coils. The effective range for this option is down to -30°F.

The purpose of a flooded condenser is to hold back enough of the condensed liquid refrigerant so that some of the condenser surface is rendered inactive. This reduction of active condensing surface results in a rise in condensing pressure and sufficient liquid line pressure for normal system operation.

A three-way modulating valve and a receiver make up the flooded condenser refrigerant components.

The valve is placed in the liquid line after the condenser. The receiver is downstream of the valve. The valve limits the flow of liquid refrigerant from the condenser while at the same time regulating the flow of discharge gas around the condenser to the receiver.

During periods of low ambient operation, the receiver pressure falls until it approaches the setting of the control point of the valve (typically 295 PSIG for R-410a). The valve then throttles to restrict the flow of liquid from the condenser. This raises the condenser pressure. Since it is the receiver pressure that is being maintained, the valve will then start to throttle open the discharge port when the differential between the condensing pressure and the receiver pressure exceeds 20 psi. The hot discharge gas serves to heat up the cold liquid being passed from the condenser to the receiver. Thus the liquid reaches the receiver warm and with sufficient pressure to assure proper expansion valve operation.

The receiver is required to hold all of the excess/ additional liquid refrigerant in the system, since the refrigerant will be returned to the receiver when high ambient conditions exist.

In the off-cycle the refrigerant can "migrate" to the condenser, during periods of low outdoor ambient. On a call for start-up, the evaporator pressure may not build up to the cut-in point of the low pressure control. The result may be a failure of the compressor to start or to short cycle. To eliminate this potential problem, a time delay is added to bypass the low pressure switch during start-up to allow the discharge pressure to build in turn increasing the suction pressure.

BUCK/BOOST TRANSFORMER

Table 1: Buck/Boost Transformer Table

United CoolAir Part Number	LOAD		Max. Size of Fuse or Breaker
4CA1901	KVA	1.44	10A
	Amps	6.25	
4CA1902	KVA	2.88	15A
	Amps	12.5	
4CA1903	KVA	4.31	20A
	Amps	18.75	
4CA1904	KVA	5.75	30A
	Amps	25.0	
4CA1905	KVA	8.63	40A
	Amps	37.5	
4CA1906	KVA	11.5	60A
	Amps	50.0	
4CA1907	KVA	17.25	80A
	Amps	75.0	

Single-Phase

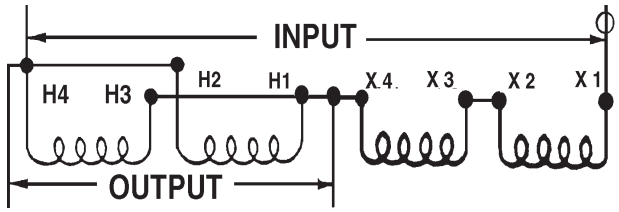


FIGURE 6: Transformer Wiring 0023CA

Units being applied on a 277V-1PH-60Hz power supply require the use of a buck/boost transformer. The transformer will reduce the voltage from 277-1-60 to 230-1-60. The unit is supplied with components for 230-1-60 application. Table 1 lists the buck/boost transformers available from United CoolAir. Figure 6 illustrates the wiring for each transformer.

HEAD PRESSURE CONTROL VALVES

Standard water-cooled units do not include a water regulating valve for head pressure control. However, if the incoming water to the unit will be at 65˚ or below, the unit should have been ordered with Head Pressure Control Valve(s).

A pressure transducer senses the liquid refrigerant pressure leaving the heat exchanger and sends a signal to a pressure controller. The controller then provides a modulating electrical signal to the head pressure control valve to adjust the valve open or closed to control the amount of water flow to maintain a refrigerant pressure set point (factory set to 360 psig).

The valve can be 2-way, 3-way or 2-way with a bypass solenoid for heat pump applications (bypass solenoid only available for 150 psig applications).

TROUBLESHOOTING

WARNING: Turn OFF power to unit before conducting any troubleshooting, unless the tests you are performing require system operation. Keep hands, clothing and tools clear of electrical terminals and rotating components.

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
1	Control is erratic.	Wired improperly or connections are broken	Check wiring connections against schematic diagram
2	Blower fails to start.	Defective contactor	Repair or replace contactor.
		Overload tripped	Reset and check cause.
		Marvel alarm	Clear alarm(s) after correcting problem.
3	Compressor fails to start.	Thermostat set too high	Adjust to desired temperature.
		Complete loss of refrigerant charge	Repair leak and recharge refrigerant system.
		Head pressure too high (high pressure switch open)	Check condenser for obstructions and remove. Check for the required water flow through the condenser coil. Manually reset thermostat. With Marvel, turn off alarm and reset.
		PTCR will keep compressor OFF for 3 - 5 minutes	Wait for PTCR to cool off. Compressor should start in 3 - 5 minutes.
		Low line voltage causing compressor to overheat and trip on thermal overload	Stop unit and troubleshoot power supply and compressor circuit for low voltage. Please note that it may take the compressor an hour or more for the thermal overload to reset itself.
4	Compressor short cycles	Drain pan switch open	Check if the unit is draining properly.
		Ice or dirt on evaporator coil (reduced air flow)	Defrost coil and replace dirty filters, clean evaporator coil
		Lack of refrigerant (bubbles in sight glass)	Check for leak. Repair and recharge the system.
		Short cycling of conditioned air	Make sure that duct connections are proper for return air and supply air and ensure that they do not mix with each other.

NOTE: For operating and troubleshooting instructions for Marvel Controller or humidifier, refer to specific operating instructions that accompany the unit.

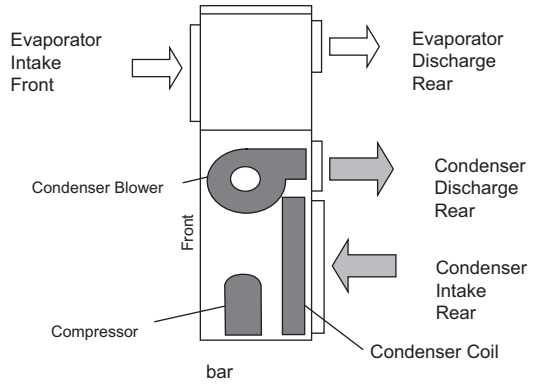
ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
5	Evaporator coil ices.	Lack of proper air quantity	Check filters: Clean or replace if necessary. Check for obstruction across coil. Check rotation of evaporator blower to ensure correct rotation of evaporator blowers.
		Low return air temperature	Raise return air set point or check for short cycling of supply air.
		Low refrigerant charge	Check for leaks and repair and recharge the system.
6	Noisy compressor.	Expansion valve stuck in open position (cold suction line)	Ensure thermal expansion valve bulb is tight on suction line. Confirm that bulb is located properly on suction line. Check operation and superheat.
		Broken compressor valve (compressor knocking)	Replace compressor.
		Worn or scarred compressor bearings	Replace compressor.
		Liquid slugging	System overcharged. Reclaim excess refrigerant from the high side of the system. Check superheat and subcooling
		Excessive head pressure	Reduce head pressure (see item 8 below).
7	System short of capacity	Flash gas in liquid line (bubbles in sight glass)	Check for leaks. Repair and recharge the system. Check subcooling.
		Expansion valve stuck open or possibly obstructed	Replace Valve.
		Clogged filter drier	Replace with new filter-drier.
		Ice or dirt on evaporator coil	Defrost or clean evaporator coil or replace dirty filter.
		Head pressure control valve not fully open	Make sure that the required GPM of water flows through the condensing section
		Low on refrigerant	Check operating pressures and subcooling. Add charge
		Condenser coil dirty	Clean condenser coil

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
8	Head pressure too high.	Possible non-condensable in system	Evacuate system and recharge. Install new filter-drier
		Condenser air intake, duct or coil blocked	Clean away debris
		Overcharge of refrigerant	Reclaim excess from high pressure side of the system
		Condenser fan not operating	Check power to motor and ensure correct rotation of blower
		Condenser water not circulating	Check water flow rate and adjust for required GPM through the unit
		Condenser blower running backwards	Check phase of incoming power to unit (3 ph units only). Reverse any two incoming power supply wires (except ground).
9	Head pressure too low.	See Item 3, 4, & 7 above	Correct as indicated
10	Suction pressure too low	Flash gas in liquid line (bubbles in sight glass) due to a leak.	Repair leak and recharge
		Obstructed expansion valve	Repair or replace valve
		Loss of fluid within expansion valve bulb	Replace expansion valve or power head.
		Clogged filter-drier	Replace with new filter-drier
		Ice or dirt on evaporator coil	Defrost and clean evaporator coil and replace filter
		Evaporator blower running backwards	Check phase of incoming power to unit (3 ph units only). Reverse any two incoming power supply wires (except ground).
11	Heater inoperative	Thermostat set too low	Adjust thermostat to the desired temperature
		Circuit breaker tripped or does not reset	Check for electrical short. Replace breaker if defective.
		Heater high limit switch open	Insufficient air across heater elements. Check for obstructed or dirty filters
		Heat elements burned out	Check continuity with OHM meter. Replace heater element

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
12	Water carry over	Excessive air through unit	Reduce CFM to unit specifications
13	System short of capacity in free cool (water coil) mode	Check for control wiring to the free cool solenoid valve	Check wiring diagram and rewire
		Low water flow rate	Check source of water flow.
14	Condensate Pump does not run	Check to see that power to the pump is present	Locate and repair electrical connection problem
		Float not able to move freely	Clean pump and float
		Dirt or algae not allowing float to activate pump	Clean pump and float
15	Condensate Pump runs with no discharge	Tubing blocked or kinked	Inspect, clean or straighten as necessary
		Check valve blocked	Clean check valve
		Impeller blocked	Remove debris from pump impeller
		Tubing elevation or run exceeds head capability	Verify tubing run is within pump head limitations
16	Lock out relay tripped	High or low pressure condition exists	Refer to Items 8 & 10 above
			Manually turn off system at thermostat and then back on to reset. Manually reset high pressure switch if tripped.

VertiCool Aurora Series

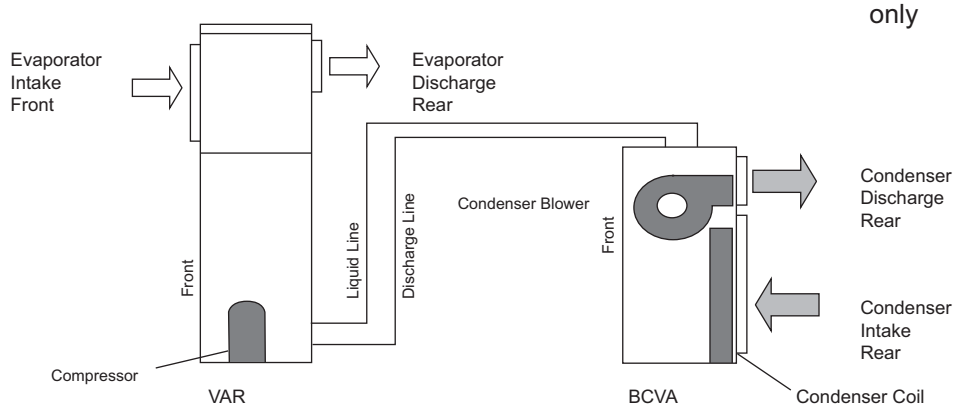
Basic Model Configurations



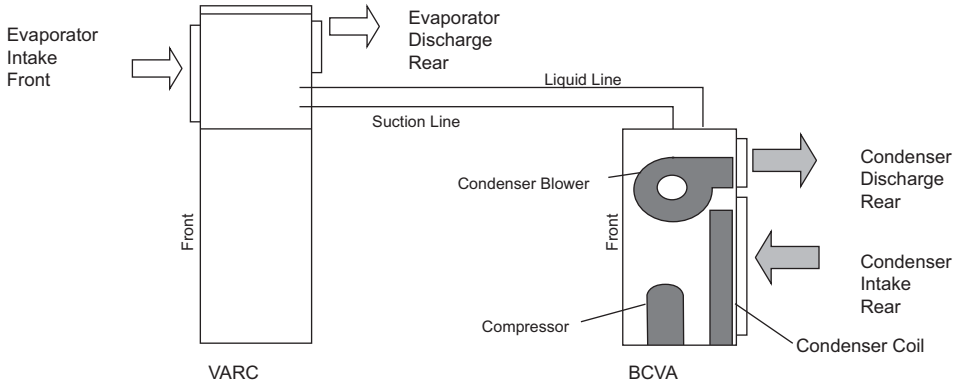
bar

BVA, BCVA, BVW and EVA

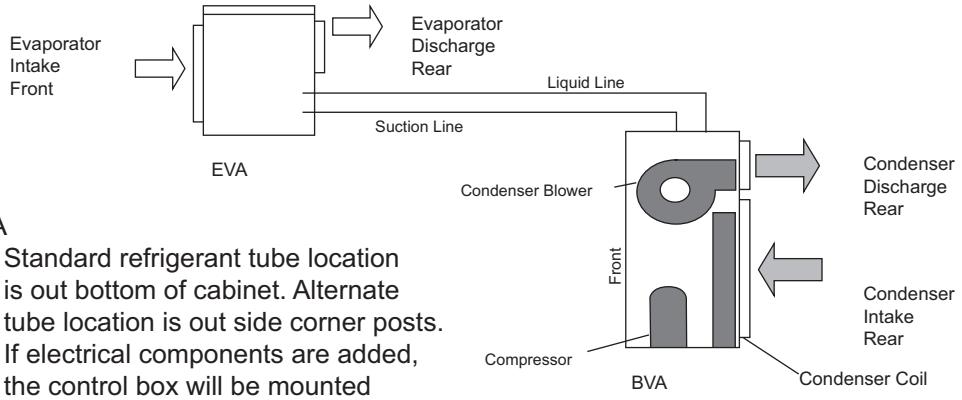
a. If no interconnect kit is ordered, unit will be supplied with lines capped and a holding charge only



VAR BCVA



VARC BCVA



EVA BVA

EVA

a. Standard refrigerant tube location is out bottom of cabinet. Alternate tube location is out side corner posts.
b. If electrical components are added, the control box will be mounted externally.

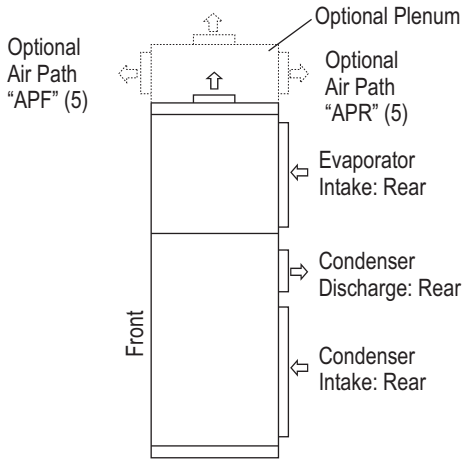
Manufacturer reserves the right to make changes without notice.

VertiCool Aurora Series

Air-Cooled Air Path Configurations (2) (4)

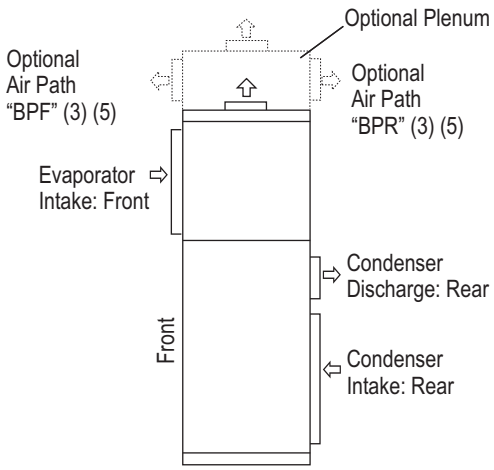
Basic Air Path "A"
Evaporator Discharge: Top
(Less the Penum)

Optional Air Path "APT" (5)



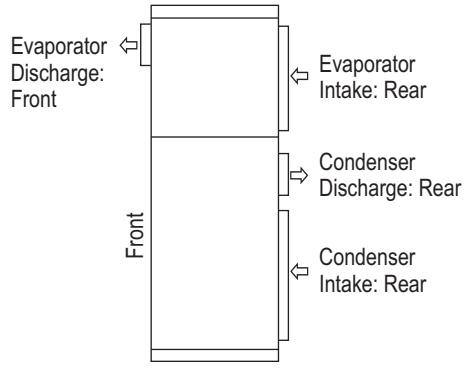
Basic Air Path "B" (3)
Evaporator Discharge: Top
(Less the Penum)

Optional Air Path "BPT" (3) (5)

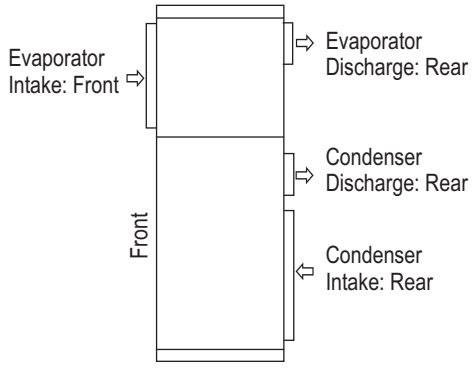


Reference Notes on Page

Basic Air Path "C" (1)
Straight Through
Front Discharge



Basic Air Path "D" (1)
Straight Through
Rear Discharge



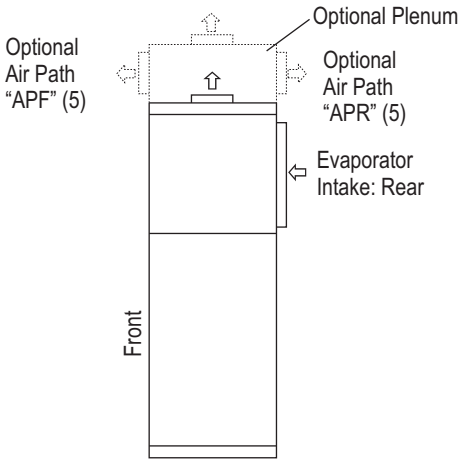
Manufacturer reserves the right to make changes without notice.

VertiCool Aurora Series

Water-Cooled Air Path Configurations (2) (4)

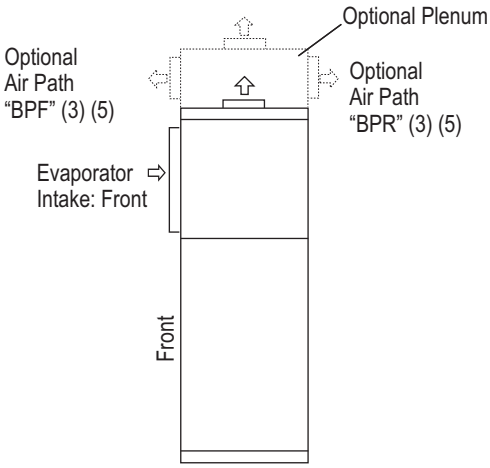
Basic Air Path "A"
Evaporator Discharge: Top
(Less the Penum)

Optional Air Path "APT" (5)



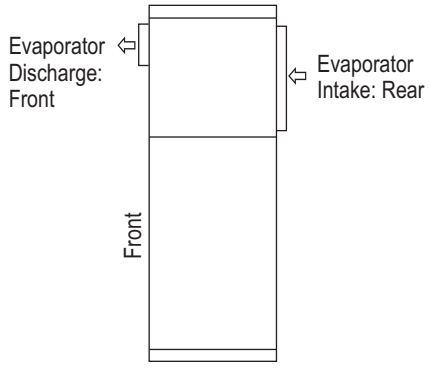
Basic Air Path "B" (3)
Evaporator Discharge: Top
(Less the Penum)

Optional Air Path "BPT" (3) (5)

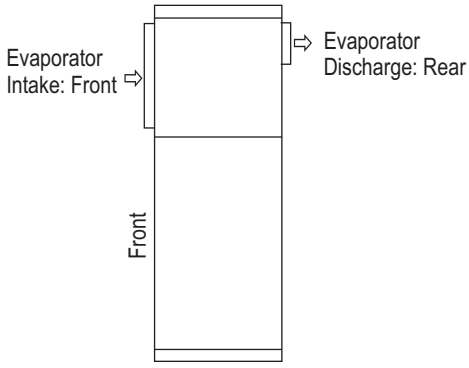


Reference Notes on Page

Basic Air Path "C" (1)
Straight Through
Front Discharge



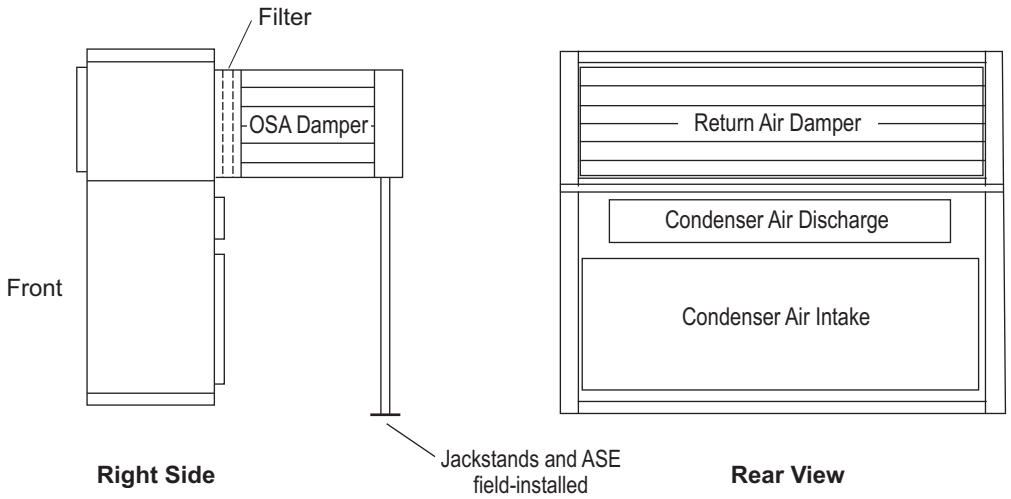
Basic Air Path "D" (1)
Straight Through
Rear Discharge



Manufacturer reserves the right to make changes without notice.

Air-Cooled with Air Side Economizer (1)

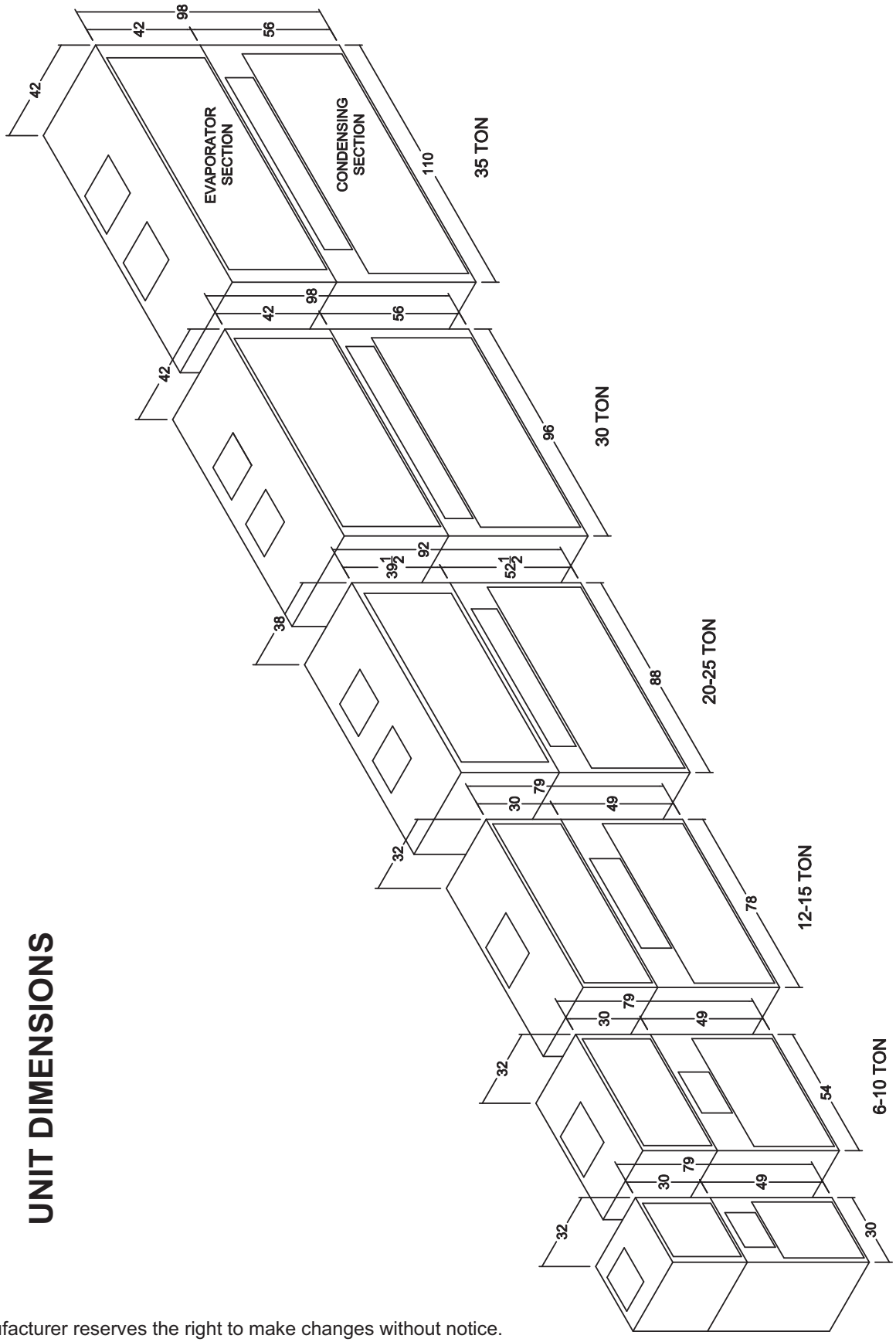
Air Side Economizer consists of dampers with operators on Return Air and Fresh Air sides, Enthalpy Sensor and Remote Mixed Air Temperature Sensor.



Notes:

(1) Side access required.
(2) Filter access available on each side of evaporator inlet.
(3) Side or Rear access required.
(4) Refer to unit drawings for specific inlet and discharge flange locations and dimensions.
(5) The evaporator blower motor must be upgraded when ducting out of plenum.
(6) Condenser filter box option includes 2", MERV 8 Pleated Throwaway Filters.
(7) 3 thru 12 and 20 and 25 Ton units with plenums flanged for ductwork will require a motor upgrade.
(8) 12 thru 35 Ton units if shipped split will have the plenum factory installed on evaporator section, otherwise plenum is shipped seperate for field installation.

UNIT DIMENSIONS



For specific dimensional details and air path configurations go to WWW.UNITEDCOOLAIR.COM

Manufacturer reserves the right to make changes without notice.

NOTES

NOTES

VERTICOOL AURORA SERIES
BASIC MODEL DESIGNATION

EXAMPLE:	VA	3	G	3	AS	05	–	A	G	X
	a	c	d	e	f	g		h	i	j

a. “VA”, “VW”, “VHW”, “E”, “B” or “BC”

“VA”	Air-Cooled Air Conditioner
“VW”	Water-Cooled Air Conditioner
“VHW”	Water-Cooled Heat Pump
“E”	When E appears as a prefix to any of the above, it is the Evaporator Section only
“B”	When B appears as a prefix to any of the above, it is the Condensing Section only
“BC”	When BC appears as a prefix to any of the above, it is the Condenser Section only

b. “R” or “RC”

“R”	Remote Condenser Unit being used
“RC”	Remote Condensing Unit being used

c. “3”, “4”, “5”, “6”, “8”, “10”, “12”, “15”, “20”, “25”, “30”, “35”
Nominal Cooling Capacity in Tons

d. “G” Common to all

e. “1”, “3”, “4” or “5” Indicates Voltage

“1”	208-230V, 1 PH
“3”	208-230V, 3 PH
“4”	460V, 3 PH
“5”	575V, 3 PH

f. “AS”, “A”

“AS”	Indicates 1 Compressor
“A”	Indicates 2 Compressor

g. “05”, “10”, “15”, “20”, “25”, “30”, “40”, “45”, “50”, “55”, “60”
Indicates kW Rating for Heaters

h. “A”, “APF”, “APT”, “APR”, “B”, “BPF”, “BPT”, “BPR”, “C”, “D”
Indicates Air Path Configuration

i. “H”, “-” Indicates Vertical Stacking Unit

“H” R-410a High Efficiency

j. “X” Special Configuration