

Installation Manual *for*
"C" SERIES HORIZONTAL
AIR CONDITIONING UNITS
1 Ton – 15 Ton
Air-Cooled • Water-Cooled • Heat Pump



590A

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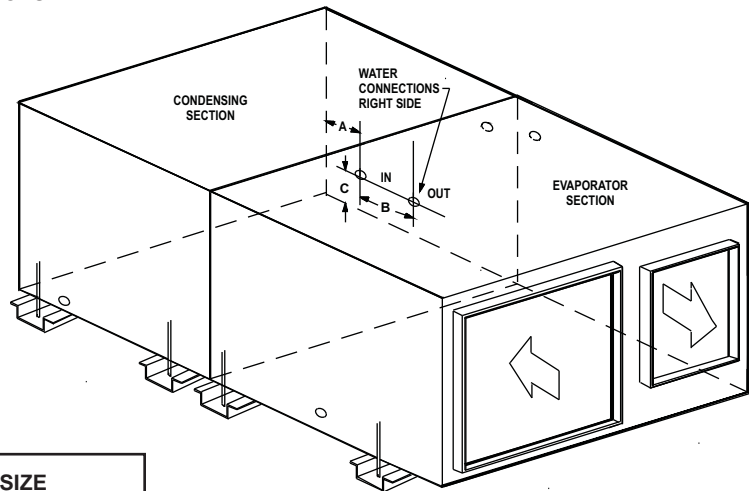


AIR-COOLED 1 THRU 15 TONS

NOTE: Refer to United CoolAir web site www.unitedcoolair.com for the most current dimensional drawings.

WATER-COOLED 1 THRU 15 TONS

FIGURE 1: Water-Cooled Water Connections



NOTE: CONDENSATE DRAIN MUST BE PIPED IN BOTH EVAPORATOR AND CONDENSING SECTIONS.

UNIT	A	B	C	PIPE SIZE
1 and 1-1/2 Ton Single Circuit	5"	5"	3-1/16"	IN & OUT 7/8" O.D.
2 thru 4 Ton Single Circuit	3-1/4"	13"	3-3/4"	IN & OUT 7/8" O.D.
5 Ton Single Circuit	3-1/4"	13"	3-3/4"	IN & OUT 1-1/8" O.D.
4 thru 8 Ton Dual Circuit	4-1/2"	13"	3-3/4"	IN & OUT 1-1/8" O.D.
10 Ton Dual Circuit	4-1/8"	14"	3-3/4"	IN & OUT 1-3/8" O.D.
12 thru 15 Ton Triple Circuit	4-1/8"	14"	3-3/4"	IN & OUT 1-3/8" O.D.

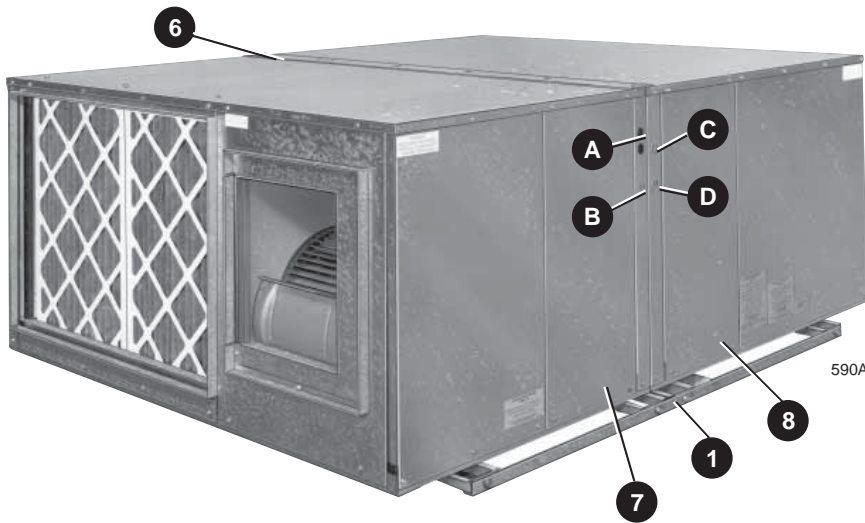


Listing
for Water Cooled or
Heat Pump Units

FIGURE 2: Approximate Net Weights (Basic Units only)

	TOTAL UNITS		CONDENSING SECTION ONLY	
	AIR-COOLED	WATER-COOLED	AIR-COOLED	WATER-COOLED
1 TON	415 lbs.	395 lbs.	250 lbs.	230 lbs.
1-1/2 TON	430 lbs.	410 lbs.	290 lbs.	270 lbs.
2 TON	665 lbs.	605 lbs.	395 lbs.	335 lbs.
3 TON	685 lbs.	625 lbs.	390 lbs.	330 lbs.
4 TON SINGLE COMP.	700 lbs.	640 lbs.	415 lbs.	355 lbs.
4 TON DUAL COMP.	950 lbs.	905 lbs.	570 lbs.	525 lbs.
5 TON SINGLE COMP.	720 lbs.	660 lbs.	425 lbs.	365 lbs.
5 TON DUAL COMP.	970 lbs.	925 lbs.	585 lbs.	540 lbs.
6 TON DUAL COMP.	970 lbs.	925 lbs.	585 lbs.	540 lbs.
8 TON DUAL COMP.	995 lbs.	945 lbs.	600 lbs.	550 lbs.
10 TON DUAL COMP.	1340 lbs.	1205 lbs.	800 lbs.	665 lbs.
12 TON TRIPLE COMP.	1520 lbs.	1375 lbs.	915 lbs.	770 lbs.
15 TON TRIPLE COMP.	1580 lbs.	1450 lbs.	950 lbs.	820 lbs.

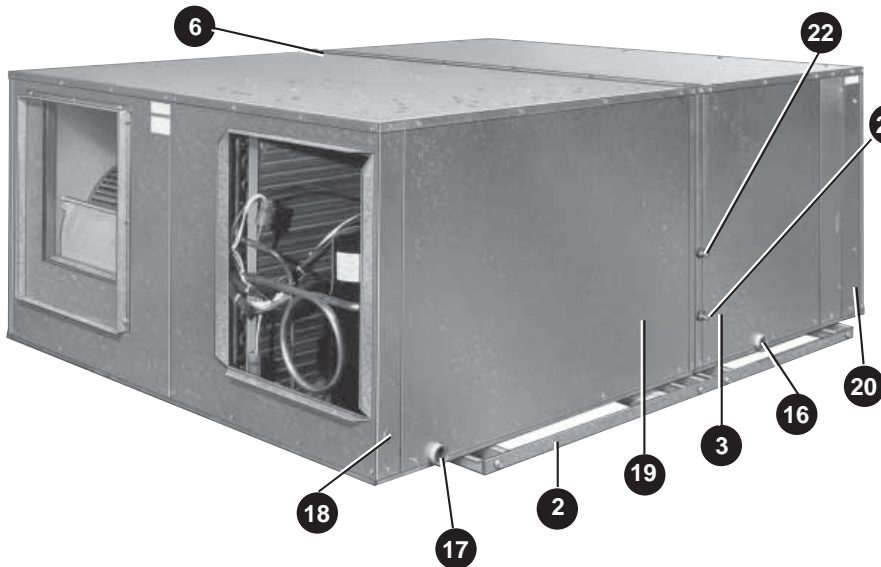
UNIT COMPONENTS



LEGEND OF ITEMS

- ① Tie Rail
- ⑥ Unit Top Tie Piece
- ⑦ Access Panel, Evaporator Box
- ⑧ Access Panel, Condenser Box
- Ⓐ Thermostat Wiring Connection
- Ⓑ Power Wiring (Split-Unit – Evaporator Section)
- Ⓒ Low Voltage Wiring Connection
- Ⓓ Power Wiring Connection (for package units and for condensing sections in split systems).

Figure 3: Unit (toward evaporator section and right side)

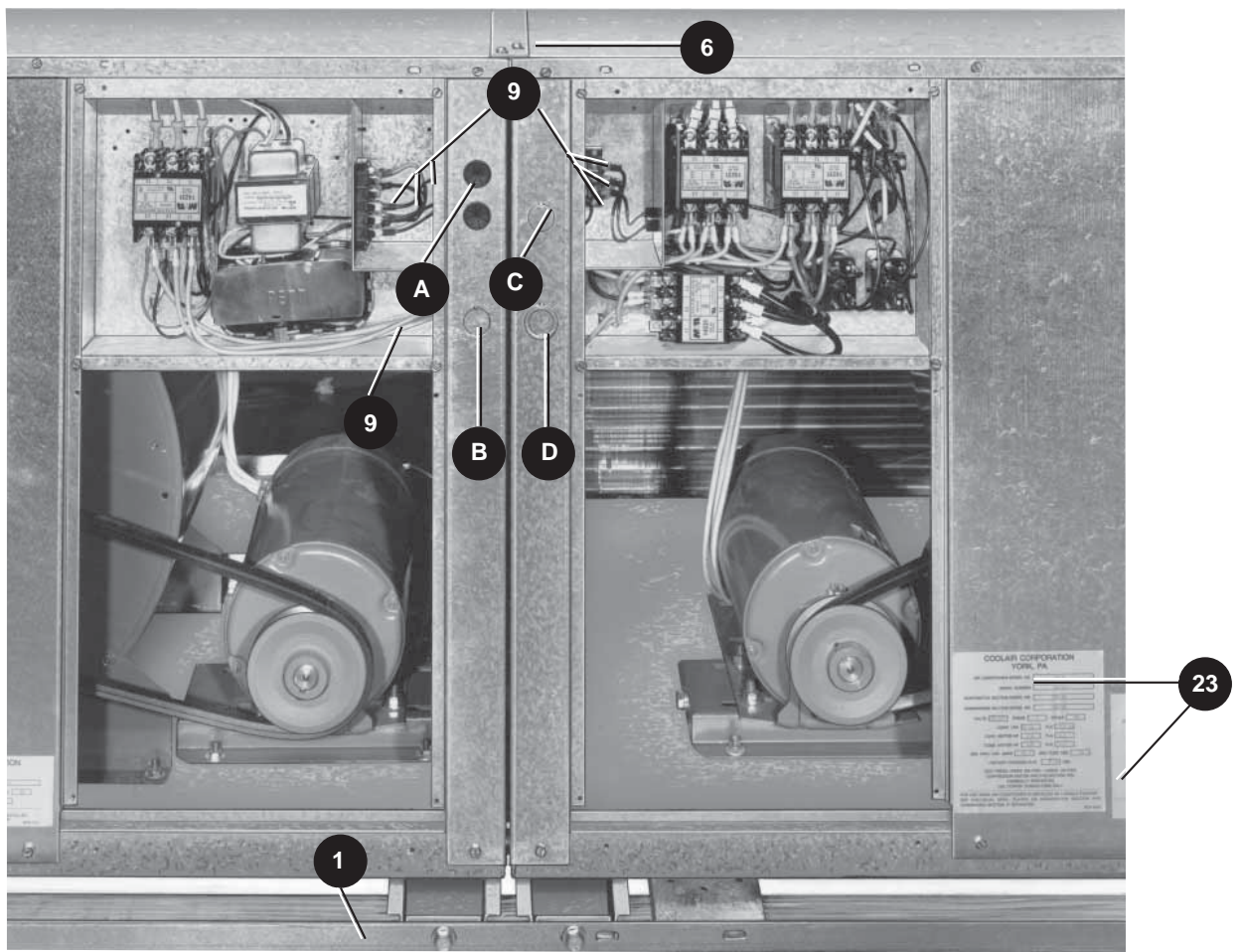


LEGEND OF ITEMS

- ② Tie Rail
- ③ Evaporator Access Panel
- ⑥ Unit Top Tie Piece
- ⑯ Evaporator Condensate Drain
- ⑰ Condenser Drain
- ⑱ Grommet, Low Ambient Tube
- ⑲ Condenser Access Panel
- ⑳ Filter Access Panel
- ㉑ Condensate Pump Connection
- ㉒ Humidifier Connection

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Figure 4: Unit (toward condensing section and left side)



EVAPORATOR

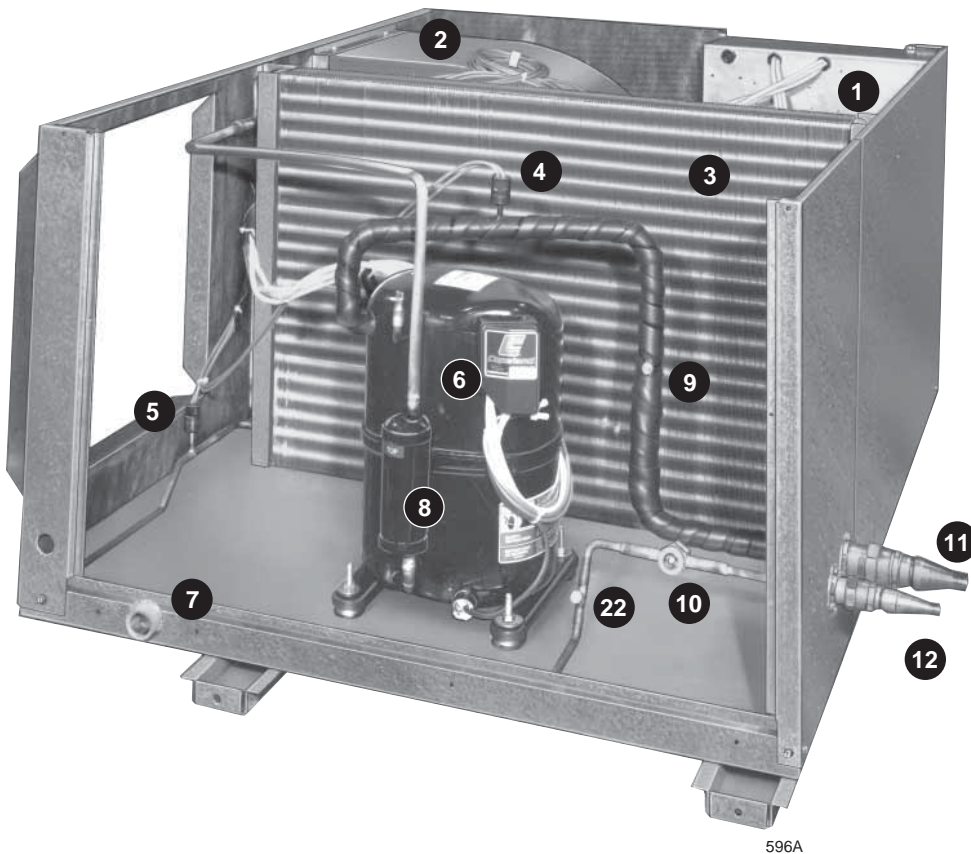
CONDENSING SECTION

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LEGEND OF ITEMS

- ① Tie Rail
- ⑥ Unit Top Tie Piece
- ⑨ Wires to Disconnect (Split-unit)
- ⑳ Specification Plates
- Ⓐ Thermostat Wiring Connection
(for both package and split units)
- Ⓑ Power Wiring (for unit evaporator)
- Ⓒ Low Voltage Wiring Connection
- Ⓓ Power Wiring Connection

Figure 5: Right Side (with control box access panels and control box covers removed)



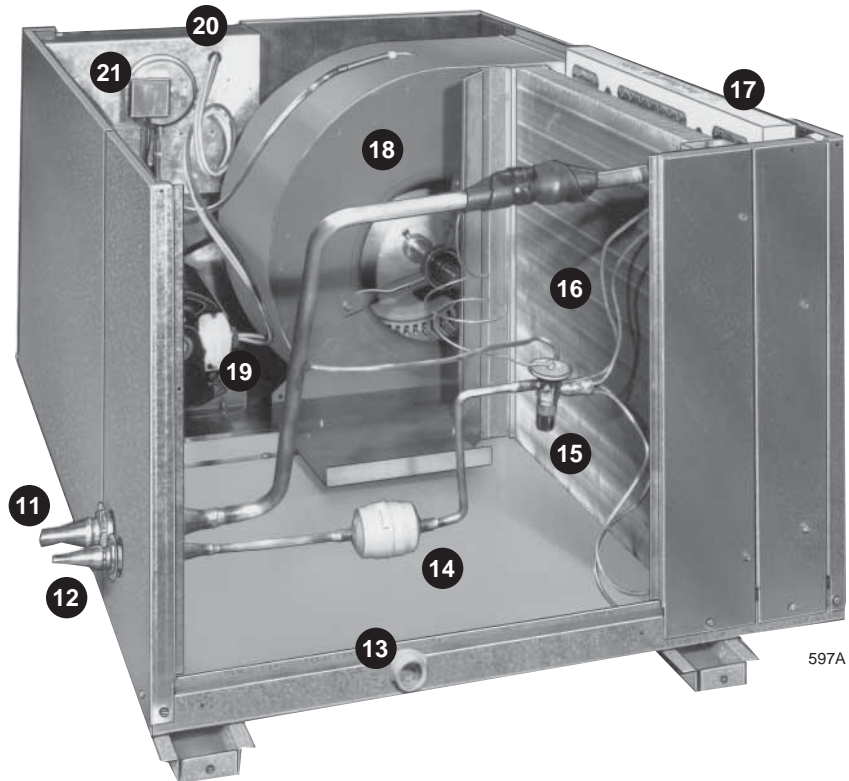
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Figure 6: Split Unit (Condensing Section)

Note: Air Switch (filter differential) located in same area as 21.

LEGEND

1. Electrical Control Box (condenser)
2. Condenser Blower
3. Condenser Coil
4. Low Pressure Control
5. High Pressure Control
6. Compressor
7. Condenser Drain Connection
8. Muffler
9. Suction Service Port
10. Sight Glass
11. Self-sealing Coupling (suction line)
12. Self-sealing Coupling (liquid line)
13. Evaporator Drain Connection
14. Filter-drier
15. Thermal Expansion Valve
16. Evaporator Coil
17. Air Filter
18. Evaporator Blower
19. Evaporator Motor
20. Electrical Control Box (Evaporator)
21. Air Switch (used only when Electric Heat is incorporated)
22. Liquid Service Port



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Figure 7: Split Unit (Evaporator Section)

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.

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 be “walked” on the corners of the skid. Use dolly trucks or pipe rollers to move the unit to its proper location.

LOCATION

Unit can be installed either as a complete package or split into two sections. It can be either floor mounted or ceiling mounted.

Before unit is installed, a thorough study should be made of the structure. Careful consideration must be given to location of wiring, condensate disposal, ductwork and accessibility to the unit for maintenance and servicing. It is necessary that a minimum clearance space be allowed on each side of the unit to accommodate maintenance and servicing. This minimum clearance must be 36" for all units. Attention must also be given to floor, ceiling or wall load limitations (See Figure 2). Location should also provide for condensate removal, trapping and disposal.

! Discharge Air from condenser coil should be deflected away from supply air to condenser, to prevent recirculation. See also “Condensing Section Outdoor Modification Kit” on page 27.

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

MOUNTING AND SETTING IN PLACE

Units can be shipped as an integral package with a tie rail [Items ① and ②; Figures 3, 4 & 5] attached to both sides of the unit at each of the four mounting channels.

If unit is not to be split but is to be hung, **do not** remove tie rail. Use field supplied (3/8" minimum diameter) hanging rods, with proper washers and locknuts, then elevate unit to the exact location where it is to be installed. Fasten the rods securely to the supporting structure using vibration isolator-type mounts (field supplied), and level as required.

If unit is to be floor mounted and not separated, do not remove tie rails. Locate on a level pad and secure, using vibration isolators. See Figures 3, 4 and 5, Items ① and ②.

INSTALLATION

1. Air conditioner is shipped assembled and ready for operation.
2. Unit contains a full charge of R-410a refrigerant.
3. Evaporator section must be mounted so that there is a 0.375" to 0.5" tilt down toward the condensate drain connection. This is to ensure that the water drains to the condensate removal point (See Figure 8).

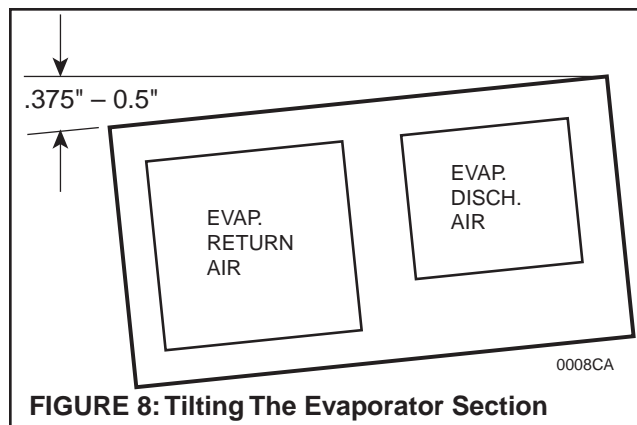


FIGURE 8: Tilting The Evaporator Section

4. Install unit so that controls and side panels are accessible to the operator and maintenance personnel.
5. Run the condensate drain line by following the guidelines on page 15.

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.

ELECTRICAL WIRING

- a. Once the unit is installed, refer to the wiring diagrams which are provided on the backside of the covers of the control boxes. (See Figure 5.)
- b. Units are completely internally wired at the factory.
- c. Check unit specification plates close to outer access panels for required voltage, wire and fuse sizing (see Item ②, Figure 5).
- d. The factory wiring terminates in two boxes; one each in the evaporator and condensing sections. These control boxes are located behind the outer access panels, Item ⑦ and Item ⑧ in Figure 3. Each is supplied with an individual control box cover with a wiring diagram attached inside.
- e. All the units are provided with terminal blocks.
- f. The power wiring to the unit is brought through the holes marked on the unit for electrical power connections. See Figure 5.
- g. The control wiring is brought through the holes provided in the unit: Item ① for integrated units and Items ③ & ④ for split units. See Figure 5.
- h. Supply wiring must comply with all National or Local codes. The power supply must be suitably fused or protected.
- i. 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.

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

FIGURE 9: Control Wire Sizes

- k. Run the low voltage wiring from the thermostat to the unit. Connect to low voltage terminal block supplied. See “Thermostat” under “Options”, page 23.

Properly locate thermostat to avoid vibration, drafts, sun exposure, or internal heat sources. Use an inside wall.

COMPRESSOR MOUNTING - WARNING

Compressors on some units are spring mounted but are tightened down for shipping. Before initial start-up, compressor nuts must be backed-off to the point where they are flush with the top of the studs. FAILURE TO DO SO WILL CAUSE UNNECESSARY VIBRATION.

SEPARATION OF SECTIONS

If the unit is to be installed as a split system, the following steps must be carefully followed in performing the separation.

1. Remove evaporator access panel (Item ③, Figure 4).
2. Using an open-end wrench and turning counter-clockwise, disconnect the female half of the self-sealing couplings on both the suction and discharge lines (Items ⑪ and ⑫, Figure 7). These are located in the bottom left area of the evaporator section. When there is a hot gas bypass option, that connection is to the right of the self-sealing coupling connections. There is one suction line, one liquid line, and one hot gas by-pass line (option) for each compressor. See Figures 6 and 7.

Two circuit units have 2 groups of couplings; three circuit units have 3 groups. It's a good idea to label or mark the various connections on both the evaporator and condensing sections **BEFORE DISCONNECTING THE COUPLINGS** to eliminate the possibility of intermixing the circuits when the interconnecting tubing is installed. The suction and discharge lines in the evaporator section will now be dangling, so be careful you don't damage the tubing connections. Do not dis-

connect the male half of the self-sealing couplings (Item ⑤, Figure 10), which are still attached to the bulkhead of the condensing section.

3. Remove the unit top tie piece* (Item ⑥, Figures 3, 4 & 5), removing only those screws which attach the top piece to the two top panels. (*If unit is already shipped split, these are not included.)
4. Remove control box access panels from the evaporator section (Item ⑦, Figure 3), and the

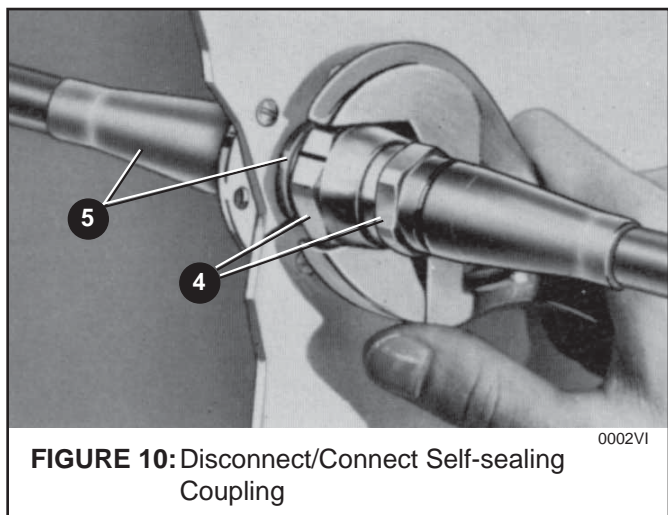


FIGURE 10: Disconnect/Connect Self-sealing Coupling

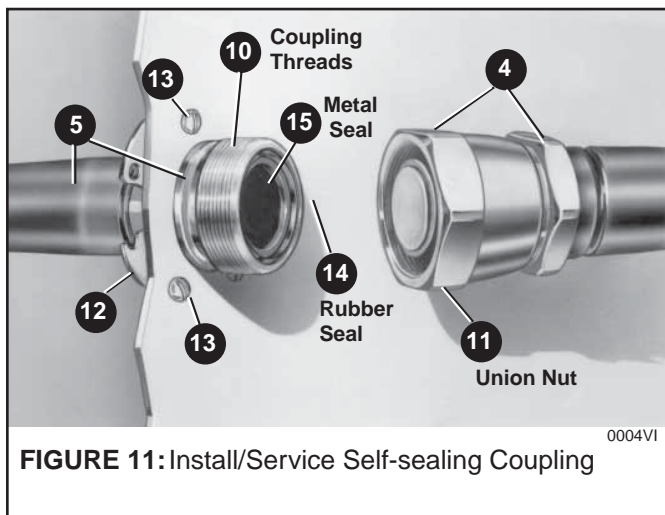


FIGURE 11: Install/Service Self-sealing Coupling

For Legend of Items, See Figure 12

FIGURE 12: Bill of Material for Each Interconnect Tubing Kit¹
For 2 Ton thru 15 Ton Units (applies only to a matched "C" series evaporator and condensing section) [Items in brackets are for Hot Gas Bypass Kit]

ITEM #	QUANTITY	DESCRIPTION
—	4 [2]	Schrader Access Valves
④	1	Self-Sealing Coupling, Female Half (for suction line – outside of condensing section)
④	1 [1]	Self-Sealing Coupling, Female Half (for discharge line – outside of condensing section)
⑤	1	Self-Sealing Coupling, Male Half (for suction line – outside of evaporator section)
⑤	1 [1]	Self-Sealing Coupling, Male Half (for discharge line – outside of evaporator section)
⑫	1 [1]	Self-Sealing Flange (for holding male half on discharge line to outside of evaporator section)
⑫	1	Self-Sealing Flange (for holding male half on suction line to outside of evaporator section)
⑫	12 [6]	#10 x 3/8" SMS Slotted Hex Head Screws (for fastening flanges to outside of evaporator)

¹ For single circuit, use one kit; for dual circuits, use two kits; for triple circuits, use 3 kits.

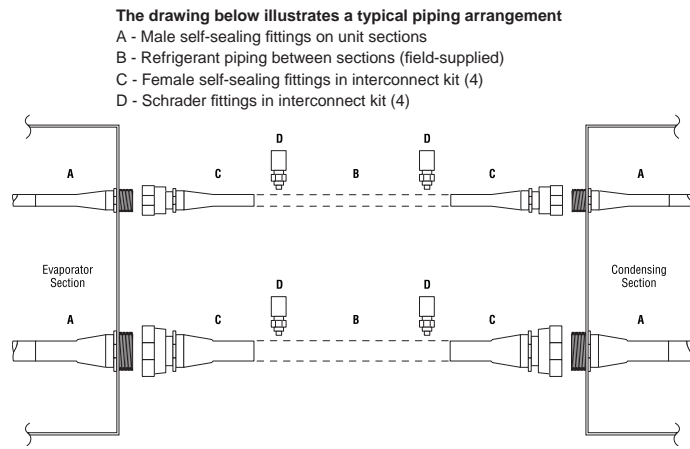
FIGURE 13: Guidelines for Interconnecting Tubing Sizing

Always follow accepted industry practices for sizing lines based on line length and elevation differences.

Max. total equivalent line length = 100 ft. (a)

Max. elevation difference between Evap. and Cond. = 40 ft. (a) (b)

TONS	SUCTION LINE	LIQUID LINE
1 Ton	5/8	3/8
1.5 Ton	3/4	3/8
2 Ton	3/4	1/2
3 Ton	7/8	1/2
4 Ton Single	1-1/8	1/2
4 Ton Dual	(2) 3/4	(2) 1/2
5 Ton Single	1-1/8	5/8
5 Ton Dual	(2) 7/8	(2) 1/2
6 Ton	(2) 7/8	(2) 1/2
8 Ton	(2) 1-1/8	(2) 1/2
10 Ton	(2) 1-1/8	(2) 5/8
12 Ton	(3) 1-1/8	(3) 1/2
15 Ton	(3) 1-1/8	(3) 5/8



(a) Contact the factory for installations with elevation differences greater than 40 feet or total equivalent line lengths greater than 100 feet. Alternate line sizes and specific refrigerant components may be required.

(b) If condensing section is 20 feet or more above the evaporator include an oil separator for each circuit.

United CoolAir Corporation's C-Series horizontal units are provided with unique self-sealing fittings on the refrigerant lines between sections. These fittings or couplings allow the two-unit section to be separated and reconnected without losing refrigerant charge.

When installed as a split system, an interconnect kit is required for each refrigerant circuit or hot gas bypass line.

If the unit is defined as a split system when ordered, the fittings will be male fittings on both sections. The interconnect kit will then consist of the matching female fittings. The interconnect kit is required for the field to connect refrigerant lines between both sections. Refrigerant piping between the sections is field supplied.

The interconnect kit also contains four (4) Schrader fittings. The installer can place at least one in each refrigerant line or at the end of the refrigerant line. These enable the refrigerant line to be evacuated and charged as needed based on size and length.

In some situations, the desired refrigerant line size may differ from the self-sealing fitting size provided. The line size should be reduced or enlarged at the fittings as necessary.

condensing section (Item ⑧, Figure 3), by removing the screws at the top and bottom of each access panel.

- Disconnect and discard the wires which run between the two internal control boxes (Item ⑨, Figure 5). Single circuit units will have two low voltage wires to be disconnected, dual and triple units will have 3 low voltage wires. See Wiring Diagram on the inside of the evaporator control box access panels (Item ⑦, Figure 3) for disconnecting power wiring.
- Remove the two side cross-member angles (Item ①, Figures 3 and 5; and Item ②, Figure 4).

- Carefully pull the evaporator section away from the condensing section. Double check that the self-sealing couplings are completely disengaged.

The sections may now be moved to their individual locations, either floor-mounted or hung.

INTERCONNECTING REFRIGERANT TUBING

After the separated sections have been installed, the interconnecting tubing can be run, using the self-sealing couplings supplied in the interconnect tubing kit (See Figure 12). For dual circuits, 2 kits are supplied; for

triple circuits, 3 kits are supplied. It is recommended that some refrigerant oil be placed on the coupling threads (Item ⑩, Figure 11), to facilitate threading. The following instructions apply:

1. Hand thread the female halves (Item ④, Figures 10 and 11) of the self-sealing couplings (supplied with the interconnect tubing kit, Figure 12) onto the male couplings (still fastened to the condensing unit, Item ⑤, Figures 10 and 11). Turn union nut (Item ⑪, Figure 11), approximately 1 to 1-1/2 turns. This is to make sure that the interconnecting tubing will be routed and brazed with the self-sealing couplings in their final proper location, so that there will be no difficulty when the final coupling assembly is made.
2. Attach the male couplings (same as Item ⑤, supplied with the interconnecting tubing kit) to the outside of the back panel of the evaporator section at the location vacated by the original couplings, using the flanges (Item ⑫) and screws (Item ⑬) provided in the kits (See Figures 11 and 12). The panel has holes to accept the screws (Item ⑬) to be utilized. Mount male coupling halves, same as Item ⑤, by sliding the flanges (Item ⑫, from interconnect kit) over end of couplings before brazing tubing and attach with screws (Item ⑬) to outer back panel of evaporator section. Do not connect female half of couplings (Item ④, still dangling inside evaporator section) until brazing is complete. If there is a hot gas bypass option, connect that coupling the same way.
3. Run the interconnecting tubing required.

NOTE: Installations may be made with up to 100 feet equivalent line lengths by installing the recommended tube sizes (See Figure 13) and adding the necessary refrigerant, R-410a (See Step 7, page 14). For equivalent line lengths greater than 100 ft., contact the factory for line sizing and additional accessories required.

IMPORTANT! On units with more than one refrigerant circuit, be careful not to intermix lines of the various circuits. If the connections were labeled before disconnecting the couplings, this should not be a problem. The 4

Ton Dual, 5 Ton Dual, 6 Ton, 8 Ton and 10 Ton units have 2 circuits (with 2 suction line couplings and 2 liquid line couplings). The 12 Ton and 15 Ton units have 3 circuits (with 3 suction line couplings and 3 liquid line couplings). Half couplings may be removed to make brazing to the interconnecting tubing more convenient.

CAUTION: When brazing tubing to the self-sealing couplings, be sure to use a wet rag, running water bath or chill blocks on the quick-connects to prevent overheating the valves and damaging the seals.

NOTE: The interconnect tubing kit (Figure 12) contains a sufficient number of Schrader access valves to permit you to install one in each end of both the liquid and suction lines of the field-supplied tubing. Each interconnecting line (suction, liquid, hot gas) must have one of the supplied Schrader access fittings installed into the field supplied tubing. However, for short lengths of tubing, only one Schrader in each line is necessary.

4. Install the Schrader valve fittings into the tubing before brazing the couplings onto the ends of the tubing. Use a 1/4" hole to mount the valve. Clean and debur the tubing before doing any brazing to ensure that no chips or debris are left in the refrigerant circuit. Remove the Schrader valve cap and core before doing any brazing.
5. After brazing the tubing to the self-sealing coupling halves, evacuate each line to 300 microns. Check to make sure that each line holds a vacuum after removal of the vacuum pump (indicating no leaks). Add the appropriate charge of R-410a Refrigerant using the Schrader valves. Refasten male halves to outer back panel of evaporator section with flanges and screws (if they were removed for brazing to tubing). Wipe off coupling seals and threaded surfaces with a clean cloth to prevent the inclusion of dirt or foreign material into the system (See Figure 11). Lubricate rubber seal (Item ⑭) and metal seal (Item ⑮) in the male halves (Item ⑤) with refrigeration oil. Thread coupling halves together by hand to insure proper mating of threads. Continue to hand-thread each half-coupling

to its mating half until resistance is felt (approximately 1-1/2 to 1-3/4 turns). Complete the connection of the mating half-couplings with a wrench. The suction line couplings (size-12) will be totally engaged after an additional 5-1/2 to 5-3/4 turns. The liquid line couplings (size-8) will be totally engaged after an additional 4-1/2 to 4-3/4 turns.

6. Refrigerant piping shall be insulated in accordance with local codes and / or applicable ASHRAE Standards. Insulation exposed to weather shall be suitable for outdoor use. Provide protection from water and shielding from solar radiation as necessary.
7. Add R-410a refrigerant to the system to compensate for the additional interconnecting tubing as follows:
 - a. For 3/8" liquid line – add 0.6 oz. per foot
 - b. For 1/2" liquid line – add 1.2 oz. per foot
 - c. For 5/8" liquid line – add 1.8 oz. per foot

The suction line should be pitched downward to the compressor, sloping approximately 1/4" every ten feet to facilitate oil return.

“P” traps (field supplied) are required for all suction line risers every 15 feet. When the evaporator is above the condensing section, an inverted “P” trap should be incorporated as close as possible to the evaporator (this minimizes floodback/oil slugging during the off cycle). If the condensing section is more than 40 feet above the evaporator, consult the factory for specific refrigeration components.

PACKAGE UNIT

If the unit is to be installed as an integral (close-coupled) unit, low voltage (thermostat) wiring is to be brought through connection (A), Figures 3 and 5, and power wiring will be brought through connection (D), Figures 3 and 5. See unit specification plate (Item ②, Figure 5) for power wiring minimum circuit ampacity and maximum fuse size.

SPLIT SYSTEM

If the unit is split (condensing unit remote from evaporator), the thermostat wiring is to be brought through connection (A), Figures 3 and 5. Power wiring for the

condensing unit is to be brought through connection (D), and the power wiring for the evaporator through connection (B). Interconnecting low voltage wiring will be brought through (A) and (C) to replace those discarded when separating the unit.

Power wiring to the condensing and evaporator units must be wired through circuit breakers or service disconnects. Minimum circuit ampacity and maximum fuse sizes for the condenser unit are shown on the condenser unit specification plate. Refer to specification plate (Item ②, Figure 5) for evaporator minimum circuit ampacity and maximum fuse size per the National Electric Code.

DUCT CONNECTION

It is recommended to use a flex collar or other means to isolate any unit vibration from being transmitted to the duct or structure.

Ductwork and plenums shall be insulated in accordance with applicable ASHRAE standards or local codes.

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 the unit 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. Not on Marvel Systems.

NOTE: Microprocessor controlled units do not incorporate a lock out relay. After resolving the high or low pressure situation reset the microprocessor as required. Consult separate manual for microprocessor control.

WATER-COOLED CONDENSING 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 unit pipe sizes from the factory connections on the unit. Both the water inlet and outlet of the condensing package should be equipped with hand 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 is likely to occur. Provisions should be made for ease of piping cleaning by using plugged tees at all turns, rather than ordinary elbows.

Hook Up

Each system requires 3 gallons of water per ton per minute. Braze in the water lines. 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. See "Cleaning The Water Cooled Condenser" on page 16.

Water Connection

Install and connect a fresh water strainer (not supplied) to the water in supply. Strainer should be readily accessible for periodic cleaning. Shut-off valves on both strainer inlet and outlet are recommended to facilitate cleaning.

CAUTION: High Temperature Fresh Water – unusually high water temperature (above 95°F) or marginal water pressure at the condenser water inlet may result in nuisance tripping of the high pressure switch.

WARNING: Water cooled units are for use with fresh water application only. Do not use for brackish water or salt water unless appropriate condenser has been installed as an option.

CONDENSATE DRAIN CONNECTION

Units are equipped with two 3/4" IPS drains; one for the evaporator condensate (Item ⑩, Figure 4); one for the condensing section (Item ⑰, Figure 4). All units require evaporator section drains to be installed. Heat pumps and water cooled condensing units also always require the installation of a condensing section drain. Units with air cooled condensers need a condensing section drain when units are installed in areas which may permit rain to enter. It is **EXTREMELY IMPORTANT** that the lines attached to these connections contain a **trap**, to ensure positive draining. It is highly recommended that the trap be primed with water prior to start-up.

The drain lines **must** be trapped because the coils are located on the negative sides of the blowers. 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" column. The condensate trap must be of sufficient depth in water column to permit the condensate to flow from the drain pan (See Figure 14). 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. When evaporator section was installed, it should have been tilted 0.375" to 0.5" down on the condensate drain side. Check to be sure this was done. See Figure 8.

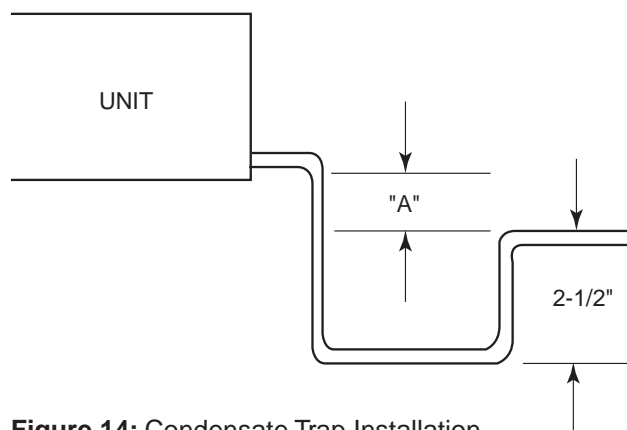


Figure 14: Condensate Trap Installation

MAINTENANCE PROCEDURES

FILTERS

Do NOT run unit without filters.

Throw-away filters are supplied with units of 2 Ton and over, and are an Underwriters Laboratories Class 2 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. Units under 2 Ton are supplied with permanent filters. They should be checked monthly for dirt accumulation and cleaned when necessary.

Field access is attained by removing the cover located on the side of the left front corner of the evaporator section (Item ⑳, Figure 4). In some situations, an external filter box will be incorporated or included in the mixing box.

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 right direction.

Figure 15: Filter Sizes And Types

UNIT	FILTER SIZE/TYPE	QUANTITY
1 to 1-1/2 Ton	17-1/2 x 13-1/2 x 1 Permanent	1
2 to 5 Ton, Single	20 x 24 x 2 Throw-Away	1
4 to 8 Ton Dual	16 x 24 x2 Throw-Away	2
10 to 15 Ton Triple	20 x 25 x 2 Throw-Away	2

CLEANING THE WATER-COOLED CONDENSER

Refer to the 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

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%.

Figure 16: Fan Capacities

UNIT	EVAPORATOR CFM	CONDENSER CFM
1 Ton	400	700
1-1/2 Ton	600	850
2 Ton	800	1600
3 Ton	1200	2000
4 Ton	1600	2500
5 Ton	2000	3300
6 Ton	2400	3800
8 Ton	3200	4250
10 Ton	4000	6000
12 Ton	4800	6000
15 Ton	6000	7500

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.

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 and counter-clockwise to reduce blower speed.

CAUTION: Setscrew must be positioned directly above a 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 (7-8 months). 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 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.

Overgreasing, either in quantity or speed of injection, can cause premature bearing failure. Apply the recommended quantity of grease gradually while rotating the motor shaft as the grease is being applied.

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 United CoolAir systems contain a liquid line sightglass. (See Item ⑩, Figure 6.) If bubbles appear in the sightglass, the system is either undercharged with refrigerant or there may be a restriction in the liquid line upstream of the sightglass. 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.

NOTE: It should be noted that systems using R-410a refrigerant may not run clear and may have a "washed look".

The sightglass contains a moisture indicator which changes color when moisture is present in the system. 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 indicator is "WET", an abnormal condition exists. If an abnormal appearance exists, servicing is required. See Figure 17 for unit charges.

NOTE: After installation and during equipment startup, the sightglass 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.

MINIMUM SERVICE ACCESS

All Service and Maintenance access is through both sides of the unit. 36" for all units.

APPLICATION DATA

	208 / 230	460
Voltage Variation	187 / 253	414 / 504

Cooling (Air Over Evap.)	DB (Min./Max.)	45 / 120
	WB (Min./Max.)	57 / 72

Heat Pump (Air Over ID Coil)	DB (Min./Max.)	50 / 80
---	-----------------------	---------

Water- Cooled	GPM/Ton (Min./Max.)	2.5 / 3.5
	Leaving Water Temp. (Min./Max.)	60 / 115

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

PHYSICAL DATA

Figure 17: Physical Data

		TONS					
		1	1-1/2	2	3	4	5
Voltage (d)		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
		---	---	208/230-3-60	208/230-3-60	208/230-3-60	208/230-3-60
		---	---	460-3-60	460-3-60	460-3-60	460-3-60
Supply Air (a)	CFM	400	600	800	1200	1600	2000
	ESP	.2 to 1"	.2 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"
Evap. Blower	Size	7 x 7	7 x 7	12 x 9	12 x 9	12 x 9	12 x 9
	HP	1/2	1/2	1/2	3/4	1	1
	Qty	1	1	1	1	1	1
Evaporator Coil	Rows Deep	3	3	2	2	4	4
	Face Area	1.5	1.5	3.1	3.1	3.1	3.1
Filter	Size	13-1/2 x 17-1/2 x 1	13-1/2 x 17-1/2 x 1	20 x 24 x 2	20 x 24 x 2	20 x 24 x 2	20 x 24 x 2
	Qty	1	1	1	1	1	1
Condenser Air (a)	CFM	700	850	1600	2000	2500	3300
	Max. ESP	.2 to 1"	.2 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"
Cond. Blower	Size	7 x 7	7 x 7	12 x 9	12 x 9	12 x 9	12 x 9
	HP	1/2	1/2	3/4	1	1-1/2	2
	Qty	1	1	1	1	1	1
Condenser Coil	Rows Deep	3	3	3	3	4	4
	Face Area	2.6	2.6	4.4	4.4	4.4	4.4
Water-Cooled Cond.	Pressure Drop (b)	3.7	9.42	7	6.4	8.76	10.2
	GPM	3	4.5	6	9	12	15
	Int. Volume (Water, Gallons)	0.1	0.1	0.2	0.3	0.4	0.7
Compressor	Qty	1	1	1	1	1	1
Charge R-410a (Lbs-Ozs) (c)	Water-Cooled	2 - 0	2 - 0	2 - 8	3 - 0	4 - 12	5 - 0
	Air-Cooled	2 - 8	2 - 8	4 - 5	4 - 5	5 - 8	5 - 8
	Heat Pump	2 - 11	2 - 11	4 - 8	4 - 8	5 - 11	5 - 11
Weight (Net Operating)	Water-Cooled	310	310	540	545	600	605
	Air-Cooled	375	375	600	610	660	665
	Chilled Water	125	125	200	210	220	220
	Heat Pump	400	400	625	635	690	695

(a) Air flow performance may require other than standard drive components.

(b) Does not include water regulating valve.

(c) Split units need additional refrigerant. Refer to note 7, page 14.

(d) 277-1-60 supply voltage requires use of Buck/Boost Transformer. Refer to page 26.

All specifications subject to change without notice.

PHYSICAL DATA

Figure 17: Physical Data (continued)

		TONS						
		4	5	6	8	10	12	15
Voltage (d)		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	---	---	---
		---	---	208/230-3-60	208/230-3-60	208/230-3-60	208/230-3-60	208/230-3-60
		460-3-60	460-3-60	460-3-60	460-3-60	460-3-60	460-3-60	460-3-60
Supply Air (a)	CFM	1600	2000	2400	3200	4000	4800	6000
	ESP	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"
Evap. Blower	Size	12 x 9	12 x 9	12 x 9	12 x 9	15 x 9	15 x 9	15 x 9
	HP	1	1	2	3	3	5	7.5
	Qty	1	1	1	1	1	1	1
Evaporator Coil	Rows Deep	3	3	3	3	3	4	4
	Face Area	5.2	5.2	5.2	5.2	6.8	6.8	6.8
Filter	Size	16 x 24 x 2	16 x 24 x 2	16 x 24 x 2	20 x 25 x 2	20 x 25 x 2	20 x 25 x 2	20 x 25 x 2
	Qty	2	2	2	2	2	2	2
Condenser Air (a)	CFM	2500	3300	3800	4250	6000	6000	7500
	Max. ESP	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"	.1 to 1"
Cond. Blower	Size	15 x 9	15 x 9	15 x 9	15 x 9	15 x 15	15 x 15	15 x 15
	HP	1-1/2	2	2	3	5	5	7.5
	Qty	1	1	1	1	1	1	1
Condenser Coil	Rows Deep	6	6	6	6	8	8	8
	Face Area	6.4	6.4	6.4	6.4	7.3	7.3	7.3
Water-Cooled Cond.	Pressure Drop (b)	7	8.1	6.4	8.8	10.2	8.8	10.2
	GPM	12	15	18	24	30	36	45
	Int. Volume (Water, Gallons)	.2 ea	.2 ea	.3 ea	.4 ea	.7 ea	.4 ea	.7 ea
Compressor	Qty	2	2	2	2	2	3	3
Charge R-410a (Lbs-Ozs) (c)	Water-Cooled	2 - 14 ea	3 - 4 ea	3 - 14 ea	4 - 0 ea	5 - 0 ea	4 - 0 ea	5 - 0 ea
	Air-Cooled	4 - 8 ea	4 - 14 ea	5 ea	4 - 8 ea	6 - 10 ea	5 - 8 ea	6 ea
	Heat Pump	4 - 11 ea	5 - 1 ea	5 - 3 ea	4 - 11 ea	6 - 13 ea	5 - 11 ea	6 - 3 ea
Weight (Net Operating)	Water-Cooled	865	870	880	895	966	1071	1092
	Air-Cooled	910	915	930	945	1100	1215	1225
	Chilled Water	---	---	290	300	340	360	370
	Heat Pump	960	965	980	995	1150	1290	1300

(a) Air flow performance may require other than standard drive components.

(b) Does not include water regulating valve.

(c) Split units need additional refrigerant. Refer to note 7, page 14.

(d) 277-1-60 supply voltage requires use of Buck/Boost Transformer. Refer to page 26.

All specifications subject to change without notice.

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.
2. For water-cooled units, make sure condenser water is available. Open all stop valves. 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 may be required.
 - 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 may be required.
 - 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

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.
2. For water-cooled units, make sure condenser water is available. Open all stop valves. 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 to the instructions for that device may be required.
 - 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 extreme condensate conditions exist, it is possible to have a condensate pump installed in the evaporator drain pan without need for separate power source (See Item ②, Figure 4 - External Flare Connection). Raise the tubing to the highest possible point above the pump (maximum 12 feet). A 4 ft. rise delivers 50 GPH; a 10 ft. rise delivers 15 GPH. Form an inverted “U” trap as shown in Figure 18 below. This helps to prevent backward siphoning, which causes excessive pump cycling. If this configuration is not possible, the installation of a check valve (Hartell Model VCV-4) is recommended.

Operation of the condensate pump is automatic. Water is collected in the drain pan. When the internal float raises to a pre-set point, the pump will be activated. As the condensate level goes down, the float turns off the pump at another preset point.

NOTE: In case of algae formation, use a commercially available algaecide. After use of the algaecide, rinse with water. Repeat as necessary. Be careful not to clog the check valve or tubing when starting the pump.

CAUTION: Flexible tubing (1/4" I.D.) should be supported to prevent kinking and possible pump damage.

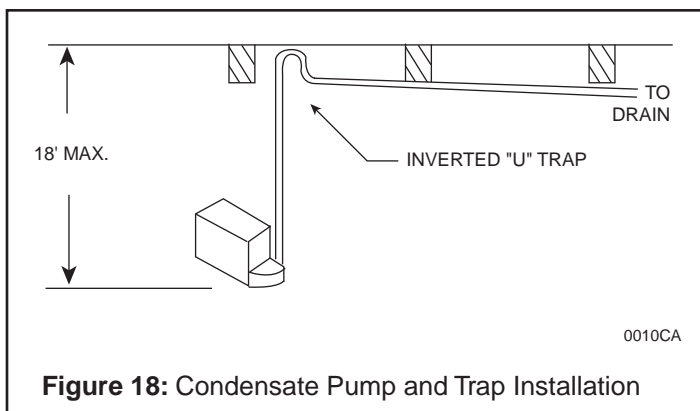


Figure 18: Condensate Pump and Trap Installation

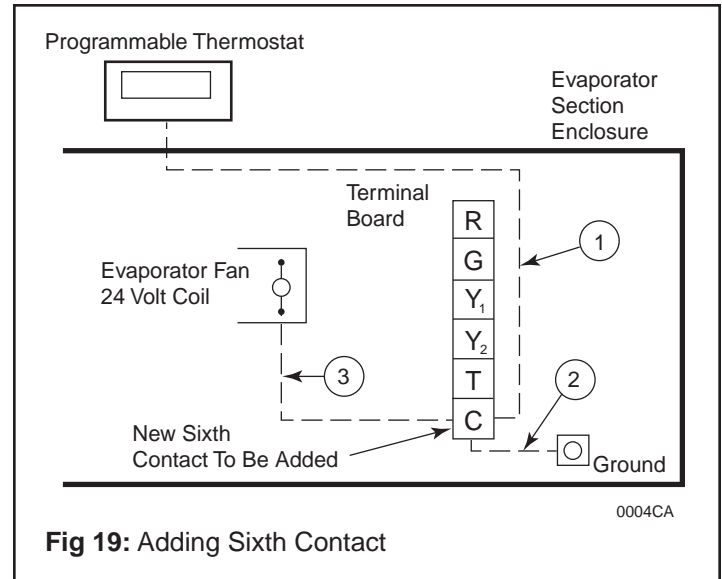


Fig 19: Adding Sixth Contact

THERMOSTAT

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

When a programmable thermostat is used, three connections must be made from the “c” contact . . . ① to the programmable thermostat, ② to a ground and ③ to the 24 volt coil of the evaporator fan motor contactor. See Figure 19.

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

CHECKING HOT GAS BYPASS VALVE

1. Using a calibrated meter, connect a calibrated 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.
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 top of 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

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 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 on the top of the hot gas bypass valve.
4. Adjust the valve by turning the stem. A 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.

MARVEL MICROPROCESSOR CONTROLLER

The microprocessor controller allows you to control up to 16 separate zones independently from one location. There are 12 critical alarm sensors per zone to monitor such things as cooling, heat, humidity; and there are optional day/night setbacks for multiple time cycles. User setpoints are easily programmed at the keypad location. For further information, refer to the Installation Instructions for the Marvel controller which accompanies the unit.

HUMIDIFIER

The optional steam humidifier that comes with the unit functions on the electrode principle. As water fills the plastic steam generator, it immerses metal electrodes which then permits electrical current flow through the water. This current flow produces heat which then boils the water into steam. This steam is then injected on the downstream side of the cooling coil to provide humidification for the area being served by the unit. Water is replenished through tubing and the 1/4" flare located on the evaporator coil panel structure. See Item ②, Figure 4. For further information on operation refer to the Installation Instruction for air conditioning humidifiers which accompanies the unit.

ELECTRIC HEAT

Electric heat is possible in two options. Option 1 is integrally built into the unit behind the evaporator coil, separate power supply is not required.

Option 2 is field installed in the form of a duct heater and must be installed a minimum of 4' downstream from the unit in the evaporator discharge duct. A separate power supply is required for the heat. Consult wiring diagrams on inside of control box covers, which are inside Item ⑦ and Item ⑧, Figure 3, and on the electric heater. See Figure 5, for photo details of wiring.

ELECTRIC REHEAT

On a call for dehumidification the compressor comes on and the evaporator coil removes the moisture from the air passing through it. The electric heater then reheats the air passing through it to maintain the temperature in the space that needs to be conditioned.

STEAM COIL

The steam coil is located directly behind the DX cooling coil. 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.

HOT WATER COILS

The hot water coil is located directly behind the DX cooling coil. The coil is copper tube/aluminum fin. Connections exit the cabinet at the coil location. Controls and valves for hot water coils are supplied by others.

FLOODED CONDENSER

When the outdoor ambient falls, the condensing pressure falls. This causes the discharge pressure to fall as well. Since the pressure differential across the thermostatic expansion valve port affects the rate of refrigerant flow, low head 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.

BUCK/BOOST TRANSFORMER

Units being applied on a 277-1-60 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 20 illustrates the wiring for each transformer.

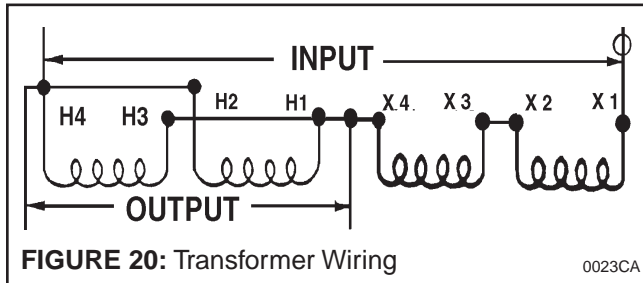


Table 1: Buck/Boost Transformer Table

United CoolAir Part Number	LOAD		Max. Size of Fuse or Breaker
	KVA	Amps	
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

CHILLED WATER VALVES

Chilled water valves, if supplied by United CoolAir, are typically on/off only. The valve would be shipped loose for installation in the field. The valve is to be mounted in the outlet line of the coil.

ECONOMIZER OPERATION (AIRSIDE)

The optional economizer operation utilizes outside air as much as possible for temperature and humidity control in the conditioned spaces.

To ensure that outside conditions are suitable for this, an enthalpy sensor, mounted in a position where it is continuously exposed to the ambient, decides whether a call for cooling is best answered by mechanical cooling or by a mixture of outside and re-circulated air. If the system brings in a continuous supply of some fresh air, the sensing unit can be mounted on the duct with the sensor in the air stream.

The enthalpy sensor and its associated signal conditioner measures both humidity and temperature. The combination of both determines the total heat content of the air.

When these conditions meet the setting selected on the enthalpy sensing unit, a SPDT switch is energized and a call for cooling from the first stage of the room thermostat is then directed to the damper controller, which is usually mounted in the conditioned space near the regular thermostat.

The damper controller has its own temperature sensor, which causes the unit to send a signal of variable strength to the damper motor(s), depending on the difference between the sensed temperature and the selected setting on the controller.

This signal controls the ratio of how far open the outside and re-circulated air dampers are to each other, resulting in just the right amount of outside air that must be introduced into the room to maintain the selected temperature that has been set on the damper controller.

Some accommodation must be made to exhaust excess air, brought into the conditioned spaces from outside. In the case of a full economizer installation, this can be as much as the total volume of air circulated in normal cooling operation.

When outside conditions are no longer suitable for cooling the conditioned space, the outdoor air enthalpy sensor will return control of room tem-

perature to the regular room thermostat , which will then cycle the compressors on and off as required to maintain the set space temperature.

Refer to the system electrical control circuit diagram for proper wiring to integrate the enthalpy sensor and damper controller into the remainder of the system control circuitry.

ECONOMIZER OPERATION – (WATERSIDE)

The waterside economizer is also referred to as a “free cooling coil”.

The free cooling coil is installed after the DX cooling coil in the cabinet.

A sensor is provided in the water inlet side of the water cooled condenser. If the incoming water temperature is below the control setpoint, a normally closed solenoid valve opens and lets the water pass through the free cooling coil. The refrigerant circuit is deactivated during the free cooling economizer operation.

CONDENSING SECTION OUTDOOR MODIFICATION KIT

This kit is available to attach to the outside condenser/condensing section. The air deflector prevents condenser discharge air from re-circulating into the condenser return air. The weather hood minimizes the possibility of water and snow being pulled in.

The screens keep debris, wildlife and hands out of unit. A clearance distance of 6 feet is preferable on the inlet/outlet face of the section for adequate air flow with minimal re-circulation.

SPLIT CONDENSER / CONDENSING SECTIONS

Condensers (without compressors) or condensing sections (with compressors) are available for split applications, both air- and water-cooled. For condensers/condensing units to be used with evaporator sections, other than United CoolAir products, the units are supplied with the refrigerant lines capped with only a holding charge of nitrogen.

VERTICAL STACKING UNIT

The vertical stacking option is designed for installations where floor space is minimal and a ceiling space is not available. The evaporator section is placed above the condensing section for location in small spaces. Evaporator discharge air is available through the front or top for easy duct installation. **Note: For other sheet metal arrangements, contact your local sales office.**

A rigid frame system supports the evaporator and provides vibration-free operation. Quick-connect couplings allow the unit to be split in the field, if needed, for installation. The interconnecting wiring is protected by a cover.

The stacking units are available in all models.

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 Overload tripped Marvel alarm	Repair or replace contactor. Reset and check cause. Clear alarm(s) after correcting problem.
3	Compressor fails to start.	Thermostat set too high Complete loss of refrigerant charge Head pressure too high (high pressure switch open) PTCR will keep compressor OFF for 3 - 5 minutes	Adjust to desired temperature. Repair leak and recharge refrigerant system. Check condenser for obstructions and remove. Check for the required water flow through the water regulating valve and the condenser coil. Manually reset thermostat. With Marvel, turn off alarm and reset. Wait for PTCR to cool off. Compressor should start in 3 - 5 minutes.
4	Compressor short cycles.	Drain pan switch open Low line voltage causing compressor to overheat Dry or icy evaporator coil (reduced air flow) Lack of refrigerant (bubbles in sight glass) Short cycling of conditioned air	Check if the unit is draining properly. Check power source for cause of electric variation of line voltage. Defrost and clean coil and replace dirty filters. Check for leak. Repair and recharge the system. 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.	<p>Lack of proper air quantity</p> <p>Low return air temperature</p> <p>Low refrigerant</p>	<p>Check filters: Clean or replace if necessary. Check for obstruction across coil. Check rotation of evaporator blower to ensure correct rotation of evaporator blowers.</p> <p>Raise return air setpoint.</p> <p>Check for leaks and repair and recharge the system.</p>
6	Noisy compressor	<p>Expansion valve stuck in open position (cold suction line)</p> <p>Broken compressor valve (compressor knocking)</p> <p>Worn or scarred compressor bearings</p> <p>Liquid slugging</p> <p>Excessive head pressure</p>	<p>Ensure feeler bulb is tight on suction line. Check operation and superheat.</p> <p>Replace compressor.</p> <p>Replace compressor.</p> <p>System overcharged. Reclaim excess refrigerant from the high side of the system. Check superheat and subcooling</p> <p>Reduce head pressure (see item 8 below).</p>
7	System short of capacity	<p>Flash gas in liquid line (bubbles in sight glass)</p> <p>Expansion valve stuck open or possibly obstructed</p> <p>Clogged filter drier</p> <p>Ice or dirt on evaporator coil</p> <p>Water regulating valve not fully open</p> <p>Low on refrigerant</p> <p>Condenser coil dirty</p>	<p>Check for leaks. Repair, and recharge the system.</p> <p>Replace Valve.</p> <p>Replace with new filter-drier.</p> <p>Defrost or clean evaporator coil or replace dirty filter.</p> <p>Make sure that the required GPM of water flows through the condensing section</p> <p>Check operating pressures and subcooling. Add charge.</p> <p>Clean condenser coil.</p>

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
8	Head pressure too high	<p>Air or other non-condensable gas in system</p> <p>Condenser air intake blocked</p> <p>Overcharge of refrigerant</p> <p>Condenser fan not operating</p> <p>Condenser water not circulating</p>	<p>Evacuate system and recharge. Install new filter-drier.</p> <p>Clean away debris.</p> <p>Reclaim excess from high pressure side of the system.</p> <p>Check power to motor and ensure correct rotation of blower.</p> <p>Check water regulating valve and adjust for required GPM through the unit.</p>
9	Head pressure too low	See Item 3, 4, & 7 above	Correct as indicated.
10	Suction pressure too low	<p>Flash gas in liquid line (bubbles in sight glass) due to a leak.</p> <p>Obstructed expansion valve</p> <p>Loss of fluid within expansion valve bulb.</p> <p>Clogged filter-drier</p> <p>Ice or dirt on evaporator coil</p>	<p>Repair leak and recharge.</p> <p>Repair or replace valve.</p> <p>Replace power head and valve.</p> <p>Replace with new filter-drier.</p> <p>Defrost and clean evaporator coil and replace filter.</p>
11	Heater inoperative	<p>Thermostat set too low</p> <p>Circuit breaker tripped or blown</p> <p>Heater high limit switch open</p> <p>Heat elements burned out</p>	<p>Adjust thermostat to the desired temperature.</p> <p>Check for electrical short. Replace breaker.</p> <p>Insufficient air across heater elements. Check for obstructed or dirty filters.</p> <p>Check continuity with OHM meter. Replace heater element.</p>
12	Water carry over	Excessive air through unit	Reduce CFM to unit specifications.

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
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.
14	Condensate Pump does not run	<p>Check to see that power to the pump is present.</p> <p>Float not able to move freely.</p> <p>Dirt or algae not allowing float to activate pump.</p>	<p>Locate and repair electrical connection problem.</p> <p>Clean pump and float.</p> <p>Clean pump and float.</p>
15	Condensate Pump runs with no discharge	<p>Tubing blocked or kinked</p> <p>Check valve blocked</p> <p>Impeller blocked</p> <p>Tubing elevation or run exceeds head capability</p>	<p>Inspect, clean or straighten as necessary.</p> <p>Clean check valve.</p> <p>Remove debris from pump impeller.</p> <p>Verify tubing run is within pump head limitations.</p>
16	Lock out relay tripped	High or low pressure condition exists	<p>Refer to items 8 & 10 above.</p> <p>Manually turn off system at thermostat and then back on to reset.</p>

INSTALLATION AND SET-UP

Project: _____

Model: _____ / _____

Options _____

Set Points: Cooling _____
Heating _____
RH% _____

Design: CFM _____ / _____ ESP
Voltage _____
EWT _____ GPM _____
EAT _____
OD Design _____

Controls Calibrated: Y N

Air Balance Completed: Y N

Service Agency: _____

Date: _____

NOTES

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NOTES

TRADITIONAL 'C' SERIES BASIC MODEL DESIGNATION

EXAMPLE: C 5 G 3 ASN I A X or MA 8 G 3 A I A 10 V
 a b c d e f g j a b c d e f g h i

- a. "C", "SP", "CW", "SPW", "H", "HW", "MA", "MW", "CCW", "E", "B" or "BC"
 - "C" Air-Cooled Air Conditioner 2 thru 15 Tons
 - "SP" Air-Cooled Air Conditioner 1 & 1.5 Tons
 - "CW" Water-Cooled Air Conditioner 2 thru 15 Tons
 - "SPW" Water-Cooled Air Conditioner 1 & 1.5 Tons
 - "H" Air-Cooled Heat Pump 1 thru 15 Tons
 - "HW" Water-Cooled Heat Pump 1 thru 15 Tons
 - "MA" Air-Cooled, MagnaCool Unit 1 thru 15 Tons
 - "MW" Water-Cooled, MagnaCool Unit 1 thru 15 Tons
 - "CCW" Chilled Water Unit 1 thru 8 Tons
 - "E" Evaporator Section only of the unit 1 thru 15 Tons
(can be a prefix for some of the above)
 - "B" Condensing Section only of the unit 1 thru 15 Tons
 - "BC" Condenser Section only of the unit 1 thru 15 Tons
- b. "2", "3", "4", "5", "6", "8", "10", "12", "15" Nominal Cooling Capacity in Tons
 ("12" or "18" for SP units 1 & 1.5 Tons)
- c. "G" Common to all
- d. "1", "3", "4" or "7" Indicates Voltage
 - "1" 208-230V, 1 PH (277 Volt Handled by Optional Buck-Boost Trans.)
 - "3" 208-230V, 3 PH
 - "4" 460V, 3 PH
 - "5" 575V, 3 PH
- e. "AS", "ASN", "A" or "B" Quantity of Refrigerant Circuits
 - "AS" Indicates 1 Circuit
 - "ASN" Indicates 1 Circuit 4 or 5 Ton Low Height Traditional Cabinet
 - "A" Indicates 2 Circuits
 - "B" Indicates 3 Circuits
- f. "T" Unit Series
 - "T" Traditional
- g. "A", "C" Refrigerant Type
 - "A" R-410a
 - "C" R-407c
- h. "02", "05", "10", "15", "20", "25", "30" Indicates kW Rating for Heaters
- i. "V" Indicates Vertical Stacking Unit
- j. "X" Special Configuration