

Installation Manual *for*
"C13" SERIES HORIZONTAL
AIR CONDITIONING UNITS
2 Ton – 8 Ton
Air-Cooled • Water-Cooled • Heat Pump



**UNITED COOLAIR
CORPORATION**

P.O. Box 5085, York, PA 17405 – (717) 843-4311 • FAX (717) 854-4462
491 E. Princess St., York, PA 17403 Email: uca@unitedcoolair.com

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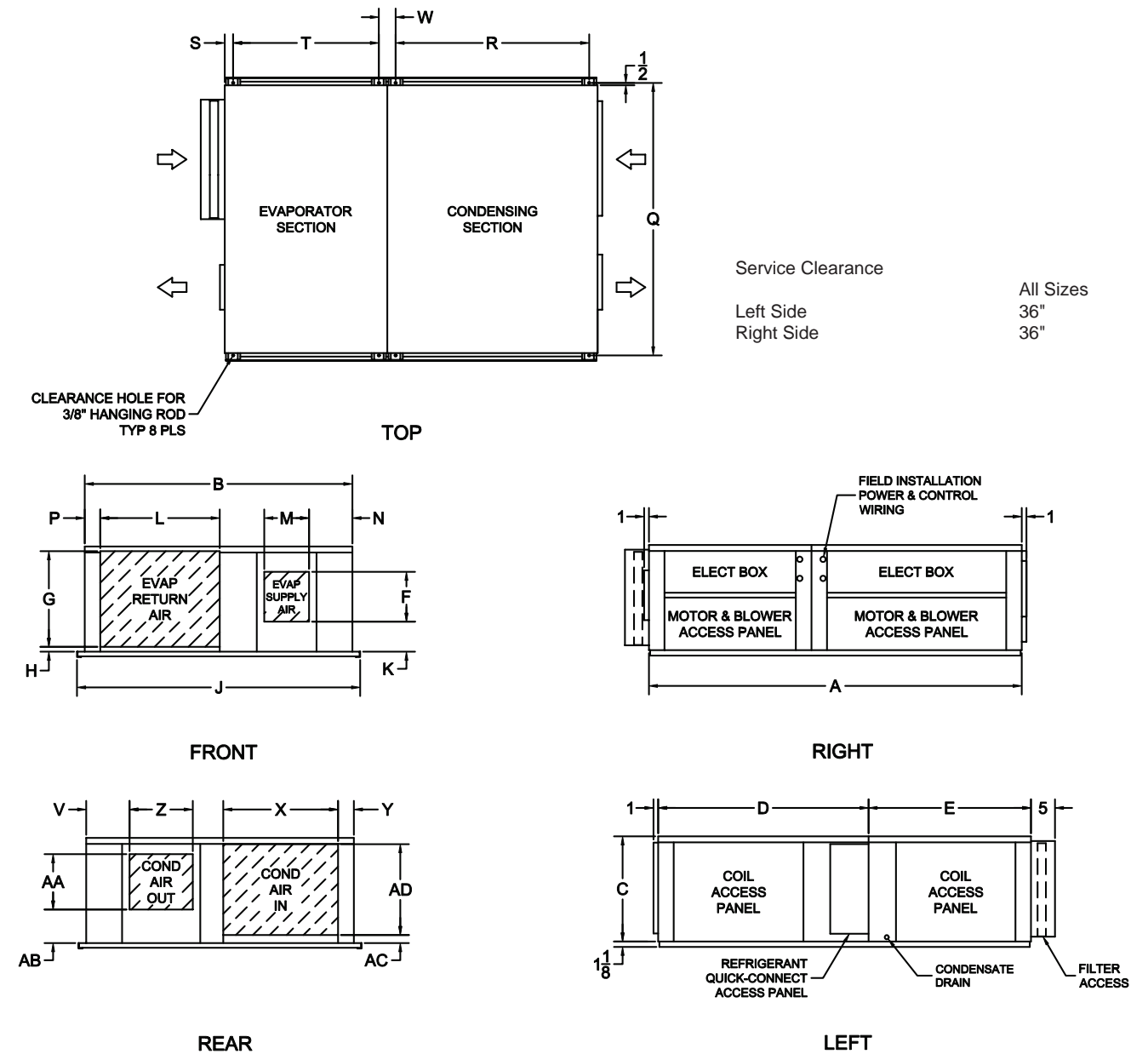
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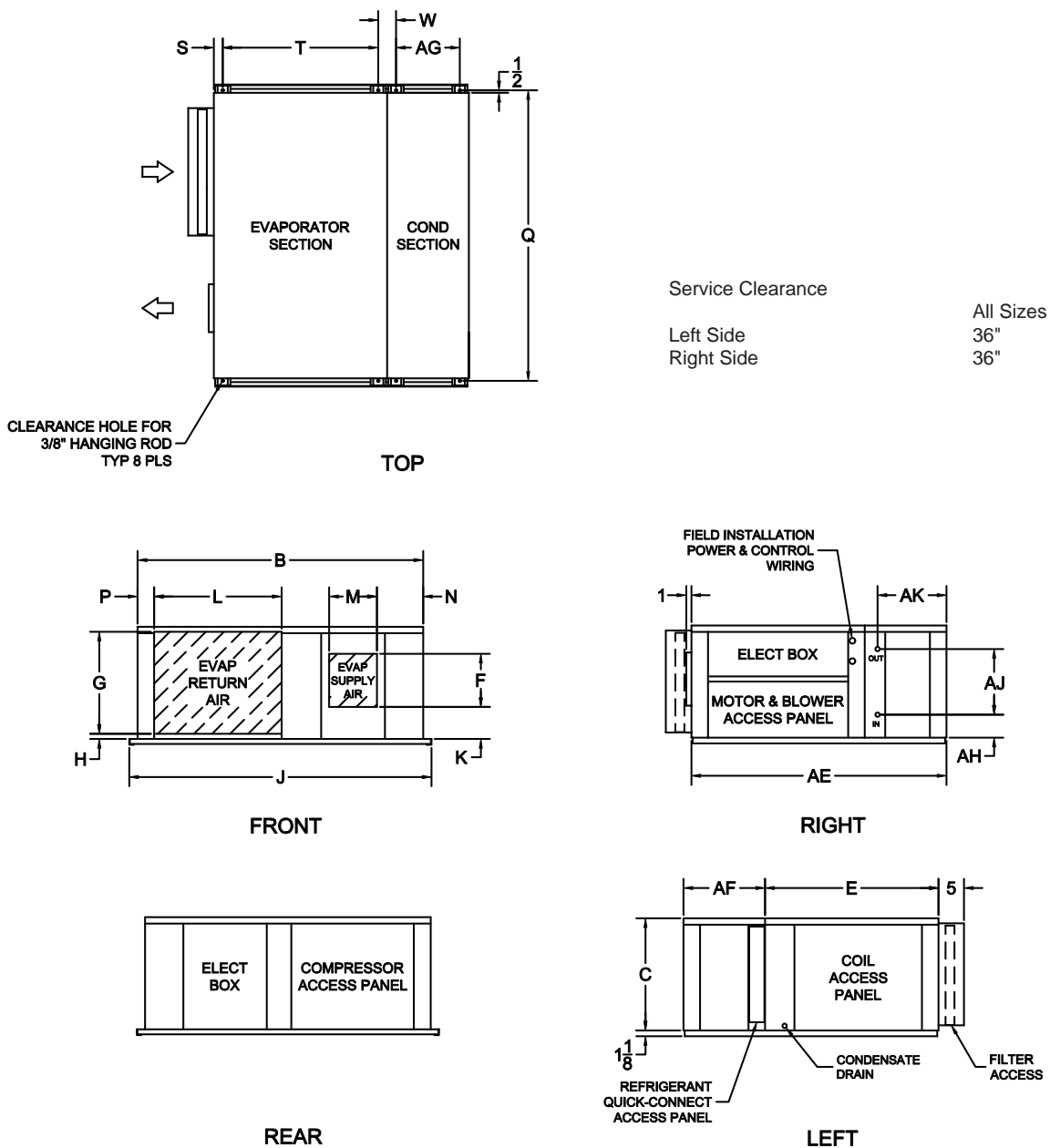
HIGH-EFFICIENCY C-SERIES AIR-COOLED PACKAGE



TONS	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	V	W	X	Y	Z	AA	AB	AC	AD
2-3	78	56	22	44	34	11 ⁹ / ₁₆	20	1	59	7	25	10 ¹¹ / ₁₆	9 ¹ / ₁₆	3 ¹ / ₄	57	40 ¹ / ₂	1 ³ / ₄	30 ¹ / ₂	9 ¹ / ₁₆	3 ¹ / ₂	24	3 ⁵ / ₁₆	13 ¹ / ₄	11 ⁹ / ₁₆	7	1 ¹¹ / ₁₆	19
4-5	86	64	25	46	40	13 ⁹ / ₁₆	25	0	67	8 ¹ / ₁₆	31 ¹ / ₂	12 ³ / ₈	9 ¹ / ₁₆	3	65	42 ¹ / ₂	1 ³ / ₄	36 ¹ / ₂	9 ¹ / ₁₆	3 ¹ / ₂	32	3 ⁵ / ₁₆	12 ³ / ₈	13 ⁹ / ₁₆	8 ¹ / ₁₆	1 ¹¹ / ₁₆	22
6-8	108 ¹ / ₂	70 ¹ / ₂	32	63	45 ¹ / ₂	18 ³ / ₄	31 ¹ / ₂	1 ¹ / ₄	73 ¹ / ₂	6 ⁵ / ₈	39 ¹ / ₂	16 ¹ / ₁₆	6 ¹³ / ₁₆	1 ⁵ / ₈	71 ¹ / ₂	59 ¹ / ₂	1 ³ / ₄	42	9 ¹ / ₁₆	3 ¹ / ₂	24	1 ¹ / ₁₆	18 ¹¹ / ₁₆	16	9 ⁷ / ₁₆	1 ¹¹ / ₁₆	29

Figure 1: Dimension Drawings

HIGH-EFFICIENCY C-SERIES WATER-COOLED PACKAGE



TONS	B	C	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	W	AE	AF	AG	AH	AJ	AK	WATER PIPING IN & OUT SIZE
2-3	56	22	34	11 ⁹ / ₁₆	20	1	59	7	25	10 ¹¹ / ₁₆	9 ¹ / ₁₆	3 ¹ / ₄	57	40 ¹ / ₂	1 ³ / ₄	30 ¹ / ₂	3 ¹ / ₂	50	16	12 ¹ / ₂	6 ¹ / ₄	9 ¹ / ₈	13	Ø ⁷ / ₈
4-5	64	25	40	13 ⁹ / ₁₆	25	0	67	8 ¹ / ₁₆	31 ¹ / ₂	12 ³ / ₈	9 ¹ / ₁₆	3	65	42 ¹ / ₂	1 ³ / ₄	36 ¹ / ₂	3 ¹ / ₂	56	16	12 ¹ / ₂	6 ¹ / ₂	11 ⁵ / ₈	13	Ø ¹ / ₈
6-8	70 ¹ / ₂	32	45 ¹ / ₂	18 ³ / ₄	31 ¹ / ₂	1/4	73 ¹ / ₂	6 ⁵ / ₈	39 ¹ / ₂	16 ¹ / ₁₆	6 ¹³ / ₁₆	1 ⁵ / ₈	71 ¹ / ₂	59 ¹ / ₂	1 ³ / ₄	42	3 ¹ / ₂	65 ¹ / ₂	20	16 ¹ / ₂	7 ¹ / ₈	10 ¹ / ₂	17	Ø ³ / ₈

Figure 2: Water Cooled Dimension Drawings

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 of 36" be allowed on each side of the unit to accommodate maintenance and servicing. Attention must also be given to floor, ceiling or wall load limitations. Location should also provide for condensate removal, trapping and disposal.

! Discharge Air from condenser coil air outlet should be deflected away from condenser air inlet, to prevent recirculation. See also “Condensing Section Outdoor Modification Kit” on page 26.

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

MOUNTING AND SETTING IN PLACE

Units can be shipped as an integral package with a tie rail 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. Install field supplied vibration isolation as required. Level unit.

If unit is to be floor mounted and not separated, **do not** remove tie rails. Locate on a level pad and secure as necessary. Field supplied unit isolation can be installed as required.

INSTALLATION

1. Air conditioner is shipped assembled and ready for operation.
2. Unit contains a full charge of R-410a refrigerant.
3. Install unit so that controls and side panels are accessible to the operator and maintenance personnel.
4. Run the condensate drain line by following the guidelines on page 11.
5. Electrical Wiring
 - a. Once the unit is installed, refer to the wiring diagrams which are provided on the backside of the control box covers.
 - b. Units are completely internally wired at the factory for commonly rated supply voltages. Check unit data tags for required voltage, wire and fuse sizing. 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. Each is supplied with an individual control box cover with a wiring diagram attached inside.
 - c. All the units are provided with terminal blocks.
 - d. The power wiring to the unit is to be brought through one of the available holes for the unit electrical power connection(s).
 - e. The control wiring is brought through the holes provided in the unit.
 - f. Supply wiring must comply with all National or Local codes. The power supply must be suitably fused for wire protection.
 - g. Use copper conductors only. The unit must be earth grounded using the ground lug provided in the electrical box. Metal conduit is **not** an acceptable ground.
6. Run the low voltage wiring from the thermostat to the unit. Connect to low voltage terminal block supplied. See “Thermostat” under “Options”, page 22.

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 3: Control Wire Sizes

Select a location to install the thermostat to avoid vibration, drafts, sun exposure, or internal heat sources. Use an inside wall.

SPLIT SYSTEMS

If the unit was ordered for a split system application each section will contain male resealable refrigerant fittings. Install the mating female fittings and field supplied tubing per the instructions that follow. Note that Optional Interconnect Kits are required for each circuit and external Hot Gas Bypass circuit.

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.
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. 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.

Two circuit units have 2 groups of couplings. 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, be careful not to damage the tubing connections. Do not disconnect the male half of the self-sealing couplings, which are still attached to the bulkhead of the condensing section.

3. Remove the unit top tie piece*, 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 and the condensing section by removing the screws at the top and bottom of each access panel.
5. Disconnect and discard the wires which run between the two internal control boxes. Single circuit units will have two low voltage wires to be disconnected, dual units will have 3 low voltage wires. See Wiring Diagram on the inside of the evaporator control box access panels for disconnecting power wiring.
6. Remove the two unit tie rails attached to the unit mounting rails on each side of the unit.
7. Carefully pull the evaporator section away from the condensing section.

8. Verify that the self-sealing couplings are completely disengaged and not leaking refrigerant.

The sections may now be moved to their individual locations for installation (either floor-mounted or hung).

INTERCONNECTING REFRIGERANT TUBING

After the separated sections have been installed, the field supplied interconnecting tubing can be run, using the self-sealing couplings supplied in the optional interconnecting tubing kit. For dual circuit units, two kits are supplied. It is recommended that some refrigerant oil be placed on the coupling threads (Item ⑩, Figure 5), to facilitate threading. The following instructions apply:

1. Hand thread the female halves of the self-sealing couplings (supplied with the interconnect tubing kit) onto the male couplings (fastened to the unit, Item ⑤, Figures 4 and 5). Turn union nut (Item ⑪, Figure 5), 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. If there is a hot gas bypass option, connect that coupling the same way.
3. Run the interconnecting tubing required.

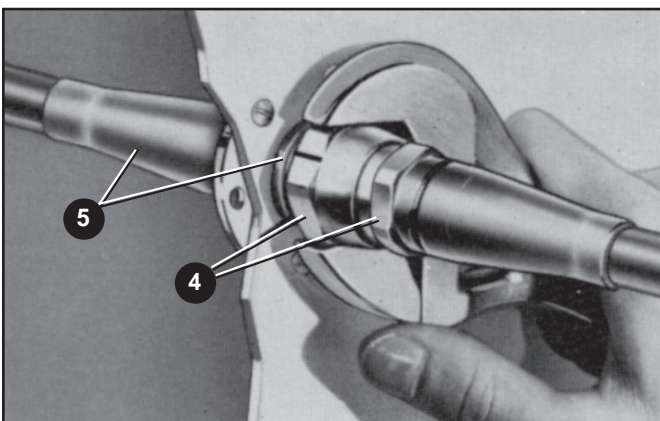


FIGURE 4: Disconnect/Connect Self-sealing Coupling

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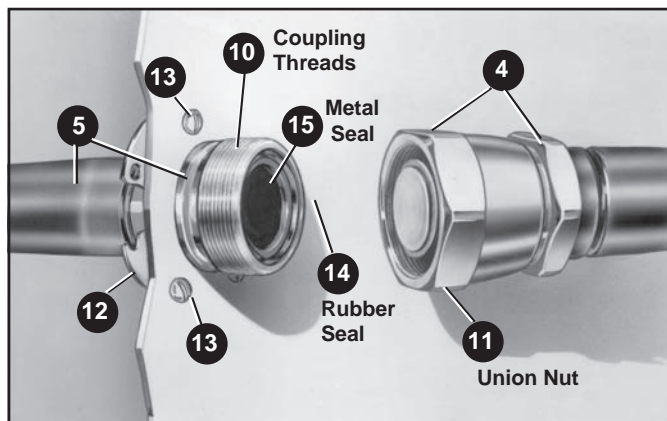


FIGURE 5: Install/Service Self-sealing Coupling

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

Max. total equivalent line length is 100 ft. ^(a)

Max. elevation difference between Evap. and Cond. is 40 ft. ^{(a) (b)}

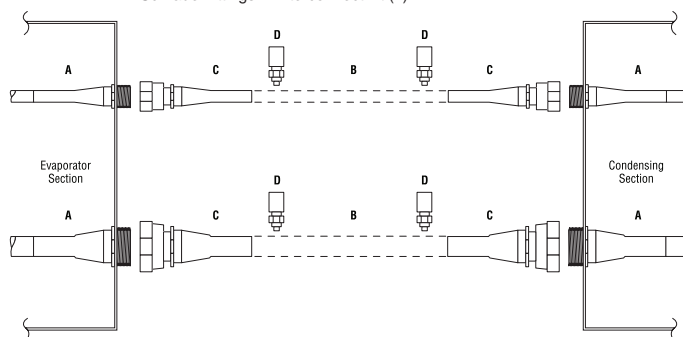
TONS	SUCTION LINE	LIQUID LINE
2 Ton	3/4	1/2
3 Ton	7/8	1/2
4 Ton	1-1/8	1/2
5 Ton	1-1/8	5/8
6 Ton	(2) 7/8	(2) 1/2
8 Ton	(2) 1-1/8	(2) 1/2

(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 additional refrigerant components may be required.

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

The drawing below illustrates a typical piping arrangement for factory ordered split systems

- A - Male self-sealing fittings on unit sections
- B - Refrigerant piping between sections (field-supplied)
- C - Female self-sealing fittings in interconnect kit (4)
- D - Schrader fittings in interconnect kit (4)



Systems not ordered from the factory to be installed as a split system will contain Female Fittings on the evaporator section. Interconnect kit(s) must be ordered indicating that a Male / Female Kit is required.

United CoolAir Corporation's C13-Series horizontal units are provided with unique self-sealing fittings on the refrigerant lines between sections. These fittings or couplings allow the two-section unit 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. An 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 self-sealing fittings as necessary.

FIGURE 6: Guidelines for Interconnecting Tubing Sizing

NOTE: Installations may be made with up to 100 feet equivalent line lengths by installing the recommended tube sizes (See Figure 6) and adding the necessary additional refrigerant, R-410a for the field installed line set. (See Step 7, page 10). For equivalent line lengths greater than 100 ft., contact the factory for line sizing and additional refrigerant circuit accessories required.

IMPORTANT! On units with more than one refrigerant circuit, be careful not to intermix liquid, suction and/or hot gas lines of the various circuits. If the connections were labeled before disconnecting the couplings, this should not be a problem. The 6 Ton and 8 Ton units have 2 circuits (with 2 suction line couplings and 2 liquid line couplings).

CAUTION: When brazing tubing to the self-sealing couplings, use a water-soaked wet rag, running water bath or chill blocks on the quick-connects to prevent overheating the valves and damaging the seals. Always apply heat toward the field installed refrigerant line. Do not apply heat toward the coupling valve and seal.

NOTE: The interconnect tubing kit (Figure 6) contains a sufficient number of Schrader access valves to permit installation of one Schrader in each end of both the liquid and suction lines of the field supplied tubing. Each interconnecting line (suction, liquid, or hot gas) must have at a minimum one Schrader access fitting. However for short lengths of tubing, only one Schrader in each line is necessary.

4. The suction line should be pitched downward to the compressor, sloping approximately 1/4" every ten feet to facilitate oil return.
5. "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.
6. 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.
7. Leak check line sets with nitrogen at 500 psig. 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) (micron level should not go above 500 microns within 10 minutes). Add the appropriate charge of R-410a Refrigerant using the Schrader valves. 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 5). 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 will be totally engaged after an additional 5-1/2 to 5-3/4 turns. The liquid line couplings will be totally engaged after an additional 4-1/2 to 4-3/4 turns.
8. 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.

9. 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

SINGLE PACKAGE UNIT WIRING

If the system is to be installed as a single package unit route the low voltage wiring through the appropriate hole in the condensing section. A single power supply can be routed through the appropriate hole in the condensing section. The unit is factory wired internally for the evaporator. Refer to the unit data tag for power wiring minimum circuit ampacity and maximum fuse size. Power wiring must be wired through over current protective devices such as a circuit breaker or fused disconnect as required by the National Electric Code. A method to disconnect main power such as a non-fused service disconnect must be installed within sight of the unit.

SPLIT SYSTEM WIRING

If the unit was ordered for a split system application (condensing section remote from the evaporator section) each section will require separate power supplies. Route these through the appropriate holes for each section. Power wiring must be wired through over circuit protective devices such as a circuit breaker or fused disconnect as required by the National Electric Code. A method to disconnect main power such as a non-fused service disconnect must be installed within sight of the unit. Route the low voltage wiring through the appropriate holes in the evaporator section. Run the interconnecting low voltage wiring out of the evaporator section and through the appropriate hole in the condensing section.

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.

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 unit 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 unit 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. Refer to the separate instructions for any units that incorporate a microprocessor for control.

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 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 ball 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 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 13.

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 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; one for the condensing section. 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 7).

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.

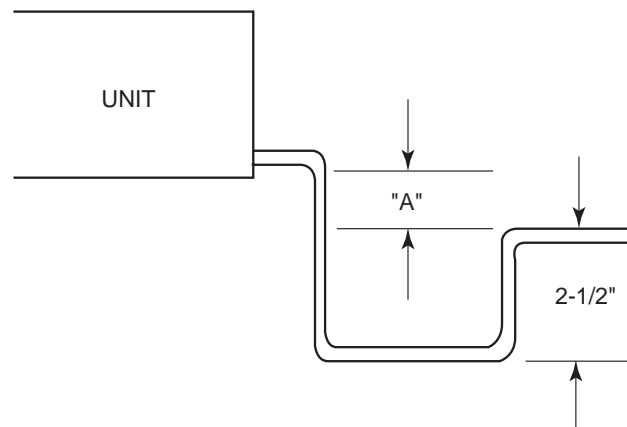


Figure 7: Condensate Trap Installation

MAINTENANCE PROCEDURES

FILTERS

Do NOT run unit without filters.

Throw-away filters are supplied which 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.

In some situations, an external filter box will be incorporated or included in the mixing box.

Figure 8: Filter Sizes

UNIT	FILTER SIZE/TYPE	QUANTITY
2 & 3 Ton	25 X 20 X 2	1
4 & 5 Ton	20 X 16 X 2	2
6 & 8 Ton	20 X 16 X 2	4

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 airflow.

CLEANING THE WATER-COOLED CONDENSER

Cleaning a water cooled condenser helps to improve the heat transfer rate, reduce operational cost, restore efficiency, prolong heat exchanger life, and reduce pressure drop pumping cost. Deposits from water or water treatments, such as scale, lime, rust, or mud are removed.

Each installation is unique. Therefore, the fluid quality and operating conditions will dictate when the heat exchanger needs to be cleaned.

For future reference, it may be beneficial during the startup to record the water pressure drop across as well as the inlet and outlet water temperatures of the water condenser. After a period of time these values can be checked to see how much loss of

operating performance has occurred. If a 10% or greater change has occurred it would be beneficial to clean the heat exchanger.

A 5% solution of Phosphoric Acid or Oxalic Acid can be considered for cleaning. However, there are several other commercially available environmentally safe products on the market that will do an excellent job. Contact your local wholesaler for availability. Follow all safety guidelines published by the cleaner manufacturer.

There is a safety concern whenever using any chemical cleaner at elevated temperatures. The cleaner manufacturers recommend using the cleaners at 120°F or lower. Since the heat exchanger might be in operation just prior to the cleaning, it should be cooled to lower than the 120°F threshold. Due to the ability of the heat exchangers mass to hold heat, this may take a period of time. If possible, circulate cool water through the unit to help dissipate some of the heat.

Check each field installed component to ensure the chemical cleaner will not damage them when the cleaner is circulated. For example, the structural makeup of the strainer may not stand up to the chemical detergent and rapidly deteriorate or fail to function after cleaning. If there is a possibility of this happening, use an alternative cleaner that all components will withstand or create another method of circulating the cleaner that would isolate the component in question from the cleaner. While cleaning the heat exchanger, it may also be a good idea to check and clean the strainer as well.

NOTE: Do not chemically clean a refrigerant circuit.

1. Record performance values (Ref. following charts). Turn off the fluid source.
2. Cool the heat exchanger, if above 120°F.
3. Close the valves to and from the fluid circuit loop.

4. Open the drain valve and drain all fluid from the heat exchanger.
5. Back flush the heat exchanger to remove any loose particles.
6. Attach pump and hoses as illustrated below, making sure all fittings and connections are secure.
7. Check all valving to make sure valves to system are closed and valves for cleaning loop are open.
8. Calculate the total gallons volume of the heat exchanger and the piping using the following charts:

NOMINAL PIPE SIZE	STD. STEEL PIPE VOLUME GAL./FT.	TYPE L COPPER TUBE VOLUME GAL./FT.
1/2"	.0157	.0121
5/8"	—	.0181
3/4"	.0277	.0251
1"	.0449	.0429
1-1/4"	.0779	.0653
1-1/2"	.1060	.0924
2"	.1740	.1610
2-1/2"	.2490	.2480

UNIT _____ Gallons

Pipe (") _____ Gallons/ft x _____ ft = _____ Gallons

Pipe (") _____ Gallons/ft x _____ ft = _____ Gallons

Pipe (") _____ Gallons/ft x _____ ft = _____ Gallons

TOTAL = _____ Gallons

9. Calculate the volume of de-scaler required:
 Water Quantity = 1/2 Total Gallons = _____ Gallons
 De-Scaler Quantity = 1/2 Total Gallons = _____ Gallons

10. Make sure pump is primed.
11. Circulate the required quantity until fluid characteristics indicate that de-scaling process is complete. Manufacturer's instructions will provide details on this.
12. Disconnect pump, hoses and tank from heat exchanger.
13. Flush entire water system with water.
14. Return heat exchanger and system components to service. Check all valves and fitting connections.
15. Record performance values:

	BEFORE	AFTER
Pressure Drop	_____ psig	_____ psig
Entering Temp.	_____ °F	_____ °F
Leaving Temp.	_____ °F	_____ °F

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%.

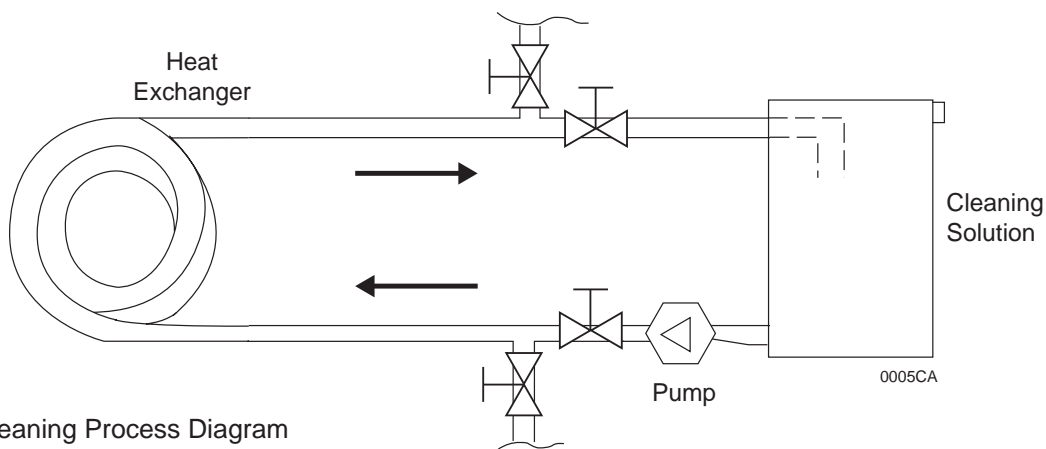


Figure 9: Cleaning Process Diagram

! 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.

Figure 10: Fan Capacities

UNIT	EVAPORATOR CFM	CONDENSER CFM
2 Ton	800	1600
3 Ton	1200	2000
4 Ton	1600	2500
5 Ton	2000	2900
6 Ton	2400	4000
8 Ton	3200	5200

! **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 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.**

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. 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.

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 indicator is green, the refrigerant is normal. When the indicator is yellow, an abnormal condition exists such as moisture within the refrigerant circuit. If an abnormal appearance exists, servicing is required. See Figure 10 for unit charges.

NOTE: After installation and during equipment start-up, the sight glass may appear pink or purple. This occurs during prolonged periods of non-operation and should turn blue 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" clearance is required.

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 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.

PHYSICAL DATA

Figure 11: Physical Data / Air-Cooled

		TONS					
		2	3	4	5	6	8
Air-Cooled	SEER	14.5	13.5	14.3	13	---	---
	EER	---	---	---	---	13	12
Total (f)	BTUH	24,490	36,920	46,280	58,620	75,840	90,395
Sensible (f)	BTUH	17,460	26,650	34,560	42,550	55,290	67,690
Evaporator Supply Air	CFM	800	1200	1600	2000	2400	3200
	Std. ESP	0.25					
	Max. ESP (c)	1.00					
Evaporator Blower	Size	10-8	10-8	12-9	12-9	15-15	15-15
	Qty.	1					
Evaporator Motors	Std. HP	0.33	0.33	0.33	0.50	0.50	0.75
	Opt. HP	0.33 (e)	0.50	0.75	1	1	1.5
Evaporator Coil	Rows	2	3				
	Face Area	3.44	4.31	6.11	6.11	8.94	8.94
	FPI	13	12				
Filter	Type	Pleated Throwaway					
	Qty	1		2		4	
	Dimensions	25 X 20 X 2		20 X 16 X 2			
	Efficiency	MERV 8					
Compressor	Type	Scroll					
	Qty	1			2		
Condenser Air	CFM	1600	2000	2500	2900	4000	5200
	Std. ESP	0.25					
	Max. ESP (c)	1.00					
Condenser Blower	Size	10-10		12-9		15-15	
	Qty	1					
Condenser Motors	Std. HP	0.33	0.5	0.75	1	1.5	2
	Opt. HP	0.75	1	1.5	1.5	2	2
Condenser Coil	Rows	4					
	Face Area	5.56		7.5		12.1	
	FPI	16			14		
COP (Air-Air Heat Pump) Heating Capacity		3.7	3.5	4.0	3.8	3.9	3.7
	47DB/43WB	23,410	34,200	42,760	57,800	72,055	84,740
	17DB/15WB	14,940	22,650	27,635	37,345	44,845	55,682
Charge R-410a (Lbs-Ozs)(a) (Charge per circuit)	Air-Cooled	6-8	6-9	8-12	8-13	9-9	9-10
Weight (Net Operating) (b)	Air-Cooled						
Available Voltages	208/230-1-60	•	•	•	•	•	
	208/230-3-60	•	•	•	•	•	•
	460-3-60	•	•	•	•	•	•

(a) R-410a Refrigerant charge is for base unit configuration. Addition of some options may alter refrigerant amount.

(b) Net Operating weight is for basic unit only. Options will add weight.

(c) Requires optional motor/drive upgrade.

(d) Some refrigerant circuit components may impact unit performance.

(e) Pulley & Belt upgrade only.

(f) Capacities are gross values and are not adjusted for motor heat. Units rated using standards 210/240 and 340/360.

PHYSICAL DATA

Figure 12: Physical Data / Water-Cooled

		TONS					
		2	3	4	5	6	8
Water-Cooled	EER	16.7	16.3	18.1	16.6	16.8	17.3
Total (f)	BTUH	25,210	37,910	48,350	61,675	78,260	94,535
Sensible (f)	BTUH	17,800	27,030	35,465	43,785	56,440	69,335
Evaporator Supply Air	CFM	800	1200	1600	2000	2400	3200
	Std. ESP	0.25					
	Max. ESP (c)	1.00					
Evaporator Blower	Size	10-8	10-8	12-9	12-9	15-15	15-15
	Qty	1					
Evaporator Motors	Std. HP	0.33	0.33	0.33	0.50	0.50	0.75
	Opt. HP	0.33(e)	0.50	0.75	1	1	1.5
Evaporator Coil	Rows	2	3				
	Face Area	3.44	4.31	6.11	6.11	8.94	8.94
	FPI	13	12				
Filter	Type	Pleated Throwaway					
	Qty	1		2		3	
	Dimensions	25 X 20 X 2		20 X 16 X 2			
	Efficiency	MERV 8					
Compressor	Type	Scroll					
	Qty	1				2	
Water-Cooled Condenser	Type	Co-Axial					
	Qty	1				2	
COP (Water-Air Heat Pump)		4.7	5.1	5.3	4.9	5.1	5.1
Heating Capacity		28,800	44,500	54,665	71,700	89,130	108,845
Charge R-410a (Lbs-Ozs) (a) (Charge per circuit)	Water-Cooled	2-12	3-11	4-15	5-1	4-15	5-2
Weight (Net Operating) (b)	Water-Cooled						
Available Voltages	208/230-1-60	•	•	•	•	•	
	208/230-3-60	•	•	•	•	•	•
	460-3-60	•	•	•	•	•	•

(a) R-410a Refrigerant charge is for base unit configuration. Addition of some options may alter refrigerant amount.

(b) Net Operating weight is for basic unit only. Options will add weight.

(c) Requires optional motor/drive upgrade.

(d) Some refrigerant circuit components may impact unit performance.

(e) Pulley & Belt upgrade only.

(f) Capacities are gross values and are not adjusted for motor heat. Units rated using standards 210/240 and 340/360.

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 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 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

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.
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 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 an optional condensate pump is to be used it will be mounted external to the unit. The pump incorporates mounting tabs for securing the pump in a suitable location.

If the unit is an air source heat pump the unit drains from the evaporator and the condensing section will both have to go into the pump.

NOTE: The condensate lines out of the unit, both evaporator and condenser, need to be trapped before going into the condensate pump.

Insert the condensate line(s) through one of the drain inlet holes of the pump sump. Make sure the condensate line does not interfere with the float. Cut an angle on the inlet tube so that it does not close off against the bottom of the pump (See Figure 11).

The pump has a built in check valve. Use 3/8" ID flexible plastic tubing from the pump to a suitable discharge location. Care should be taken not to kink the tubing as this will impede the flow of condensate out of the pump. Support the tubing as necessary with suitable clamps.

Do not exceed the maximum lift of the pump which is 18 feet (35 GPH at 18'). Provide an inverted "U" trap at the highest point of the tubing (See Figure 14). Slope the discharge tubing downward to a point below the bottom of the condensate pump.

The condensate pump has a grounded plug with a 6' cord. Plug the condensate pump into a 115 volt outlet.

Connect the low voltage leads of the auxiliary safety switch to the thermostat control circuit as shown on the unit wiring diagram. This will disrupt / shut down the unit operation until the cause of the high water condition can be rectified. In some situations an alarm (field supplied) should also be activated dependent upon the application.

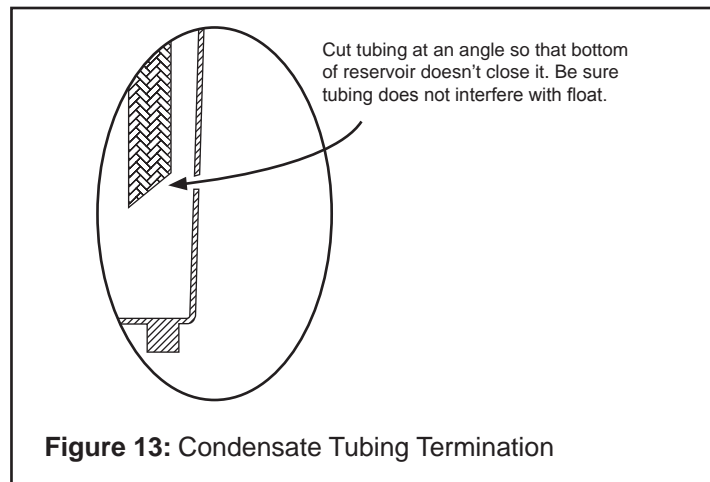


Figure 13: Condensate Tubing Termination

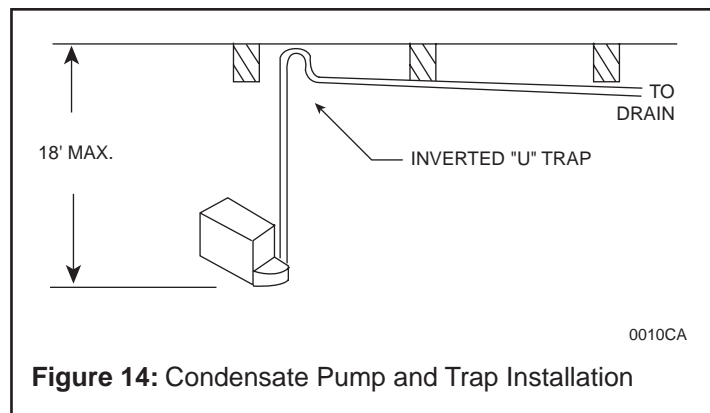


Figure 14: Condensate Pump and Trap Installation

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, a sixth contact must be added to the terminal board in the evaporator section. Three connections must be made from this sixth contact . . . ① to the programmable thermostat, ② to a ground and ③ to the 24 volt coil of the evaporator fan motor contactor (K2). See Figure 15.

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.

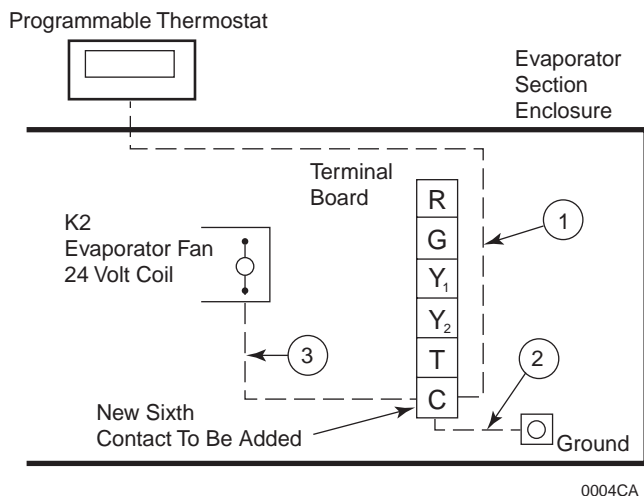


Fig 15: Adding Sixth Contact

CHECKING HOT GAS BYPASS VALVE

1. 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.
3. Connect a high pressure refrigerant gauge to the liquid line.
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 400 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 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

MICROPROCESSOR CONTROLLER

For units controlled by a microprocessor refer to the specific instructions for that device.

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. For further information on operation refer to the Humidifier Installation Instruction which accompanies the unit.

NOTE: If the humidifier could be subjected to below freezing conditions as the result of outside air being introduced, the humidifier should not be located inside the unit air stream. Contact the factory for an externally mounted humidifier.

ELECTRIC HEAT

Electric heat is possible in two options. Option 1 is integrally built into the unit in the return air as a factory supplied option. A separate power supply is not required.

Option 2 is field supplied and installed in the form of a duct heater. A duct heater must be installed a minimum of 4 feet downstream from the unit in the evaporator discharge / supply duct. A separate power supply will be required for the duct heater.

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 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.

HOT WATER COILS

The hot water coil is located in the return air. 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 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.

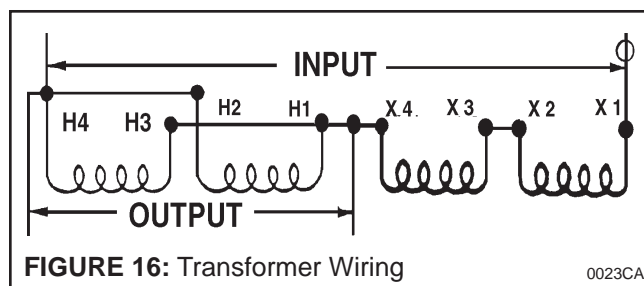
In the off-cycle the refrigerant can “migrate” to the condenser, during periods of low outdoor ambient. On a call for start-up, the evaporator pressure may not build up to the cut-in point of the low pressure control. The result may be a failure of the compressor to start or to short cycle. To eliminate 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 5: 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



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 16 illustrates the wiring for each transformer.

CHILLED WATER VALVES OR HOT WATER VALVES

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.

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.

ECONOMIZER OPERATION (AIRSIDE)

The optional economizer setup utilizes outdoor air as much as possible to maintain the temperature in the space being conditioned. Airside Economizer uses outdoor air to condition the space when the outdoor air enthalpy is less than the indoor air enthalpy and the outdoor air enthalpy is less than the Economizer Module's enthalpy set point. To ensure that the outside air conditions are suitable to operate in the airside economizer mode, an outdoor air enthalpy sensor and a return air enthalpy sensor must be installed at locations where they can continuously monitor outdoor air and return air conditions.

The outdoor air enthalpy sensor must be mounted in ambient outdoor air at a location not influenced by radiant sunlight or other radiating elements. If outdoor air is continuously being supplied to the space being conditioned to satisfy minimum fresh air requirements required by specific codes, the Outdoor Air Enthalpy Sensor can be installed inside the outdoor air ducting; otherwise, it must be installed outdoors in the outdoor air intake plenum. Install the Return Air Enthalpy Sensor in the return air duct before the return air damper.

Economizer Operation

When a call for cooling is initiated by the thermostat located in the space being conditioned, and if the enthalpy conditions are satisfied as sensed by the economizer module, the outdoor air provided for cooling the space could be from a small portion up to 100% total air flow of outdoor air. The determination of how much outdoor air to use for cooling is determined by additional sensors that monitor mixed and discharge air temperatures.

These additional sensors are optional and when they are used in the application, they limit the discharge air temperature so that the discharge air does not become too cold. If these optional sensors are not used, the module will drive the dampers completely open for economizer and use as much cold outdoor air as possible. Refer to the additional instructions provided and electrical diagrams for installation of

Economizer Module, Enthalpy Sensors, and Setup and Operating Instructions.

When the indoor air conditions are better than the outdoor air conditions the Economizer Module will send a signal to the compressors to use mechanical cooling instead of economizer and limit the amount of outdoor air provided to the setting of the minimum outdoor air set point.

ECONOMIZER OPERATION – (WATERSIDE)

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

The free cooling coil is installed before the DX cooling coil in the return air stream.

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.

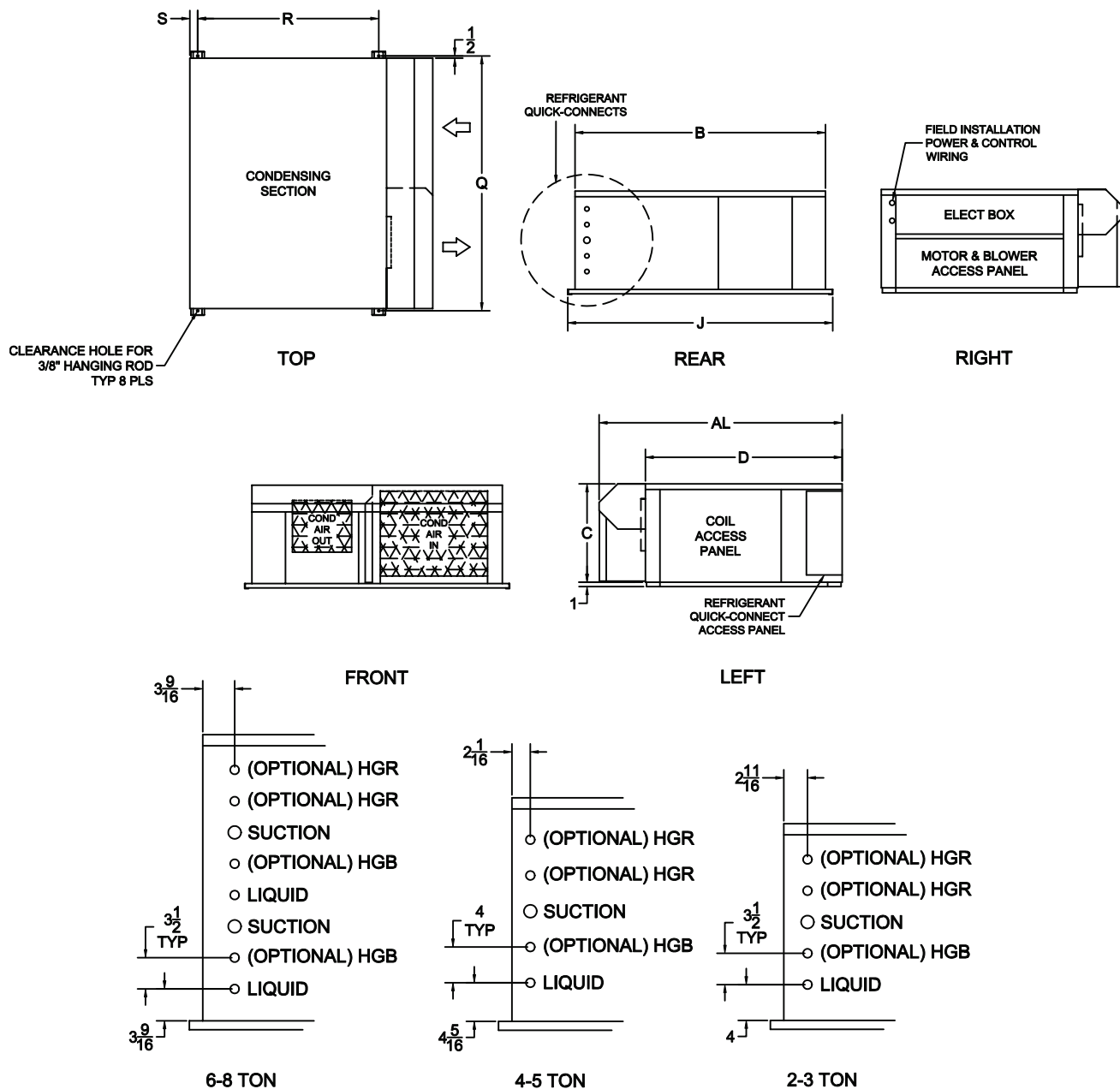
CONDENSING SECTION OUTDOOR MODIFICATION KIT

This kit is available to attach to the outside condenser/condensing section (See Fig. 17). 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.

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.

HIGH EFFICIENCY C-SERIES AIR-COOLED CONDENSER/ CONDENSING SECTION WITH OUTDOOR MODIFICATION KIT



Service Clearance

Left Side
Right Side

All Sizes
36"
36"

TONS	B	C	D	J	Q	R	S	AL
2-3	56	22	44	59	57	40 ^{1/2}	1 ^{3/4}	54 ^{5/16}
4-5	64	25	46	67	65	42 ^{1/2}	1 ^{3/4}	56 ^{5/16}
6-8	70 ^{1/2}	32	63	73 ^{1/2}	71 ^{1/2}	59 ^{1/2}	1 ^{3/4}	73 ^{5/16}

Figure 17: Condensing Section Outdoor Modification Kit (Optional)

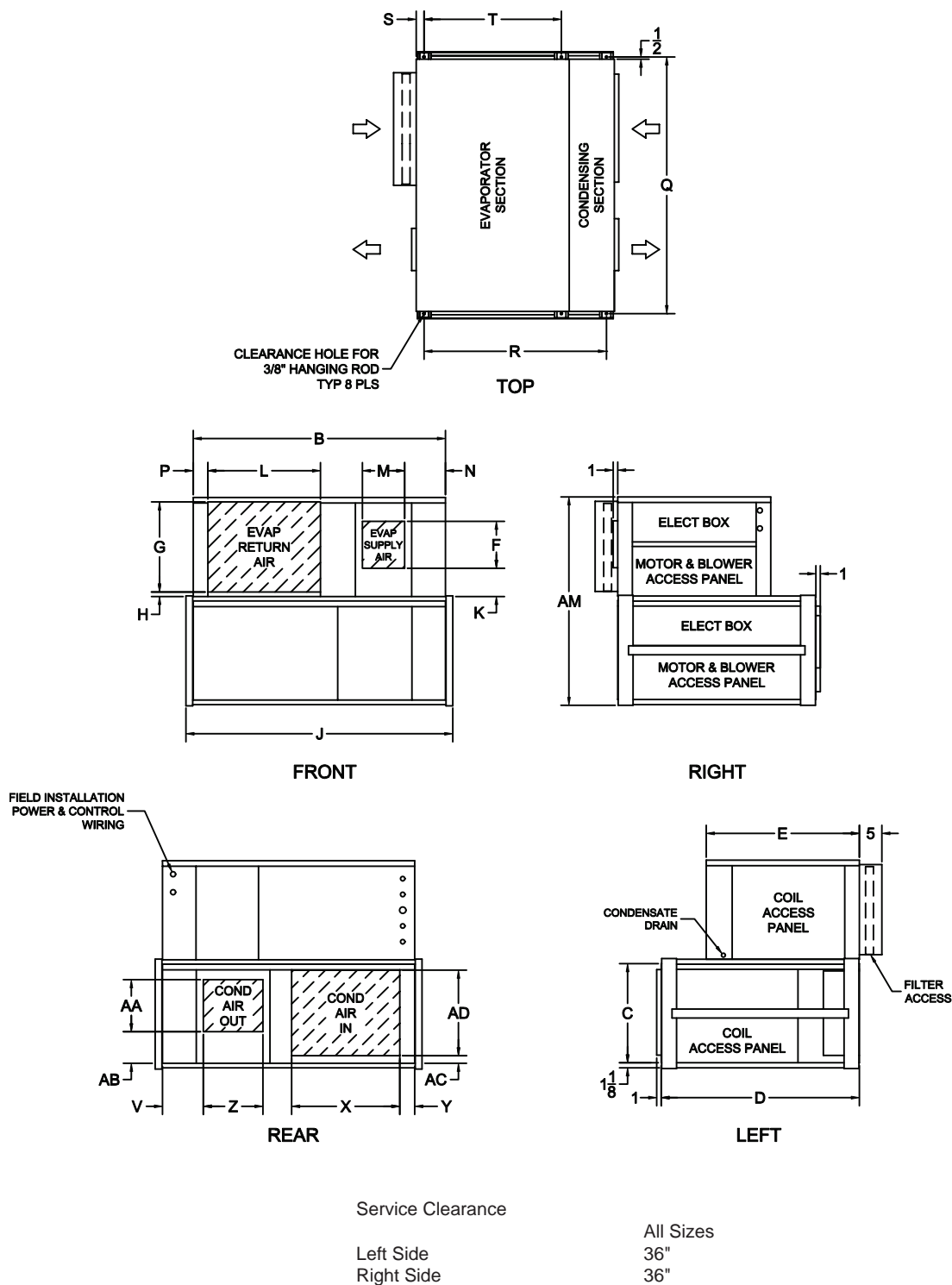
VERTICAL STACKING UNIT

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 air-cooled models.



TONS	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	V	X	Y	Z	AA	AB	AC	AD	AM
2-3	56	22	44	34	11 ⁵ / ₁₆	20	1	59	7	25	10 ¹¹ / ₁₆	9 ¹ / ₁₆	3 ¹ / ₄	57	40 ¹ / ₂	1 ³ / ₄	30 ¹ / ₂	9 ¹ / ₁₆	24	3 ⁵ / ₁₆	13 ¹ / ₄	11 ⁹ / ₁₆	7	1 ¹ / ₁₆	19	46 ⁵ / ₁₆
4-5	64	25	46	40	13 ⁹ / ₁₆	25	0	67	8 ¹ / ₁₆	31 ¹ / ₂	12 ³ / ₈	9 ¹ / ₁₆	3	65	42 ¹ / ₂	1 ³ / ₄	36 ¹ / ₂	9 ¹ / ₁₆	32	3 ⁵ / ₁₆	12 ³ / ₈	13 ⁹ / ₁₆	8 ¹ / ₁₆	1 ¹ / ₁₆	22	52 ⁵ / ₁₆
6-8	70 ¹ / ₂	32	63	45 ¹ / ₂	18 ³ / ₄	31 ¹ / ₂	1/4	73 ¹ / ₂	6 ⁵ / ₈	39 ¹ / ₂	16 ¹ / ₁₆	6 ¹³ / ₁₆	1 ⁵ / ₈	71 ¹ / ₂	59 ¹ / ₂	1 ³ / ₄	42	9 ¹ / ₁₆	24	1 ¹ / ₁₆	181 ¹ / ₁₆	16	9 ⁷ / ₁₆	1 ¹ / ₁₆	29	66 ⁵ / ₁₆

Figure 18: Outline Dimensions For Air-Cooled Vertical Stacking Units

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 Low line voltage causing compressor to overheat and trip on thermal overload	Adjust to desired temperature. Repair leak and recharge refrigerant system. 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. Wait for PTCR to cool off. Compressor should start in 3 - 5 minutes. 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 Ice or dirt on evaporator coil (reduced air flow) Lack of refrigerant (bubbles in sight glass) Short cycling of conditioned air	Check if the unit is draining properly. Defrost coil and replace dirty filters, clean evaporator coil 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 charge</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 set point or check for short cycling of supply air.</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 thermal expansion valve bulb is tight on suction line. Confirm that bulb is located properly 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.</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>Head pressure control valve not fully open</p> <p>Condenser coil dirty</p>	<p>Check for leaks. Repair and recharge the system. Check sub-cooling.</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>Clean condenser coil</p>

ITEM CODE	PROBLEM	PROBABLE CAUSE	SOLUTION
8	Head pressure too high.	Possible non-condensable in system Condenser air intake, duct or coil blocked Overcharge of refrigerant Condenser fan not operating Condenser water not circulating Condenser blower running backwards	Evacuate system and recharge. Install new filter-drier Clean away debris Reclaim excess from high pressure side of the system Check power to motor and ensure correct rotation of blower Check water flow rate and adjust for required GPM through the unit 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. Obstructed expansion valve Loss of fluid within expansion valve bulb Clogged filter-drier Ice or dirt on evaporator coil Evaporator blower running backwards	Repair leak and recharge Repair or replace valve Replace expansion valve or power head. Replace with new filter-drier Defrost and clean evaporator coil and replace filter 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 Circuit breaker tripped or does not reset Heater high limit switch open Heat elements burned out	Adjust thermostat to the desired temperature Check for electrical short. Replace breaker if defective. Insufficient air across heater elements. Check for obstructed or dirty filters 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.

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

'C13' SERIES
High Efficiency
BASIC MODEL DESIGNATION

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

- a. "C", "CW", "H", "HW", "MA", "MW", "CCW", "E", "B" or "BC"
 - "C" Air-Cooled Air Conditioner 2 thru 8 Tons
 - "CW" Water-Cooled Air Conditioner 2 thru 8 Tons
 - "H" Air-Cooled Heat Pump 2 thru 8 Tons
 - "HW" Water-Cooled Heat Pump 2 thru 8 Tons
 - "MA" Air-Cooled, MagnaCool Unit 2 thru 8 Tons
 - "MW" Water-Cooled, MagnaCool Unit 2 thru 8 Tons
 - "CCW" Chilled Water Unit 2 thru 8 Tons
 - "E" Evaporator Section only of the unit 2 thru 8 Tons
(can be a prefix for some of the above)
 - "B" Condensing Section only of the unit 2 thru 8 Tons\
 - "BC" Condenser Section only of the unit 2 thru 8 Tons

- b. "2", "3", "4", "5", "6", "8" Nominal Cooling Capacity in Tons

- c. "G" Common to all

- d. "1", "3", "4" or "5" 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", "A" Quantity of Refrigerant Circuits
 - "AS" Indicates 1 Circuit
 - "A" Indicates 2 Circuits

- f. "H" Unit Series
 - "H" High Efficiency

- g. "A" Refrigerant Type
 - "A" R-410a

- h. "05", "10", "15", "20", "25" Indicates kW Rating for Heaters

- i. "V" Indicates Vertical Stacking Unit

- j. "X" Special Configuration