INSTALLATION MANUAL

R-22
OUTDOOR SPLIT-SYSTEM
HEAT PUMP

MODELS: 12 SEER - YMA / HC2A / HL2A SERIES
2 TO 5 TONS

ISO 9000 REGISTRATION

This product was manufactured in a plant whose quality system is certified/registered as being in conformity with ISO 9001.

Certification applies only when the complete system is listed with ARI.

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SECTION I: GENERAL

The outdoor units are designed to be connected to a matching indoor coil with sweat connect lines. Sweat connect units are factory charged with refrigerant for a matching indoor coil plus 15 feet of field supplied lines.

Matching indoor coils are available with a thermal expansion valve or an orifice liquid feed sized for the most common usage. The orifice size and/or refrigerant charge may need to be changed for some indoor-outdoor unit combinations, elevation differences, or total line lengths. Refer to Application Data covering “General Piping Recommendations and Refrigerant Line Length” (Part Number 036-61920-001).

SECTION II: SAFETY

This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention to the signal words **DANGER**, **WARNING**, or **CAUTION**.

DANGER indicates an **imminently** hazardous situation, which, if not avoided, **will result in death or serious injury**.

WARNING indicates a **potentially** hazardous situation, which, if not avoided, **could result in death or serious injury**.

CAUTION indicates a potentially hazardous situation, which, if not avoided **may result in minor or moderate injury**. It is also used to alert against unsafe practices and hazards involving only property damage

⚠WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage.

Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual for assistance or for additional information, consult a qualified contractor, installer, or service agency.

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state, and national codes including, but not limited to building, electrical, and mechanical codes.

INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's delivery receipt. A separate request for inspection by the carrier's agent should be made in writing. See Local Distributor for more information.

LIMITATIONS

The unit should be installed in accordance with all National, State, and Local Safety Codes and the limitations listed below:

1. Limitations for the indoor unit, coil, and appropriate accessories must also be observed.
2. The outdoor unit must not be installed with any duct work in the air stream. The outdoor fan is the propeller type and is not designed to operate against any additional external static pressure.
3. The maximum and minimum conditions for operation must be observed to assure a system that will give maximum performance with minimum service.

AIR TEMPERATURE AT OUTDOOR COIL, °F				AIR TEMPERATURE AT INDOOR COIL, °F			
Min.		Max.		Min.		Max.	
DB Cool	DB Heat	DB Cool	DB Heat	WB Cool	DB Heat	WB Cool	DB Heat
50	-10	115	75	57	50[1]	72	80

1. Operation below this temperature is permissible for a short period of time, during morning warm-up.

4. The maximum allowable line length for this product is 75 feet.

SECTION III: UNIT INSTALLATION

LOCATION

Before starting the installation, select and check the suitability of the location for both the indoor and outdoor unit. Observe all limitations and clearance requirements.

The outdoor unit must have sufficient clearance for air entrance to the condenser coil, for air discharge, and for service access. See Figure 1.

NOTE: For multiple unit installations, units must be spaced a minimum of 18 inches apart. (Coil face to coil face.)

If the unit is to be installed on a hot sun exposed roof or a black-topped ground area, the unit should be raised sufficiently above the roof or ground to avoid taking the accumulated layer of hot air into the outdoor unit.

Provide an adequate structural support.

ADD-ON REPLACEMENT/RETROFIT

The following steps should be performed in order to insure proper system operation and performance.

1. Change-out of the indoor coil to an approved R-22 coil/ condensing unit combination with the appropriate metering device.
2. If the outdoor unit is being replaced due to a compressor burnout, then installation of a 100% activated alumina suction-line filter drier is required, in addition to the factory installed liquid-line drier. Operate the system for 10 hours. Monitor the suction drier pressure drop. If the pressure drop exceeds 3 psig, replace both the suction-line and liquid-line driers. After a total of 10 hours run time where the suction-line pressure drop has not exceeded 3 psig, replace the liquid line drier, and remove the suction-line drier. Never leave a suction-line drier in the system longer than 50 hours of run time.

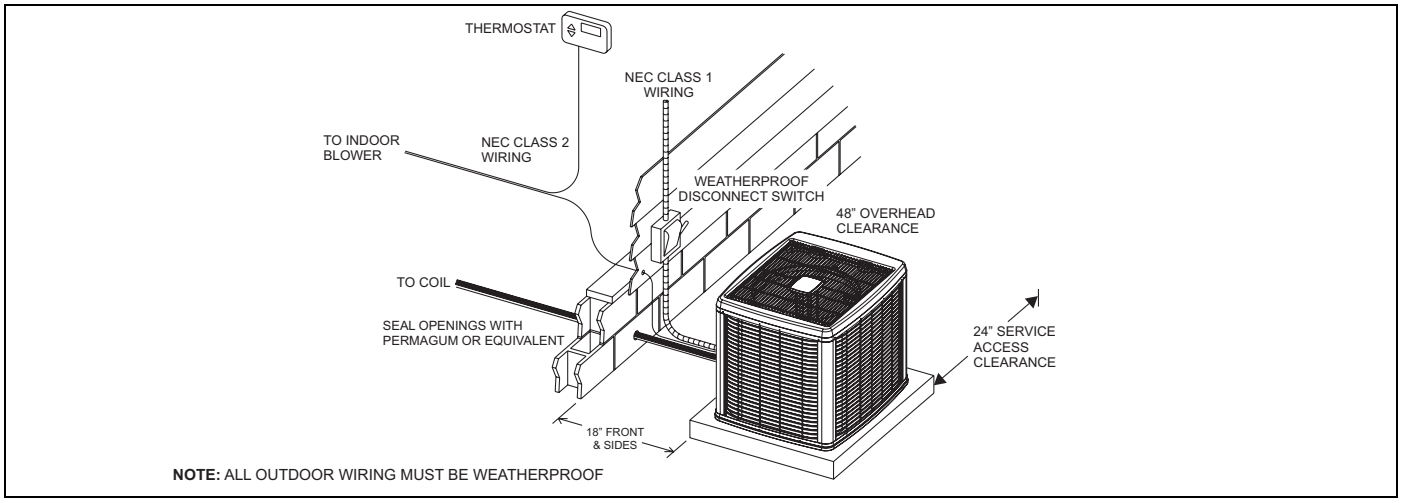

FIGURE 1: Typical Installation

GROUND INSTALLATION

The unit may be installed at ground level on a solid base that will not shift or settle, causing strain on the refrigerant lines and possible leaks. Maintain the clearances shown in Figure 1 and install the unit in a level position.

Normal operating sound levels may be objectionable if the unit is placed directly under windows of certain rooms (bedrooms, study, etc.).

Condensate will drain from beneath the coil of the outdoor unit during the defrost cycle. Normally this condensate may be allowed to drain directly on the ground.

⚠WARNING

The outdoor unit should not be installed in an area where mud or ice could cause personal injury. Remember that condensate will drip from the unit coil during heat and defrost cycles and that this condensate will freeze when the temperature of the outdoor air is below 32°F.

Elevate the unit sufficiently to prevent any blockage of the air entrances by snow in areas where there will be snow accumulation. Check the local weather bureau for the expected snow accumulation in your area.

Isolate the unit from rain gutters to avoid any possible wash out of the foundation.

ROOF INSTALLATION

When installing units on a roof, the structure must be capable of supporting the total weight of the unit, including a pad, lintels, rails, etc., which should be used to minimize the transmission of sound or vibration into the conditioned space.

UNIT PLACEMENT

1. Provide a base in the pre-determined location.
2. Remove the shipping carton and inspect for possible damage.
3. Compressor tie-down bolts should remain tightened.
4. Position the unit on the base provided.

NOTE: Heat pumps will defrost periodically resulting in water drainage. The unit should not be located where water drainage may freeze and create a hazardous condition - such as sidewalks and steps.

LIQUID LINE FILTER-DRIER

The heat pumps have a solid core bi-flow filter/drier located on the liquid line.

NOTE: *Replacements for the liquid line drier must be exactly the same as marked on the original factory drier. See* Source 1 for O.E.M. replacement driers.

⚠ CAUTION

Failure to do so or using a substitute drier or a granular type may result in damage to the equipment.

Filter-Drier Source 1 Part No.	Apply with Models YMA / HC2A / HL2A
026 - 25512 - 000	All Sizes

PIPING CONNECTIONS

The outdoor unit must be connected to the indoor coil using field supplied refrigerant grade copper tubing that is internally clean and dry. Units should be installed only with the tubing sizes for approved system combinations as specified in Tabular Data Sheet. The charge given is applicable for total tubing lengths up to 15 feet. See Application Data Part Number 036-61920-001 for installing tubing of longer lengths and elevation differences.

NOTE: Using a larger than specified line size could result in oil return problems. Using too small a line will result in loss of capacity and other problems caused by insufficient refrigerant flow. Slope horizontal vapor lines at least 1" every 20 feet toward the outdoor unit to facilitate proper oil return.

ORIFICE SELECTION (ORIFICE TYPE COILS ONLY)

NOTE: The proper orifice must be installed in the indoor coil liquid line connection prior to the connection of the refrigerant lines.

⚠WARNING

Coil is under 30 to 35 psig (inert gas) pressure.
Each coil has an orifice installed in the fitting between the liquid line connection and distributor. The orifice is identified on a label next to the liquid line connection.

The orifice shipped with the outdoor unit is based on the “most sold” combination, but it may be changed, depending on the capacity and efficiency of the outdoor unit, elevation differences, and/or long total line lengths. An additional orifice(s) is shipped with most outdoor units for the most commonly required replacement combinations. Other sizes must be ordered from Source 1 Parts if required.

See the appropriate Tabular Data Sheet for the correct orifice size and charge adder. If the orifice size matches, nothing further is required and the refrigerant lines may be connected per the outdoor unit instruction. However, if another orifice should be used, see the coil instruction for details to change the orifice in the coil.

PRECAUTIONS DURING LINE INSTALLATION

1. Install the lines with as few bends as possible. Care must be taken not to damage the couplings or kink the tubing. Use clean hard drawn copper tubing where no appreciable amount of bending around obstruction is necessary. If soft copper must be used, care must be taken to avoid sharp bends which may cause a restriction.
2. The lines should be installed so that they will not obstruct service access to the coil, air handling system, or filter.
3. Care must also be taken to isolate the refrigerant lines to minimize noise transmission from the equipment to the structure.
4. The vapor line must be insulated with a minimum of 1/2" foam rubber insulation (Armaflex or equivalent). Liquid lines that will be exposed to direct sunlight and/or high temperatures must also be insulated.

Tape and suspend the refrigerant lines as shown. DO NOT allow tube metal-to-metal contact. See Figure 2.

5. Use PVC piping as a conduit for all underground installations as shown in Figure 3. Buried lines should be kept as short as possible to minimize the build up of liquid refrigerant in the vapor line during long periods of shutdown
6. Pack fiberglass insulation and a sealing material such as permagum around refrigerant lines where they penetrate a wall to reduce vibration and to retain some flexibility.
7. See Form 690.01-AD1V for additional piping information.

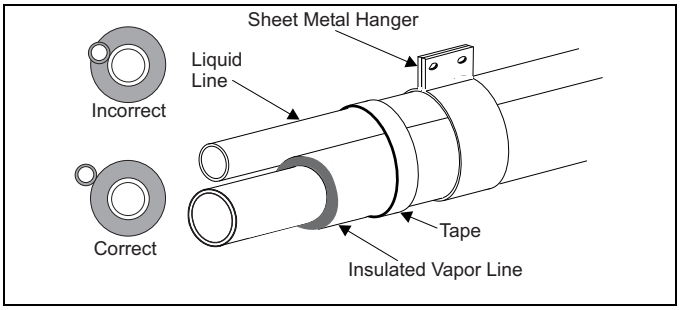

FIGURE 2: Tubing Hanger

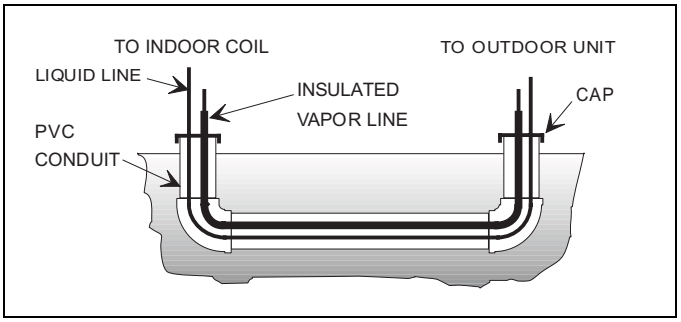

FIGURE 3: Underground Installation

PRECAUTIONS DURING BRAZING OF LINES

All outdoor unit and evaporator coil connections are copper-to-copper and should be brazed with a phosphorous-copper alloy material such as Silfos-5 or equivalent. DO NOT use soft solder. The outdoor units have reusable service valves on both the liquid and vapor connections. The total system refrigerant charge is retained within the outdoor unit during shipping and installation. The reusable service valves are provided to evacuate and charge per this instruction.

Serious service problems can be avoided by taking adequate precautions to assure an internally clean and dry system.

⚠ CAUTION

Dry nitrogen should always be supplied through the tubing while it is being brazed, because the temperature is high enough to cause oxidation of the copper unless an inert atmosphere is provided. The flow of dry nitrogen should continue until the joint has cooled. Always use a pressure regulator and safety valve to insure that only low pressure dry nitrogen is introduced into the tubing. Only a small flow is necessary to displace air and prevent oxidation.

PRECAUTIONS DURING BRAZING SERVICE VALVE

Precautions should be taken to prevent heat damage to service valve by wrapping a wet rag around it as shown in Figure 4. Also, protect all painted surfaces, insulation, and plastic base during brazing. After brazing cool joint with wet rag.

⚠WARNING

This is not a backseating valve. The service access port has a valve core. Opening or closing valve does not close service access port.
If the valve stem is backed out past the chamfered retaining wall, the O-ring can be damaged causing leakage or system pressure could force the valve stem out of the valve body possibly causing personal injury.

Valve can be opened by removing the plunger cap and fully inserting a hex wrench into the stem and backing out counter-clockwise until valve stem just touches the chamfered retaining wall.

Connect the refrigerant lines using the following procedure:

1. Remove the cap and Schrader core from both the liquid and vapor service valve service ports at the outdoor unit. Connect low pressure nitrogen to the liquid line service port.
2. Braze the liquid line to the liquid valve at the outdoor unit. Be sure to wrap the valve body with a wet rag. Allow the nitrogen to continue flowing. Refer to the Tabular Data Sheet for proper liquid line sizing.
3. Carefully remove the rubber plugs from the evaporator liquid and vapor connections at the indoor coil.

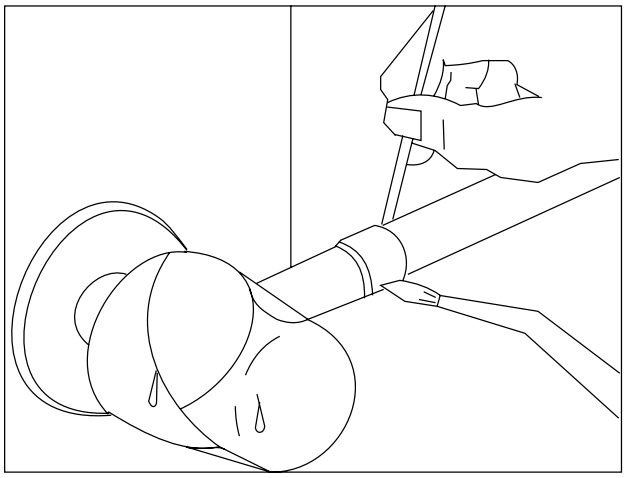

FIGURE 4: Heat Protection

⚠ CAUTION

The evaporator is pressurized.

4. Braze the liquid line to the evaporator liquid connection. Nitrogen should be flowing through the evaporator coil.
5. Slide the grommet away from the vapor connection at the indoor coil. Braze the vapor line to the evaporator vapor connection. After the connection has cooled, slide the grommet back into original position. Refer to the Tabular Data Sheet for proper vapor line sizing.
6. Protect the vapor valve with a wet rag and braze the vapor line connection to the outdoor unit. The nitrogen flow should be exiting the system from the vapor service port connection. After this connection has cooled, remove the nitrogen source from the liquid fitting service port.
7. Replace the Schrader core in the liquid and vapor valves.
8. Go to “SECTION IV” for TXV installation.
9. Leak test all refrigerant piping connections including the service port flare caps to be sure they are leak tight. DO NOT OVERTIGHTEN (between 40 and 60 inch - lbs. maximum).
10. Evacuate the vapor line, evaporator, and the liquid line to 500 microns or less.

NOTE: Line set and indoor coil can be pressurized to 250 psig with dry nitrogen and leak tested with a bubble type leak detector. Then release the nitrogen charge.

NOTE: Do not use the system refrigerant in the outdoor unit to purge or leak test.

11. Replace cap on service ports. Do not remove the flare caps from the service ports except when necessary for servicing the system.

⚠ CAUTION

Do not connect manifold gauges unless trouble is suspected. Approximately 3/4 ounce of refrigerant will be lost each time a standard manifold gauge is connected.

12. Release the refrigerant charge into the system. Open both the liquid and vapor valves by removing the plunger cap and with an allen wrench back out counter-clockwise until valve stem just touches the chamfered retaining wall. See Page 4 "PRECAUTIONS DURING BRAZING SERVICE VALVE".
13. Replace plunger cap finger tight, then tighten an additional 1/12 turn (1/2 hex flat). Cap must be replaced to prevent leaks.

⚠WARNING

Never attempt to repair any brazed connections while the system is under pressure. Personal injury could result.

See "System Charge” section for checking and recording system charge.

SECTION IV: INSTALLATIONS REQUIRING TXV

For installations requiring a TXV, the following are the basic steps for installation. For detailed instructions, refer to the Installation Instructions accompanying the TXV kit.

Install TXV kit as follows:

1. First, relieve the holding charge by depressing the Schrader valve located in the end of the liquid line.
2. After holding charge is completely discharged, loosen and remove the liquid line fitting from the orifice distributor assembly. Note that the fitting has **right hand threads**.
3. Remove the orifice from the distributor body using a small diameter wire or paper clip. Orifice is not used when the TXV assembly is installed.
4. After orifice is removed, install the thermal expansion valve to the orifice distributor assembly with supplied fittings. Hand tighten and turn an additional 1/8 turn to seal. Do not overtighten fittings.

5. Reinstall the liquid line to the top of the thermal expansion valve. Hand modify the liquid line to align with casing opening.
6. Install the TXV equalizer line into the vapor line as follows:
   a. Select a location on the vapor line for insertion of the equalizer line which will not interfere with TXV bulb placement.
   b. Use an awl to punch through the suction tube and insert the awl to a depth to achieve a 1/8" diameter hole.
7. Install TXV equalizer line in 1/8" hole previously made in vapor line. Equalizer line should not be bottomed out in vapor line. Insert equalizer line at least 1/4" in the vapor line. Braze equalizer line making sure that tube opening is not brazed closed.

⚠ CAUTION

Dry nitrogen should always be supplied through the tubing while it is being brazed, because the temperature is high enough to cause oxidation of the copper unless an inert atmosphere is provided. The flow of dry nitrogen should continue until the joint has cooled. Always use a pressure regulator and safety valve to insure that only low pressure dry nitrogen is introduced into the tubing. Only a small flow is necessary to displace air and prevent oxidation.

All connections to be brazed are copper-to-copper and should be brazed with a phosphorous-copper alloy material such as Silfos-5 or equivalent. DO NOT use soft solder.

Install the TXV bulb to the vapor line near the equalizer line, using the two bulb clamps furnished with the TXV assembly. Ensure the bulb is making maximum contact. Refer to TXV installation instruction for view of bulb location.

⚠ CAUTION

In all cases, mount the TXV bulb after vapor line is brazed and has had sufficient time to cool.

   a. Bulb should be installed on a horizontal run of the vapor line if possible. On lines under 7/8" OD the bulb may be installed on top of the line. With 7/8" OD and over, the bulb should be installed at the position of about 2 or 10 o'clock.
   b. If bulb installation is made on a vertical run, the bulb should be located at least 16 inches from any bend, and on the tubing sides opposite the plane of the bend. The bulb should be positioned with the bulb tail at the top, so that the bulb acts as a reservoir.
   c. Bulb should be insulated using thermal insulation provided to protect it from the effect of the surrounding ambient temperature.

SECTION V: ELECTRICAL CONNECTIONS

GENERAL INFORMATION & GROUNDING

Check the electrical supply to be sure that it meets the values specified on the unit nameplate and wiring label.

Power wiring, control (low voltage) wiring, disconnect switches, and over current protection must be supplied by the installer. Wire size should be sized per NEC requirements.

⚠ CAUTION

All field wiring must USE COPPER CONDUCTORS ONLY and be in accordance with Local, National Fire, Safety & Electrical Codes. This unit must be grounded with a separate ground wire in accordance with the above codes.

The complete connection diagram and schematic wiring label is located on the inside surface of the unit service access panel and in Figure 12 of this instruction.

FIELD CONNECTIONS POWER WIRING

1. Install the proper size weatherproof disconnect switch outdoors and within sight of the unit.
2. Remove the screws at the bottom of the corner cover. Slide corner cover down and remove from unit. See Figure 5.
3. Run power wiring from the disconnect switch to the unit.
4. Remove the service access panel to gain access to the unit wiring. Route wires from disconnect through power wiring opening provided and into the unit control box as shown in Figure 5.
5. Install the proper size time-delay fuses or circuit breaker, and make the power supply connections.
6. Energize the crankcase heater if equipped to save time by preheating the compressor oil while the remaining installation is completed.

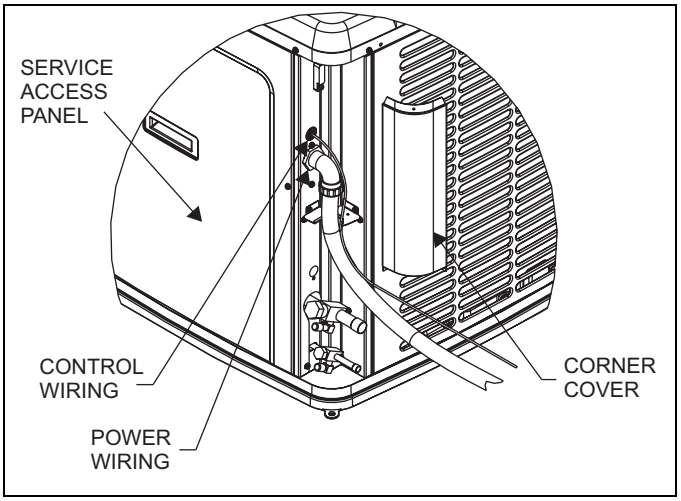

FIGURE 5: Typical Field Wiring

FIELD CONNECTIONS CONTROL WIRING

1. Route low voltage wiring into bottom of control box as shown in Figure 5. Make low voltage wiring connections inside the junction box per Figures 7& 8.
2. Replace the corner cover and service access panel that were removed in Steps 2 and 4 of the "Field Connections Power Wiring" section.
3. All field wiring to be in accordance with national electrical codes (NEC) and/or local-city codes.

NOTE: A Start Assist Kit is available and recommended for long line set applications or in areas of known low voltage problems.

4. Mount the thermostat about 5 ft. above the floor, where it will be exposed to normal room air circulation. Do not place it on an outside wall or where it is exposed to the radiant effect from exposed glass or appliances, drafts from outside doors or supply air grilles.
5. Route the 24-volt control wiring (NEC Class 2) from the outdoor unit to the indoor unit and thermostat.

NOTE: To eliminate erratic operation, seal the hole in the wall at the thermostat with permagum or equivalent to prevent air drafts affecting the operation of in the thermostat.

DEHUMIDIFICATION CONTROL

A dehumidification control accessory 2HU06700124 may be used with variable speed air handlers or furnaces in high humidity areas. This control works with the variable speed indoor unit to provide cooling at a reduced air flow, lowering evaporator temperature and increasing latent capacity. The humidistat in this control opens the humidistat contacts on humidity rise. To install, refer to instructions packaged with the accessory and Figure 8. Prior to the installation of the dehumidification control, the jumper across the HUMIDISTAT terminals on the indoor variable speed air handler or furnace CFM selection board must be removed.

During cooling, if the relative humidity in the space is higher than the desired set point of the dehumidification control, the variable speed blower motor will operate at lower speed until the dehumidification control is satisfied. A 40-60% relative humidity level is recommended to achieve optimum comfort.

If a dehumidification control is installed, it is recommended that a minimum air flow of 325 cfm/ton be supplied at all times.

CFM SELECTION BOARD SETTINGS

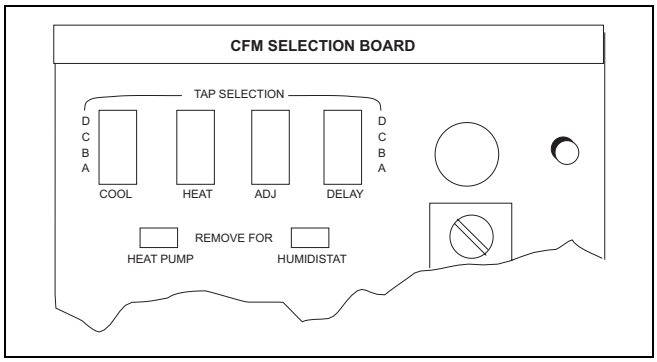

FIGURE 6: CFM Selection Board

For proper system operation the CFM Selection Board jumpers must be set properly.

Refer to the Tabular Data Sheet for the recommended air flow settings for each size condensing unit.

Set the cooling speed per the instructions for the air handler or furnace by selecting the correct COOL and ADJ taps. Verify the airflow using the LED display on the CFM selection board.

The HEAT PUMP jumper **MUST** be removed for proper system operation.

The HUMIDISTAT jumper must also be removed if a dehumidistat is installed.

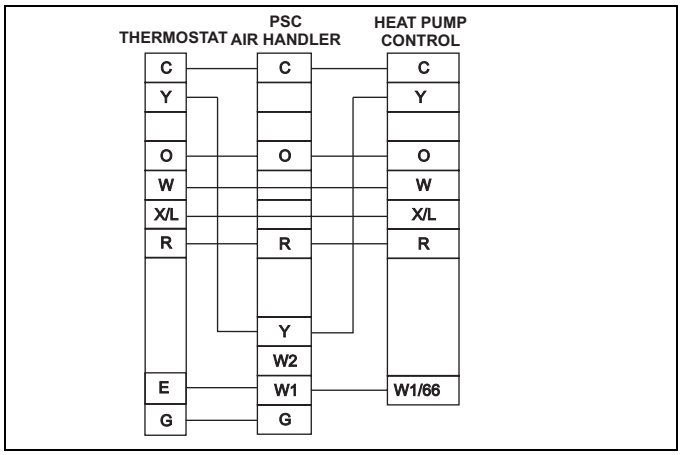

FIGURE 7: Typical Air Handler Conventional Heat Pump Thermostat Wiring

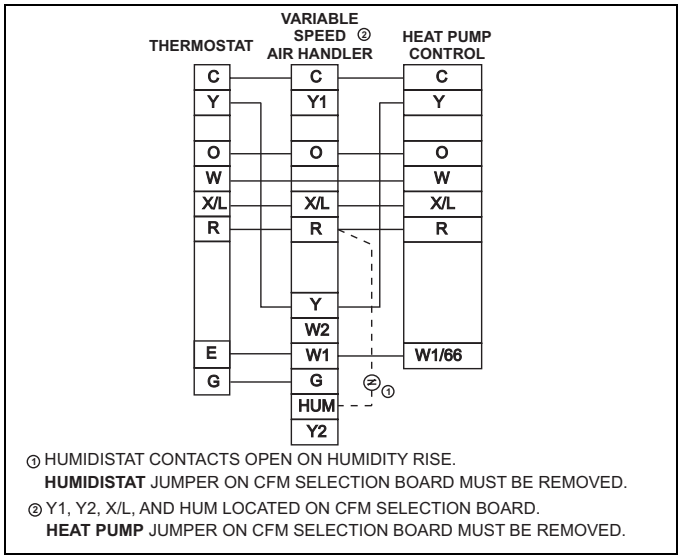

FIGURE 8: Typical Variable Speed Air Handler Conventional Heat Pump Thermostat Wiring

SECTION VI: EVACUATION

It will be necessary to evacuate the system to 500 microns or less. If a leak is suspected, leak test with dry nitrogen to locate the leak. Repair the leak and test again.

To verify that the system has no leaks, simply close the valve to the vacuum pump suction to isolate the pump and hold the system under vacuum. Watch the micron gauge for a few minutes. If the micron gauge indicates a steady and continuous rise, it's an indication of a leak. If the gauge shows a rise, then levels off after a few minutes and remains fairly constant, its an indication that the system is leak free but still contains moisture and may require further evacuation if the reading is above 500 microns.

SECTION VII: SYSTEM CHARGE

The factory charge in the outdoor unit includes enough charge for the unit, a 15 ft. line set and the smallest indoor coil match-up. Some indoor coil matches may require additional charge. See tabular data sheet provided in unit literature packet for charge requirements.

⚠ CAUTION

Do not leave the system open to the atmosphere.

The "TOTAL SYSTEM CHARGE" must be permanently stamped on the unit data plate.

Total system charge is determined as follows:

1. Determine outdoor unit charge from tabular data sheet.
2. Determine indoor coil adjustment from tabular data sheet.
3. Calculate the line charge using the tabular data sheet if line length is greater than 15 feet.
4. Total system charge = item 1 + item 2 + item 3.
5. Permanently stamp the unit data plate with the total amount of refrigerant in the system.

⚠ CAUTION

Refrigerant charging should only be carried out by a qualified air conditioning contractor.

⚠ CAUTION

Compressor damage will occur if system is improperly charged. On new system installations, charge system per tabular data sheet for the matched coil and follow guidelines in this instruction.

If a calibrated charging cylinder or accurate weighing device is available, add refrigerant accordingly. Otherwise, model-specific charging charts are provided in Tables 5 - 9 for cooling mode only. There is no accurate method for charging these units in the heating mode. If charging is required during the heating mode, the unit must be evacuated and charge weighed in according to the rating plate. If TXV indoor coils are used with the 2 through 3-1/2 ton models, the following subcooling charging method must be used. Superheat charging charts are not valid with TXV equipped systems.

Subcooling Charging Method - Cooling Only

The recommended subcooling is 10°F

1. Set the system running in the cooling mode by setting the thermostat at least 6°F below the room temperature.
2. Operate the system for a minimum of 15-20 minutes.
3. Refer to the tabular data sheet for the recommended airflow and verify this indoor airflow (it should be about 400 SCFM per ton).
4. Measure the liquid refrigerant pressure P and temperature T at the service valve.
5. Calculate the saturated liquid temperature ST from Table 1.
6. Subcooling temperature TC = Saturated Temperature (ST) - Liquid Temp (T).

Example: The pressure P and temperature T measured at the liquid service port is 196 psig and 90°F, respectlvely. From Table 1, the saturated temperature for 196 psig is 100°F. The subcooling temperature TC = 100°-90°=10°F

Add charge if the calculated subcooling temperature TC in Step 6 is lower than the recommended level. Remove and recover the refrigerant if the subcooling TC is higher than the recommended level. See table 1 for R-22 saturation temperatures

See Figure 9 to trace the flow of refrigerant through the system.

Check flare caps on service ports to be sure they are leak tight. DO NOT OVERTIGHTEN (between 40 and 60 inch - lbs. maximum).

TABLE 1: R-22 Saturated Properties

Pressure PSIG	Temp °F	Pressure PSIG	Temp °F	Pressure PSIG	Temp °F	Pressure PSIG	Temp °F	Pressure PSIG	Temp °F	Pressure PSIG	Temp °F
80	48	110	64	140	78	170	91	200	101	230	111
82	49	112	65	142	79	172	91	202	102	232	112
84	50	114	66	144	80	174	92	204	103	234	112
86	51	116	67	146	81	176	93	206	103	236	113
88	52	118	68	148	82	178	94	208	104	238	114
90	54	120	69	150	83	180	94	210	105	240	114
92	55	122	70	152	84	182	95	212	105	242	115
94	56	124	71	154	84	184	96	214	106	244	115
96	57	126	72	156	85	186	97	216	107	246	116
98	58	128	73	158	86	188	97	218	107	248	117
100	59	130	74	160	87	190	98	220	108	250	117
102	60	132	75	162	88	192	99	222	109	252	118
104	61	134	76	164	88	194	99	224	109	254	118
106	62	136	77	166	89	196	100	226	110	256	119
108	63	138	78	168	90	198	101	228	111	258	119

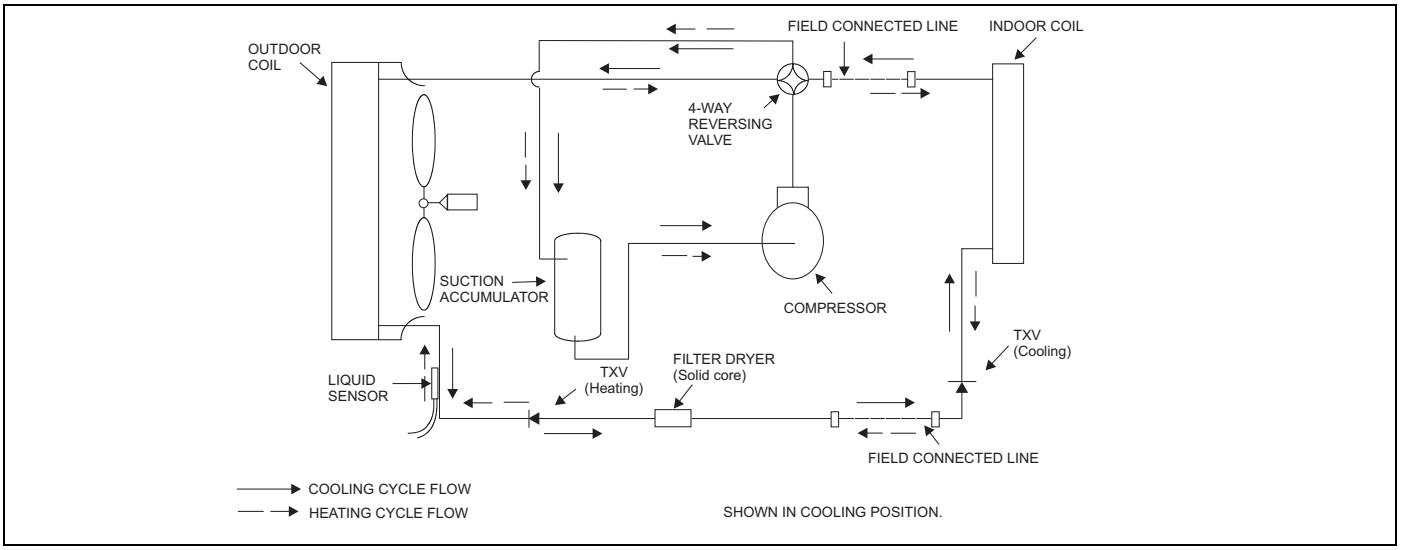

FIGURE 9: Heat Pump Flow Diagram

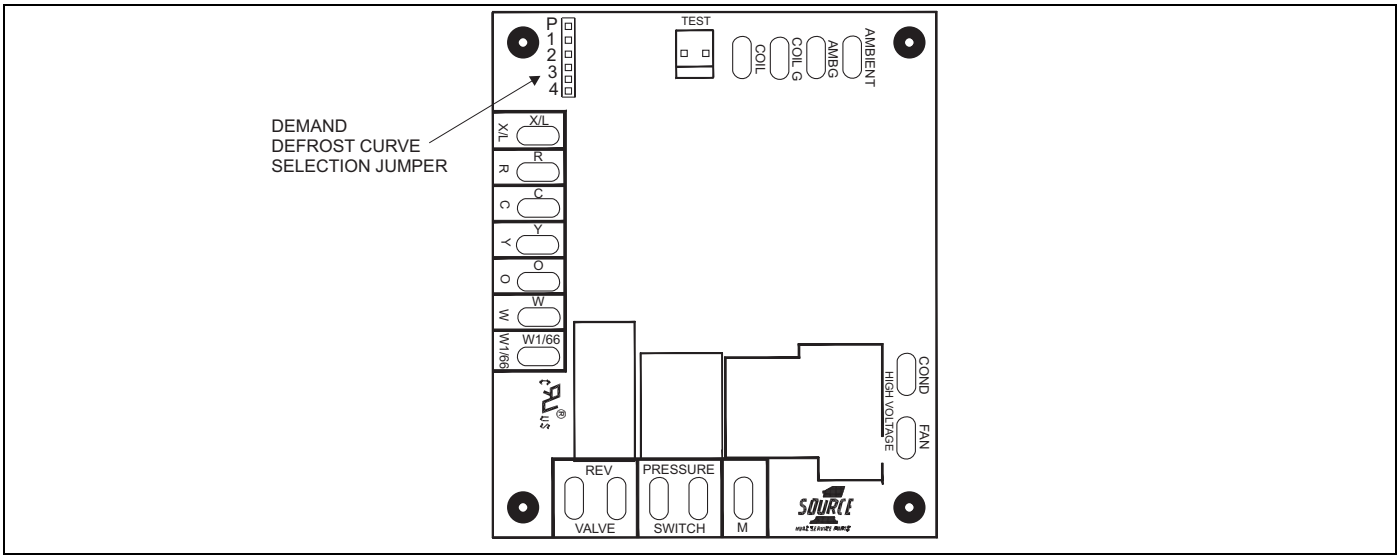

FIGURE 10: Demand Defrost Control Module

SECTION VIII: SYSTEM OPERATION

ANTI-SHORT CYCLE DELAY

The control includes a five-minute anti-short cycle delay (ASCD) timer to prevent the compressor from short cycling after a power or thermostat signal interruption. The ASCD timer is applied when the control is first powered from the indoor unit thermostat and immediately following the completion of a compressor run cycle. The compressor and the outdoor fan will not operate during the five minutes that the timer is active.

The ASCD timer can be bypassed by connecting the TEST terminals for three seconds while the thermostat is calling for compressor operation (Y input signal energized).

LOW VOLTAGE DETECTION

The control monitors the transformer secondary (24 VAC) voltage and provides low voltage protection for the heat pump and its components. In particular, the control prevents contactor chatter during low voltage conditions. If the voltage drops below approximately 19 VAC, the control will continue to energize any relays that are already energized but will not energize any additional relays until the voltage level increases. If the voltage drops below approximately 16 VAC, the control will immediately de-energize the relay outputs and will not energize any relays until the voltage level increases.

TEST INPUT

The control includes a TEST input connector that can be used for various testing functions during installation and service. The TEST input connector is shown in Figure 10. The following table summarizes the behavior of the control when the two TEST pins are connected. More detailed descriptions of the various functions are included in other sections of this document.

TABLE 2: TEST Input Functionality

Duration of connection (seconds)	Control behavior
Less than 2	No response
2-6	Bypass ASCD. If Y is present and pressure switch is closed, contactors will be energized.
	Clear lockout
More than 6	Initiate defrost cycle ignoring the liquid line and outdoor ambient temp. Energize X/L with active defrost curve flash code
Connection removed	Terminate defrost as normal.
Connection not removed	Continue defrost cycle and X/L flash code until TEST connection removed.

FAULT CODE DISPLAY

X/L Output

The X/L terminal of the heat pump control is typically connected to the X/L input of the room thermostat. The thermostat uses this signal to notify the homeowner of a problem with the heat pump using an LED or LCD display. When the control energizes the X/L terminal, the thermostat displays the flash code so the homeowner can see it.

TABLE 3: X/L Output Categories

Condition	X/L
Pressure Switch lockout - last mode of operation was heating	2 flashes
Pressure Switch lockout - last mode of operation was defrost	3 flashes

When the control locks out the compressor because of a pressure switch lockout, it will energize the X/L output as shown in Table 3. The control has a three second delay between fault code flashes.

DEFROST OPERATION

General

The control maintains proper airflow through the outdoor coil during heating operation by melting frost and ice that may form on the coil. Frost may accumulate unevenly in different sections of the coil because of the arrangement of the refrigeration circuit within the coil. The control may initiate a defrost cycle even when the coil is not completely covered with frost. This is normal operation.

The control regulates the defrost operation of the heat pump based on accumulated compressor run time, outdoor coil temperature, and outdoor ambient temperature. The control will cause the unit to operate in the normal heating mode until it determines that a defrost cycle is needed.

All defrost timings are based on accumulated compressor run time.

Operation

The defrost mode is equivalent to the cooling mode except that the outdoor fan motor is de-energized. The control shall do the following to initiate a defrost cycle.

- De-energize the outdoor fan
- Energize the reversing valve
- Energize the auxiliary heat output through the W1/66 terminal.
- Begin the maximum defrost cycle length timer

If the call for heating (Y) is removed from the control during the defrost cycle, it will terminate the defrost cycle and de-energize the compressor. The control will also stop the defrost cycle length timer but not reset it. When the control receives another call for heating, it will restart the defrost cycle and the timer at the point at which the call for heating was removed. This will happen only if the liquid line temperature conditions allow defrost to occur.

Defrost Curves

The control uses a set of defrost curve parameters that are selected using the defrost curve selection jumper. The location of the defrost curve selection jumper is shown in Figures 10. Table 4 shows the jumper position that is appropriate for each heat pump model. Jumper position 4 is not used and the control will not allow the compressor to operate when the jumper is in this position.

Defrost Curve Selection

The factory activates the correct defrost curve during production. They will place the defrost curve selection jumper in the P position or in a numbered position appropriate for the specific heat pump model. You should not have to change the defrost curve selection jumper during initial installation.

If the jumper is inadvertently moved, it should be placed in the appropriate numbered location based on the model number and Table 4. If the factory has activated the curve using the P position, the jumper may also be returned to that position. If, however, the factory has not activated the curve in the P position and the jumper is placed in the P position, the control will not energize the compressor. The control will also not energize the compressor if the defrost curve selection jumper is in a numbered position that is not described in Table 4 or if the defrost curve selection jumper is missing. The control will display the proper fault code when a defrost curve jumper error is present. If the jumper is missing, the control will behave as if the jumper was in the P position. If the jumper is placed in a numbered position, the defrost curve selected by the jumper will override the defrost curve activated at the factory until the jumper is returned to the P position. The control will display the active defrost curve using the X/L terminal when the heat pump is operating in a defrost cycle that has been forced using the TEST inputs.

It will also display the active defrost curve using the X/L terminal when the operational mode is being displayed using the LED's. For instance, the X/L output will be energized with two flashes when defrost curve 2 is active. The control only reads the jumper input when the Y and W thermostat inputs are de-energized. If a jumper position is changed while either of these inputs is energized, the control will not act upon the jumper changes until the thermostat calls are de-energized or power (24 VAC) to the control is cycled.

Defrost Cycle Initiation

The control will allow the heat pump to operate in the heating mode until the combination of outdoor ambient and outdoor coil temperatures indicate that a defrost cycle is necessary.

The control will initiate a defrost cycle when the liquid line temperature is below the initiate point for the measured ambient temperature (See Figure 11) continuously for 4-1/2 minutes. This delay eliminates unnecessary defrost cycles caused by refrigeration surges such as those that occur at the start of a heating cycle.

The control will initiate a defrost cycle every 6 hours (accumulated compressor run time) to recirculate refrigerant lubricants. This forced defrost timer will be reset and restarted following the completion or termination of a defrost cycle.

The control will also initiate a defrost cycle when the TEST terminals are shorted. This feature allows an installer or service technician to start a defrost cycle immediately as required. When the TEST terminals are shorted for more than six seconds with a Y input energized and the pressure switch input is closed, the ASCD will be bypassed and the compressor and the W1/66 terminal to auxiliary heat will be energized.

When the TEST inputs are used to force a defrost cycle, the control will ignore the state of the liquid line temperature and outdoor ambient temperature inputs. The coil does not have to be cold and the outdoor temperature does not have to be within a certain range for the heat pump to be forced into a defrost cycle. After the TEST input jumper is removed, the defrost mode will be terminated as normal. The defrost cycle length timer will not be started until the TEST input is removed. If the TEST terminals remain shorted, the control will keep the unit in defrost mode.

Defrost Inhibition

The control will not initiate a defrost cycle if the liquid line temperature is above 40F unless the defrost cycle is forced using the TEST input.

The control will not initiate a defrost cycle when the outdoor ambient temperature is below –25F or above 55F unless the defrost cycle is forced using the TEST input.

The control will also prevent a defrost cycle from being initiated too soon after the initiation of the previous defrost cycle. When power is applied to the control and after the completion or termination of each defrost cycle, the control will start a 40-minute timer. When this timer expires, the control will allow another defrost cycle when needed. The timer is based on accumulated compressor run time.

Defrost Termination

The control will terminate the defrost cycle immediately after the liquid line temperature reaches 80F or after eight minutes of defrost operation.

The control will do the following to terminate a defrost cycle.

- Energize the outdoor fan
- De-energize the reversing valve
- De-energize the auxiliary heat output through the W1/66 terminal
- Reset and restart the 40-minute defrost inhibit timer

TABLE 4: Defrost Initiate Curves

Defrost Curve Selection Jumper Position	1	2	3	4
Heat Pump Model	3 Ton	2.5, 3.5, 4, 5 Ton	2 Ton	None

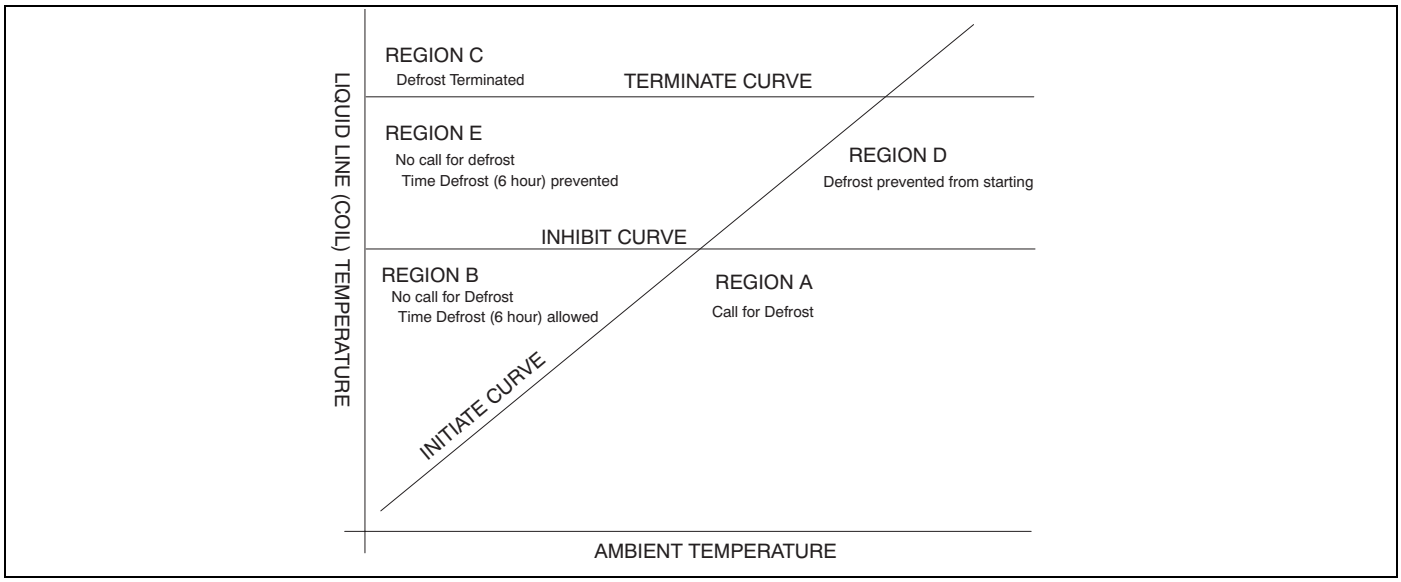

FIGURE 11: Defrost Operation Curves

COOLING OPERATION

During cooling operation, the control will receive thermostat signals at the Y and O input terminals. The control will energize the M compressor output terminal. This signal energizes the coil of the compressor contactor causing the compressor to run. The control also delivers power to the COND FAN terminals causing the outdoor fan to operate. The control energizes the REV VALVE terminal with 24VAC to switch the reversing valve.

HEATING OPERATION

During normal heating mode, the control will receive a thermostat signal at the Y input terminal. The control will energize the M compressor output terminal. This signal energizes the coil of the compressor contactor causing the compressor to run. The control also delivers power to the COND FAN terminals causing the outdoor fan to operate. The reversing valve is not energized in heating mode.

EMERGENCY HEAT

When the thermostat calls for emergency heat operation (W signal without a Y signal), the control will de-energize the compressor and energize the W1/66 terminal immediately.

PRESSURE SWITCH FAULT & LOCKOUT

The heat pump is equipped with a pressure switch and an optional low pressure switch that are connected to the control at the pressure switch terminals. If the pressure switch input opens for more than 40 milliseconds, the control will de-energize the compressor. If the pressure switch closes and a thermostat call for compressor operation is present, the control will apply the five-minute anti-short cycle delay timer and start the compressor when the timer expires.

When the compressor is started following a pressure switch fault, the control will start a six-hour timer based on accumulated compressor run time. If the control senses another opening of the pressure switch before the timer expires, it will cause a soft lockout condition. The second opening of the pressure switch must be greater than 160 milliseconds for the lockout to occur. If the second opening is between 40 and 160 milliseconds, the control will de-energize the compressor but not cause a soft lockout condition. If the control does not sense a second pressure switch opening before the six-hour timer expires, the timer and counter will be reset.

During the soft lockout mode, the control will de-energize the compressor and energize the X/L output with the appropriate flash code.

The control will reset the soft lockout condition when any of the following occur following removal of the fault condition.

1. Power is cycled to the R or Y inputs of the control. This will cause the soft lockout condition to be reset when the thermostat is satisfied or when the thermostat is set to SYSTEM OFF and back to HEAT or COOL mode.
2. The TEST terminals are shorted for more than two seconds.

When the soft lockout condition is reset, the control will stop displaying the fault code and will respond to thermostat inputs normally.

INDICATIONS OF PROPER OPERATION

Cooling

Cooling operation is the same as any conventional air conditioning unit.

1. The outdoor fan should be running, with warm air being discharged from the top of the unit.
2. The indoor blower (furnace or air handler) will be operating, discharging cool air from the ducts. Coils or other parts in the air circuit should be cleaned as often as necessary to keep the unit clean. Use a brush, vacuum cleaner attachment, or other suitable means.
3. The vapor line at the outdoor unit will feel cool to the touch.
4. The liquid line at the outdoor unit will feel warm to the touch.

Heating

Indications of proper Heating operation is as follows:

1. The outdoor fan should be running, with cool air being discharged from the top of the unit.
2. The indoor blower (furnace or air handler) will be operating, discharging warm air from the ducts.
3. The vapor line at the outdoor unit will feel warm to the touch.
4. The liquid line at the outdoor unit will feel cool to the touch.

SECTION IX: INSTRUCTING THE OWNER

Assist owner with processing warranty cards and/or online registration. Review Owners Guide and provide a copy to the owner and guidance on proper operation and maintenance. Instruct the owner or the operator how to start, stop and adjust temperature setting.

When applicable, instruct the owner that the compressor is equipped with a crankcase heater to prevent the migration of refrigerant to the compressor during the “OFF” cycle. The heater is energized only when the unit is not running. If the main switch is disconnected for long periods of shut down, do not attempt to start the unit until 8 hours after the switch has been connected. This will allow sufficient time for all liquid refrigerant to be driven out of the compressor.

The installer should also instruct the owner on proper operation and maintenance of all other system components.

MAINTENANCE

1. Dirt should not be allowed to accumulate on the outdoor coils or other parts in the air circuit. Clean as often as necessary to keep the unit clean. Use a brush, vacuum cleaner attachment, or other suitable means.
2. The outdoor fan motor is permanently lubricated and does not require periodic oiling.
3. If the coil needs to be cleaned, it should be washed with Calgon Coilclean (mix one part Coilclean to seven parts water). Allow solution to remain on coil for 30 minutes before rinsing with clean water. Solution should not be permitted to come in contact with painted surfaces.
4. Refer to the furnace or air handler instructions for filter and blower motor maintenance.
5. The indoor coil and drain pan should be inspected and cleaned regularly to prevent odors and assure proper drainage.

⚠ CAUTION

IT IS UNLAWFUL TO KNOWINGLY VENT, RELEASE OR DISCHARGE REFRIGERANT INTO THE OPEN AIR DURING REPAIR, SERVICE, MAINTENANCE OR THE FINAL DISPOSAL OF THIS UNIT.

WHEN THE SYSTEM IS FUNCTIONING PROPERLY AND THE OWNER HAS BEEN FULLY INSTRUCTED, SECURE THE OWNER’S APPROVAL.

TABLE 5: 12Z24AC -Superheat Charging Chart

Outdoor Ambient Dry Bulb (°F)	Evaporator Suction Pressure (psig)																		
	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94
	Evaporator Suction Temperature (°F)																		
65	..	..	..	..	42	52	62	72	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	..	38	47	55	63	71	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	..	40	47	53	59	66	..	..	..	..	..	..	..	..	..
80	..	..	..	..	..	..	44	48	53	57	61	66	..	..	..	..	..	..	..
85	..	..	..	..	..	..	..	45	49	52	55	58	61	..	..	..	..	..	..
90	..	..	..	..	..	..	..	..	47	50	52	54	57	59	..	..	..	..	..
95	..	..	..	..	..	..	..	..	..	49	51	52	54	56	57	59	..	..	..
100	..	..	..	..	..	..	..	..	..	..	51	52	53	54	56	57	58	..	..
105	..	..	..	..	..	..	..	..	..	..	..	53	54	55	56	57	58	..	..
110	..	..	..	..	..	..	..	..	..	..	..	..	54	55	56	58	59	60	..
115	..	..	..	..	..	..	..	..	..	..	..	..	..	55	56	58	59	61	62
120	..	..	..	..	..	..	..	..	..	..	..	..	..	..	57	58	60	61	63
125	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	58	59	61	62

TABLE 6: 12Z30AC -Superheat Charging Chart

Outdoor Ambient Dry Bulb (°F)	Evaporator Suction Pressure (psig)																		
	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94
	Evaporator Suction Temperature (°F)																		
65	..	..	49	60	71	..	..	..	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	49	58	67	75	..	..	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	49	56	63	70	..	..	..	..	..	..	..	..	..	..	..
80	..	..	..	..	..	48	53	58	63	68	..	..	..	..	..	..	..	..	..
85	..	..	..	..	..	..	48	52	56	60	64	68	..	..	..	..	..	..	..
90	..	..	..	..	..	..	..	48	51	54	57	60	63	..	..	..	..	..	..
95	..	..	..	..	..	..	..	..	48	51	53	56	59	62	..	..	..	..	..
100	..	..	..	..	..	..	..	..	..	48	51	53	56	58	61	..	..	..	..
105	..	..	..	..	..	..	..	..	..	..	49	51	53	56	58	60	..	..	..
110	..	..	..	..	..	..	..	..	..	..	..	51	53	55	57	59	61	..	..
115	..	..	..	..	..	..	..	..	..	..	..	..	53	54	56	58	59	61	..
120	..	..	..	..	..	..	..	..	..	..	..	..	..	54	56	57	59	60	..
125	..	..	..	..	..	..	..	..	..	..	..	..	..	..	55	56	57	58	59

TABLE 7: 12Z36AC -Superheat Charging Chart

Outdoor Ambient Dry Bulb (°F)	Evaporator Suction Pressure (psig)																		
	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94
	Evaporator Suction Temperature (°F)																		
65	..	..	39	50	60	71	..	..	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	42	51	60	69	..	..	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	43	50	57	63	70	..	..	..	..	..	..	..	..	..	..
80	..	..	..	..	..	45	50	54	59	64	69	..	..	..	..	..	..	..	..
85	..	..	..	..	..	43	47	50	54	57	61	64	..	..	..	..	..	..	..
90	..	..	..	..	..	..	46	48	51	54	56	59	61	64	..	..	..	..	..
95	..	..	..	..	..	..	..	47	49	52	54	56	58	61	63	..	..	..	..
100	..	..	..	..	..	..	..	..	49	51	53	55	56	58	60	62	..	..	..
105	..	..	..	..	..	..	..	..	..	51	52	54	55	57	59	60	62	..	..
110	..	..	..	..	..	..	..	..	..	..	52	54	55	57	59	60	62	..	..
115	..	..	..	..	..	..	..	..	..	..	..	53	55	57	59	60	62	64	..
120	..	..	..	..	..	..	..	..	..	..	..	..	55	57	58	60	62	63	..
125	..	..	..	..	..	..	..	..	..	..	..	..	..	57	58	59	61	62	63

TABLE 8: 12Z42AC -Superheat Charging Chart

Outdoor Ambient Dry Bulb (°F)	Evaporator Suction Pressure (psig)																		
	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94
	Evaporator Suction Temperature (°F)																		
65	..	..	39	45	52	58	64	70	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	41	47	53	59	65	70	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	45	50	55	60	65	70	..	..	..	..	..	..	..	..	..
80	..	..	..	..	43	47	52	56	60	64	69	..	..	..	..	..	..	..	..
85	..	..	..	..	..	45	48	52	56	60	64	68	..	..	..	..	..	..	..
90	..	..	..	..	..	..	47	50	54	57	60	64	67	..	..	..	..	..	..
95	..	..	..	..	..	..	46	49	52	55	58	60	63	66	..	..	..	..	..
100	..	..	..	..	..	..	..	48	51	54	56	59	62	65	..	..	..	..	..
105	..	..	..	..	..	..	..	..	50	52	55	57	60	62	65	..	..	..	..
110	..	..	..	..	..	..	..	..	49	52	54	57	59	61	64	66	..	..	..
115	..	..	..	..	..	..	..	..	..	50	53	55	58	60	62	65	..	..	..
120	..	..	..	..	..	..	..	..	..	..	53	55	57	59	61	64	66	..	..
125	..	..	..	..	..	..	..	..	..	..	..	54	56	58	59	61	63	65	..

TABLE 9: 12Z48HP Subcooling Charging Chart

COOLING MODE				
Outdoor Ambient	**Indoor Wet Bulb (°F)**			
	57	62	67	72
DB (°F)	Liquid Pressure (Subcooling)			
65	147 (6)	147 (6)	148 (6)	151 (6)
70	161 (7)	161 (7)	162 (7)	165 (7)
75	176 (8)	176 (8)	177 (7)	180 (7)
80	191 (9)	192 (8)	193 (8)	195 (7)
85	207 (9)	208 (8)	209 (8)	211 (8)
90	224 (9)	224 (8)	225 (8)	227 (8)
95	241 (9)	241 (8)	242 (8)	244 (8)
100	258 (9)	259 (9)	260 (8)	262 (8)
105	277 (9)	277 (9)	278 (8)	280 (8)
110	296 (9)	296 (9)	297 (8)	299 (8)
115	315 (9)	315 (9)	316 (8)	318 (8)
120	335 (9)	335 (8)	336 (7)	338 (7)
125	355 (8)	355 (8)	356 (7)	359 (7)

TABLE 10: 12Z60AC -Superheat Charging Chart

Outdoor Ambient Dry Bulb (°F)	Evaporator Suction Pressure (psig)																		
	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94
	Evaporator Suction Temperature (°F)																		
65	..	..	41	47	53	58	64	..	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	43	48	54	59	64	..	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	47	51	55	60	64	..	..	..	..	..	..	..	..	..	..
80	..	..	..	..	..	48	51	55	58	61	..	..	..	..	..	..	..	..	..
85	..	..	..	..	..	47	50	53	56	59	62	..	..	..	..	..	..	..	..
90	..	..	..	..	..	..	49	51	53	56	58	61	..	..	..	..	..	..	..
95	..	..	..	..	..	..	..	50	52	54	57	59	61	..	..	..	..	..	..
100	..	..	..	..	..	..	..	50	52	54	56	57	59	61	..	..	..	..	..
105	..	..	..	..	..	..	..	..	51	53	55	57	58	60	62	..	..	..	..
110	..	..	..	..	..	..	..	..	..	53	55	56	58	60	61	..	..	..	..
115	..	..	..	..	..	..	..	..	..	..	54	55	57	59	60	62	..	..	..
120	..	..	..	..	..	..	..	..	..	..	54	55	57	58	59	61	62	..	..
125	..	..	..	..	..	..	..	..	..	..	..	55	56	58	59	60	61	..	..

SECTION X: WIRING DIAGRAM

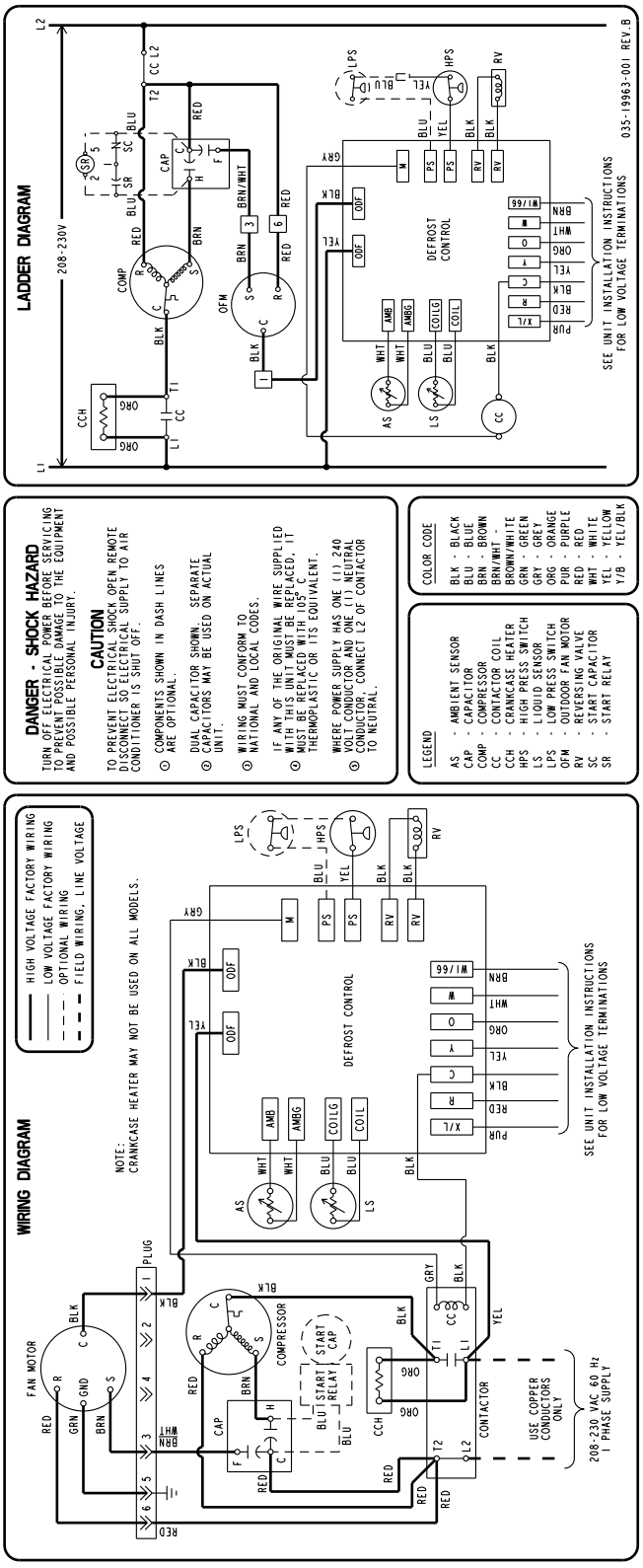

FIGURE 12: Wiring Diagram

NOTES

NOTES

035-19960-002 Rev. A (0904)
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