Installation Instructions

PHN3 Series – 3 Phase

PACKAGED HEAT PUMP UNITS

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Lewisburg, TN. 37091

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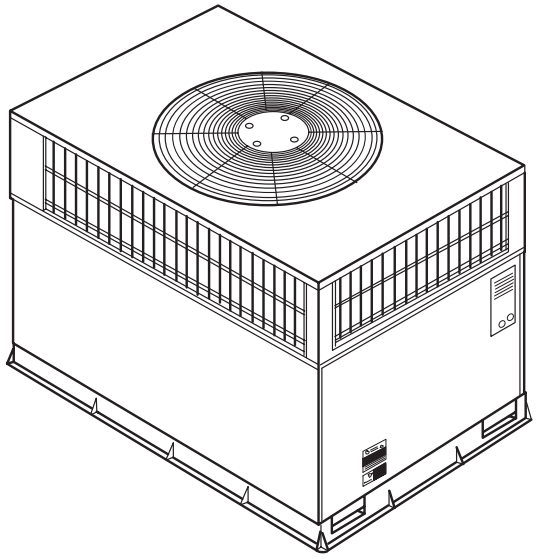
SAFE INSTALLATION REQUIREMENTS

FIGURE 1 PHN3 HEAT PUMP UNIT



Installation and servicing of this equipment can be hazardous due to mechanical and electrical components. Only trained and qualified personnel should install, repair, or service this equipment.

Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. When working on this equipment, observe precautions in the literature, on tags, and on labels attached to or shipped with the unit and other safety precautions that may apply.

Follow all safety codes. Installation must be in compliance with local and national building codes. Wear safety glasses, protective clothing, and work gloves. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words **DANGER**, **WARNING**, **CAUTION**, and **NOTE**. These words are used with the safety-alert symbol. **DANGER** identifies the most serious hazards which **will** result in serious injury or death. **WARNING** signifies a hazard which **could** result in serious injury or death. **CAUTION** is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. **NOTE** is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing system, always turn off power supply to unit and install lockout tag. There may be more than one disconnect switch. Turn off accessory heater power switch if applicable.

INTRODUCTION

The PHN3 packaged heat pump is fully self-contained and designed for outdoor installation (see Fig. 1). See Fig. 3 and 4 for unit dimensions. All unit sizes have discharge openings for both horizontal and downflow configurations and are factory shipped with all downflow duct openings covered. The unit may be installed either on a rooftop or at ground level.

RECEIVING AND INSTALLATION

Step 1—Check Equipment

IDENTIFY UNIT

The unit model number and serial number are stamped on the unit information plate. Check this information against shipping papers.

INSPECT SHIPMENT

Inspect for shipping damage while unit is still on shipping pallet. If unit appears to be damaged or is torn loose from its anchorage, have it examined by transportation inspectors before removal. Forward claim papers directly to transportation company. Manufacturer is not responsible for any damage incurred in transit. Check all items against shipping list. Immediately notify the nearest equipment distribution office if any item is missing. To prevent loss or damage, leave all parts in original packages until installation.

Step 2—Provide Unit Support

For hurricane tie downs, contact distributor for details and PE (Professional Engineering) Certificate if required.

ROOFCURB

Install accessory roof curb in accordance with instructions shipped with curb. Install insulation, cant strips, roofing, and flashing. Ductwork must be attached to curb.

IMPORTANT: The gasketing of the unit to the roof curb is critical for a water tight seal. Install gasketing material supplied with the roof curb. Improperly applied gasketing also can result in air leaks and poor unit performance.

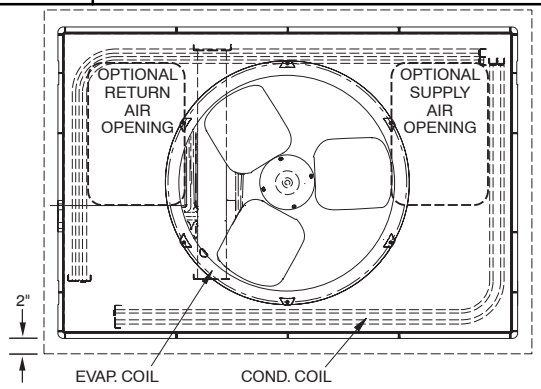
Curb should be level to within 1/4 in. (6mm) This is necessary for unit drain to function properly. Refer to accessory roof curb installation instructions for additional information as required.

SLAB MOUNT

Place the unit on a solid, level concrete pad that is a minimum of 4 in. (102mm) thick with 2 in. (51mm) above grade (See Fig. 2). The slab should extend approximately 2 in. beyond the casing on all 4 sides of the unit. Do not

secure the unit to the slab *except* when required by local codes.

FIGURE 2 **Slab Mounting Details**



ADDITIONAL GROUND LEVEL PLATFORM REQUIREMENTS

The unit MUST be situated to provide safe access for servicing.

The unit must be level and supported above grade by beams, platform, or a pad.

Platform or pad can be of open or solid construction but should be of permanent materials such as concrete, bricks, blocks, steel, or pressure-treated timbers approved for ground contact. Soil conditions must be considered so that the platform or pad does not shift or settle and leave the unit partially supported.

Position platform separate from building foundation.

Install in well-drained area, with top surface of platform above grade level.

Platform must be high enough to allow for proper condensate trap installation and drainage.

Step 3—Provide Clearances

The required minimum service clearances are shown in Fig. 3 and 4. Adequate ventilation and outdoor air must be provided. The outdoor fan draws air through the outdoor coil and discharges it through the top fan grille. Be sure that the fan discharge does not recirculate to the outdoor coil. Do not locate the unit in either a corner or under an overhead obstruction. The minimum clearance under a partial overhang (such as a normal house overhang) is 48 in. (1219mm) above the unit top. The maximum horizontal extension of a partial overhang must not exceed 48 in. (1219mm).

IMPORTANT: Do not restrict outdoor airflow. An air restriction at either the outdoor-air inlet or the fan discharge may be detrimental to compressor life.

Do not place the unit where water, ice, or snow from an overhang or roof will damage or flood the unit. Do not install the unit on carpeting or other combustible materials. Slab-mounted units should be at least 4 in. (102mm) above the highest expected water and runoff levels. Do not use unit if it has been under water.

Step 4—Field Fabricate Ductwork

Secure all ducts to roof curb and building structure on vertical discharge units. Do not connect ductwork to unit. For horizontal applications, unit is provided with flanges on the horizontal openings. All ductwork should be secured to the flanges. Insulate and weatherproof all external ductwork, joints, and roof openings with counter flashing and mastic in accordance with applicable codes.

Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier.

If a plenum return is used on a vertical unit, the return should be ducted through the roof deck to comply with applicable fire codes.

A minimum clearance is not required around ductwork. Cabinet return-air static shall not exceed -.25 in. wc.

Step 5—Rig and Place Unit

Rigging and handling of this equipment can be hazardous for many reasons due to the installation location (roofs, elevated structures, etc.).

Only trained, qualified crane operators and ground support staff should handle and install this equipment.

When working with this equipment, observe precautions in the literature, on tags, stickers, and labels attached to the equipment, and any other safety precautions that might apply.

Training for operators of the lifting equipment should include, but not be limited to, the following:

1. Application of the lifter to the load, and adjustment of the lifts to adapt to various sizes or kinds of loads.
2. Instruction in any special operation or precaution.
3. Condition of the load as it relates to operation of the lifting kit, such as balance, temperature, etc.

Follow all applicable safety codes. Wear safety shoes and work gloves.

INSPECTION

Prior to initial use, and at monthly intervals, all rigging brackets and straps should be visually inspected for any damage, evidence of wear, structural deformation, or cracks. Particular attention should be paid to excessive wear at hoist hooking points and load support areas. Brackets or straps showing any kind of wear in these areas must not be used and should be discarded.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Turn off accessory heater power switch if applicable. Tag disconnect switch with a suitable warning label.

⚠ WARNING

UNIT FALLING HAZARD

Failure to follow this warning could result in personal injury or death.

Never stand beneath rigged units or lift over people.

⚠ WARNING

PROPERTY DAMAGE HAZARD

Failure to follow this warning could result in personal injury/death or property damage.

Rigging brackets for one unit use only. When removing a unit at the end of its useful life, use a new set of brackets.

USE OF RIGGING BRACKET

NOTE: Rigging brackets are factory installed on 3–phase units only. Single–Phase units require accessory kit NPLIFTBK003A10.

Field Installation of Rigging Bracket (if not already installed)

1. Remove unit from shipping carton. Leave top shipping skid on the unit for use as a spreader bar to prevent the rigging straps from damaging the unit. If the skid is not available, use a spreader bar of sufficient length to protect the unit from damage.
2. Remove 4 screws in unit corner posts.
3. Attach each of the 4 metal rigging brackets under the panel rain lip (See Fig. 5). Use the screws removed in step 2 above to secure the brackets to the unit.

⚠ WARNING

PROPERTY DAMAGE HAZARD

Failure to follow this warning could result in personal injury/death or property damage.

Rigging bracket MUST be under the rain lip to provide adequate lifting.

⚠ WARNING

PROPERTY DAMAGE HAZARD

Failure to follow this warning could result in personal injury/death or property damage.

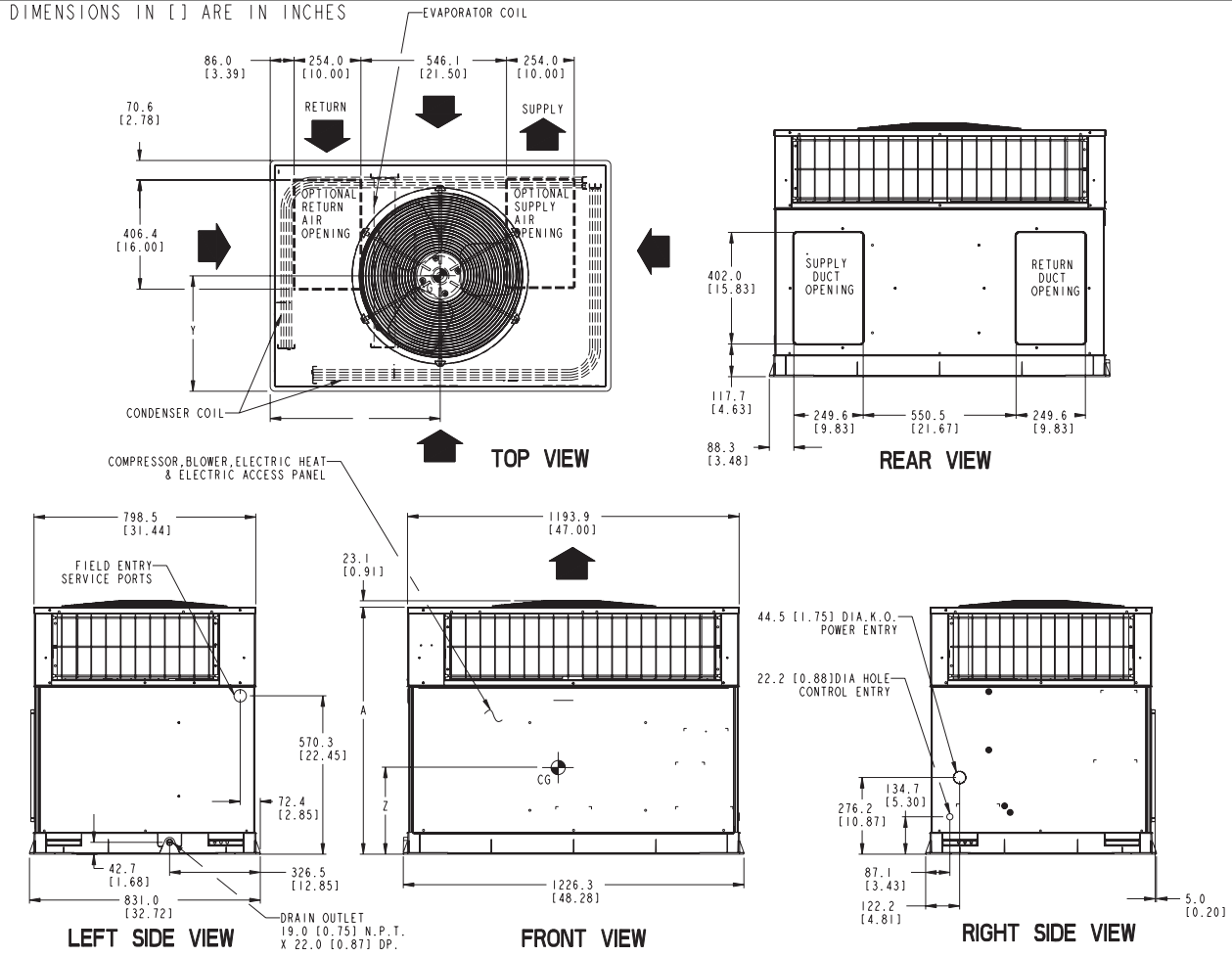
Do not strip screws when re–securing the unit. If a screw is stripped, replace the stripped one with a larger diameter screw (included). When straps are taut, the clevis should be a minimum of 36 inches (914) above the unit top cover.

Rigging/Lifting of Unit

1. Bend top of brackets down approximately 30 degrees from the corner posts.
2. Attach straps of equal length to the rigging brackets at opposite ends of the unit. Be sure straps are rated to hold the weight of the unit (See Fig. 5).
3. Attach a clevis of sufficient strength in the middle of the straps. Adjust the clevis location to ensure unit is lifted level with the ground.
4. After unit is securely in place detach rigging straps. Remove corner posts screws, and rigging brackets then reinstall screws.

After the unit is placed on the roof curb or mounting pad, remove the top crating. On PHN360 units only, 2 wire ties fastened to the outdoor coils and reversing valve/accumulator assembly must be cut. Remove the left and front louvered panels and corner post to access wire ties. The wire tie to be cut on the left is located approximately 4 in. (102mm) down the tube sheet. The wire tie to be cut on the right is located approximately 6 in. (152mm) down the tube sheet.

FIGURE 3 | **PHN330 DIMENSIONS**



REQUIRED CLEARANCE TO COMBUSTIBLE MATL
(Refer to Maximum Operating Clearances)

	INCHES [mm]
TOP OF UNIT	14.00 [355.6]
DUCT SIDE OF UNIT	2.00 [50.8]
SIDE OPPOSITE DUCTS	14.00 [355.6]
BOTTOM OF UNIT	0.50 [12.7]

NEC. REQUIRED CLEARANCES.

	INCHES [mm]
BETWEEN UNITS, POWER ENTRY SIDE	42.00 [1066.8]
UNIT AND UNGROUNDED SURFACES, POWER ENTRY SIDE	36.00 [914.0]
UNIT AND BLOCK OR CONCRETE WALLS AND OTHER GROUNDED SURFACES, POWER ENTRY SIDE	42.00 [1066.8]

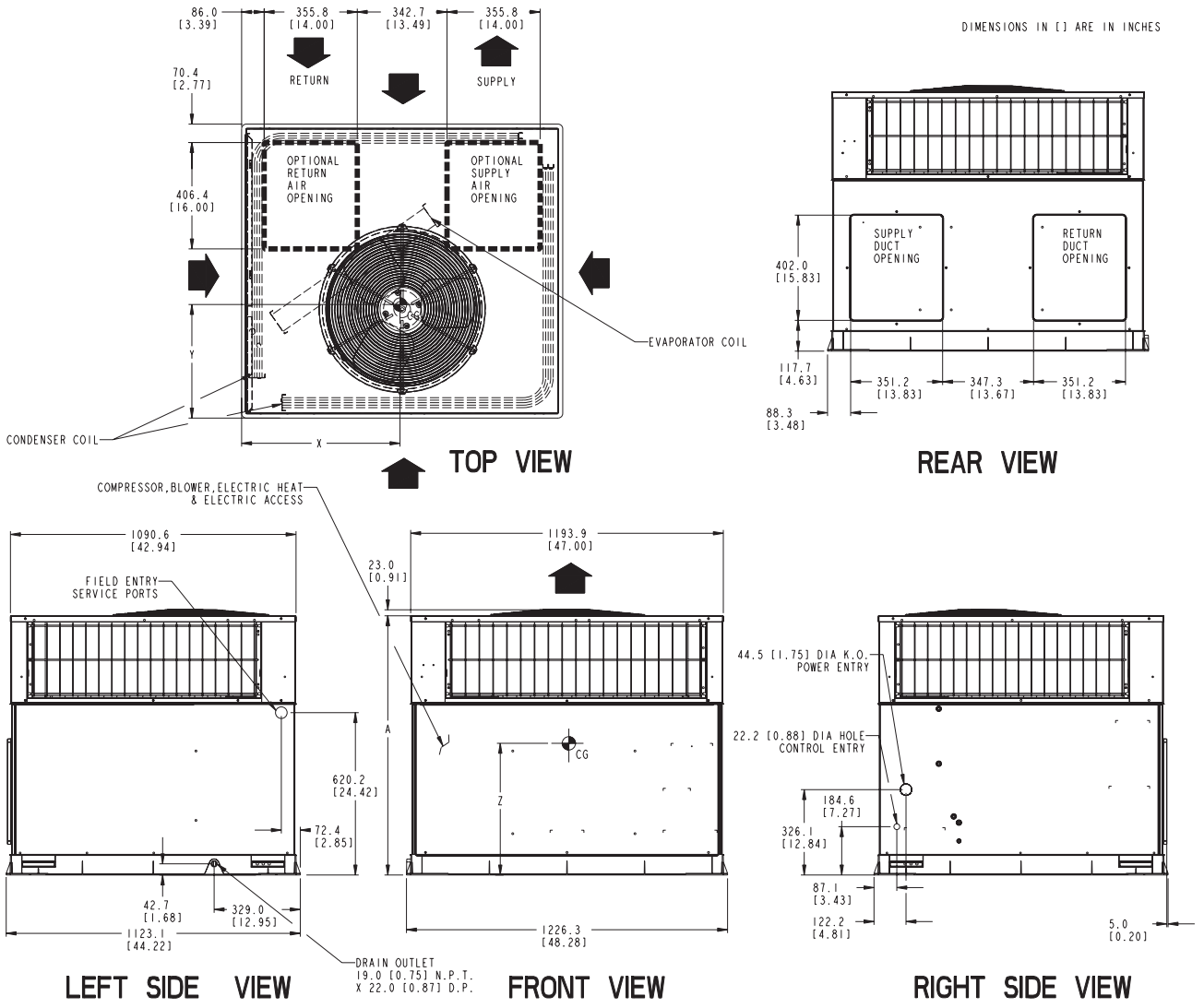
REQUIRED CLEARANCE FOR OPERATION AND SERVICING

	INCHES [mm]
EVAP. COIL ACCESS SIDE	36.00 [914.0]
POWER ENTRY SIDE	42.00 [1066.8]
(EXCEPT FOR NEC REQUIREMENTS)	
UNIT TOP	48.00 [1219.2]
SIDE OPPOSITE DUCTS	36.00 [914.0]
DUCT PANEL	12.00 [304.8] *

*MINIMUM DISTANCES: IF UNIT IS PLACED LESS THAN 304.8 [12.00] FROM WALL SYSTEM, THEN SYSTEM PERFORMANCE MAYBE COMPROMISE.

UNIT	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		UNIT HEIGHT IN. [MM] "A"	CENTER OF GRAVITY IN. [MM]		
		lb	kg		X	Y	Z
PHN330	208/230-3-60	366	166	41.02 [1042]	20.0 [508]	14.0 [356]	13.0 [330]

FIGURE 4 | **PHN336-60 DIMENSIONS**



REQUIRED CLEARANCE TO COMBUSTIBLE MAT'L
(Refer to Maximum Operating Clearances)

	INCHES [mm]
TOP OF UNIT	14.00 [355.6]
DUCT SIDE OF UNIT	2.00 [50.8]
SIDE OPPOSITE DUCTS	14.00 [355.6]
BOTTOM OF UNIT	0.50 [12.7]

NEC. REQUIRED CLEARANCES.

	INCHES [mm]
BETWEEN UNITS, POWER ENTRY SIDE	42.00 [1066.8]
UNIT AND UNGROUNDED SURFACES, POWER ENTRY SIDE	36.00 [914.0]
UNIT AND BLOCK OR CONCRETE WALLS AND OTHER GROUNDED SURFACES, POWER ENTRY SIDE	42.00 [1066.8]

REQUIRED CLEARANCE FOR OPERATION AND SERVICING

	INCHES [mm]
EVAP. COIL ACCESS SIDE	36.00 [914.0]
POWER ENTRY SIDE	42.00 [1066.8]
(EXCEPT FOR NEC REQUIREMENTS)	
UNIT TOP	48.00 [1219.2]
SIDE OPPOSITE DUCTS	36.00 [914.0]
DUCT PANEL	12.00 [304.8] *

*MINIMUM DISTANCES: IF UNIT IS PLACED LESS THAN 304.8 [12.00] FROM WALL SYSTEM, THEN SYSTEM PERFORMANCE MAYBE COMPROMISE.

UNIT	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		UNIT HEIGHT IN. [MM] "A"	CENTER OF GRAVITY IN. [MM]		
		lb	kg		X	Y	Z
PHN336	208/230-3-60, 460-3-60	433	196	42.98 [1092]	21.0 [533]	20.5 [520]	16.6 [422]
PHN342	208/230-3-60, 460-3-60	460	209	46.98 [1193]	21.0 [533]	20.5 [520]	17.1 [434]
PHN348	208/230-3-60, 460-3-60	480	218	46.98 [1193]	21.0 [533]	20.0 [508]	17.4 [442]
PHN360	208/230-3-60, 460-3-60	492	223	46.98 [1193]	21.0 [533]	20.0 [508]	17.6 [447]

Table 1—Filter Data - PHN330-60

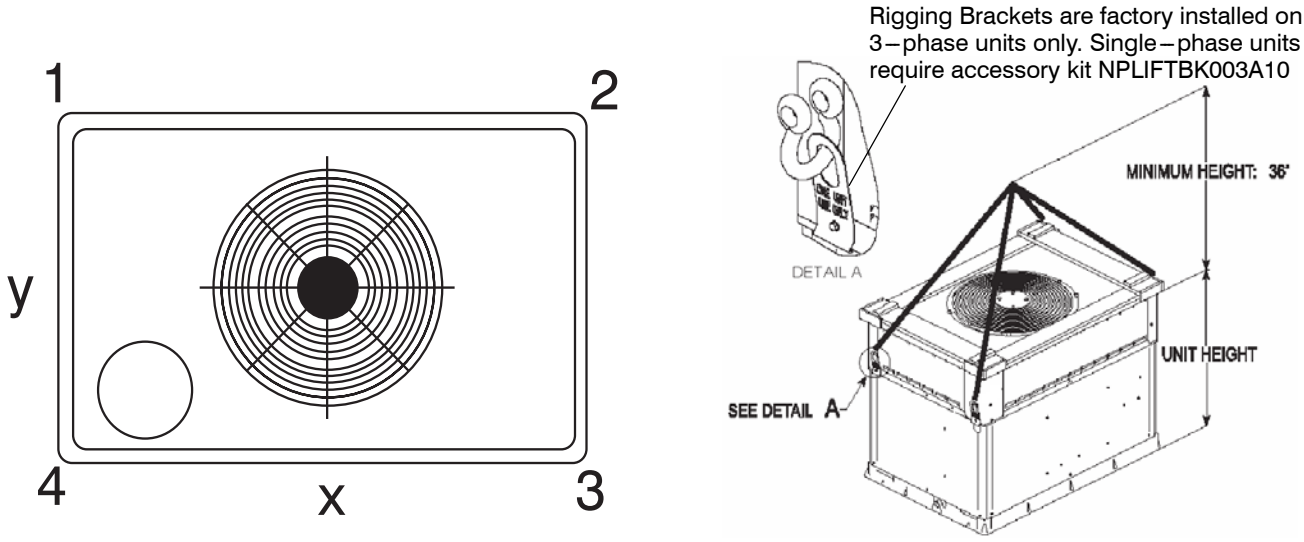
UNIT SIZE	030	036	042	048	060
RETURN-AIR FILTERS (IN.)* Throwaway	20x24x1	24x36x1	24x36x1	24x36x1	24x36x1

*Required filter sizes shown are based on the larger of the ARI (Air Conditioning and Refrigeration Institute) rated cooling airflow or the heating airflow velocity of 300 ft/minute for throwaway type. For permanent filters, follow filter manufacturer's recommendations for filter size based on allowable face velocity. Air filter pressure drop for non−standard filters must not exceed 0.08 in. wc.

Table 2—Minimum Airflow for Safe Electric Heater Operation (Cfm)

SIZE	024	030	036	042	048	060
Cfm	800	1000	1200	1400	1600	1750

FIGURE 5 Unit Corner Weight (lbs) and Rigging



CORNER WEIGHTS (lbs) (SMALL CABINET)			CORNER WEIGHTS (lbs) (LARGE CABINET)				
Unit	030		Unit	036	042	048	060
Total Weight	366		Total Weight	433	460	480	492
Corner Weight 1	74		Corner Weight 1	87	93	97	99
Corner Weight 2	57		Corner Weight 2	68	72	74	76
Corner Weight 3	88		Corner Weight 3	104	111	116	119
Corner Weight 4	147		Corner Weight 4	174	184	193	198
Rigging Weight	376		Rigging Weight	443	470	490	502

Step 6—Connect Condensate Drain

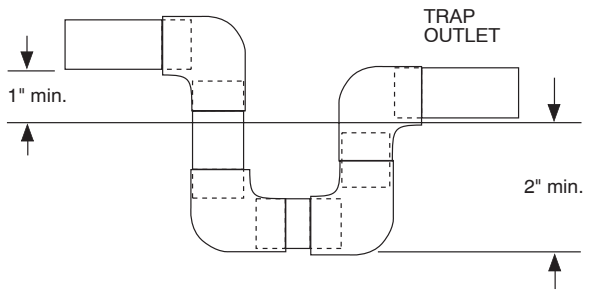
NOTE: When installing condensate drain connection be sure to comply with local codes and restrictions.

The PHN3 disposes of condensate water through a 3/4 in. NPT fitting which exits through the base on the evaporator coil access side. See Fig. 3 & 4 for location.

Condensate water can be drained directly onto the roof in rooftop installations (where permitted) or onto a gravel apron in ground level installations. Install a field–supplied 2–in. (51mm) condensate trap at the end of condensate connection to ensure proper drainage. Make sure that the outlet of the trap is at least 1 in. (25mm) lower than the drain–pan condensate connection to prevent the pan from overflowing (See Fig. 6). Prime the trap with water. When using a gravel apron, make sure it slopes away from the unit.

Connect a drain tube using a minimum of 3/4–in. PVC or 3/4–in. copper pipe (all field–supplied) at the outlet end of the 2–in. (51mm) trap. Do not undersize the tube. Pitch the drain tube downward at a slope of at least 1–in. (25mm) for every 10 ft (3048mm) of horizontal run. Be sure to check the drain tube for leaks.

FIGURE 6 **Condensate Drain**



Step 7—Select and Install Duct Connections

The design and installation of the duct system must be in accordance with the standards of the NFPA for installation of non–residence type air conditioning and ventilating systems, NFPA 90A or residence type, NFPA 90B and/or local codes and ordinances.

Select and size ductwork, supply–air registers, and return air grilles according to ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) recommendations. The unit has duct flanges on the supply– and return–air openings on the side of the unit.

When designing and installing ductwork, consider the following:

1. All units should have field–supplied filters or accessory filter rack installed in the return–air side of the unit. Recommended sizes for filters are shown in Table 1.
2. Avoid abrupt duct size increases and reductions. Abrupt change in duct size adversely affects air performance.

IMPORTANT: Use flexible transitions between ductwork and unit to prevent transmission of vibration. Use suitable gaskets to ensure weather tight and airtight seal. When electric heat is installed, use fireproof canvas (or similar heat resistant material) connector between ductwork and unit discharge connection. If flexible duct is used, insert a sheet metal sleeve inside duct. Heat resistant duct connector (or sheet metal sleeve) must extend 24–in. from electric heater element.

3. Size ductwork for cooling air quantity (cfm). The minimum air quantity for proper electric heater operation is listed in Table 2. Heater limit switches may trip at air quantities below those recommended.
4. Seal, insulate, and weatherproof all external ductwork. Seal, insulate and cover with a vapor barrier all ductwork passing through conditioned spaces. Follow latest Sheet Metal and Air Conditioning Contractors National Association (SMACNA) and Air Conditioning Contractors Association (ACCA) minimum installation standards for residential heating and air conditioning systems.
5. Secure all ducts to building structure. Flash, weatherproof, and vibration–isolate duct openings in wall or roof according to good construction practices.

CONFIGURING UNITS FOR DOWNFLOW (VERTICAL) DISCHARGE

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing system, turn off power supply to theunit and install lockout tag. There may be more than one disconnect switch.

1. Open all electrical disconnects before starting any service work.
2. Remove return duct cover located on duct panel by breaking four (4) connecting tabs with screwdriver and a hammer (see Fig. 7 & 8).
3. To remove supply duct cover, break front and right side connecting tabs with a screwdriver and a hammer. Push louver down to break rear and left side tabs (see Fig. 7 & 8).
4. If unit ductwork is to be attached to vertical opening flanges on the unit base (jackstand applications only), do so at this time. Collect ALL screws that were removed. Do not leave screws on rooftop, as permanent damage to the roof may occur.

⚠ CAUTION

PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in property damage.

Collect ALL screws that were removed. **Do not** leave screws on rooftop as permanent damage to the roof may occur.

5. It is recommended that the base insulation around the perimeter of the vertical return–air opening be secured to the base with aluminum tape. Applicable local codes may require aluminum tape to prevent exposed fiberglass.
6. Cover both horizontal duct openings with the provided duct covers. Ensure opening is air and water tight.

7. After completing unit conversion, perform all safety checks and power up unit.

NOTE: The design and installation of the duct system must be in accordance with the standards of the NFPA for installation of nonresidence–type air conditioning and ventilating systems, NFPA 90A or residence–type, NFPA 90B; and/or local codes and ordinances.

FIGURE 7 Supply and Return Duct Opening

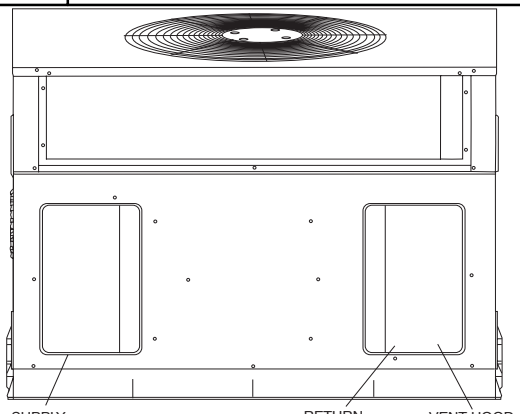
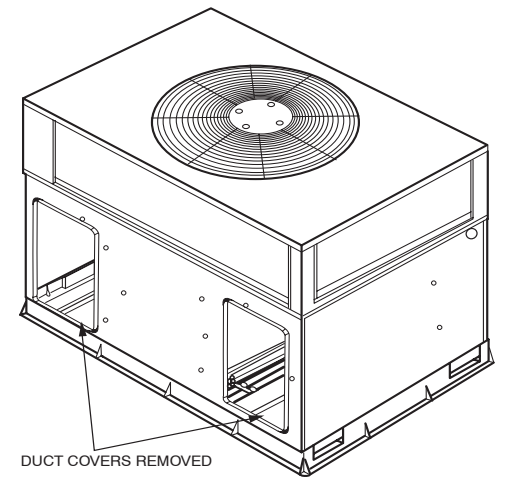


FIGURE 8 Vertical Duct Cover Removed



Adhere to the following criteria when selecting, sizing, and installing the duct system:

1. Units are shipped for horizontal duct installation (by removing duct covers).
2. Select and size ductwork, supply–air registers, and return–air grilles according to American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) recommendations.
3. Use flexible transition between rigid ductwork and unit to prevent transmission of vibration. The transition may be screwed or bolted to duct flanges. Use suitable gaskets to ensure weather–tight and airtight seal.
4. All units must have field–supplied filters or accessory filter rack installed in the return–air side of the unit. Recommended sizes for filters are shown in Table 1.
5. Size all ductwork for maximum required airflow (either heating or cooling) for unit being installed. Avoid abrupt duct size increases or decreases or performance may be affected.
6. Adequately insulate and weatherproof all ductwork located outdoors. Insulate ducts passing through unconditioned space, and use vapor barrier in accordance with latest issue of Sheet Metal and Air Conditioning Contractors National Association (SMACNA) and Air Conditioning Contractors of America (ACCA) minimum installation standards for heating and air conditioning systems. Secure all ducts to building structure.
7. Flash, weatherproof, and vibration isolate all openings in building structure in accordance with local codes and good building practices.

Step 8—Install Electrical Connections

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

The unit cabinet must have an uninterrupted, unbroken electrical ground. This ground may consist of an electrical wire connected to the unit ground screw in the control compartment, or conduit approved for electrical ground when installed in accordance with NEC, ANSI/NFPA American National Standards Institute/National Fire Protection Association (latest edition) (in Canada, Canadian Electrical Code CSA C22.1) and local electrical codes.

⚠ CAUTION

UNIT COMPONENT DAMAGE HAZARD

Failure to follow this caution may result in damage to the unit being installed.

1. Make all electrical connections in accordance with NEC ANSI/NFPA (latest edition) and local electrical codes governing such wiring. In Canada, all electrical connections must be in accordance with CSA standard C22.1 Canadian Electrical Code Part 1 and applicable local codes. Refer to unit wiring diagram.
2. Use only copper conductor for connections between field–supplied electrical disconnect switch and unit. DO NOT USE ALUMINUM WIRE.
3. Be sure that high–voltage power to unit is within operating voltage range indicated on unit rating plate.
4. Do not damage internal components when drilling through any panel to mount electrical hardware, conduit, etc.

HIGH–VOLTAGE CONNECTIONS

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before making any wiring changes, **make sure** the gas supply is switched off first. *Then* switch off the power supply to the unit and install lockout tag.

The unit must have a separate electrical service with a field–supplied, waterproof disconnect switch mounted at, or within sight from the unit. Refer to the unit rating plate, NEC and local codes for maximum fuse/circuit breaker size and minimum circuit amps (ampacity) for wire sizing.

The field–supplied disconnect switch box may be mounted on the unit over the high–voltage inlet hole when the standard power and low–voltage entry points are used (See Fig. 3 and 4 for acceptable location).

If the unit has an electric heater, a second disconnect may be required. Consult the Installation, Start–Up, and Service Instructions provided with the accessory for electrical service connections.

Operation of unit on improper line voltage constitutes abuse and may cause unit damage that could affect warranty.

Proceed as follows to complete the high–voltage connections to the unit.

1. Run the high–voltage (L1, L2, L3) and ground lead into the control box.
2. Connect ground lead to chassis ground connection.
3. Locate the black and yellow wires connected to the line side of the contactor.
4. Connect field L1 to black wire on connection 11 of the compressor contactor.
5. Connect field wire L2 to yellow wire on connection 13 of the compressor contactor.
6. Connect field wire L3 to blue wire from compressor.

ROUTING POWER LEADS INTO UNIT

Use only copper wire between disconnect and unit. The high–voltage leads should be in a conduit until they enter the duct panel; conduit termination at the duct panel must be watertight. Run the high–voltage leads through the power entry knockout on the power entry side panel. See Fig. 3 and 4 for location and size. When the leads are inside the unit, run leads up the high–voltage raceway to the line wiring splice box (see Fig. 9). For single–phase units, connect leads to the black and yellow wires (see Fig. 10).

CONNECTING GROUND LEAD TO GROUND SCREW

Connect the ground lead to the chassis using the ground screw in the wiring splice box (see Fig. 11).

ROUTING CONTROL POWER WIRES (24–V)

Form a drip–loop with the thermostat leads before routing them into the unit. Route the thermostat leads through grommeted, low–voltage hole provided in unit into unit control power splice box (see Fig. 2 and 3). Connect thermostat leads to unit control power leads as shown in Fig. 9.

The unit transformer supplies 24–v power for complete system including accessory electrical heater. A manual–reset circuit breaker is provided in the 24–v circuit; see the caution label on the transformer. Transformer is factory wired for 230–v operation. If supply voltage is 208–v, rewire transformer primary as described in Special Procedures for 208–v Operation section.

SPECIAL PROCEDURES FOR 208–V OPERATION

1. Disconnect the yellow primary lead from the transformer. See unit wiring label (see Fig. 9).
2. Connect the yellow primary lead to the transformer terminal labeled 200–v.

Indoor blower–motor speeds may need to be changed for 208–v operation. Refer to indoor airflow and airflow adjustments section.

FIGURE 9 **Control Connections**

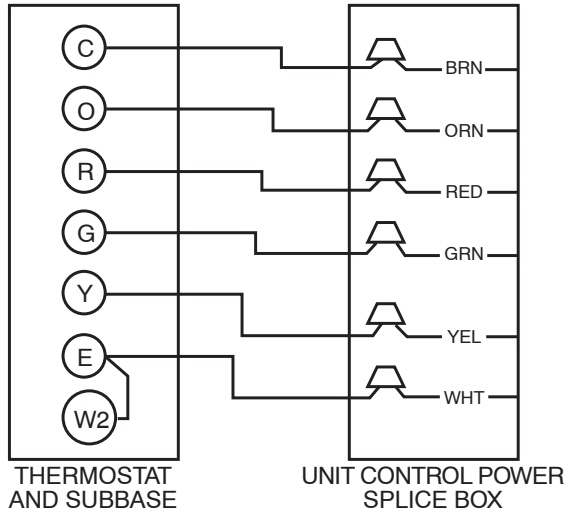


FIGURE 10 **Line Power Connections**

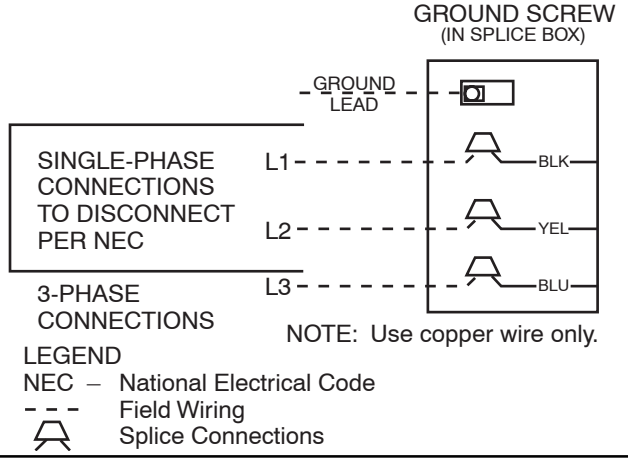
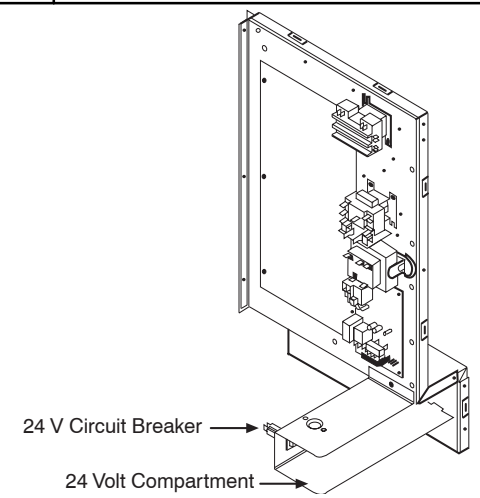


FIGURE 11 **Control Wiring Plate**



PRE-START-UP

⚠ WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK HAZARD

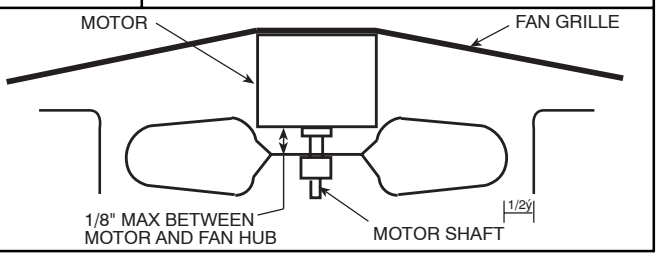
Failure to follow this warning could result in personal injury or death.

1. Follow recognized safety practices and wear protective goggles when checking or servicing refrigerant system.
2. Relieve and recover all refrigerant from system before touching or disturbing anything inside terminal box if refrigerant leak is suspected around compressor terminals.
3. Never attempt to repair soldered connection while refrigerant system is under pressure.
4. Do not use torch to remove any component. System contains oil and refrigerant under pressure.
5. To remove a component, wear protective goggles and proceed as follows:
   a. Shut off electrical power to unit and install lockout tag.
   b. Relieve and reclaim all refrigerant from system using both high- and low-pressure ports.
   c. Cut component connecting tubing with tubing cutter and remove component from unit.
   d. Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

Use the Start-Up Checklist supplied at the end of this book and proceed as follows to inspect and prepare the unit for initial start-up:

1. Remove access panel.
2. Read and follow instructions on all DANGER, WARNING, CAUTION, and INFORMATION labels attached to, or shipped with unit.
3. Make the following inspections:
   a. Inspect for shipping and handling damage, such as broken lines, loose parts, disconnected wires, etc.
   b. Inspect for oil at all refrigerant tubing connections and on unit base. Detecting oil generally indicates a refrigerant leak.
   c. Leak-test all refrigerant tubing connections using electronic leak detector, or liquid-soap solution. If a refrigerant leak is detected, see following Check for Refrigerant Leaks section.
   d. Inspect all field- and factory-wiring connections. Be sure that connections are completed and tight.
   e. Ensure wires do not touch refrigerant tubing or sharp sheet metal edges.
   f. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.
4. Verify the following conditions:
   g. Make sure that condenser-fan blade is correctly positioned in fan orifice. Top 1/3 of condenser-fan blade should be within fan orifice venturi.
   h. Make sure that condensate drain pan and trap are filled with water to ensure proper drainage.
   i. Make sure that all tools and miscellaneous loose parts have been removed.
5. Each unit system has two (2) Schrader-type ports, one low-side Schrader fitting located on the suction line, and one high-side Schrader fitting located on the compressor discharge line. Be sure that caps on the ports are tight.
6. High flow valves are located on the compressor hot gas and suction tubes. These valves can not be accessed for service in the field. Ensure the plastic caps are in place and tight or the possibility of refrigerant leakage could occur.

FIGURE 12 Fan Blade Clearance



START-UP

Step 1—CHECK FOR REFRIGERANT LEAKS

Proceed as follows to locate and repair a refrigerant leak and to charge the unit:

1. Locate leak and make sure that refrigerant system pressure has been relieved and reclaimed from both high- and low-pressure ports.
2. Repair leak following accepted practices.

NOTE: Install a filter drier whenever the system has been opened for repair.

3. Add a small charge of R-22 refrigerant vapor to system and leak-test unit.
4. Recover refrigerant from refrigerant system and evacuate to 500 microns if no additional leaks are found.
5. Charge unit with R-22 refrigerant, using a volumetric charging cylinder or accurate scale. Refer to unit rating plate for required charge. Be sure to add extra refrigerant to compensate for internal volume of filter drier.

STEP 2—START-UP ADJUSTMENTS

Complete the required procedures given in the Pre-Start-Up section before starting the unit. Do not jumper any safety devices when operating the unit. Do not operate the unit in cooling mode when the outdoor temperature is below 40°F (4°C) (unless accessory low-ambient kit is installed). Do not rapid cycle the compressor. Allow 5 min. between “on” cycles to prevent compressor damage.

CHECK COOLING AND HEATING CONTROL

Start and check the unit for proper cooling operation as follows:

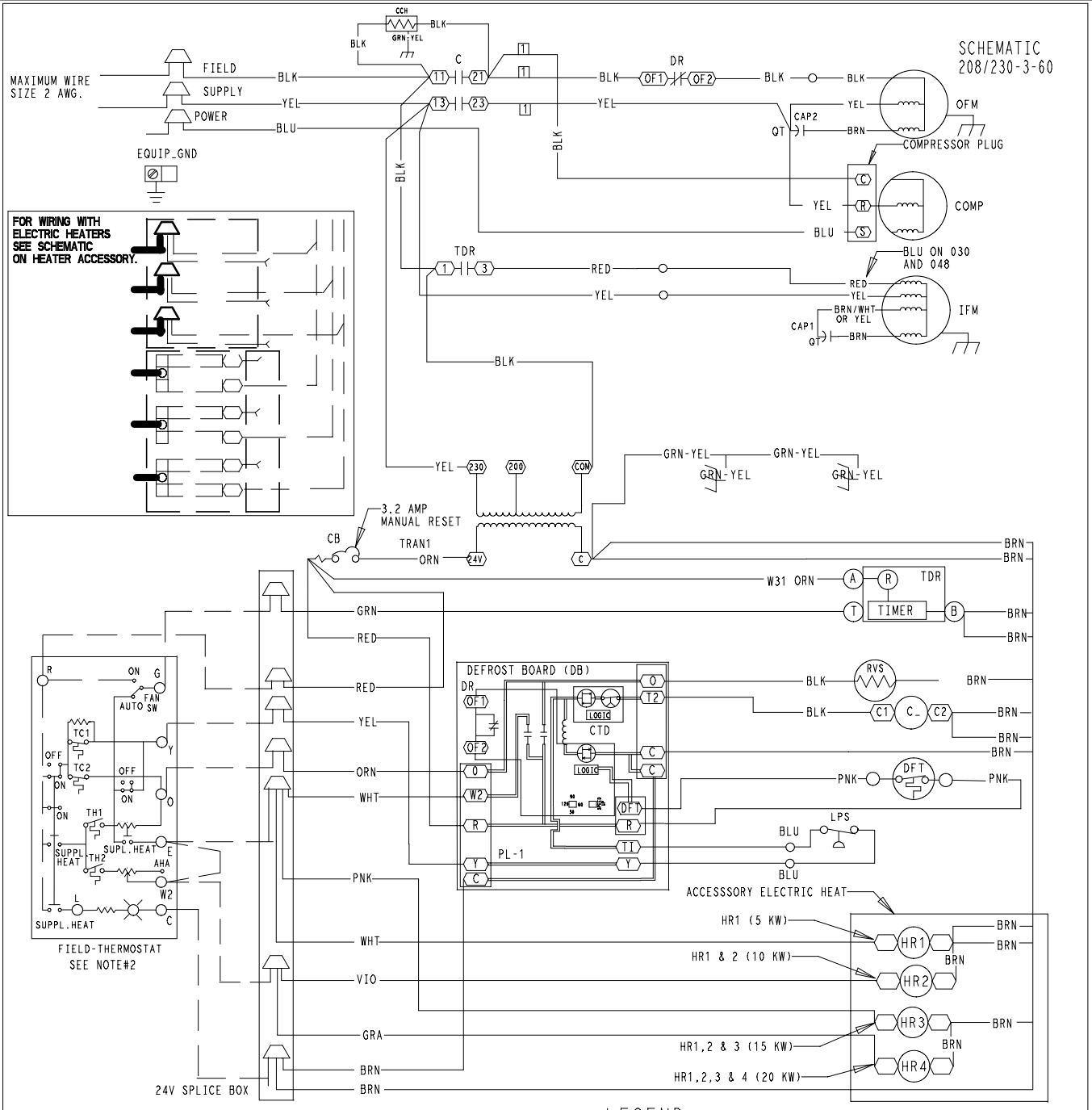
1. Place room thermostat SYSTEM switch in OFF position. Observe that blower motor starts when FAN switch is placed in ON position and shuts down within 60 sec. when FAN switch is placed in AUTO position.
2. Place SYSTEM switch in COOL position and FAN switch in AUTO position. Set control below room

temperature. Observe that cooling cycle shuts down when control setting is satisfied.

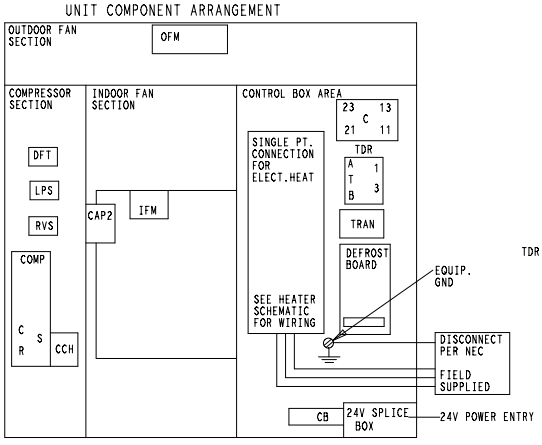
3. Place system switch in HEAT position. Set control above room temperature. Observe that compressor, outdoor fan, and indoor blower motor starts. Observe that heating cycle shuts down when control setting is satisfied.
4. When using an automatic changeover room thermostat, place both SYSTEM and FAN switches in AUTO positions. Observe that unit operates in Cooling mode when temperature control is set to call for Cooling (below room temperature), and unit operates in Heating mode when temperature control is set to call for Heating (above room temperature).

IMPORTANT: Three-phase, scroll compressors are direction oriented. Unit must be checked to ensure proper compressor 3-phase power lead orientation. If not corrected within 5 minutes, the internal protector will shut off the compressor. The 3-phase power leads to the unit must be reversed to correct rotation. When turning backwards, the difference between compressor suction and discharge pressures may be dramatically lower than normal.

FIGURE 13 | **PHN330-60 - 208/230v, 3 Phase Wiring Diagram**



UNIT COMPONENT ARRANGEMENT

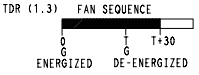


LEGEND

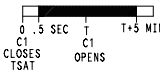
- FIELD SPLICE
- TERMINAL (MARKED)
- TERMINAL (UNMARKED)
- SPLICE
- SPLICE (MARKED)
- FACTORY WIRING
- FIELD CONTROL WIRING
- FIELD POWER WIRING
- ACCESSORY OR OPTIONAL WIRING
- TO INDICATE COMMON POTENTIAL ONLY; NOT TO REPRESENT WIRING

C	CONTACTOR
CAP	CAPACITOR
CB	CIRCUIT BREAKER
COMP	COMPRESSOR MOTOR
CTD	COMPRESSOR TIME DELAY
DB	DEFROST BOARD
DFT	DEFROST THERMOSTAT
DR	DEFROST RELAY
GND	GROUND
HR	HEATER RELAY
IFM	INDOOR FAN MOTOR
LPS	LOW PRESSURE SWITCH
OFM	OUTDOOR FAN MOTOR
QT	QUADRUPLE TERMINAL
RVS	REVERSING VALVE SOLENOID
TDR	TIME DELAY RELAY
TRAN	TRANSFORMER

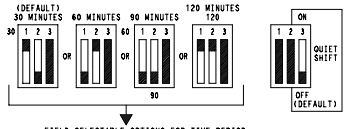
TDR (1.3) FAN SEQUENCE



CTD (T1,T2) COMPRESSOR DELAY



DIP SWITCH SETTINGS



FIELD SELECTABLE OPTIONS FOR TIME PERIOD BETWEEN DEFROST CYCLES (MINUTES)
THE COMPRESSOR WILL SHUT OFF FOR 30 SEC. ON DEFROST INITIATION AND TERMINATION IN THE "QUIET SHIFT" ON POSITION

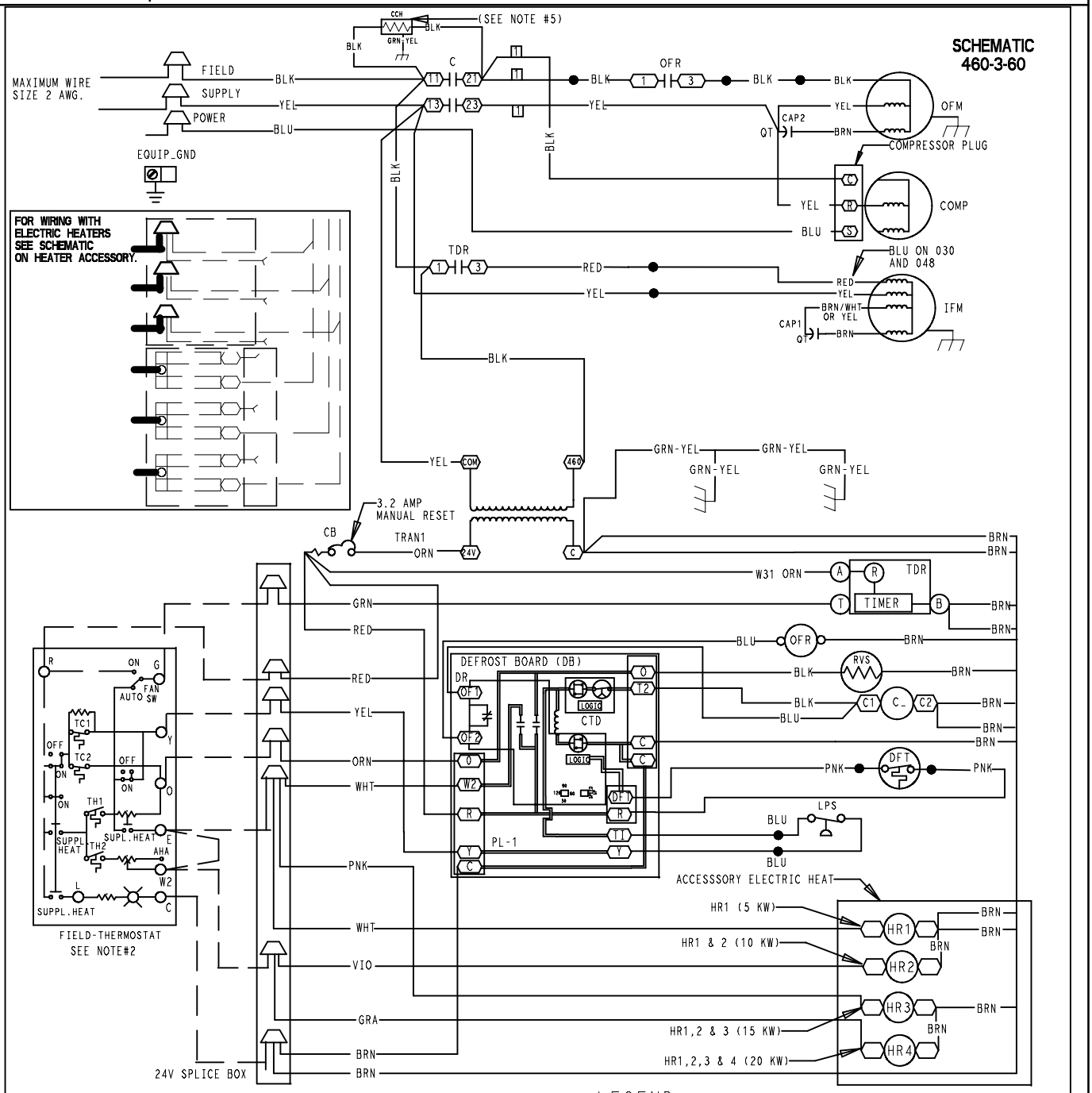
SPEED UP — JUMPERED TEST PINS (USE METAL OBJECT) FIELD SPEED-UP CYCLE

1) MOMENTARILY SHORT PINS AND RELEASE TO BYPASS COMPRESSOR OFF DELAY.
2) SHORT FOR 5+ SEC. AND RELEASE FOR FORCED DEFROST.
3) PERMANENT SHORT WILL BE IGNORED.

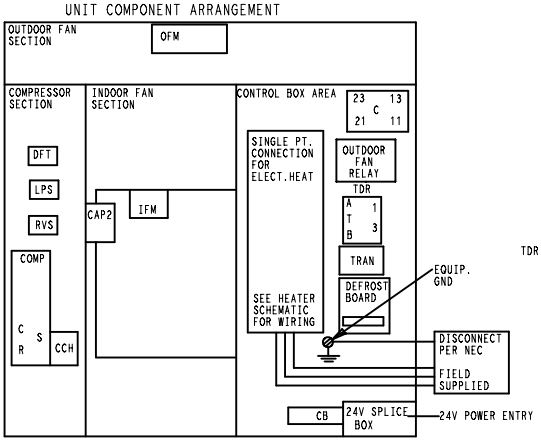
DEFROST WILL TERMINATE IN 30 SEC. IF DFT OPEN.
DEFROST WILL TERMINATE NORMALLY IF DFT IS CLOSED.

NOTES:
1. IF ANY OF THE ORIGINAL WIRES FURNISHED ARE REPLACED, THEY MUST BE REPLACED WITH TYPE 90 DEG. C WIRE OR ITS EQUIVALENT.
2. SEE PRICE PAGES FOR THERMOSTAT AND SUBBASES.
3. USE 75 DEG. COPPER CONDUCTORS FOR FIELD INSTALLATION.
4. FOR "HIGH SPEED" IFM, DISCONNECT "RED" OR "BLUE" WIRE FROM TDR-3 AND CONNECT THE "BLK" WIRE.

FIGURE 14 | **PHN330-60 - 460v, 3 Phase Wiring Diagram**



UNIT COMPONENT ARRANGEMENT



LEGEND

FIELD SPLICE	C CONTACTOR
TERMINAL	CAP 1 CAPACITOR, IFM
SPLICE	CAP 2 CAPACITOR, OFM
FACTORY WIRING	CB CIRCUIT BREAKER
FIELD CONTROL WIRING	COMP COMPRESSOR MOTOR
FIELD POWER WIRING	CTD COMPRESSOR TIME DELAY
ACCESSORY OR OPTIONAL WIRING	DB DEFROST BOARD
TO INDICATE COMMON POTENTIAL ONLY: NOT TO REPRESENT WIRING	DFT DEFROST THERMOSTAT
	DR DEFROST RELAY
	GND GROUND
	HR HEATER RELAY
	IFM INDOOR FAN MOTOR
	LPS LOW PRESSURE SWITCH
	OFM OUTDOOR FAN MOTOR
	OFR OUTDOOR FAN RELAY
	QT QUADRUPLE TERMINAL
	RVS REVERSING VALVE SOLENOID
	TDR TIME DELAY RELAY
	TRAN TRANSFORMER

TDR (1.3) FAN SEQUENCE: 0 G ENERGIZED; T G DE-ENERGIZED; T+30

CTD (T1,T2) COMPRESSOR DELAY: 0 C1 CLOSES TSAT; .5 SEC T C1 OPENS; T+5 MIN.

DIP SWITCH SETTINGS

(DEFAULT) 30 MINUTES | 60 MINUTES | 90 MINUTES | 120 MINUTES 120

ON (DEFAULT) QUIET SHIFT

FIELD SELECTABLE OPTIONS FOR TIME PERIOD BETWEEN DEFROST CYCLES (MINUTES) THE COMPRESSOR WILL SHUT OFF FOR 30 SEC. ON DEFROST INITIATION AND TERMINATION IN THE "QUIET SHIFT" ON POSITION

SPEED UP — JUMPERED TEST PINS (USE METAL OBJECT) FIELD SPEED-UP CYCLE

1) MOMENTARILY SHORT PINS AND RELEASE TO BYPASS COMPRESSOR OFF DELAY.
2) SHORT FOR 5+ SEC. AND RELEASE FOR FORCED DEFROST.
3) PERMANENT SHORT WILL BE IGNORED.

DEFROST WILL TERMINATE IN 30 SEC. IF DFT OPEN.
DEFROST WILL TERMINATE NORMALLY IF DFT IS CLOSED.

NOTES:
1. IF ANY OF THE ORIGINAL WIRES FURNISHED ARE REPLACED, THEY MUST BE REPLACED WITH TYPE 90 DEG. C WIRE OR ITS EQUIVALENT.
2. SEE PRICE PAGES FOR THERMOSTAT AND SUBBASES.
3. USE 75 DEG. COPPER CONDUCTORS FOR FIELD INSTALLATION.
4. FOR "HIGH SPEED" IFM, DISCONNECT "RED" OR "BLUE" WIRE FROM TDR-3 AND CONNECT THE "BLK" WIRE.
5. CCH NOT USED ON ALL UNITS.

50SZ500264 | 5.0

CHECKING AND ADJUSTING REFRIGERANT CHARGE

The refrigerant system is fully charged with R-22 refrigerant and is tested and factory sealed. Allow system to operate a minimum of 15 minutes before checking or adjusting charge.

NOTE: Adjustment of the refrigerant charge is not required unless the unit is suspected of not having the proper R-22 charge. The charging label and the tables shown refer to system temperatures and pressures in cooling mode only. A refrigerant charging label is attached to the outside of the service access door. If charge level is suspect in Heating mode, reclaim all refrigerant and charge to nameplate amount. (This information may be obtained from the physical data table also.)

IMPORTANT: When evaluating the refrigerant charge, an indicated adjustment to the specified factory charge must always be very minimal. If a substantial adjustment is indicated, an abnormal condition exists somewhere in the cooling system, such as insufficient airflow across either or both coils.

REFRIGERANT CHARGE

The amount of refrigerant charge is listed on the unit nameplate and/or the physical data table. Refer to the Refrigeration Service Techniques Manual, Refrigerants Section.

NO CHARGE

Check for leak. Use standard evacuating techniques. After evacuating system to 500 microns, weigh in the specified amount of refrigerant (refer to system data plate).

LOW CHARGE COOLING

Use Cooling Charging Charts (see Table 4). Vary refrigerant until the conditions of the chart are met. Note that charging charts are different from the type normally used. Charts are based on charging the units to correct superheat for the various operating conditions.

Accurate pressure gauge and temperature sensing devices are required. Connect the pressure gauge to the service port on the suction line. Mount the temperature sensing device on the suction line and insulate it so that the outdoor ambient does not affect the reading. Indoor air CFM must be within the normal operating range of the unit.

TO USE COOLING CHARGING CHARTS

Take the outdoor ambient temperature and read the suction pressure gauge. Refer to the chart to determine what the suction temperature should be.

NOTE: If the problem causing the inaccurate readings is a refrigerant leak, refer to Check for Refrigerant Leaks section.

INDOOR AIRFLOW AND AIRFLOW ADJUSTMENTS

NOTE: For cooling operation, the recommended airflow is 350 to 450 cfm for each 12,000 Btuh of rated cooling capacity. For units with optional electric heat, the airflow must not be reduced below those stated in Table 2.

Table 8 shows cooling airflows at various external static pressures. Refer to this table to determine the airflow for the system being installed.

NOTE: Be sure that all supply- and return-air grilles are open, free from obstructions, and adjusted properly.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect electrical power to the unit and install lockout tag before changing blower speed.

Airflow can be changed by changing the lead connections of the blower motor.

All PHN3 units are factory wired for low speed, except sizes 030 and 048 which are wired for medium speed.

FOR 208/230V

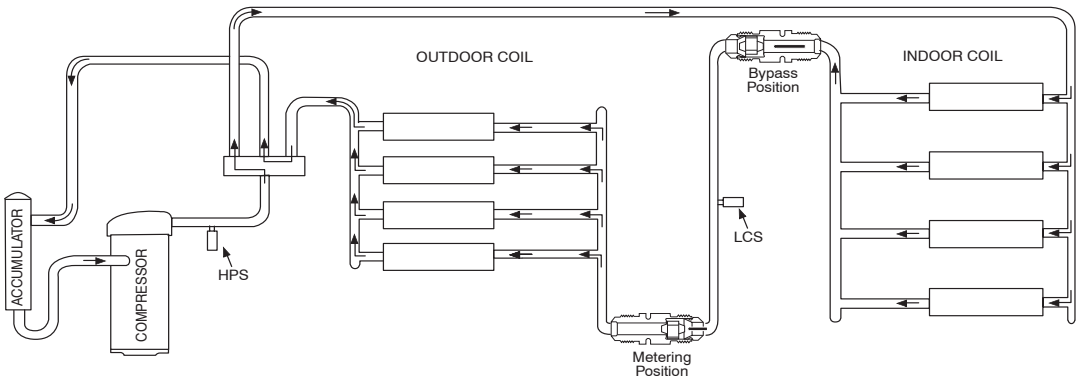
For color coding on the 208/230V motor leads, see Table 3.

Table 3—Color Coding for 208/230V Motor Leads

BLACK = HIGH SPEED
Blue = Medium Speed
Red = Low Speed

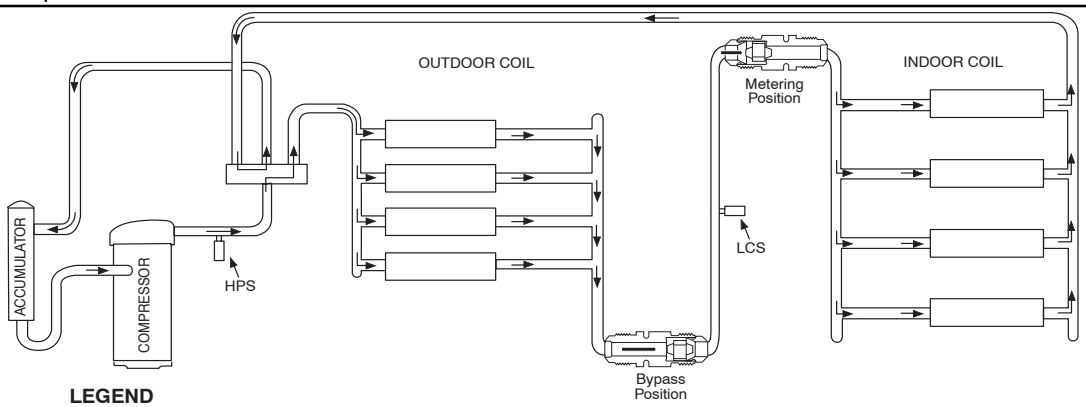
To change the speed of the indoor fan motor (IFM), remove the fan motor speed leg lead from the time delay relay (TDR). To change the speed, remove and replace with lead for desired blower motor speed. Insulate the removed lead to avoid contact with chassis parts.

FIGURE 15 **Typical Heat Pump Operation – Heating Mode**



LEGEND
HPS – High Pressure Switch
LCS – Loss of Charge Switch
Metering Device
Arrow indicates direction of flow

FIGURE 16 **Typical Heat Pump Operation – Cooling Mode**



LEGEND
HPS – High Pressure Switch
LCS – Loss of Charge Switch
Metering Device
Arrow indicates direction of flow

Table 4—Cooling Charging Chart

Suction Line Temperature (°F)															
OD Temp. (°F)	Suction Line Pressure (PSIG)														
	52	54	56	59	61	64	67	70	73	76	79	82	85	89	92
45	51	55	60	64	69	-	-	-	-	-	-	-	-	-	-
55	-	-	53	57	62	66	70	-	-	-	-	-	-	-	-
65	-	-	-	-	53	57	62	66	71	75	-	-	-	-	-
75	-	-	-	-	-	-	-	56	61	66	71	76	-	-	-
85	-	-	-	-	-	-	-	-	53	58	63	67	72	-	-
95	-	-	-	-	-	-	-	-	-	50	54	58	62	66	-
105	-	-	-	-	-	-	-	-	-	-	50	53	57	60	64
115	-	-	-	-	-	-	-	-	-	-	49	52	55	58	61
125	-	-	-	-	-	-	-	-	-	-	-	50	53	56	59

Suction Line Temperature (°C)															
OD Temp. (°C)	Suction Line Pressure (kPa)														
	361	370	387	405	423	442	462	482	502	523	544	566	589	612	636
7	11	13	15	18	21	-	-	-	-	-	-	-	-	-	-
13	-	-	12	14	16	19	21	-	-	-	-	-	-	-	-
18	-	-	-	-	12	14	17	19	21	24	-	-	-	-	-
24	-	-	-	-	-	-	-	13	16	19	22	24	-	-	-
29	-	-	-	-	-	-	-	-	12	14	17	20	22	-	-
35	-	-	-	-	-	-	-	-	-	10	12	14	17	19	-
41	-	-	-	-	-	-	-	-	-	-	10	12	14	16	18
46	-	-	-	-	-	-	-	-	-	-	9	11	13	14	16
52	-	-	-	-	-	-	-	-	-	-	-	10	11	13	15

MAINTENANCE

To ensure continuing high performance and to minimize the possibility of premature equipment failure, periodic maintenance must be performed on this equipment. This unit should be inspected at least once each year by a qualified service person. To troubleshoot unit, refer to Table 10, Troubleshooting Chart.

NOTE TO EQUIPMENT OWNER: Consult your local dealer about the availability of a maintenance contract.

⚠ WARNING

PERSONAL INJURY AND UNIT DAMAGE HAZARD

Failure to follow this warning could result in personal injury or death and unit component damage.

The ability to properly perform maintenance on this equipment requires certain expertise, mechanical skills, tools and equipment. If you do not possess these, do not attempt to perform any maintenance on this equipment, other than those procedures recommended in the Owner's Manual.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow these warnings could result in personal injury or death:

1. Turn off power supply to the unit and install lockout before performing any maintenance or service on this unit.
2. Use extreme caution when removing panels and parts.
3. Never place anything combustible either on or in contact with the unit.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in improper operation.

Errors made when reconnecting wires may cause improper and dangerous operation. Label all wires prior to disconnecting when servicing.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect air filter(s) each month. Clean or replace when necessary.
2. Inspect indoor coil, drain pan, and condensate drain each cooling season for cleanliness. Clean when necessary.

3. Inspect blower motor and wheel for cleanliness at the beginning of each heating and cooling season. Clean when necessary.
4. Check electrical connections for tightness and controls for proper operation each heating and cooling season. Service when necessary.
5. Ensure electric wires are not in contact with refrigerant tubing or sharp metal edges.

AIR FILTER

IMPORTANT: Never operate the unit without a suitable air filter in the return-air duct system. Always replace the filter with the same dimensional size and type as originally installed. See Table 1 for recommended filter sizes.

Inspect air filter(s) at least once each month and replace (throwaway-type) or clean (cleanable-type) at least twice during each cooling season and twice during the heating season, or whenever the filter becomes clogged with dust and lint.

INDOOR BLOWER AND MOTOR

NOTE: All motors are pre-lubricated. Do not attempt to lubricate these motors.

For longer life, operating economy, and continuing efficiency, clean accumulated dirt and grease from the blower wheel and motor annually.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect and tag electrical power to the unit before cleaning the blower motor and wheel.

To clean the blower motor and wheel:

1. Remove and disassemble blower assembly as follows:
   a. Remove unit access panel.
   b. Disconnect motor lead from time delay relay (TDR). Disconnect yellow lead from terminal L2 of the contactor.
   c. On all units remove blower assembly from unit. Remove screws securing blower to blower partition and slide assembly out. Be careful not to tear insulation in blower compartment.
   d. Ensure proper reassembly by marking blower wheel and motor in relation to blower housing before disassembly.
   e. Loosen setscrew(s) that secures wheel to motor shaft, remove screws that secure motor mount brackets to housing, and slide motor and motor mount out of housing.
2. Remove and clean blower wheel as follows:
   a. Ensure proper reassembly by marking wheel orientation.
   b. Lift wheel from housing. When handling and/or cleaning blower wheel, be sure not to disturb balance weights (clips) on blower wheel vanes.
   c. Remove caked-on dirt from wheel and housing with a brush. Remove lint and/or dirt accumulations from wheel and housing with vacuum cleaner, using soft brush attachment. Remove grease and oil with mild solvent.
   d. Reassemble wheel into housing.
   e. Reassemble motor into housing. Be sure setscrews are tightened on motor shaft flats and not on round part of shaft.
   f. Reinstall unit access panel.
3. Restore electrical power to unit. Start unit and check for proper blower rotation and motor speeds during heating and cooling cycles.

OUTDOOR COIL, INDOOR COIL, AND CONDENSATE DRAIN PAN

Inspect the condenser coil, evaporator coil, and condensate drain pan at least once each year.

The coils are easily cleaned when dry; therefore, inspect and clean the coils either before or after each cooling season. Remove all obstructions, including weeds and shrubs that interfere with the airflow through the condenser coil.

Straighten bent fins with a fin comb. If coated with dirt or lint, clean the coils with a vacuum cleaner, using the soft brush attachment. Be careful not to bend the fins. If coated with oil or grease, clean the coils with a mild detergent and water solution. Rinse coils with clear water, using a garden hose. Be careful not to splash water on motors, insulation, wiring, or air filter(s). For best results, spray condenser coil fins from inside to outside the unit. On units with an outer and inner condenser coil, be sure to clean between the coils. Be sure to flush all dirt and debris from the unit base.

Inspect the drain pan and condensate drain line when inspecting the coils. Clean the drain pan and condensate drain by removing all foreign matter from the pan. Flush the pan and drain trough with clear water. Do not splash water on the insulation, motor, wiring, or air filter(s). If the drain trough is restricted, clear it with a “plumbers snake” or similar probe device.

OUTDOOR FAN

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in damage to unit components.

Keep the condenser fan free from all obstructions to ensure proper cooling operation. Never place articles on top of the unit.

1. Remove 6 screws holding outdoor grille and motor to top cover.
2. Turn motor/grille assembly upside down on top cover to expose fan blade.
3. Inspect the fan blades for cracks or bends.
4. If fan needs to be removed, loosen setscrew and slide fan off motor shaft.
5. When replacing fan blade, position blade so that the hub is 1/8 in. (3mm) away from the motor end (1/8 in. (3mm) of motor shaft will be visible) (See Fig. 12).
6. Ensure that setscrew engages the flat area on the motor shaft when tightening.
7. Replace grille.

ELECTRICAL CONTROLS AND WIRING

Inspect and check the electrical controls and wiring annually. Be sure to turn off the electrical power to the unit.

Remove access panel to locate all the electrical controls and wiring. Check all electrical connections for tightness. Tighten all screw connections. If any smoky or burned connections are noticed, disassemble the connection, clean all the parts, re-strip the wire end and reassemble the connection properly and securely.

After inspecting the electrical controls and wiring, replace all the panels. Start the unit, and observe at least one complete cooling cycle to ensure proper operation. If discrepancies are observed in operating cycle, or if a suspected malfunction has occurred, check each electrical component with the proper electrical instrumentation. Refer to the unit wiring label when making these checks.

REFRIGERANT CIRCUIT

Inspect all refrigerant tubing connections and the unit base for oil accumulation annually. Detecting oil generally indicates a refrigerant leak.

⚠ WARNING

EXPLOSION, PERSONAL INJURY, and ENVIRONMENTAL HAZARD

Failure to follow this warning could result in property damage, personal injury or death.

System under pressure. Relieve pressure and recover all refrigerant before system repair or final unit disposal. Use all service ports and open all flow-control devices, including solenoid valves.

If oil is detected or if low performance is suspected, leak test all refrigerant tubing using an electronic leak detector, or liquid-soap solution. If a refrigerant leak is detected, refer to Check for Refrigerant Leaks section.

If no refrigerant leaks are found and low performance is suspected, refer to **Checking and Adjusting Refrigerant Charge** section.

INDOOR AIRFLOW

The heating and/or cooling airflow does not require checking unless improper performance is suspected. If a problem exists, be sure that all supply- and return-air grilles are open and free from obstructions, and that the air filter is clean.

METERING DEVICES-PISTON

Refrigerant metering device is a fixed orifice and is located in the distributor assembly to the indoor coil.

LIQUID LINE STRAINER

The liquid line strainer (to protect metering device) is made of wire mesh and is located in the liquid line on the inlet side of the metering device.

HIGH FLOW VALVES

High flow valves are located on the compressor hot gas and suction tubes. Large black plastic caps distinguish these valves with O-rings located inside the caps. These valves can not be accessed for service in the field. Ensure the plastic caps are in place and tight or the possibility of refrigerant leakage could occur.

TIME-DELAY RELAY

The Time-Delay Relay (TDR) is a solid-state control, recycle delay timer which keeps indoor blower operating for 30 sec. after thermostat is satisfied. This delay enables blower to remove residual cooling in coil after compression shutdown, thereby improving efficiency of system. The sequence of operation is that on closure of wall thermostat and at end of a fixed on delay of 1 sec., fan relay is energized. When thermostat is satisfied, an off delay is initiated. When fixed delay of 30 ± 5 sec. is completed, fan relay is de-energized and fan motor stops. If wall thermostat closes during this delay, TDR is reset and fan relay remains energized. TDR is a 24-v device that operates within a range of 15-v to 30-v and draws about 0.5 amps. If the blower runs continuously instead of cycling off when the fan switch is set on AUTO, the TDR is probably defective and must be replaced.

Table 5—Filter Pressure Drop Table (in. wc)

FILTER SIZE	CFM																		
	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
20X20X1	0.05	0.07	0.08	0.1	0.12	0.13	0.14	0.15	—	—	—	—	—	—	—	—	—	—	—
20X24X1	—	—	—	—	0.09	0.1	0.11	0.13	0.14	0.15	0.16	—	—	—	—	—	—	—	—
24X30X1	—	—	—	—	—	—	—	0.07	0.08	0.09	0.1	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18

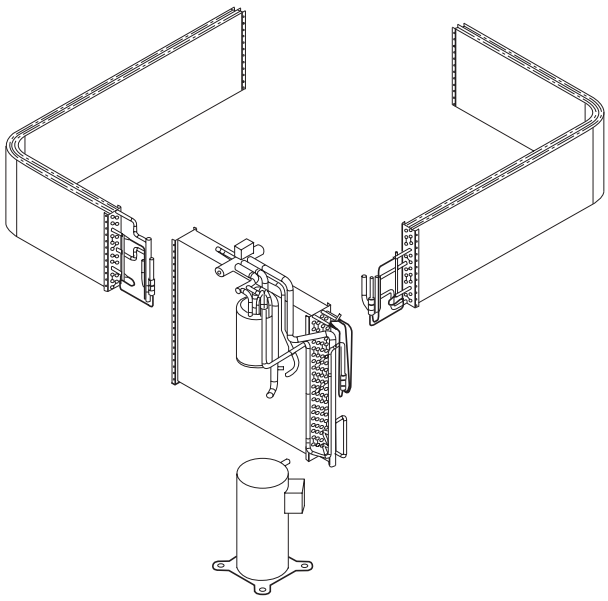
Table 6—Electric Heat Pressure Drop Table
Small Cabinet: 024-030

	CFM											
	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
5 kw	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.06	0.07
10 kw	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.06	0.07	0.09	0.10	0.11
15 kw	0.00	0.00	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18
20 kw	0.00	0.00	0.02	0.04	0.06	0.08	0.09	0.11	0.13	0.15	0.17	0.19

Table 7—Electric Heat Pressure Drop Table
Large Cabinet: 036-060

	CFM														
	1100	**1200**	**1300**	**1400**	**1500**	**1600**	**1700**	**1800**	**1900**	**2000**	**2100**	**2200**	**2300**	**2400**	**2500**
5kw	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12
10 kw	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13
15 kw	0.00	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15
20 kw	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16

FIGURE 17 Refrigerant Circuit



LOSS OF CHARGE SWITCH

The loss of charge switch is located on the outdoor liquid line. This switch contains a Schrader core depressor. This switch opens at 7 psig and closes at 22 psig. No adjustment is necessary.

NOTE: Because these switches are attached to refrigeration system under pressure, it is not advisable to remove this device for troubleshooting unless you are reasonably certain that a problem exists. If switch must be removed, remove and recover all system charge so that pressure gauges read 0 psi. Never open system without breaking vacuum with dry nitrogen.

CHECK DEFROST THERMOSTAT

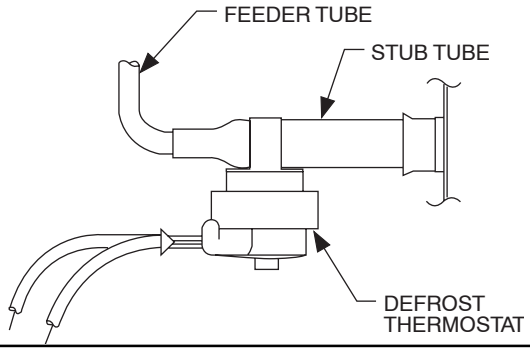
There is a liquid header with a brass distributor and feeder tube going into outdoor coil. At the end of one of the feeder tubes, there is a 3/8-in. OD stub tube approximately 3 in. long (see Fig. 21). The defrost thermostat should be located on this stub tube. Note that there is only one stub tube used with liquid header, and on most units it is the bottom circuit.

DEFROST THERMOSTAT

Defrost thermostat signals heat pump that conditions are right for defrost or that conditions have changed to terminate defrost. It is a thermally-actuated switch clamped to outdoor coil to sense its temperature. Normal temperature range is closed at 30° +/- 3°F and open at 80° +/- 5°F.

NOTE: The defrost thermostat must be located on the liquid side of the outdoor coil on the bottom circuit and as close to the coil as possible.

FIGURE 18 Refrigerant Circuit



TROUBLESHOOTING

Refer to the Troubleshooting Chart (Table 9) for troubleshooting information.

START-UP CHECKLIST

Use the Start-Up Checklist at the back of this manual.

Table 8—Wet Coil Air Delivery* — Horizontal Discharge(Deduct 10% for 208-Volt Operation)
(Deduct 10% for 208-Volt Operation)

230 VOLT HORIZONTAL DISCHARGE											
UNIT SIZE	MOTOR SPEED	AIR DELIVERY	EXTERNAL STATIC PRESSURE (IN. WC)									
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
024	Low	Watts	311	309	304	301	286	—	—	—	—	—
		CFM	935	885	820	757	686	—	—	—	—	—
	Med	Watts	—	—	—	—	379	357	357	345	327	—
		CFM	—	—	—	—	957	868	769	647	365	—
	High	Watts	—	—	—	—	—	—	447	435	421	—
		CFM	—	—	—	—	—	—	970	853	712	—
030	Low	Watts	311	309	304	301	—	—	—	—	—	—
		CFM	935	885	820	757	—	—	—	—	—	—
	Med	Watts	411	405	398	390	379	357	357	—	—	—
		CFM	1195	1155	1100	1028	957	868	769	—	—	—
	High	Watts	—	—	—	—	477	467	447	435	—	—
		CFM	—	—	—	—	1185	1088	970	853	—	—
036	Low	Watts	437	433	424	417	403	391	379	362	—	—
		CFM	1353	1318	1283	1235	1187	1123	1059	975	—	—
	Med	Watts	—	—	—	531	516	496	478	459	435	—
		CFM	—	—	—	1489	1437	1362	1289	1208	1099	—
	High	Watts	—	—	—	—	—	—	—	629	602	—
		CFM	—	—	—	—	—	—	—	1470	1357	—
042	Low	Watts	625	606	586	571	550	534	509	483	457	—
		CFM	1539	1496	1466	1437	1387	1330	1264	1183	1093	—
	Med	Watts	—	741	715	694	669	645	610	573	544	—
		CFM	—	1738	1698	1653	1604	1538	1457	1362	1271	—
	High	Watts	—	—	—	—	—	798	772	738	700	—
		CFM	—	—	—	—	—	1720	1648	1540	1414	—
048	Low	Watts	627	617	607	584	567	548	528	503	—	—
		CFM	1550	1530	1493	1461	1414	1361	1320	1250	—	—
	Med	Watts	771	755	734	711	690	665	639	607	572	—
		CFM	1798	1771	1734	1687	1645	1595	1530	1449	1355	—
	High	Watts	—	—	908	887	858	827	804	767	748	—
		CFM	—	—	2000	1994	1876	1811	1735	1647	1555	—
060	Low	Watts	786	769	754	736	722	705	684	658	—	—
		CFM	2027	1960	1901	1821	1759	1693	1616	1513	—	—
	Med	Watts	873	849	833	815	798	782	763	748	—	—
		CFM	2095	2026	1962	1887	1817	1748	1679	1583	—	—
	High	Watts	1012	993	981	963	948	927	904	886	—	—
		CFM	2184	2109	2036	1963	1886	1812	1729	1647	—	—

*Air delivery values are based on operating voltage of 230v, wet coil, without filter or electric heater. Deduct filter and electric heater pressure drops to obtain static pressure available for ducting.

NOTES:

1. Do not operate the unit at a cooling airflow that is less than 350 cfm for each 12,000 Btuh of rated cooling capacity. Evaporator coil frosting may occur at airflows below this point.
2. Dashes indicate portions of table that are beyond the blower motor capacity or are not recommended.

Table 9—Troubleshooting Chart

SYMPTOM	CAUSE	REMEDY
Compressor and outdoor fan will not start	Power failure	Call power company
	Fuse blown or circuit breaker tripped	Replace fuse or reset circuit breaker
	Defective contactor, transformer, control relay, or high-pressure, loss-of-charge or low-pressure switch	Replace component
	Insufficient line voltage	Determine cause and correct
	Incorrect or faulty wiring	Check wiring diagram and rewire correctly
	Thermostat setting too low/too high	Reset Thermostat setting
Compressor will not start but condenser fan runs	Faulty wiring or circuit Loose connections in compressor	Check wiring and repair or replace
	Compressor motor burned out, seized, or internal overload open	Determine cause Replace compressor
	Defective run capacitor, overload, or PTC (positive temperature coefficient) thermistor	Determine cause and replace
	One leg of 3-phase power dead	Replace fuse or reset circuit breaker Determine cause
	Low input voltage (20 percent low)	Determine cause and correct
Three-phase scroll compressor (size 030-060 unit) has a low pressure differential	Scroll compressor is rotating in the wrong direction	Correct the direction of rotation by reversing the 3-phase power leads to the unit
Compressor cycles (other than normally satisfying) cooling/heating calls	Refrigerant overcharge or undercharge	Recover refrigerant, evacuate system, and recharge to capacities shown on rating plate
	Defective compressor	Replace and determine cause
	Insufficient line voltage	Determine cause and correct
	Blocked outdoor coil	Determine cause and correct
	Defective run/start capacitor, overload or start relay	Determine cause and replace
	Faulty outdoor fan motor or capacitor	Replace
	Restriction in refrigerant system	Locate restriction and remove
Compressor operates continuously	Dirty air filter	Replace filter
	Unit undersized for load	Decrease load or increase unit size
	Thermostat temperature set too low	Reset Thermostat setting
	Low refrigerant charge	Locate leak, repair, and recharge
	Air in system	Recover refrigerant, evacuate system, and recharge
	Outdoor coil dirty or restricted	Clean coil or remove restriction
Excessive head pressure	Dirty air filter	Replace filter
	Dirty indoor or outdoor coil	Clean coil
	Refrigerant overcharged	Recover excess refrigerant
	Air in system	Recover refrigerant, evacuate system, and recharge
	Indoor or outdoor air restricted or air short-cycling	Determine cause and correct
Head pressure too low	Low refrigerant charge	Check for leaks, repair and recharge
	Restriction in liquid tube	Remove restriction
Excessive suction pressure	High Heat load	Check for source and eliminate
	Reversing valve hung up or leaking internally	Replace valve
	Refrigerant overcharged	Recover excess refrigerant
Suction pressure too low	Dirty air filter	Replace filter
	Low refrigerant charge	Check for leaks, repair and recharge
	Metering device or low side restricted	Remove source of restriction
	Insufficient coil airflow	Check filter–replace if necessary
	Temperature too low in conditioned area	Reset thermostat setting
	Outdoor ambient below 55°F	Install low-ambient kit
	Filter drier restricted	Replace

START-UP CHECKLIST
(Remove and Store in Job File)

I. Preliminary Information

MODEL NO.:_____
SERIAL NO.:_____
DATE:_____
TECHNICIAN:_____

II. PRE-START-UP (Insert checkmark in box as each item is completed)

( ) VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT
( ) REMOVE ALL SHIPPING HOLD DOWN BOLTS AND BRACKETS PER INSTALLATION INSTRUCTIONS
( ) CHECK ALL ELECTRICAL CONNECTIONS AND TERMINALS FOR TIGHTNESS
( ) CHECK THAT INDOOR (EVAPORATOR) AIR FILTER IS CLEAN AND IN PLACE
( ) VERIFY THAT UNIT INSTALLATION IS LEVEL
( ) CHECK FAN WHEEL, AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE AND SETSCREW TIGHTNESS

III. START-UP

ELECTRICAL

SUPPLY VOLTAGE _____
COMPRESSOR AMPS_____
INDOOR (EVAPORATOR) FAN AMPS_____

TEMPERATURES

OUTDOOR (CONDENSER) AIR TEMPERATURE _____DB
RETURN-AIR TEMPERATURE _____DB _____WB
COOLING SUPPLY AIR _____DB _____WB

PRESSURES

REFRIGERANT SUCTION _____PSIG SUCTION LINE TEMP*_____
REFRIGERANT DISCHARGE _____PSIG DISCHARGE TEMP†_____
( ) VERIFY REFRIGERANT CHARGE USING CHARGING CHARTS

*Measured at suction inlet to compressor
†Measured at liquid line leaving condenser.