

# INSTALLATION MANUAL

**Single Package  
Heat Pump with Electric Heat**  
**Models: PHE4 Series**  
**3 ton to 5 ton - 460 V - Three-Phase**



Assembled at a facility with  
an ISO 9001:2015-certified  
Quality Management  
System

## List of sections

<b>General information</b> . . . . .	<b>1</b>	<b>Operation</b> . . . . .	<b>11</b>
<b>Safety</b> . . . . .	<b>1</b>	<b>Maintenance</b> . . . . .	<b>14</b>
<b>Nomenclature</b> . . . . .	<b>2</b>	<b>R-410A quick reference guidelines</b> . . . . .	<b>14</b>
<b>Installation</b> . . . . .	<b>3</b>	<b>Typical wiring diagrams</b> . . . . .	<b>15</b>
<b>Airflow performance</b> . . . . .	<b>10</b>	<b>Start-up sheet</b> . . . . .	<b>17</b>

## List of figures

Component location . . . . .	3	Typical field power wiring diagram . . . . .	7
Unit four-point load weight . . . . .	4	Single-point wiring kit . . . . .	8
Unit dimensions . . . . .	5	Demand defrost control board . . . . .	12
Duct dimensions (in.) - bottom view looking up . . . . .	6	Measuring external static pressure . . . . .	13
Duct dimensions (in.) - rear view . . . . .	6	Connection wiring diagram . . . . .	15
Typical field control wiring diagram for heat pump models . . . . .	7	Ladder wiring diagram . . . . .	16

## List of tables

Nomenclature . . . . .	2	Electric heat performance data: 460-3-60 . . . . .	8
Unit limitations . . . . .	3	Physical data . . . . .	9
Application limitations . . . . .	3	Airflow performance - side duct application . . . . .	10
Weights and dimensions . . . . .	4	Electric heat minimum supply air . . . . .	10
Unit dimensions . . . . .	5	Additional static resistance . . . . .	11
Unit clearances . . . . .	5	Demand defrost selection . . . . .	11
Electrical data - 460-3-60 - single source power . . . . .	7	Test pins . . . . .	12
Electrical data - 460-3-60 multi source power . . . . .	7	Demand defrost fault codes . . . . .	12
Single-point wiring kit . . . . .	8	Thermostat signals . . . . .	12

## Section I: General information

PHE units are factory-assembled heat pumps designed for outdoor installation on a rooftop or a slab. Field-installed optional electric heater accessories are available to provide supplemental electric heat combined with electric cooling and heating.

The units are completely assembled on rigid, removable base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require only electric power condensate drain and duct connections at the point of installation.

## 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. **Failure to carefully read and follow all instructions in this manual can result in furnace malfunction, death, personal injury, and/or property damage.** Only a qualified contractor, installer, or service agency should install this product.

## ▲ CAUTION

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

**⚠ WARNING**

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury. Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency, or the gas supplier.

**⚠ CAUTION**

This system uses R-410A refrigerant, which operates at higher pressures than R-22. No other refrigerant may be used in this system. Gauge sets, hoses, refrigerant containers, and recovery systems must be designed to handle R-410A. If you are unsure, consult the equipment manufacturer. Failure to use R-410A compatible servicing equipment may result in property damage or injury.

**⚠ CAUTION**

If performing any brazing in or around the unit, use a heat shield to prevent damage to the unit wiring, gaskets, and insulating materials. If you do not use a heat shield, damage to the unit and unit failure can occur.

Due to system pressure, moving parts, and electrical components, installation and servicing of air conditioning equipment can be hazardous. Only qualified, licensed service personnel must install, repair, or service this equipment. Unlicensed personnel can perform the basic maintenance functions of cleaning coils and filters and replacing filters.

Observe all precautions in the literature, labels, and tags accompanying the equipment when working on air conditioning equipment. Install this product in strict compliance with the installation instructions and any applicable local, state, and national codes, including but not limited to building, electrical, and mechanical codes.

Wear safety glasses and work gloves. Use quenching cloth and have a fire extinguisher available during brazing operations.

**Inspection**

On receiving a unit, inspect the unit for possible damage during transit. If damage is evident, note the extent of the damage on the carrier's freight bill. Make a separate request for inspection by the carrier's agent in writing.

**Replacement parts**

Contact your local Ducted Systems parts distribution center for authorized replacement parts.

**Section III: Nomenclature**

Table 1: Nomenclature

Model family	PHE	PHE = packaged heat pump with electric heat
		PCG = packaged AC with gas heat
		PHG = packaged heat pump with gas heat
		PCE = packaged AC with electric heat
Nominal cooling efficiency	4	4 = standard efficiency
		6 = high efficiency
Cabinet size	B	A = small, 35.75 in. x 51.25 in.
		B = large, 45.75 in. x 51.25 in.
Nominal air conditioning cooling capacity Btu/h x 1000	36	36 = 36,000 Btu/h
		48 = 48,000 Btu/h
		60 = 60,000 Btu/h
Gas heating input Btu/h x 1000		050 = 50,000 Btu/h input
		065 = 65,000 Btu/h input
		075 = 75,000 Btu/h input
		100 = 100,000 Btu/h input
		125 = 125,000 Btu/h input
		blank = electric heat
Voltage-phase-frequency	4	2 = 208/230-1-60
		3 = 208/230-3-60
		4 = 460-3-60
NOx approval		X = Low NOx
		blank = not Low NOx
Generation level	4	1 = first generation
		2 = second generation
		3 = third generation
		4 = fourth generation
Revision level	A	A = original release
		B = second release

**Nomenclature example:** PHE4B3644A is a packaged heat pump with electric heat, standard efficiency, large cabinet, 3 ton, 460 V, three-phase model, fourth generation, original release.

## Section IV: Installation

### Limitations

Install these units in accordance with the following national and local safety codes:

- National Electrical Code ANSI/NFPA No. 70 or Canadian Electrical Code Part 1, C22.1 (latest editions)
- Local plumbing and wastewater codes and other applicable local codes

See **Table 4** and **Table 5** for unit physical data and **Table 7** and **Table 8** for electrical data.

If it is necessary to add components to a unit to meet local codes, installation is done at the dealer's or customer's expense.

The size of the unit for proposed installation must be based on heat loss or heat gain calculations made in accordance with industry recognized procedures such as the Air Conditioning Contractors of America (ACCA) (*Manual J*).

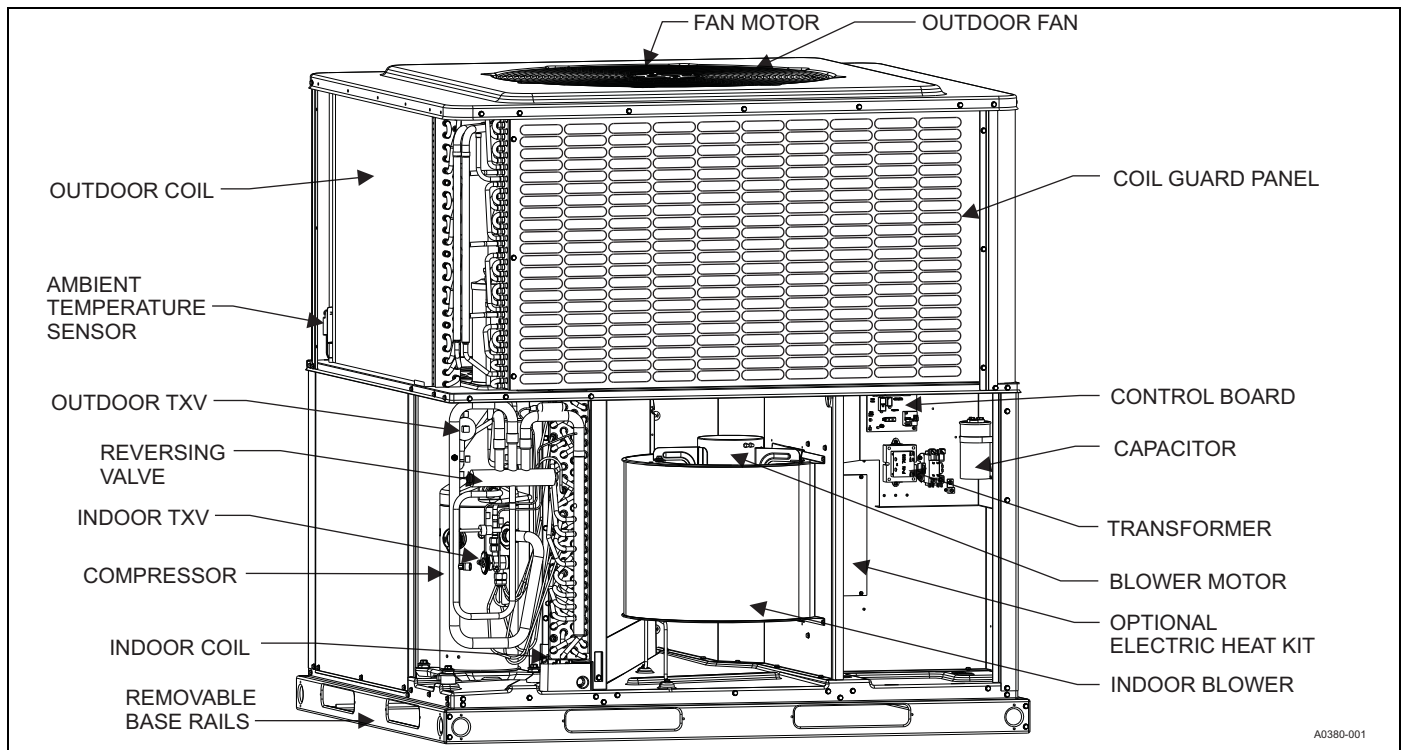
**Table 2:** Unit limitations

Model	Voltage-phase-frequency	Unit limitations		
		Applied voltage (V)		Outdoor DB temperature (°F)
		Minimum	Maximum	Maximum
PHE4B36	460-3-60	432	504	125
PHE4B48				
PHE4B60				

**Table 3:** Application limitations

Packaged equipment series	Air temperature at outdoor coil (°F)				Air temperature at indoor coil (°F)			
	Minimum		Maximum		Minimum		Maximum	
	DB cool	DB heat	DB cool	DB heat	WB cool	DB heat	WB cool	DB heat
PHE4*	55	-10	125	75	57	50	72	80

**Note:**\*PHE4A24 models are restricted to operation of 0°F outdoor air temperature.



**Figure 1:** Component location

**Location**

**⚠ WARNING**

Do not permit overhanging structures or shrubs to obstruct outdoor air discharge outlet.

Use the following guidelines to select a suitable location for these units:

- The unit is designed for only **outdoor installation**.
- Outdoor coils must have an unlimited supply of air. Where a choice of location is available, position the unit on either the north or east side of the building.
- The unit is suitable for mounting on a roof curb.

**⚠ WARNING**

Do not attach supply and return ductwork to the bottom of the unit base pan as the drain pan could be compromised.

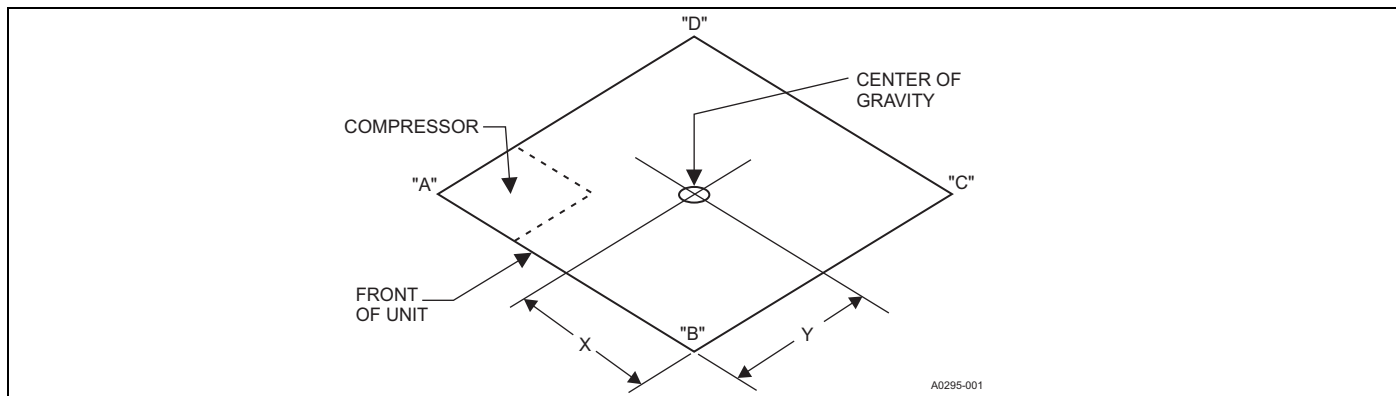
- For ground level installation, use a level pad or slab. The thickness and size of the pad or slab must meet local codes and support the weight of the unit. Do not tie the slab to the building foundation.
- Roof structures must be able to support the weight of the unit and its options or accessories. Install the unit on a solid, level roof curb or an appropriate angle iron frame.
- Maintain level tolerance to 1/8 in. across the entire width and length of the unit.

**Clearances**

All units require certain clearances for correct operation and service. See **Table 6** for the clearances required for construction, servicing, and correct unit operation.

**Table 4:** Weights and dimensions

Model	Weight (lb)		Center of gravity (in.)		Four-point load location (lb)			
	Shipping	Operating	X	Y	A	B	C	D
PHE4B36	425	420	29	18	155	90	91	74
PHE4B48	484	479	29	19	171	100	100	91
PHE4B60	490	485	29	19	174	106	102	94



**Figure 2:** Unit four-point load weight

**Rigging and handling**

**⚠ CAUTION**

If a unit is to be installed on a roof curb other than a Ducted Systems roof curb, gasket or sealant must be applied to all surfaces that come in contact with the unit underside.

**⚠ CAUTION**

All panels must be secured in place when the unit is lifted. The outdoor coils should be protected from rigging cable damage with plywood or other suitable material.

Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the lifting holes provided in the base rails.

**Note:** Use spreader bars whose length exceeds the largest dimension across the unit across the top of the unit.

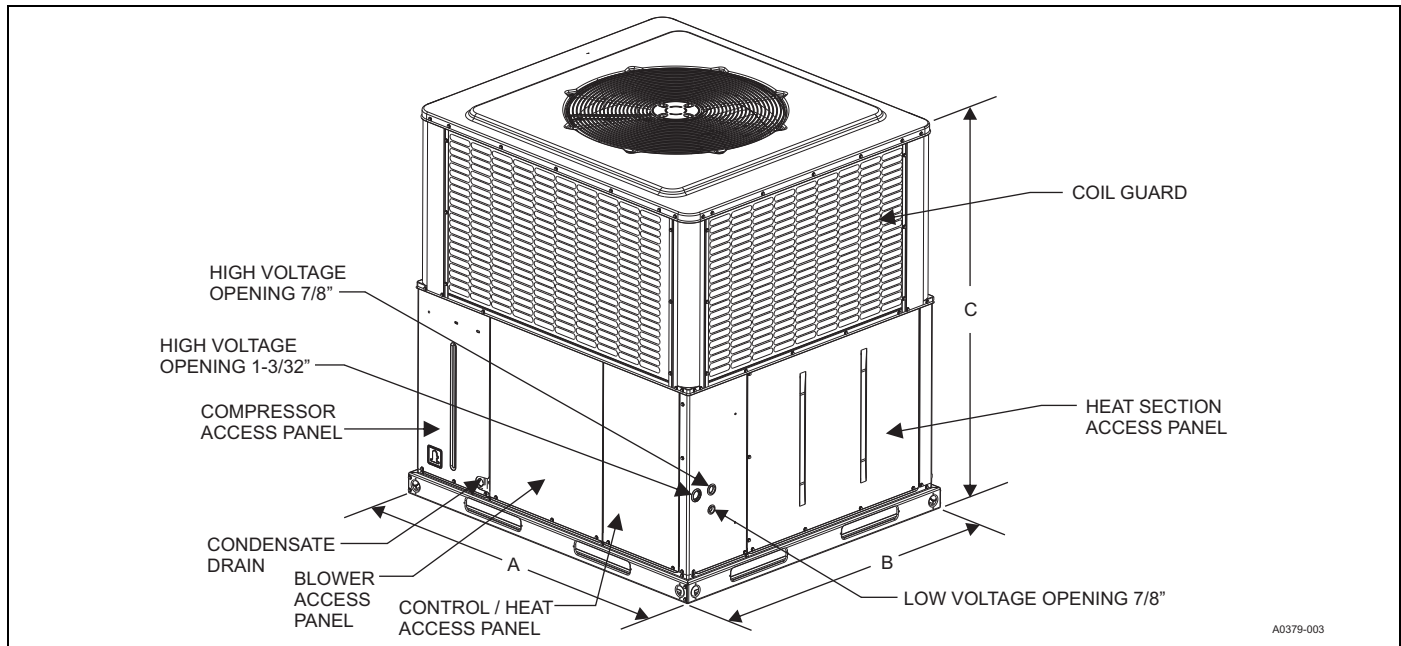
**⚠ CAUTION**

Before lifting, make sure the unit weight is distributed equally on the rigging cables so it will lift evenly.

Units can be moved or lifted with a forklift. Slotted openings in the base rails are provided for this purpose.

**Table 5:** Unit dimensions

Model	Dimensions (in.)		
	A	B	C
PHE4B36	51 1/4	45 3/4	47
PHE4B48	51 1/4	45 3/4	53
PHE4B60	51 1/4	45 3/4	55

**Figure 3:** Unit dimensions**Table 6:** Unit clearances

Direction	Distance (in.)	Direction	Distance (in.)
Top <sup>1</sup>	36	Right side	36
Side opposite ducts	36	Left side	24
Duct panel	0	Bottom <sup>2,3</sup>	1

1. Provide a minimum clearance of 1 in. on all sides of the supply air duct for the first 3 ft of the duct for 20 kW and 25 kW heaters, 0 in. thereafter. For all other heaters, make sure that there is 0 in. clearance on all sides for the entire length of the supply air duct.

2. Install units outdoors. Make sure that overhanging structures or shrubs do not obstruct the outdoor air discharge outlet.

3. You can install units on combustible materials made from wood or class A, B, or C roof covering materials if the factory base rails are left in place as shipped.

**Note:** For units installed on a roof curb, you can reduce the minimum clearance between combustible roof curb material and the supply air duct from 1 in. to 1/2 in.

### Ductwork

## NOTICE

All units are shipped in the horizontal supply/return configuration. It is important to reduce the possibility of any air leakage through the bottom duct covers (resulting from cut, torn, or rolled gasket) due to improper handling or shipping processes. To ensure a good tight seal, it is recommended that silicone caulk and/or foil tape be applied along the cover edges.

These units are adaptable to downflow use. To convert to downflow, follow these steps:

1. Remove the duct covers found in the bottom return and supply air duct openings. There are four screws securing each duct cover. Save these screws to use in Step 2.
2. Install the duct covers removed in Step 1 to the rear supply and return air duct openings. Secure with the four screws used in Step 1.
3. Seal the duct covers with silicone caulk.

Design and size ductwork according to the methods of the Air Conditioning Contractors of America (ACCA), as outlined in their *Manual D*.

Use a closed return duct system. This does not preclude use of economizers or ventilation air intake. Use flexible duct connectors in the supply and return ductwork to minimize the transmission of vibration and noise.

## CAUTION

When fastening ductwork to the side duct flanges on the unit, insert the screws through the duct flanges only. **Do not** insert the screws through the casing. Outdoor ductwork must be insulated and waterproofed.

## NOTICE

Be sure to note supply and return openings.

See **Figure 4** and **Figure 5** for information concerning rear and bottom supply and return air duct openings.

### Filters

Correct filter size is very important. Always consider filter size, type, and pressure drop during duct system design.

It is the responsibility of the installer to secure a filter in the return air ductwork or use the filter rack.

A filter rack kit is included with all three-phase units.

Always use filters and keep filters clean. When filters become dirt laden, insufficient air is delivered by the blower, decreasing your unit's efficiency and increasing operating costs and wear-and-tear on the unit and controls.

Check filters monthly. This is especially important because this unit can be used for both heating and cooling.

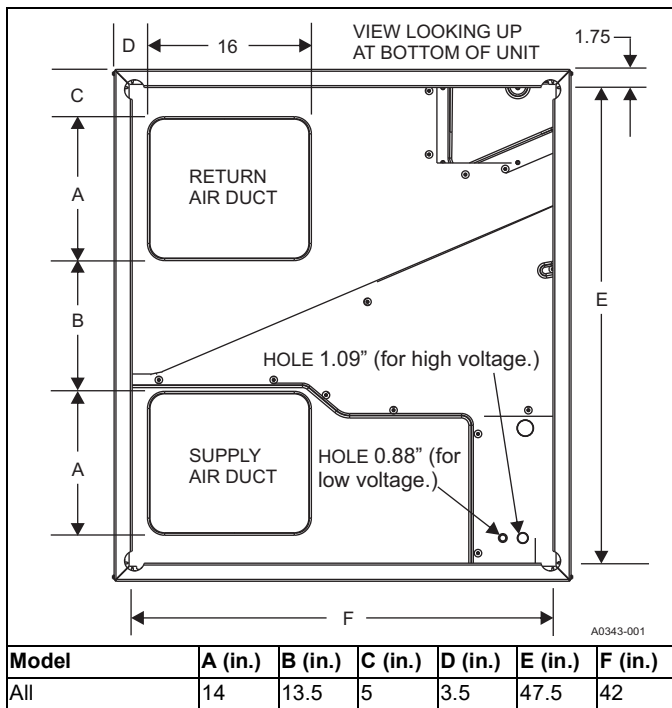


Figure 4: Duct dimensions (in.) - bottom view looking up

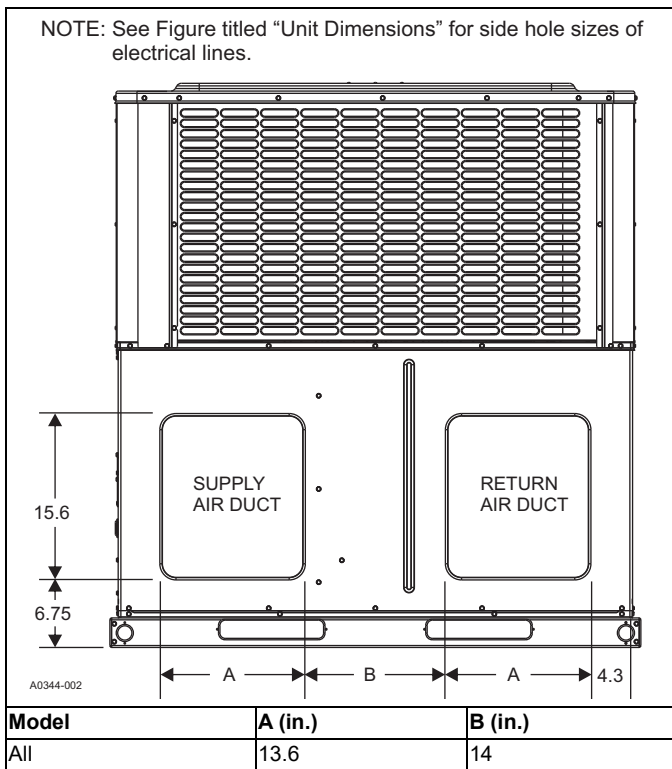


Figure 5: Duct dimensions (in.) - rear view

**Condensate drain**

Install a condensate trap in the condensate drain. The plumbing must conform to local codes.

**⚠ CAUTION**

Hand tighten only.

**Service access**

**⚠ WARNING**

Wear safety glasses and gloves when handling refrigerants. Failure to follow this warning can cause serious personal injury.

Access to all serviceable components is provided at the following locations:

- Coil guards
- Unit top panel
- Corner posts
- Blower access panel
- Control access panel
- Indoor coil access panel
- Compressor access panel
- Heat section access panel

See **Figure 3** for access locations and see **Table 6** for minimum clearances.

**⚠ CAUTION**

This system uses R-410A refrigerant, which operates at higher pressures than R-22. No other refrigerant may be used in this system. Gauge sets, hoses, refrigerant containers, and recovery systems must be designed to handle R-410A. If you are unsure, consult the equipment manufacturer. Failure to use R-410A compatible servicing equipment may result in property damage or injury.

See **Section VIII: R-410A quick reference guidelines** for more information about R-410A refrigerant.

**Thermostat**

Locate the room thermostat on an inside wall approximately 60 in. above the floor where it is not subject to drafts, sun exposure, or heat from electrical fixtures or appliances. Use sealant behind the thermostat to prevent air infiltration. Follow the manufacturer instructions enclosed with the thermostat for the general installation procedure. Use color-coded insulated wires (minimum No. 18 AWG) to connect the thermostat to the unit. See **Figure 6**. Do not use power-stealing thermostats.

**Power and control wiring**

Field wiring to the unit must conform to provisions of the current NEC ANSI/NFPA No. 70 or CEC and/or local ordinances. The unit must be electrically grounded in accordance with local codes or, in their absence, with the NEC/CEC. Refer to the unit rating plate and see **Table 2** for voltage tolerances that must be maintained at the compressor terminals during starting and running conditions.

**Note:** Provide the wiring entering the cabinet with mechanical strain relief.

A fused disconnect switch must be field provided for the unit. If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram.

Electrical service must be sized correctly to carry the load. Each unit must be wired with a separate branch circuit fed directly from the main distribution panel and correctly fused.

Single-point wiring requires the use of the single-point wiring kit accessory.

See **Figure 6** and **Figure 7** for typical field wiring and refer to the appropriate unit wiring diagram for control circuit and power wiring information.

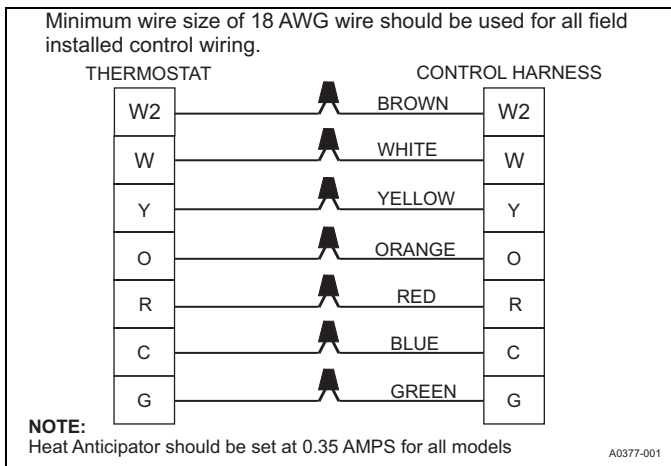


Figure 6: Typical field control wiring diagram for heat pump models

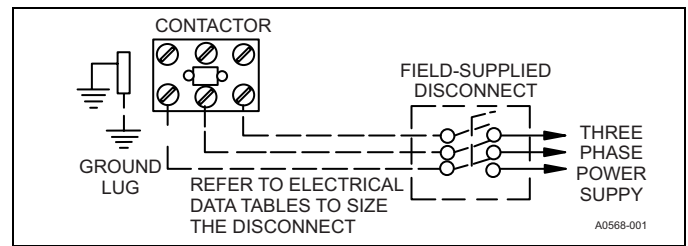


Figure 7: Typical field power wiring diagram

Table 7: Electrical data - 460-3-60 - single source power

Model	Compressor			OD fan motor FLA	Blower motor FLA	Electric heat option				MCA <sup>1</sup> Total unit (A)	Max fuse <sup>2</sup> or breaker <sup>3</sup> size Total unit (A)	MCA <sup>1</sup> Unit minus heater (A)
	RLA	LRA	MCC			Heater kit <sup>4</sup>	Heater (kW)	Stages	Heater (A)			
PHE4B36	3.8	31	5.9	1.08	1.95	none	--	--	--	7.8	15	7.8
						6HK06501046	8.8	1	11	21.5	25	7.8
						6HK06501546	13.2	1	16.6	28.5	30	7.8
PHE4B48	6	60	9.4	1.08	3.3	none	--	--	--	11.9	15	11.9
						6HK06501046	8.8	1	11	25.6	30	11.9
						6HK06501546	13.2	1	16.6	32.6	35	11.9
						6HK06502046	17.6	1	22.1	39.5	40	11.9
PHE4B60	6.3	60	9.8	1.08	3.3	none	--	--	--	12.3	15	12.3
						6HK06501046	8.8	1	11	26	30	12.3
						6HK06501546	13.2	1	16.6	33	35	12.3
						6HK06502046	17.6	1	22.1	39.9	40	12.3
						6HK06502546	22	1	27.6	46.8	50	12.3

1. Minimum circuit ampacity.

2. Maximum overcurrent protection per standard UL 1995.

3. Fuse or HACR circuit breaker is field installed.

4. Single-point connection kit is required.

**Note:** Single-source power MCA and MOP requirements are given here for reference if the unit is installed with a field-installed single-point power modification.

Table 8: Electrical data - 460-3-60 multi source power

Model	Compressor			OD fan motor FLA	Blower motor FLA	Electric heat option				Circuit 1 Unit minus heaters		Circuit 2 Heaters	
	RLA	LRA	MCC			Heater kit	Heater (kW)	Stages	Heater (A)	MCA <sup>1</sup> (A)	Max fuse <sup>2</sup> or breaker <sup>3</sup> size (A)	MCA <sup>1</sup> (A)	Max fuse <sup>2</sup> or breaker <sup>3</sup> size (A)
PHE4B36	3.8	31	5.9	1.08	1.95	none	--	--	--	7.8	15	--	--
						6HK06501046	8.8	1	11	7.8	15	13.8	15
						6HK06501546	13.2	1	16.6	7.8	15	20.8	25
PHE4B48	6	60	9.4	1.08	3.3	none	--	--	--	11.9	15	--	--
						6HK06501046	8.8	1	11	11.9	15	13.8	15
						6HK06501546	13.2	1	16.6	11.9	15	20.8	25
						6HK06502046	17.6	1	22.1	11.9	15	27.6	30
PHE4B60	6.3	60	9.8	1.08	3.3	none	--	--	--	12.3	15	--	--
						6HK06501046	8.8	1	11	12.3	15	13.8	15
						6HK06501546	13.2	1	16.6	12.3	15	20.8	25
						6HK06502046	17.6	1	22.1	12.3	15	27.6	30
						6HK06502546	22	1	27.6	12.3	15	34.5	35

1. Minimum circuit ampacity.

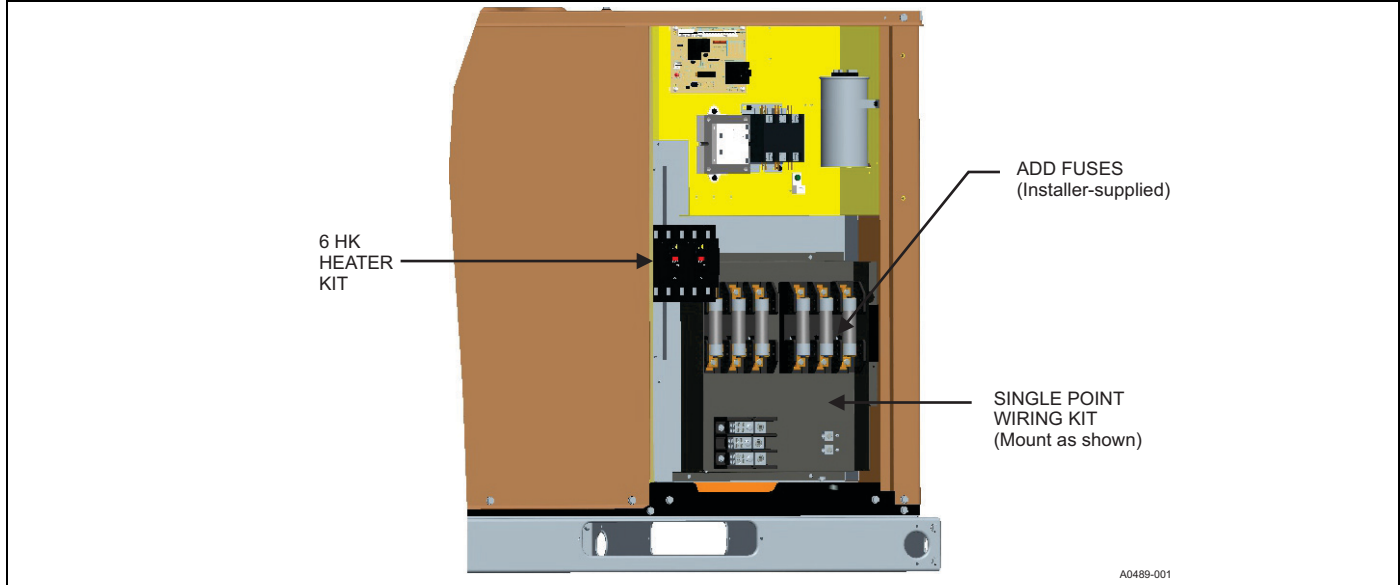
2. Maximum overcurrent protection per standard UL 1995.

3. Fuse or HACR circuit breaker is field installed.

**Table 9:** Single-point wiring kit

Unit model number	Voltage-phase-frequency	Heater kit	Single-point wiring kit
PHE4B36	460-3-60	6HK06501046	S1-2SPWK036
		6HK06501546	S1-2SPWK036
PHE4B48		6HK06501046	S1-2SPWK036
		6HK06501546	S1-2SPWK036
PHE4B60		6HK06502046	S1-2SPWK036
		6HK06501046	S1-2SPWK036
		6HK06501546	S1-2SPWK036
		6HK06502046	S1-2SPWK036
		6HK06502546	S1-2SPWK037

**Note:** The 20 kW heater kits and 25 kW heater kits include circuit breakers.



**Figure 8:** Single-point wiring kit

**Table 10:** Electric heat performance data: 460-3-60

Heater models <sup>1</sup>	Nominal kW at 480 V	Total heat	
		kW	MBH
		460 V	460 V
6HK06501046	9.6	8.8	30.1
6HK06501546	14.4	13.2	45.1
6HK06502046	19.2	17.6	60.2
6HK06502546	24.0	22.0	75.2

1. 6HK0 = no service disconnect.



Table 11: Physical data

Models		PHE4B36	PHE4B48	PHE4B60
Nominal tonnage		3.0	4.0	5.0
Refrigerant information	Refrigerant type	R-410A	R-410A	R-410A
	Refrigerant charge (lb-oz)	9-6	14-4	11-10
Dimensions	Length (in.)	51 1/4	51 1/4	51 1/4
	Width (in.)	45 3/4	45 3/4	45 3/4
	Height (in.)	47	53	55
Operating weight (lb)		420	479	485
Compressor type		Scroll	Scroll	Scroll
Outdoor coil data	Face area (sq ft)	17.6	24.2	26.4
	Rows	2	2	2
	Fins per inch	22	22	22
	Tube diameter (mm)	7	7	7
	Circuitry type	Interlaced	Interlaced	Interlaced
	Refrigerant control	TXV	TXV	TXV
Indoor coil data	Face area (sq ft)	6.3	6.3	6.3
	Rows	3	4	4
	Fins per inch	16	16	16
	Tube diameter (in.)	3/8	3/8	3/8
	Circuitry type	Interlaced	Interlaced	Interlaced
	Refrigerant control	TXV	TXV	TXV
Outdoor fan data	Fan diameter (in.)	26	26	26
	Type	Prop	Prop	Prop
	Drive type	Direct	Direct	Direct
	Number of speeds	1	1	1
	Motor (hp)	1/3	1/3	1/3
	RPM	850	850	850
	Nominal total CFM	3450	4000	4000
Direct drive indoor blower data	Fan size (in.)	11 x 10	11 x 10	11 x 10
	Type	Centrifugal	Centrifugal	Centrifugal
	Motor (hp)	1/2	3/4	1
	RPM (maximum)	1200	1200	1200
	Frame size (in.)	48	48	48
Filter size		B	B	B

**Note:** Field-supplied external filters must be sized so as not to exceed 300 FPM air velocity through disposable filters. All three-phase models include an internal filter rack kit and washable filters. Refer to the instructions supplied with the kit for replacement filter sizes. Filter sizes: B = 20 in. x 30 in.

### Compressors

The compressor used in this product is specifically designed to operate with R-410A refrigerant and cannot be interchanged with a different type of compressor.

#### ⚠ CAUTION

This system uses R-410A refrigerant, which operates at higher pressures than R-22. No other refrigerant may be used in this system.

The compressor uses polyolester (POE) oil, Mobil 3MA POE. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oil can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. If the refrigerant circuit is opened, take all necessary precautions to avoid exposure of the oil to the atmosphere.

#### ⚠ CAUTION

Do not leave the system open to the atmosphere. Unit damage could occur due to moisture being absorbed by the **POE oil** in the system. This type of oil is highly susceptible to moisture absorption

POE compressor lubricants are known to cause long-term damage to some synthetic roofing materials.

#### ⚠ CAUTION

Exposure, even if immediately cleaned up, may cause embrittlement (leading to cracking) to occur in one year or more. When performing any service that may risk exposure of compressor oil to the roof, take precautions to protect roofing.

Procedures that risk oil leakage include but are not limited to the following:

- Replacing the compressor
- Repairing refrigerant leaks
- Replacing refrigerant components such as filter drier, pressure switch, metering device, or coil

#### ⚠ CAUTION

Do not loosen compressor mounting bolts.

Units are shipped with compressor mountings that are factory-adjusted and ready for operation.

## Phasing

Three-phase, scroll compressors operate in only one direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or is producing a high noise level, the scroll compressor motor may be experiencing out-of-phase rotation and must be corrected.

If necessary, change the incoming line connection phasing to obtain the correct rotation.

## ⚠ CAUTION

Scroll compressors require proper rotation to operate properly. Failure to check and correct rotation may result in property damage.

## Section V: Airflow performance

**Table 12:** Airflow performance - side duct application

Model	Motor speed	External static pressure (in. W.C.)								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0
		SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
PHE4B36	Low (1)	880	830	770	690	620	550	500	440	200
	Medium low (2)	1180	1130	1090	1040	990	930	860	780	670
	Medium (3)	1310	1270	1230	1190	1140	1100	1040	970	840
	Medium high (4)	1440	1400	1360	1320	1280	1240	1190	1150	1010
	High (5)	1550	1510	1470	1440	1400	1350	1310	1270	1160
PHE4B48	Low (1)	1190	1130	1080	1030	970	900	840	790	680
	Medium low (2)	1520	1480	1450	1400	1360	1320	1280	1240	1150
	Medium (3)	1620	1580	1550	1510	1470	1430	1390	1350	1270
	Medium high (4)	1730	1690	1660	1620	1580	1540	1500	1470	1390
	High (5)	2010	1980	1950	1910	1870	1840	1800	1760	1680
PHE4B60	Low (1)	1340	1290	1240	1190	1140	1110	1050	1000	870
	Medium low (2)	1610	1570	1540	1500	1450	1420	1380	1340	1260
	Medium (3)	1900	1870	1840	1800	1760	1730	1690	1650	1580
	Medium high (4)	2020	1990	1960	1920	1880	1850	1810	1770	1700
	High (5)	2250	2210	2190	2160	2120	2080	2050	2000	1970

### Notes:

Airflow is tested with dry coil conditions, without air filters, at 460 V.

Applications above 0.8 in. W.C. external static pressure are not recommended.

Brushless DC high-efficiency standard ECM blower motor is used for all indoor blower assemblies.

Heating applications are tested at 0.50 in. W.C. external static pressure. Cooling applications are tested per AHRI Standard 210/240.

The differences between side duct airflows and bottom duct airflows are insignificant.

**Table 13:** Electric heat minimum supply air

Model	Voltage-phase-frequency	Minimum blower speed for electric heat			
		Heater (kW)			
		10	15	20	25
PHE4B36	460-3-60	Medium high (4)	High (5)	--	--
PHE4B48	460-3-60	Medium low (2)	Medium low (2)	Medium low (2)	--
PHE4B60	460-3-60	Medium low (2)	Medium low (2)	Medium low (2)	Medium high (4)

**Table 14:** Additional static resistance

Size (ton)	CFM	Wet indoor coil	Economizer <sup>1</sup>	Filter frame kit
036 (3.0)	700	0.01	0.00	0.04
	800	0.02	0.01	0.06
	900	0.03	0.01	0.08
	1000	0.04	0.01	0.10
	1100	0.05	0.01	0.13
	1200	0.06	0.02	0.16
	1300	0.07	0.03	0.17
	1400	0.08	0.04	0.18
048 (4.0)	1100	0.02	0.02	0.04
	1200	0.03	0.02	0.04
	1300	0.04	0.02	0.05
	1400	0.05	0.03	0.05
	1500	0.06	0.04	0.06
	1600	0.07	0.04	0.07
	1700	0.07	0.04	0.08
	1800	0.08	0.04	0.09
	1900	0.09	0.05	0.10
	2000	0.09	0.05	0.11
060 (5.0)	1100	0.02	0.02	0.04
	1200	0.03	0.02	0.04
	1300	0.04	0.02	0.05
	1400	0.05	0.03	0.05
	1500	0.06	0.04	0.06
	1600	0.07	0.04	0.07
	1700	0.07	0.04	0.08
	1800	0.08	0.04	0.09
	1900	0.09	0.05	0.10
	2000	0.09	0.05	0.11

1. The pressure drop through the economizer is greater for 100% outdoor air than for 100% return air. If the resistance of the return air duct is less than 0.25 IWG, the unit delivers less CFM during full economizer operation.

**Note:** Filter pressure drop is based on standard filter media tested at velocities not to exceed 300 ft/min.

## Section VI: Operation

The following sequences of operation are based on using a single-stage heat pump thermostat.

### Cooling sequence of operation

- When the fan switch on the thermostat is in the on position, the 24 V at G bring on the indoor blower motor at the selected airflow. When the fan switch on the thermostat is in the auto position, the blower operates only when there is a call for cooling or heating by the thermostat.
- On a call for cooling, the thermostat sends 24 V to Y and O on the demand defrost control board. The reversing valve solenoid is energized, and after the anti-short cycle period is complete, contactor coil M is energized. Power is supplied to the compressor and outdoor fan motor, and the reversing valve is switched to the cooling position. When the fan switch on the thermostat is in the auto position, the indoor blower motor is energized at the YSPD airflow.
- When the demand for cooling has been satisfied, the 24 V Y signal is removed, and the M contactor is de-energized. When the fan switch on the thermostat is in the on position, the indoor blower motor continues to run at GSPD. If the fan switch is in the auto position, the indoor motor ramps down after a 60 s delay.

### Heating sequence of operation

- When the fan switch on the thermostat is in the on position, the 24 V at G bring on the indoor blower motor at the GSPD. When the fan switch on the thermostat is in the auto position, the blower operates when there is a call for heating by the thermostat.
- On a call for heating, the thermostat sends 24 V to Y on the demand defrost control board. After the anti-short cycle period is complete, the 24 V signal energizes contactor coil M and power is supplied to the compressor and outdoor fan motor. The reversing valve remains in the heating position. When the fan switch on the thermostat is in the auto position, the indoor blower is energized at the YSPD.
- For units with supplementary electric heat, when the heat pump cannot meet the demand, the thermostat W sends 24 V. This signal is sent through the demand defrost control board terminals W to Wout and energizes the WSPD. The 24 V signal energizes the first stage of optional electric heat if installed.
- When the heating demand is satisfied, the electric heat is de-energized when the 24 V W signal is removed, and the M contactor is de-energized when the 24 V Y signal is removed. When the fan switch on the thermostat is in the on position, the indoor blower continues to run. When the fan switch is in the auto position, the indoor blower motor ramps down after a 60 s delay.

See **Table 15** for more information.

### Defrost operation

The demand defrost control board implements a temperature differential (delta-T) demand defrost algorithm. The heat pump is allowed to operate in heating mode until the combination of outdoor ambient and outdoor coil temperatures indicates that defrosting is necessary. When the coil temperature is below the initiate point for the ambient temperature continuously for 4 1/2 min, the heat pump is put into a defrost cycle. This 4 1/2 min timer eliminates unnecessary defrost cycles caused by refrigeration surges such as those that occur at the start of a heating cycle.

A timed inhibit feature prevents the system from responding to a call for defrost less than 40 min after the initiation of the previous defrost. When the 40 min inhibit time has expired, temperature conditions must call for defrost continuously for 4 1/2 min before a defrost cycle is initiated. A temperature inhibit feature prohibits defrost if the coil temperature is above 40°F.

A forced-defrost feature puts the system into a defrost period every 6 h and 4 min of accumulated compressor runtime to recirculate lubricants, unless the coil temperature is above 40°F and the ambient temperature is above 50°F. All defrost timing occurs only while the compressor is on. Defrost curve selection can be switched to pin 4 if a more aggressive defrost cycle is necessary.

During the defrost mode, the reversing valve is energized, the outdoor fan is de-energized, the compressor is energized, and the demand defrost control board provides a 24 V signal from terminal W out to energize the first stage of electric heat, if the unit is so equipped.

For troubleshooting purposes, the defrost cycle can be manually initiated by shorting the test pins together for 5 s while Y is energized. After removing the short, defrost terminates normally during the test mode.

**Table 15:** Demand defrost selection

Unit	Pin position
036–060	2
036–060	4*

**Note:** \*For extreme environments as necessary only.

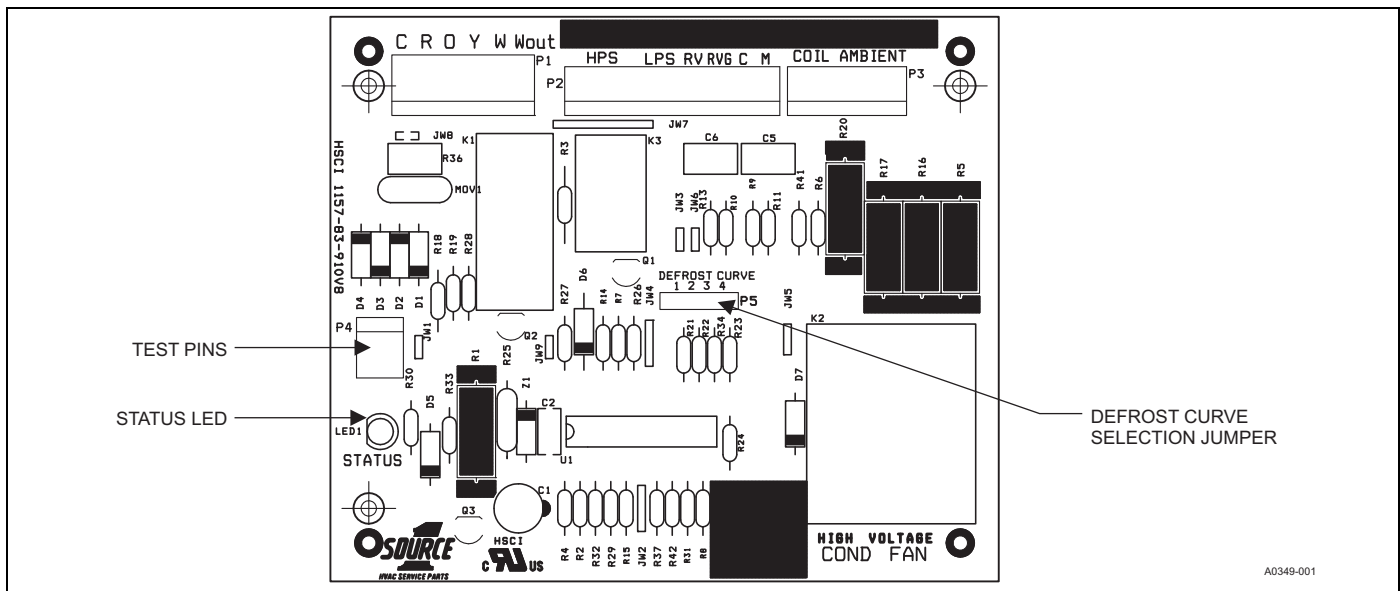


Figure 9: Demand defrost control board

**Heat pump safety switch operation**

The unit is equipped with a safety package. The high-pressure switch prevents the pressure in the refrigeration system from becoming too high. The loss of charge switch protects against loss of charge due to a leak in the refrigeration system. If either of these safety switches open, the unit is shut off for the 5 min anti-short cycle time. When this has expired, a 6 h elapsed run timer begins. If a second opening of a safety switch occurs during this 6 h period, the compressor is locked out.

To reset the lockout function, follow these steps:

1. Remove power from the control's thermostat first-stage (Y) input for more than 2 s.
2. Remove power from R for more than 2 s.
3. Short the test pins together for more than 2 s while Y is energized.
4. Short the test pins together for more than 5 s while Y is de-energized.

Table 16: Test pins

Test pin shorted	With Y Call	Without Y Call
> 2 s	Bypass ASCD	Display error codes
> 5 s	Forced defrost	Clear error codes

Table 17: Demand defrost fault codes

Description	Status LED
High-pressure switch fault (not in lockout yet)	2 flashes
System in high-pressure switch lockout (last mode of operation was normal compressor)	3 flashes
System in high-pressure switch lockout (last mode of operation was defrost)	4 flashes
System in loss of charge switch lockout (last mode of operation was normal compressor)	5 flashes
Low voltage (<19.2 VAC) preventing further relay outputs for > 2 s	6 flashes
Low voltage (<16 VAC) stopped current relay outputs for > 2 s	7 flashes
Liquid line sensor failure (open or shorted)	8 flashes
Outdoor ambient sensor failure (open or shorted)	9 flashes
Control failure	10 flashes

**Electric heat limit switch operation**

6HK three-phase heat kits use a normally closed low-voltage limit switch, a normally closed line voltage limit switch, and a normally closed fusible link. If the fusible link opens, it must be replaced with the appropriate OEM part and the cause must be investigated and corrected.

When the limit switch opens, the heating elements turn off. The indoor blower continues to run. The limit switch automatically resets when the temperature has fallen to a normal level, at which time the heating elements turn on again.

Table 18: Thermostat signals

Signal	State	Board function
G	On	Indoor blower instant on
	Off	Indoor blower off after 60 s delay
W	On	Indoor blower instant on Electric heat stages on (if so equipped)
	Off	Electric heat stages off (if so equipped) Indoor blower off after 60 s delay
G and W	On	Indoor blower instant on in heating speed Electric heat stages on (if so equipped)
	W off	Electric heat stages off (if so equipped) Indoor blower switches to continuous fan speed
G and Y	On	Outdoor fan instant on
		Indoor blower instant on in cooling speed Compressor on (after any anti-short cycle delay) System operates in heat pump heating mode
	Y off	Compressor instant off
		Outdoor fan instant off Indoor blower switches to continuous fan speed
G, Y, and O	On	Outdoor fan instant on
		Indoor blower instant on in cooling speed Compressor on (after any anti-short cycle delay) Reversing valve energized System operates in cooling mode
		Compressor instant off
	Y and O off	Outdoor fan instant off
		Reversing valve de-energized
		Indoor blower switches to continuous fan speed

## Charging

To check or adjust the unit charge, follow these steps:

1. Connect a temperature probe to the compressor discharge line approximately 6 in. away from the compressor shell.
2. Connect a high side refrigerant pressure gauge to the unit discharge pressure port.
3. Record the discharge line temperature and discharge pressure. Using an R-410A temperature pressure chart, convert the gauge pressure to saturation temperature. The difference between discharge saturation temperature and discharge line temperature is discharge superheat.
4. Obtain an entering indoor wet bulb temperature reading.
5. Compare the readings taken to the unit charging chart.

## Startup

1. Check the electrical supply voltage being supplied. Ensure that it is within the specified range on the unit data plate.
2. Make sure that all electrical connections are tight.
3. Turn on the electrical power to the unit.
4. Set the room thermostat to the cool position and set the temperature setting on the thermostat lower than the room temperature to create a call for cooling.

5. Measure the total external static pressure, and set the blower motor cooling speed appropriately according to **Table 12**.
6. If an optional electric heat kit is installed, make sure that the minimum blower speed required according to **Table 13** is set.
7. Make sure that all unit panels are in place and secured and that an air filter is installed.

## Compressor rotation

Three-phase, scroll compressors operate in only one direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or is producing a high noise level, the scroll compressor motor may be experiencing out-of-phase rotation and must be corrected.

Change the incoming line connection phasing to obtain the correct rotation.

## Measuring external static pressure

1. Measure the supply air static pressure and record this positive number.
2. Measure the return air static pressure and record this negative number.
3. Treat the negative number as a positive and add the two numbers together. This is the total external static pressure.

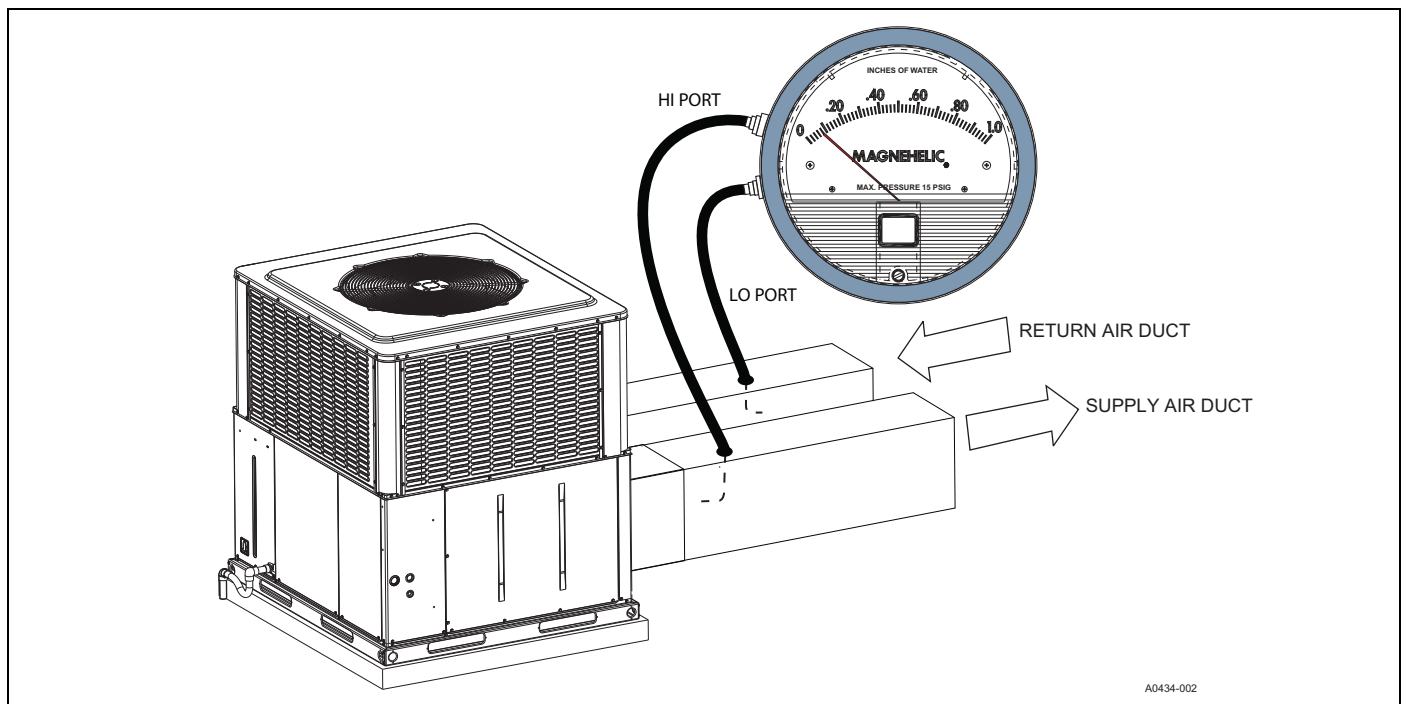


Figure 10: Measuring external static pressure

## Section VII: Maintenance

### ⚠ WARNING

Prior to any of the following maintenance procedures, shut off all power to the unit, to avoid personal injury.

Periodic maintenance consists of changing or cleaning filters and general cleaning of the outdoor coil.

#### Filters

Inspect filters once a month. Replace disposable filters or clean permanent filters as necessary.

**Note:** Do not replace permanent filters with disposable filters.

#### Motors

The indoor blower motor and outdoor fan motor are permanently lubricated and require no maintenance.

#### Outdoor coil

Do not allow dirt to accumulate on the outdoor coil surface or other parts in the air circuit. Clean the coil as often as necessary to keep the coil clean. If using water to clean the coil, make sure that the power to the unit is shut off before cleaning.

### ⚠ CAUTION

Exercise care when cleaning the coil so that the coil fins are not damaged. Do not permit the hot outdoor air discharge outlet to be obstructed by overhanging structures or shrubs.

### NOTICE

**Do not** use a pressure washer as coil fin damage will occur.

#### Troubleshooting

### ⚠ WARNING

Troubleshooting of components necessarily requires opening the electrical control box with the power connected to the unit. Use extreme care when working with live circuit! Check the unit nameplate for the correct range before making any connections with line terminals.

### ⚠ CAUTION

The wire number or color and terminal designations referred to may vary. Check the wiring label inside the control box access panel for the correct wiring.

## Section VIII: R-410A quick reference guidelines

See the installation instructions for specific installation requirements. It is important to be aware of the following:

- R-410A refrigerant operates at 50% to 70% higher pressures than R-22 refrigerant. Make sure that servicing equipment and replacement components are designed to operate with R-410A.
- R-410A refrigerant cylinders are rose-colored.
- The recovery cylinder service pressure rating must be 400 psig per DOT-4BA400 or DOT-BW400.
- Recovery equipment must be rated for R-410A.
- **Do not** use R-410A service equipment on R-22 systems. All hoses, gauges, recovery cylinders, charging cylinders, and recovery equipment must be dedicated for use only on R-410A systems.
- Manifold sets must be at least 700 psig high side and 180 psig low side with 550 psig retard.
- All hoses must have a service pressure rating of 800 psig.
- Leak detectors must be designed to detect HFC refrigerants.
- Systems must be charged with liquid refrigerant. Use a commercial type of metering device in the manifold hose.
- R-410A can be used with only POE type oils.
- POE type oils rapidly absorb moisture from the atmosphere.
- Vacuum pumps do **not** remove moisture from R-410A refrigerant oils.
- **Do not** use liquid line driers with a rated working pressure rating less than 600 psig.
- **Do not** install suction line driers in the liquid line.
- A liquid line drier is required on every unit.
- **Do not** use an R-22 TXV. If a TXV is used, it must be an R-410A TXV.
- Never open the system to the atmosphere when under a vacuum.
- If the system must be opened for service, evacuate the system, then break the vacuum with dry nitrogen and replace all the filter driers.

**Third-Party Trademarks:** For information about third-party trademarks, refer to the relevant company websites.

**Section IX: Typical wiring diagrams**

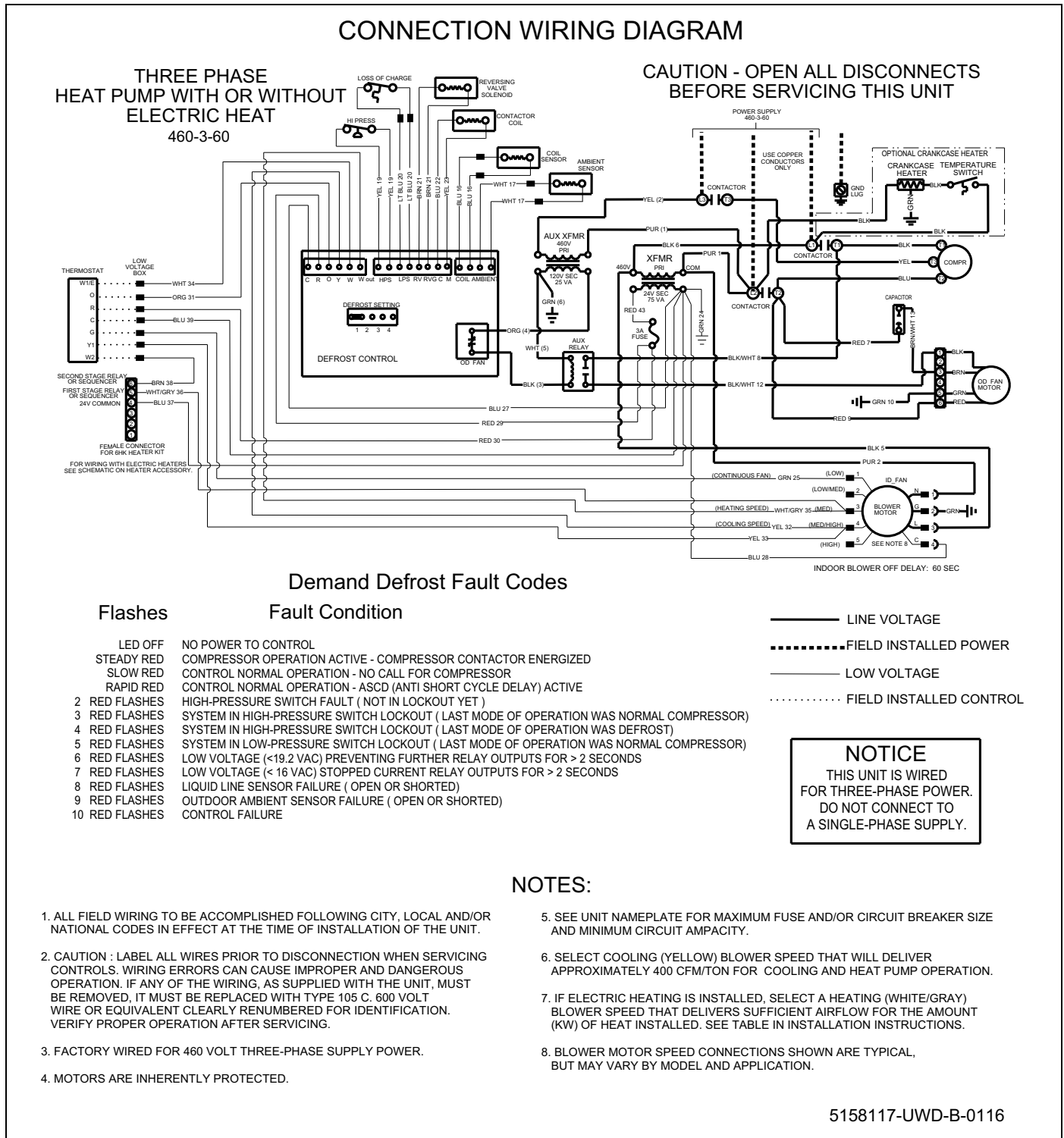


Figure 11: Connection wiring diagram

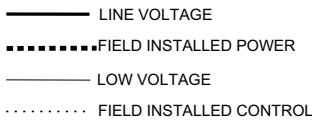
# LADDER WIRING DIAGRAM

## THREE PHASE HEAT PUMP WITH OR WITHOUT ELECTRIC HEAT 460-3-60

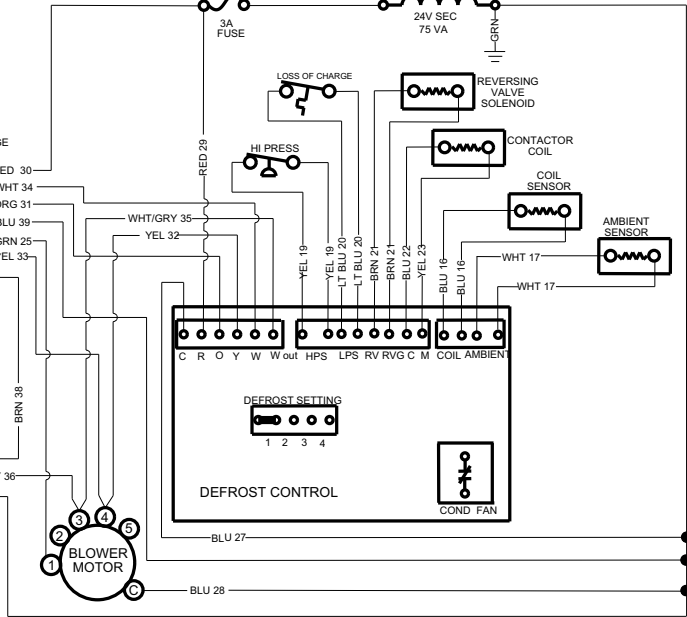
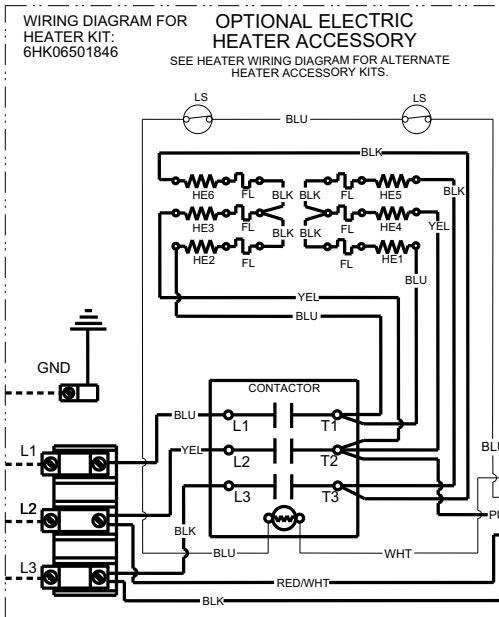
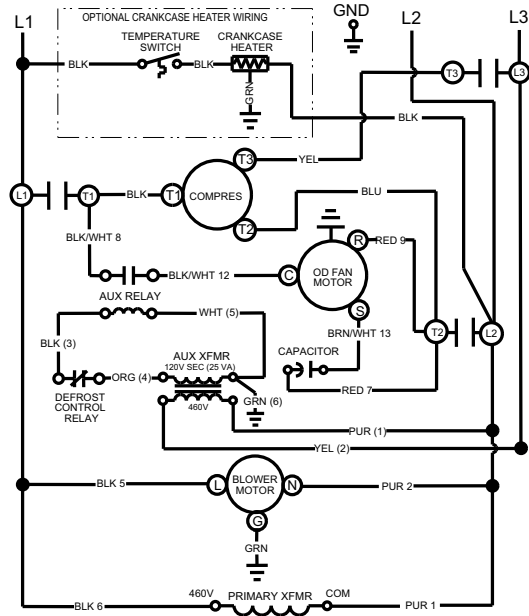
CAUTION - OPEN ALL DISCONNECTS  
BEFORE SERVICING THIS UNIT

### Demand Defrost Fault Codes

Flashes	Fault Condition
LED OFF	NO POWER TO CONTROL
STEADY RED	COMPRESSOR OPERATION ACTIVE - COMPRESSOR CONTACTOR ENERGIZED
SLOW RED	CONTROL NORMAL OPERATION - NO CALL FOR COMPRESSOR
RAPID RED	CONTROL NORMAL OPERATION - ASCD (ANTI SHORT CYCLE DELAY) ACTIVE
2 RED FLASHES	HIGH-PRESSURE SWITCH FAULT ( NOT IN LOCKOUT YET )
3 RED FLASHES	SYSTEM IN HIGH-PRESSURE SWITCH LOCKOUT ( LAST MODE OF OPERATION WAS NORMAL COMPRESSOR)
4 RED FLASHES	SYSTEM IN HIGH-PRESSURE SWITCH LOCKOUT ( LAST MODE OF OPERATION WAS DEFROST)
5 RED FLASHES	SYSTEM IN LOW-PRESSURE SWITCH LOCKOUT ( LAST MODE OF OPERATION WAS NORMAL COMPRESSOR)
6 RED FLASHES	LOW VOLTAGE (<19.2 VAC) PREVENTING FURTHER RELAY OUTPUTS FOR > 2 SECONDS
7 RED FLASHES	LOW VOLTAGE (< 16 VAC) STOPPED CURRENT RELAY OUTPUTS FOR > 2 SECONDS
8 RED FLASHES	LIQUID LINE SENSOR FAILURE ( OPEN OR SHORTED)
9 RED FLASHES	OUTDOOR AMBIENT SENSOR FAILURE ( OPEN OR SHORTED)
10 RED FLASHES	CONTROL FAILURE



**NOTICE**  
THIS UNIT IS WIRED FOR THREE-PHASE POWER. DO NOT CONNECT TO A SINGLE-PHASE SUPPLY.



SEE NOTE 8

### NOTES:

1. ALL FIELD WIRING TO BE ACCOMPLISHED FOLLOWING CITY, LOCAL AND/OR NATIONAL CODES IN EFFECT AT THE TIME OF INSTALLATION OF THE UNIT.
2. CAUTION : LABEL ALL WIRES PRIOR TO DISCONNECTION WHEN SERVICING CONTROLS. WIRING ERRORS CAN CAUSE IMPROPER AND DANGEROUS OPERATION. IF ANY OF THE WIRING, AS SUPPLIED WITH THE UNIT, MUST BE REMOVED, IT MUST BE REPLACED WITH TYPE 105 C. 600 VOLT WIRE OR EQUIVALENT CLEARLY RENUMBERED FOR IDENTIFICATION. VERIFY PROPER OPERATION AFTER SERVICING.
3. FACTORY WIRED FOR 460 VOLT THREE-PHASE SUPPLY POWER.
4. MOTORS ARE INHERENTLY PROTECTED.
5. SEE UNIT NAMEPLATE FOR MAXIMUM FUSE AND/OR CIRCUIT BREAKER SIZE AND MINIMUM CIRCUIT AMPACITY.
6. SELECT COOLING (YELLOW) BLOWER SPEED THAT WILL DELIVER APPROXIMATELY 400 CFM/TON FOR COOLING AND HEAT PUMP OPERATION.
7. IF ELECTRIC HEATING IS INSTALLED, SELECT A HEATING (WHITE/GRAY) BLOWER SPEED THAT DELIVERS SUFFICIENT AIRFLOW FOR THE AMOUNT (KW) OF HEAT INSTALLED. SEE TABLE IN INSTALLATION INSTRUCTIONS.
8. BLOWER MOTOR SPEED CONNECTIONS SHOWN ARE TYPICAL, BUT MAY VARY BY MODEL AND APPLICATION.

5158117-UWD-B-0116

Figure 12: Ladder wiring diagram



## Section X: Start-up sheet

### Residential Package Unit Heat Pump or Cooling Only with Electric Heat Start-Up Sheet

Correct start-up is critical to customer comfort and equipment longevity

Start-up date	<input type="text"/>	Company name	<input type="text"/>	Start-up technician	<input type="text"/>
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#### Owner information

Name	<input type="text"/>	Address	<input type="text"/>	Daytime phone	<input type="text"/>
City	<input type="text"/>	State or province	<input type="text"/>	Zip or postal code	<input type="text"/>

#### Equipment data

Unit model number	<input type="text"/>	Unit serial number	<input type="text"/>
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#### General information (Check all that apply)

<input type="radio"/> Residential	<input type="radio"/> New construction	<input type="radio"/> Roof level	<input type="radio"/> Down flow
<input type="radio"/> Commercial	<input type="radio"/> Retrofit	<input type="radio"/> Grade level	<input type="radio"/> Side flow

#### Unit location and connections (Check all that apply)

<input type="checkbox"/> Unit is level and installed on:	<input type="checkbox"/> Slab	<input type="checkbox"/> Roof curb	<input type="checkbox"/> Duct connections are complete:	<input type="checkbox"/> Supply	<input type="checkbox"/> Return
<input type="checkbox"/> Condensate drain correctly connected per the installation instructions	<input type="checkbox"/> Condensate trap has been primed with water				

#### Filters

<input type="checkbox"/> Filters installed	Number of filters	<input type="text"/>	Filter size	<input type="text"/>	<input type="radio"/> Filter located inside	<input type="radio"/> Filter located outside
--	-------------------	----------------------	-------------	----------------------	---	--

#### Additional kits and accessories installed (Check all that apply)

<input type="checkbox"/> Refrigerant safety kit	<input type="checkbox"/> Low ambient kit	<input type="checkbox"/> Anti-recycle timer	<input type="checkbox"/> Crankcase heater	<input type="checkbox"/> Filter frame kit
<input type="checkbox"/> Transformer kit	<input type="checkbox"/> Economizer	<input type="checkbox"/> Roof curb kit	<input type="checkbox"/> Burglar bar kit	<input type="checkbox"/> Hail guard kit
<input type="checkbox"/> Manual fresh air damper kit	<input type="checkbox"/> Motorized fresh air damper kit			

#### Electrical connections and inspection (Check all that apply)

<input type="radio"/> Single phase	<input type="radio"/> Three phase	<input type="radio"/> 208 VAC	<input type="radio"/> 230 VAC	<input type="radio"/> 460 VAC	<input type="radio"/> 575 VAC						
<input type="checkbox"/> Inspect wires and electrical connections	<input type="checkbox"/> Transformer wired correctly for primary supply voltage		<input type="checkbox"/> Ground connected								
<input type="checkbox"/> Low voltage present at control board R and C	Measured voltage R and C outdoor unit control board		<input type="text"/>								
<input type="checkbox"/> Line voltage present at disconnect	Measured voltage L1 to L2	<input type="text"/>	L2 to L3	<input type="text"/>	L1 to L3	<input type="text"/>					
Compressor amperes L1	<input type="text"/>	L2	<input type="text"/>	L3	<input type="text"/>	Total amperes L1	<input type="text"/>	L2	<input type="text"/>	L3	<input type="text"/>
<input type="radio"/> Single-stage compressor		<input type="radio"/> Two-stage compressor									

#### Airflow setup

<b>Blower type and set-up</b>	<input type="radio"/> Enhanced ECM	COOL	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D	
		DELAY	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D	
		HEAT	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D	
	<input type="radio"/> Standard ECM	COOL	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
	<input type="radio"/> Standard ECM	HEAT	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
Supply static (in. W.C.)	<input type="text"/>	Supply air dry bulb temperature	<input type="text"/>	Outside air dry bulb temperature	<input type="text"/>		
Return static (in. W.C.)	<input type="text"/>	Return air dry bulb temperature	<input type="text"/>	Return air wet bulb temperature	<input type="text"/>		
Total external static pressure	<input type="text"/>	Temperature drop	<input type="text"/>	Supply air wet bulb temperature	<input type="text"/>		

**Refrigerant charge and metering device**

<input type="radio"/> R-410A <input type="radio"/> R-454B	Data plate - lb-oz <input type="text"/>	Suction line temperature <input type="text"/>	Discharge pressure <input type="text"/>
<input type="radio"/> TXV	Discharge line temperature <input type="text"/>	Suction pressure <input type="text"/>	Liquid line temperature <input type="text"/>
		Superheat <input type="text"/>	Subcooling <input type="text"/>

**Electric heat (supplemental and emergency heat)**

Electric heat kit - Model number <input type="text"/>		Serial number <input type="text"/>		Rated kW <input type="text"/>	
<input type="radio"/> Single phase	Measured amperage	Heater 1 <input type="text"/>	Heater 2 <input type="text"/>	Heater 3 <input type="text"/>	
<input type="radio"/> Three phase		Heater 4 <input type="text"/>	Heater 5 <input type="text"/>	Heater 6 <input type="text"/>	
Number of elements <input type="text"/>	Measured voltage	Heater 1 <input type="text"/>	Heater 2 <input type="text"/>	Heater 3 <input type="text"/>	
		Heater 4 <input type="text"/>	Heater 5 <input type="text"/>	Heater 6 <input type="text"/>	
Heating return air dry bulb temperature <input type="text"/>		Heating supply air dry bulb temperature <input type="text"/>		Air temperature rise <input type="text"/>	

**Clean up job site**

Job site has been cleaned and indoor and outdoor debris removed from job site

Tools have been removed from unit

All panels have been installed

**Unit operation and cycle test**

Operate the unit through continuous fan cycles from the thermostat, noting and correcting any problems

Operate the unit through cooling cycles from the thermostat, noting and correcting any problems

Operate the unit through mechanical heating cycles from the thermostat, noting and correcting any problems

Operate the unit through emergency heating cycles from the thermostat, noting and correcting any problems

**Owner education**

Provide owner with the owner's manual

Explain operation of system to equipment owner

Explain thermostat use and programming (if applicable) to owner

Explain the importance of regular filter replacement and equipment maintenance

**Comments and additional job details**