Installation Manual: PH3 Series - 460 V - Three Phase

13.4 SEER2 R-454B Packaged Heat Pump with Optional Field-Installed Electric Heat

CAUTION

Risk of fire

This unit uses a mildly flammable (A2L) refrigerant. See A2L refrigerant safety considerations to ensure safe installation, operation, and servicing of this unit.

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About the PH3 unit

PH3 units are factory-assembled heat pumps designed for outdoor installation on a roof or at ground level. Field-installed electric heat kits are available to provide electric heat.

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 and duct connections at the point of installation.

Certification

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

GoTemp Pro app (Formerly DS Solutions app)

BHC Group Heating & Cooling believes in empowering our customers with up-to-date, unit-specific information. Download GoTemp Pro app, a powerful, comprehensive app designed for contractors on the jobsite, available now in the App Store for iOS and Google Play for Android. Use the app to scan the unique QR code on the unit rating plate for easy access to product information and resources such as nomenclature, technical guide, installation manual, wiring diagrams, parts list, product registration, warranty, and much more. Simplify your tasks, save time, and stay ahead with the most comprehensive app built for professionals.

iOS

Android

Safety

It is important to understand the safety symbols used in this manual. Read safety information carefully and follow all safety requirements.

Understanding safety symbols and instructions

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**, as well as the **NOTICE**, **Important**, and **Note** alerts.

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.

NOTICE indicates information considered important, but not hazard-related, such as messages relating to property damage.

Important indicates information that is essential to complete a task or may result in damage to the device if not followed.

Note indicates something of special interest or importance. Notes can contain any type of information except safety information.

Safety requirements

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 unit malfunction, death, personal injury, and/or property damage. A qualified contractor, installer, or service agency must 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-454B refrigerant. No other refrigerant may be used in this system. Gauge sets, hoses, refrigerant containers, and recovery systems must be designed to handle R-454B. If you are unsure, consult the equipment manufacturer. Failure to use R-454B compatible servicing equipment may result in property damage or injury.

WARNING

This appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given proper supervision and sufficient instruction concerning use of the appliance by a person responsible for their safety.

Children must be supervised to ensure that they do not play with the appliance.

CAUTION

Do not install the appliance above 3353 m (11,000 ft) altitude. Ensure the appliance's functions, including and not limited to electric heat, work properly before installation/servicing is completed.

CAUTION

In order to avoid a hazard due to inadvertent resetting of the thermal cut-out, this appliance must not be supplied through an external switching device, such as a timer, or connected to a circuit that is regularly switched on and off by the utility.

WARNING

RISK OF ELECTRIC SHOCK. CAN CAUSE INJURY OR DEATH

System contains oversize protective earthing (grounding) terminal which shall be properly connected.

WARNING

RISK OF ELECTRIC SHOCK. CAN CAUSE INJURY OR DEATH

For the installation of an optional 6HK electric heat kit, the system contains two independent protective earthing (grounding) terminals which both shall be properly connected and secured.

Adhere to the following:

- Be aware that 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 the unit 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.

A2L refrigerant safety guidance

CAUTION

You must read all of this section before installing this unit.

WARNING

Do not use means to accelerate the defrosting or thawing process or to clean, other than those recommended by the manufacturer.

The appliance shall be placed outdoors and kept away from continuously operating ignition sources (for example: open flames, a third-party operating gas appliance or a third-party operating electric heater.)

Do not pierce or burn.

Be aware that refrigerants may not contain an odor.

WARNING

Any required ventilation and circulation openings must be kept clear of obstruction.

WARNING

Any ducts connected to the unit shall not contain any potential ignition source(s).

Do not install auxiliary devices not approved by the appliance manufacturer or not declared suitable with the refrigerant in connecting ductwork.

WARNING

If disconnect switch(es) are installed within 6.6 ft (2 m) of any surfaces of the unit and/or the installation/commissioning/troubleshooting/servicing requires powering up or down the unit by operating the disconnect switch(es), confirm there is no presence of A2L refrigerant around the disconnect switch(es) before operating them. This requirement can be waived if such disconnect switch(es) are intrinsically safe or compliant with necessary safety standard to not cause any flammability concern with A2L refrigerant.

General

Table 1: General

Item number	Safety guideline
1	Typical potential continuously operating sources that could cause ignition of A2L refrigerants include but are not limited to gas appliances, electric heaters, hot surfaces over 700°C (1292°F), all sorts of continuously operating open flames, all sorts of continuously operating devices that generate open arcs and/or sparks, and cigarette smoking. Follow the A2L safety guideline in this manual to eliminate such a concern or risk and ensure safe/compliant operation of the unit.
2	Any appliance containing 1.776 kg (3.915 lb) or more of A2L charge amount for any refrigerant circuit must be constructed such that any refrigerant leak cannot flow or stagnate in a way that would create a fire or explosion hazard.
3	Ensure return and supply duct openings of the unit are not obstructed. Ensure any air vents in all rooms are not obstructed in any way. If zoning dampers are installed in a space conditioned by a unit with an A2L charge amount at or over 1.776 kg (3.915 lb), ensure that they are actuated by the A2L mitigation controls to be open in a detected A2L leakage event **and** the actual floor area of the total conditioned space (TA) is no less than the required minimum floor area of the total conditioned space (TA_{min}). ⓘ **Note:** If zoning dampers are installed in a space conditioned by a unit with an A2L charge amount under 1.776 kg (3.915 lb), there are no A2L mitigation requirements for the zoning dampers.
4	For the unit marked as LEAK DETECTION SYSTEM installed, the unit must be powered except for service. Such a unit is equipped with electrically powered safety measures. To be effective, the unit must be electrically powered at all times after installation, other than when servicing.
5	Ensure the unit refrigerant circuit is protected from physical damage in installation, operation, and service. Ensure pipe work including piping material, pipe routing, and installation follows the factory design and specification and complies with applicable national and local codes and standards such as ASHRAE 15, ASHRAE 15.2, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection before being covered or enclosed. Consider leaving sufficient inspection space in addition to following the unit clearances table.

Table 1: General

Item number	Safety guideline
6	If the refrigerant tubing in the unit needs repair during servicing, the refrigerant tubing must be pressure tested with nitrogen and then vacuum tested before refrigerant charging. Adhere to the following: • The minimum test pressure is 423 PSIG (2.92 MPa, gauge) for residential packaged units. • Field-made joints or refrigerant tubing not directly exposed to ambient air must be tightness tested. Use a tester with a sensitivity of 5 grams per year of refrigerant or better under 163+ PSIG test pressure. Ensure no leak can be detected.
7	You must verify actuation of A2L mitigation actions before installation or any A2L refrigerant-leakage-related service is completed.
8	You must replace refrigerant detection sensors only with the ones specified by the appliance manufacturer for the refrigerant detection system (RDS). There are no exceptions.
9	Do not use false ceilings or drop ceilings as a return air plenum.
10	After transporting a unit to the installation site **and** before working on any electrical connection/ wiring, ensure there is no refrigerant leak in the system, especially in the indoor coil section.
11	Before beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the refrigerating system, item 12 to item 18 below must be adhered to before conducting work on the system.
12	Work must be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.
13	Instruct all maintenance staff and others working in the local area on the nature of work being carried out. Avoid work in confined spaces.
14	The area must be checked with an appropriate refrigerant detector before and during work to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants: non-sparking, adequately sealed, or intrinsically safe.
15	If conducting any hot work on the refrigerating equipment or any associated parts, you must have appropriate fire-extinguishing equipment on hand. Have a dry powder or CO_2 fire extinguisher adjacent to the charging area.
16	If conducting work in relation to the refrigerating system that involves exposing any pipework, do not use any sources of ignition in such a manner that may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, must be kept sufficiently far away from the site of installation, repair, removal, and disposal, during which refrigerant can possibly be released to the surrounding space. Before conducting any work, survey the area around the equipment to ensure that there are no flammable hazards or ignition risks. Display “No Smoking” signs.
17	Ensure the area is in the open or that it is adequately ventilated before opening the system or while conducting any hot work. The ventilation must safely disperse any released refrigerant and preferably expel it externally into the atmosphere.
18	Ensure that the refrigerant detection sensor is not obstructed in any way.

Meeting conditioned space and system requirements

Important: It is the installer's responsibility to ensure that the actual floor area of the total conditioned space (TA) is well above the required minimum floor area of the total conditioned space (TA_{min}), in a space that is to be conditioned by a unit with an A2L system charge amount (m_c) before proceeding with the unit installation. See Table 2. For most installations, the TA value is typically well above the TA_{min} value, but you must review Table 2 carefully to ensure compliance.

For all PH3 units, the refrigerant charge is more than 1.776 kg (3.915 lb), so an A2L mitigation system that meets requirements for minimum floor area and system airflow rates as outlined in Table 2 is required. Table 3 provides an altitude adjustment factor (AAF) based on the building site ground level altitude (H_{alt}) to use if required. In typical applications, the TA value is well above the TA_{min} value, so adding natural ventilation openings to meet the TA_{min} requirement or installing a mechanical ventilation system as outlined in this procedure is not generally required. Figure 1 and Figure 2 provide more specific sizing and installation information for upper and lower natural ventilation openings if needed.

Table 2: Requirements for minimum conditioned space floor area and system airflow rates

Model	A2L system charge amount		Minimum opening for natural ventilation connecting conditioned and unconditioned spaces		Actual floor area of the total conditioned space		Required minimum floor area of the total conditioned space		Allowable maximum refrigerant charge in the total conditioned space based on TA		Minimum circulation airflow by A2L system to the total conditioned space		Minimum mechanical ventilation airflow required only if $TA<TA_{min}$ or $m_c>m_{max}$	
	m_c		Anv_{min}		TA		TA_{min}		m_{max}		Q_{min_circ}		$Q_{min_mech_vent}$	
	lb	kg	in^2	m^2	ft^2	m^2	ft^2	m^2	lb	kg	CFM	m^3/h	CFM	m^3/h
PH3E24	4.06	1.84	38.4	0.0248	75	7.0	121.8	11.32	2.50	1.13	220	374	42.3	71.8
	4.06	1.84	17.9	0.0116	100	9.3	121.8	11.32	3.33	1.51	220	374	19.7	33.5
	4.06	1.84	0	0	121.8	11.3	121.8	11.32	4.06	1.84	220	374	0	0
PH3E36	7.31	3.32	56.9	0.0367	150	13.9	219.3	20.38	5.00	2.27	396	672	62.5	106.3
	7.31	3.32	15.8	0.0102	200	18.6	219.3	20.38	6.67	3.03	396	672	17.4	29.6
	7.31	3.32	0	0	219.3	20.4	219.3	20.38	7.31	3.32	396	672	0	0
PH3E48	10.88	4.93	62.5	0.0403	250	23.2	326.1	30.30	8.34	3.78	589	1000	68.7	116.7
	10.88	4.93	21.4	0.0138	300	27.9	326.1	30.30	10.00	4.54	589	1000	23.6	40.1
	10.88	4.93	0	0	326.1	30.3	326.1	30.30	10.87	4.93	589	1000	0	0
PH3E60	11.31	5.13	73.2	0.0472	250	23.2	339.3	31.52	8.34	3.78	612	1040	80.6	136.9
	11.31	5.13	32.2	0.0208	300	27.9	339.3	31.52	10.00	4.54	612	1040	35.4	60.2
	11.31	5.13	0	0	339.3	31.5	339.3	31.52	11.31	5.13	612	1040	0	0

Table 3: Altitude adjustment factor (AAF)

AAF based on building site ground level altitude (H_{alt}) in m/ft									
H_{alt}	0 m/0 ft	200 m/656 ft	400 m/1312 ft	600 m/1969 ft	800 m/2625 ft	1000 m/3281 ft	1200m/3937 ft	1400 m/4593 ft	1600 m/5249 ft
AAF	1	1	1	1	1.02	1.05	1.07	1.1	1.12
H_{alt}	1600 m/5249 ft	1800 m/5906 ft	2000 m/6562 ft	2200 m/7218 ft	2400 m/7874 ft	2600 m/8530 ft	2800 m/9186 ft	3000 m/9843 ft	3200 m/10499 ft
AAF	1.12	1.15	1.18	1.21	1.25	1.28	1.32	1.36	1.4

Important: It is important to be aware of the following about the data provided in Table 2 and Table 3:

- The TA_{min} values, m_{max} values, Q_{min_circ} values, and $Q_{min_mech_vent}$ values shown are compliant with both UL60335-2-40 3rd Edition and UL60335-2-40 4th Edition.
- Follow national, state and local codes and standards if there are more stringent requirements on TA_{min} values, m_{max} values, Q_{min_circ} values, and $Q_{min_mech_vent}$ values. For example, if there is a building code that requires higher $Q_{min_mech_vent}$ values than shown, follow the higher airflow requirement.

- Follow national, state, and local codes and standards to check if UL60335-2-40 3rd Edition is required. If so, multiply the appropriate AAF by the TA_{min} value to get the corrected TA_{min} value. This AAF correction applies to only the TA_{min} value as required in UL60335-2-40 3rd Edition and not to the TA_{min} value as required in UL60335-2-40 4th Edition. For example, the TA_{min} value of 121.8 ft^2 (11.32 m^2) meets the UL60335-2-40 4th Edition requirement for a space conditioned by a PH3E24 unit. But if there is a code requiring compliance to UL60335-2-40 3rd Edition for the same conditioned space and the building site ground level altitude is 2400 m (7874 ft), the corrected TA_{min} value is 1.25 × 121.8 = 152.3 ft^2 (14.1 m^2). This AAF correction for UL60335-2-40 3rd Edition applies to only TA_{min} values and not to other values.
- The data in the *Minimum opening for natural ventilation connecting conditioned and unconditioned spaces* column in Table 2 is for increasing total conditioned space floor area if required. This data is not typically needed.
- One of the required warning labels on the unit refers to the following:
  - Minimum installation height, X m (W ft). The minimum installation height does not apply to this model series.
  - Minimum room area (operating or storage), Y m^2 (Z ft^2). For the minimum room area, use the values in the *Required minimum floor area of the total conditioned space* column in Table 2.

Figure 1: Natural ventilation openings - lower opening entirely below the 0.3 m point above the floor

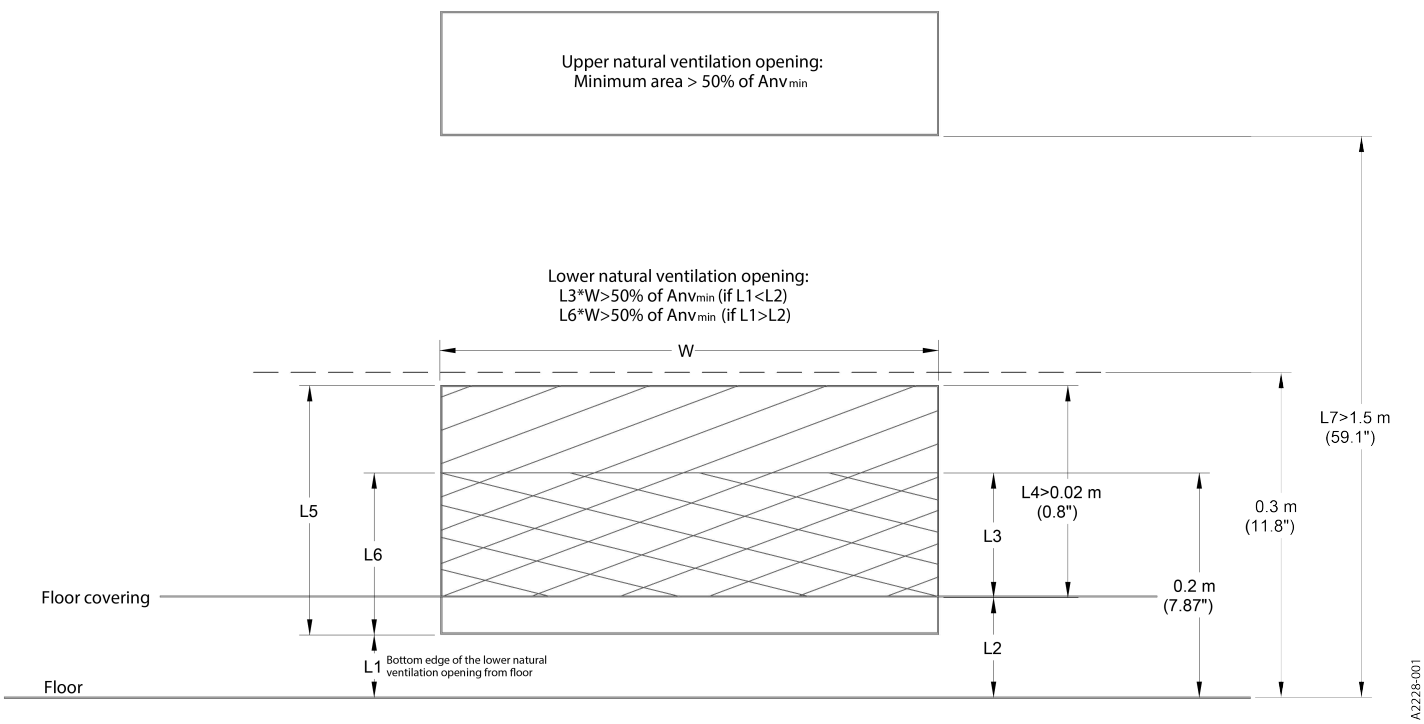
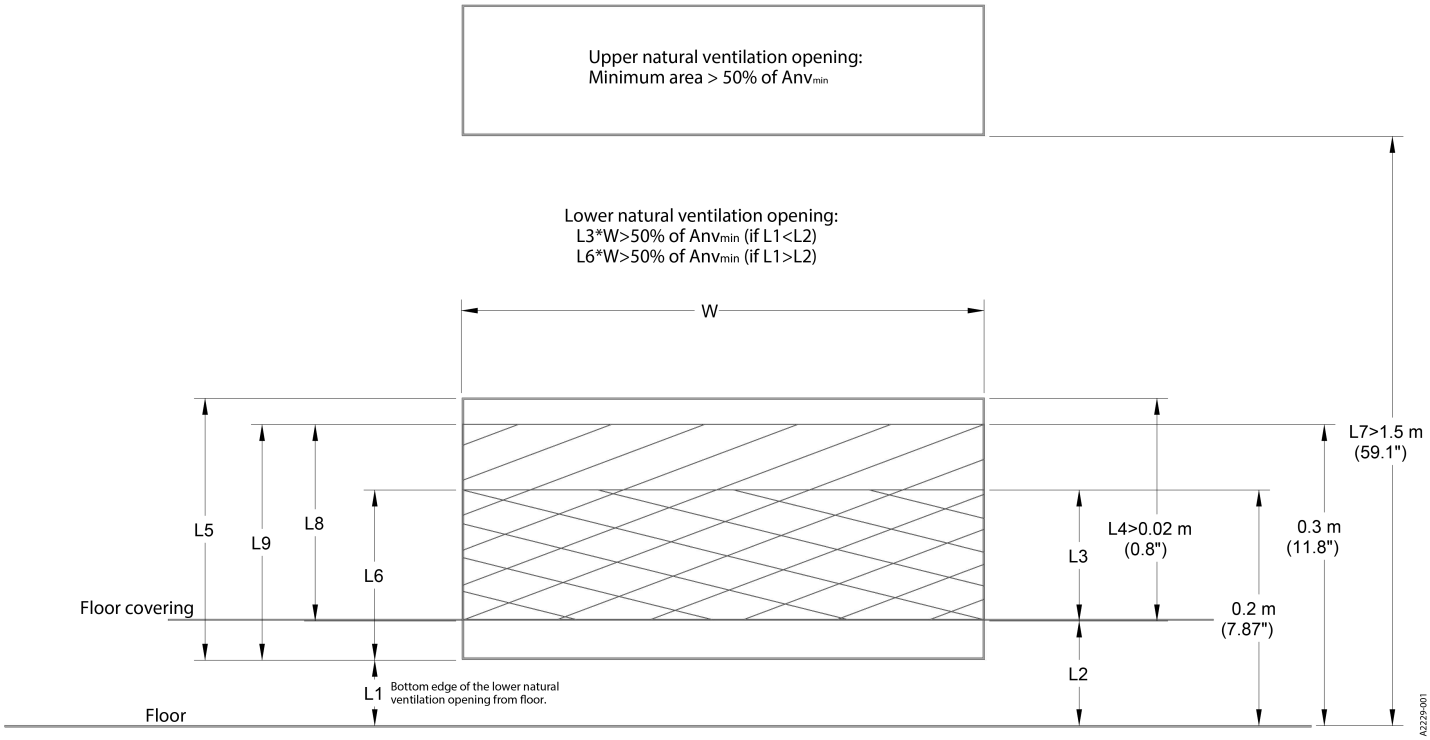


Figure 2: Natural ventilation openings - lower opening partially below the 0.3 m point above the floor



Note: In Figure 2, only the shaded opening area below the 0.3 m point and above the floor covering (L2) counts as the effective natural ventilation area for the lower natural ventilation opening. To discern the effective natural ventilation area for the lower natural ventilation opening, use the area between the 0.3 m point and whichever is higher of the floor covering height (L2) or the opening bottom edge height (L1).

To meet conditioned space and system requirements, do the following:

1. Measure the area of each conditioned space that has air vents in it, for example, bedroom, office, living room, kitchen, and dining room, to calculate the TA value.
2. Check if the TA value is equal to or above the relevant TA_{min} value:
   - If compliance with UL60335-2-40 4th Edition is required, use the TA_{min} values in Table 2.
   - If compliance with UL 60335-2-40 3rd Edition is required, use Table 3 to calculate the corrected TA_{min} value. You can use the example provided for a PH3E24 unit above as a guide.
3. Depending on the result of Step 2, proceed as follows:
   - If the TA value is equal to or above the TA_{min} value, you do not need to install a mechanical ventilation system.
   - If the TA value is below the TA_{min} value, do the following:
     i. Select one conditioned space and check its adjacent unconditioned space, for example, linen closet, space under the staircase, or pantry, to determine if it is feasible to add two natural ventilation openings to connect the two adjacent spaces, so the added floor area of the conditioned space increases. Do the same for other applicable conditioned spaces to determine if it is possible to attain a TA value equal to or above the TA_{min} value in Table 2.

     Note: The two natural ventilation openings are an upper natural ventilation opening and a lower natural ventilation opening. Each opening must be at least 50% of the Anv_{min} area and the openings must be located on the same side of the wall. See Figure 1 and Figure 2.

ii. If you can attain a TA value equal to or above the TA_{min} value in Table 2, add the natural ventilation openings as required. This is a cost-competitive approach to meet the TA_{min} requirement and avoid installing a mechanical ventilation system.

iii. If you can not attain a TA value equal to or above the TA_{min} value in Table 2, install a mechanical ventilation system to ventilate outdoors and bring in makeup air from the atmosphere.

4. Make sure that the circulation airflow is above the Q_{min_circ} value in Table 2. The factory set motor tap provides sufficiently large A2L leakage mitigation airflow to promptly remove any leaked R-454B from the unit. If you adjust the circulation airflow setting, you must take precautions to ensure the actual circulation airflow is no less than the Q_{min_circ} value in Table 2 and ensure the safety of the A2L system and the conditioned space. See and use Table 2 to help determine the motor tap for A2L mitigation flow.
5. For applications where a mechanical ventilation system is required, make sure that the mechanical ventilation airflow is above the $Q_{min_mech_vent}$ value in Table 2, and adhere to the following:
   - For mechanical ventilation, ensure that the lower edge of openings extracting air from the conditioned space are not more than 3.94 in. (100 mm) above the floor.
   - Locate the openings supplying makeup air to the conditioned space so the supplied makeup air mixes with any leaked refrigerant.
   - Set the mechanical ventilation system so the makeup air is supplied from the atmosphere and the ventilation air extracted from the conditioned space is discharged to the atmosphere. Ensure that the ventilation air discharge openings are separated by a sufficient distance, but not less than 9.84 ft (3 m), from the makeup air intake openings to prevent re-circulation to the conditioned space.

ⓘ **Note:** As the TA value increases from a very low value to the TA_{min} value, the $Q_{min_mech_vent}$ value decreases from a positive value to 0. When the TA value is above the TA_{min} value, no mechanical ventilation system is required and no opening is needed between the conditioned and unconditioned spaces for natural ventilation.

Refrigerant equipment checks

Table 4: Refrigerant equipment checks

Item number	Safety guideline
1	Where electrical components are being changed, they must be fit for the purpose and to the correct specification. At all times, the manufacturer's maintenance and service guidelines must be followed. If in doubt, consult the manufacturer's technical department for assistance.
2	Apply the following checks to installations using flammable refrigerants: • Ensure the actual refrigerant charge is in accordance with the total conditioned space floor area. • Ensure the ventilation machinery and outlets are operating adequately and are not obstructed. • Ensure marking on the equipment continues to be visible and legible. Correct any markings and signs that are illegible. • Install refrigerating pipe or components in a position where they are unlikely to be exposed to any substance that may corrode refrigerant-containing components, unless the components are constructed of materials that are inherently resistant to being corroded or are suitably protected against being corroded.

Electrical devices checks

Table 5: Electrical devices checks

Item number	Safety guideline
1	Repair and maintenance to electrical components must include initial safety checks and component inspection procedures.
2	If a fault exists that could compromise safety, then do not connect any electrical supply to the circuit until the fault is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, use an adequate temporary solution. This must be reported to the owner of the equipment so all parties are advised.
3	Initial safety checks must include: • Ensure capacitors are discharged: take care to avoid the possibility of sparking. • Ensure no live electrical components and wiring are exposed while charging, recovering, or purging the system. • Ensure there is continuity of earth bonding.
4	Check that wiring and/or cabling are not subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors, indoor blowers, and outdoor fans.

Detection of refrigerant

Table 6: Detection of refrigerant

Item number	Safety guideline
1	Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. Do not use a halide torch or any other detector using a naked flame.
2	The following leak detection methods are deemed acceptable for all refrigerant systems. • Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate or may need re-calibration. Calibrate the detection equipment in a refrigerant-free area. Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Set leak detection equipment at a percentage of the LFL of the refrigerant and calibrate to the refrigerant employed. Ensure the appropriate percentage of gas with a maximum of 25% is confirmed. • Leak detection fluids are also suitable for use with most refrigerants but avoid the use of detergents containing chlorine as the chlorine may react with the refrigerant and corrode the copper pipework. Examples of leak detection fluids are bubble method and fluorescent method agents.
3	If a leak is suspected, all naked flames shall be removed/extinguished.
4	If a leakage of refrigerant is found that requires brazing, recover all of the refrigerant from the system and purge the system with nitrogen.

Removing and evacuating refrigerant

You must follow conventional procedures to remove and evacuate A2L flammable refrigerant charge before breaking into the refrigerant circuit to make repairs or for any other purposes. Safely remove refrigerant following local and national regulations, and adhere to the following requirements:

1. During evacuation, the outlet for the vacuum pump must not be close to any potential ignition sources, and ventilation must be available. The refrigerant charge must be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. See Recovering refrigerant for servicing or decommissioning for more requirements on recovery.
2. Continuously flush or purge with oxygen-free nitrogen before and when using flame to open the refrigerant circuit. **Do not** use compressed air or oxygen for purging.

Charging

For standard charging procedures, see Checking the refrigerant charge and refer to the charging chart on the compressor barrier. Follow standard charging procedures and adhere to the following requirements:

- Ensure that contamination of different refrigerants does not occur when using charging equipment. Keep hoses or lines as short as possible to minimize the amount of refrigerant contained in them.
- Keep cylinders in an appropriate position according to the instructions.
- Ensure that the refrigerating system is grounded before charging the system with refrigerant.
- Ensure to meet the requirements for weighing scales outlined in Recovering refrigerant for servicing or decommissioning.
- Label the system when charging is complete, if this has not been done already.
- Take extreme care not to overfill the refrigerating system.
- Before recharging the system, pressure test the system with oxygen-free nitrogen. Leak test the system on completion of charging but before commissioning. Do a follow-up leak test before leaving the site.

Recovering refrigerant for servicing or decommissioning

Before you begin:
Before starting the procedure, do the following:

- Ensure that you (the technician) are completely familiar with the equipment and all its detail.
- Take an oil and refrigerant sample in case analysis is required before reusing the recovered refrigerant.
- Ensure that electrical power is available.
- Ensure that mechanical handling equipment is available, if required, for handling refrigerant cylinders.
- Ensure that all personal protective equipment is available and being used correctly.
- Ensure that a competent person is available to supervise the recovery process at all times.
- Ensure that recovery equipment and cylinders conform to the appropriate standards. Note the following:
  - The recovery equipment must be in good working order with necessary and sufficient instructions and must be suitable for the recovery of the flammable refrigerant. If in doubt, consult the manufacturer.
  - All cylinders to be used must be designated for the recovered refrigerant and labeled for that refrigerant.
  - Cylinders must have a pressure relief valve and associated shut-off valves in good working order.
  - Empty recovery cylinders must be evacuated and, if possible, cooled before recovery occurs.

To safely recover all refrigerants for unit servicing or decommissioning, do the following:

1. Isolate the system electrically.
2. Connect a recovery machine to remove refrigerant from the system.

3. Ensure that the cylinder is situated on the scales before recovery takes place and the following requirements are met:
   - The weighing scales are calibrated and in good working order.
   - The weighing scales are placed on solid horizontal foundation that can sufficiently support the total weight of the cylinders and weighing scales without any compromise.
   - Hoses are complete with leak-free disconnect couplings and in good condition.
4. Start the recovery machine and operate in accordance with the instructions provided with the machine. Adhere to the following requirements:
   - Do not overfill cylinders to more than 80% volume liquid charge.
   - Do not exceed the maximum working pressure of the cylinder, even temporarily.
5. When the cylinders have been filled correctly and the process completed, ensure that the cylinders and the equipment are removed from the site promptly and that all isolation valves on the equipment are closed off. Adhere to the following requirements:
   - Process the recovered refrigerant according to local legislation in the correct recovery cylinder, and arrange the relevant waste transfer note.
   - Do not mix refrigerants in recovery units and especially not in cylinders.
   - Do not charge recovered refrigerant into another refrigerating system unless it has been cleaned and checked.
   - If removing compressors or compressor oils, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. Do not heat the compressor body by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it must be carried out safely.

- If you are servicing the unit, read Removing and evacuating refrigerant and Charging to get the refrigerant circuit to proper function. Before any other checks, follow the guidance in Detection of refrigerant to ensure safety.
- If you are decommissioning the unit, label the equipment stating that it has been decommissioned and emptied of refrigerant. Date and sign the label. For appliances containing flammable refrigerants, ensure that there are labels on the equipment stating that the equipment contains a flammable refrigerant.

Competence of service personnel

Training on all required and relevant procedures is carried out by national training organizations or manufacturers that are accredited to teach the relevant national competency standards that may be set in legislation. The achieved competence must be documented by a certificate. Training must include but is not limited to information about the following:

- The explosive potential of flammable refrigerants to show that flammables may be dangerous when handled without care
- Potential ignition sources especially those that are not obvious
- Safety concepts such as unventilated and ventilated enclosure and ventilated room
- Refrigerant detectors or detection sensors including a focus on the following:
  - Principle of function, including influences on the operation
  - Procedures for repairing, checking, or replacing a refrigerant detection sensor or parts of it in a safe way
  - Procedures for disabling a refrigerant detection sensor if repair work on the refrigerant carrying parts is needed
- The concept of sealed components and sealed enclosures
- Correct working procedures as outlined in Table 7

Table 7: Correct working procedures

Item number	Commissioning	Maintenance and repair	Decommissioning	Disposal
1	n/a	n/a	If safety is affected when the equipment is put out of service, the refrigerant charge must be removed before decommissioning.	n/a
2	Ensure that the total conditioned space floor area is sufficient for the refrigerant charge or that the ventilation duct is assembled correctly.	Ensure that there is sufficient ventilation at the equipment place.		
3	Confirm that there is no refrigerant leak before doing any other commissioning or installation work.	Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.		n/a
4	Check safety equipment before putting it into service.	Discharge capacitors in a safe way that does not cause any spark. The standard procedure to short circuit the capacitor terminals usually creates sparks.		n/a
5	n/a	When brazing is required for A2L system, the following procedures must be carried out in the correct order: 1. Safely remove the refrigerant following local and national regulations. Follow the procedure outlined in Recovering refrigerant for servicing or decommissioning for recovery. 2. Purge the refrigerant circuit with oxygen-free nitrogen. 3. Remove parts that are to be replaced by cutting or brazing. 4. Continuously purge the braze point with nitrogen during the brazing procedure required for repair. 5. Perform a leak test. 6. Evacuate the refrigerant circuit. 7. Charge with refrigerant.	Safely remove the refrigerant following local and national regulations. Follow the procedure outlined in Recovering refrigerant for servicing or decommissioning for recovery.	
6	n/a	Reassemble sealed enclosures accurately. If seals are worn, replace them.	Fill with nitrogen up to atmospheric pressure.	Evacuate the refrigerant circuit and purge the refrigerant circuit with oxygen-free nitrogen.
7	n/a	Check safety equipment before putting it into service.	Put a label on the equipment indicating that the refrigerant is removed.	Cut out the compressor and drain the oil. Follow the procedure outlined in Recovering refrigerant for servicing or decommissioning for compressor and compressor oil treatment.

Wiring installation

Figure 3 shows mitigation control board wiring for PH3 units. The control board in the RDS is generally referred to as the A2L mitigation control board or the mitigation control board.

NOTICE

Cap unused wiring connections.

NOTICE

The mitigation control board has a bank of DIP switches. Both DIP switches must be in the 0 or off position.

Figure 3: Mitigation control wiring

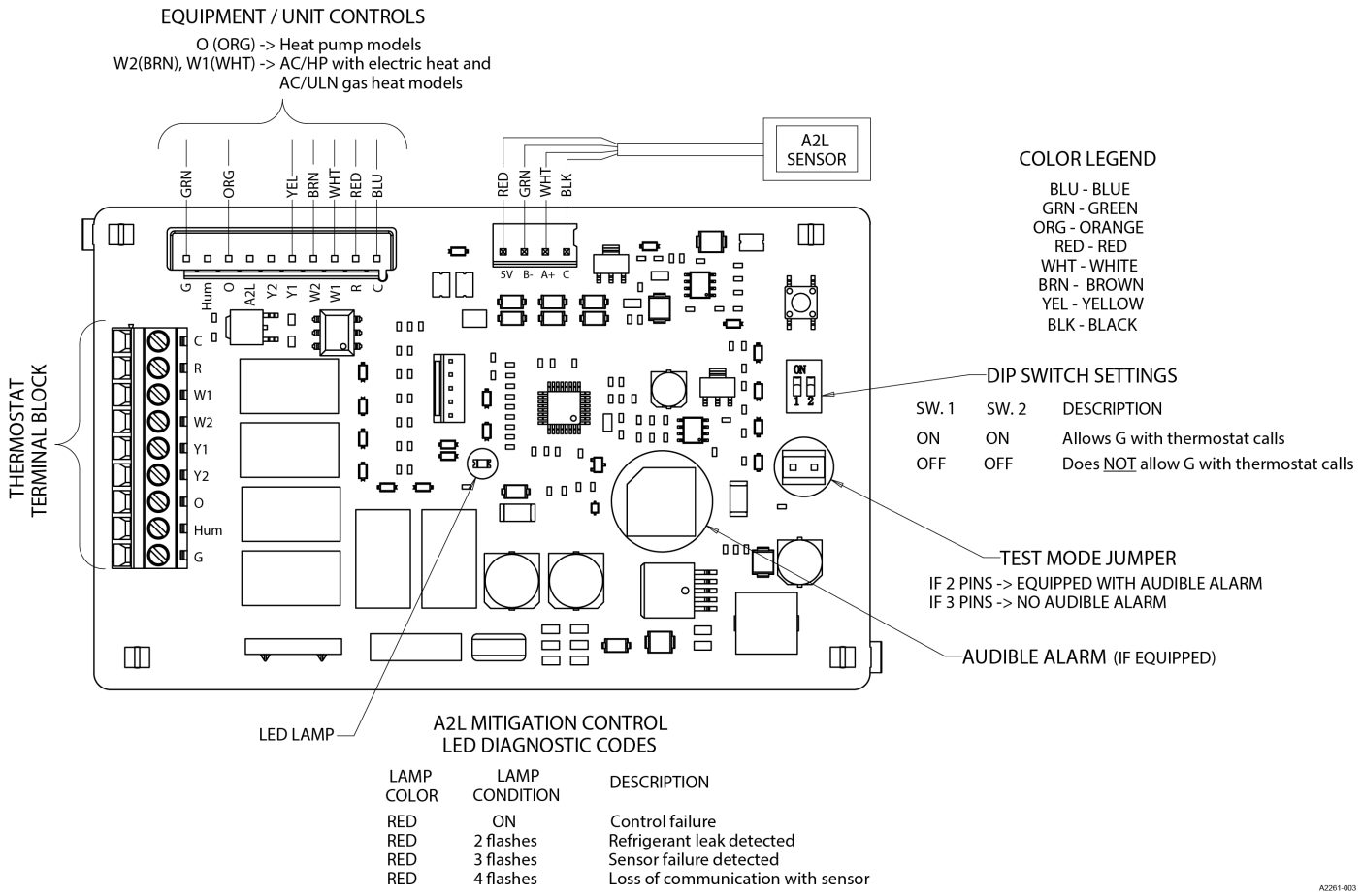
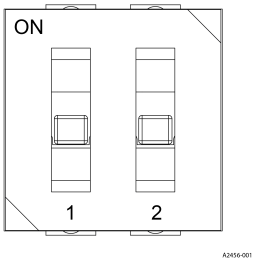


Figure 4 shows the DIP switches on the mitigation control board in the off position. **You must confirm that both DIP switches are set to the off position.**

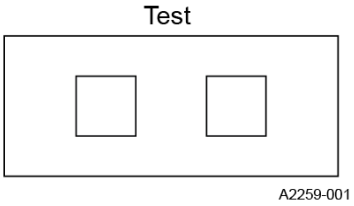
Figure 4: DIP switches in off position



Field-testing the sensor and taking A2L mitigation actions

1. After wiring and configuring the system, provide a Y call for compressor operation.
2. Simulate an A2L leak by disconnecting the A2L sensor wire from the mitigation control board **or** shorting the test pins with a screwdriver.

Figure 5: Test pins



3. After 15 s, verify that the call for the compressor is removed.
4. Verify that the Y output pin has no voltage and that the G output pin has 24 VAC.
5. Reinstall the sensor, then wait 15 s and verify that the system returns to cooling mode.
6. When the system is in standby mode, repeat the test for a W call for heating.
7. When testing is complete, put the controls access panel on until it is time for more testing of the unit normal operation.

Understanding RDS status codes and fault codes

The LED labeled as red on the mitigation control board in the RDS indicates the following:

- Status codes that indicate the state of the mitigation control board
- Fault codes

Table 8 gives an overview of how the status codes and fault codes display and troubleshooting guidance.

Table 8: RDS status codes and fault codes

LED	Condition	Solution
Off	No power to mitigation control board	Do the following: 1. Supply power to the mitigation control board. 2. Replace the fuse on the mitigation control board if the fuse is open. 3. If the mitigation control board is still off, replace it with a new mitigation control board.
Red 2 s on/red 2 s off (or slow heartbeat)	Mitigation control board is powered and microprocessor is active. No active faults, normal operation	No action needed
Red 0.5 s on/red 0.5 s off (or fast heartbeat) and buzzer sounds if equipped with audible alarm	Mitigation control board is powered and test mode has been activated by shorting test pins	No action needed
Red (solid)	Mitigation control board failure detected	Do the following: 1. Ensure the correct A2L sensor is correctly plugged in the A2L terminal of the mitigation control board. 2. Ensure the A2L sensor cable is not damaged.
2 red flashes and buzzer sounds if equipped with audible alarm	Leak detected above 15% low flammable limit (LFL)	Proceed as follows: 1. Owner is to notify service personnel as soon as possible. 2. Maintain power to the unit, and try to keep the conditioned space ventilated by opening windows if possible. 3. Service personnel to locate refrigerant leak point(s) and repair. Adjust the unit charge and get the unit back to proper functions.
3 red flashes and buzzer sounds if equipped with audible alarm	Refrigerant sensor failure	If the fault code occurs during normal operation, cycle power to the unit. If the fault code remains, replace the A2L sensor with a new one. ⓘ **Note:** The A2L sensor may have this fault code if the unit is out of temperature range or out of humidity range, or if the A2L sensor is at its end of life.
4 red flashes and buzzer sounds if equipped with audible alarm	Refrigerant sensor communications lost	Do the following: 1. Ensure the correct A2L sensor is correctly plugged in the A2L terminal of the mitigation control board. 2. Ensure the A2L sensor cable is not damaged.

Displaying and clearing stored RDS fault codes

The mitigation control board in the RDS stores fault codes for 30 days. You can use the SW1 button on the mitigation control board to retrieve and clear stored RDS fault codes if no active faults are present.

Important:

- If you press and hold the SW1 button for less than 2 s, the mitigation control board does not respond.
- If an active fault is present when you press and hold the SW1 button, the mitigation control board does not respond.

To display and clear stored RDS fault codes, do the following:

1. On the mitigation control board, press and hold the **SW1** button for 2 s to 5 s. If stored fault codes are present, the fault codes display.
2. Press and hold the **SW1** button for more than 5 s to clear the stored fault codes.

Model number nomenclature

Table 9: Model nomenclature description

Number	Category	Option	Description
1, 2	Model type	PG	Packaged air conditioner with gas heat
		PD	Packaged heat pump with gas heat
		PC	Packaged air conditioner with optional electric heat
		PH	Packaged heat pump with optional electric heat
3	Efficiency	3	13.4 SEER2
		5	15.2 SEER2
4	Refrigerant	E	R-454B
5, 6	Nominal capacity (Btu/h x 1000)	24	24,000 Btu/h or 2 ton
		30	30,000 Btu/h or 2.5 ton
		36	36,000 Btu/h or 3 ton
		42	42,000 Btu/h or 3.5 ton
		48	48,000 Btu/h or 4 ton
		60	60,000 Btu/h or 5 ton
7	Heat type	L	Low NOx <40ng/J
		U	ULNx <14ng/J
		N	Electric heat
8, 9	Gas heating input (Btu/h x 1000)	05	50,000 Btu/h
		06	65,000 Btu/h
		07	75,000 Btu/h
		10	100,000 Btu/h
		12	125,000 Btu/h
		00	Electric heat
10	Control strategy	C	Communicating
		B	Wireless, communicating
		S	Standard, conventional
		W	Wireless, conventional
11	Voltage (V-phase-Hz)	2	208/230-1-60
		3	208/230-3-60
		4	460-3-60
12	Generation	1	First generation
		2	Second generation
		3	Third generation
		4	Fourth generation
13	Style	A	Style A
		B	Style B
		C	Style C
		D	Style D

Model number nomenclature example

Table 10: Model nomenclature example

Number	1, 2	3	4	5, 6	7	8, 9	10	11	12	13
Option	PH	3	E	36	N	00	S	4	1	A

The PH3E36N00S41A model is a packaged heat pump with optional electric heat. It has a 13.4 SEER2 efficiency rating and uses R-454B refrigerant. It has a nominal capacity of 36,000 Btu/h or 3 ton for cooling. It uses a standard control strategy and voltage of 460 V, three phase, 60 Hz. It is a first generation, style A model.

Installation overview

Complete all installation stages. You may not need to perform some tasks outlined, depending on the specific installation. See Unit components and operation to familiarize yourself with unit components and system operation as required, and see Troubleshooting if needed.

Important:

- See A2L refrigerant safety guidance and follow procedures as required.
- If you do not install a 6HK electric heat kit, you must mark the unit rating plate appropriately to indicate that no electric heat kit is installed.

Preparing for installation

Complete the necessary preparation before you begin the installation:

Selecting a location for installation

Before starting the installation, you must select a suitable location for the unit. You can install the unit on a roof or on the ground.

WARNING

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

Important: The unit is designed for outdoor installation only.

To select a location for installation, do the following:

- Select a location for the unit that meets the following general requirements for installation:
  - Provides the outdoor coil with 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.
  - Allows you to maintain the required clearances for construction, servicing, and correct unit operation.
  - Allows you to maintain level tolerance to 1/8 in. across the entire width and length of the unit.
- Select a location for the unit that meets any requirements that are specific to the type of installation as outlined in Table 11.

Table 11: Additional location requirements for each type of installation

Type of installation	Additional location requirements
Ground installation	• The location of the unit allows you to install the unit on a level equipment pad or concrete slab.
Roof installation	• The location of the unit allows you to install the unit on a solid, level roof curb or an appropriate angle iron frame. • The roof structure is able to support the weight of the unit and its options and accessories.

Unit clearances

Table 12: Unit clearances

Direction	Distance (in.)	Direction	Distance (in.)
Top	36	Right side	36
Side opposite ducts	36	Left side	24
Duct panel	6	Bottom	1

Note:

- For 20 kW and 25 kW electric heat kits, provide a minimum clearance of 1 in. on all sides of the supply air duct for the first 3 ft of the supply air duct. 0 in. clearance is acceptable on all sides of the supply air duct for the remaining length of the supply air duct. For all other electric heat kits, 0 in. clearance is acceptable on all sides of the supply air duct for the entire length of the supply air duct.
- Install units outdoors. Make sure that overhanging structures or shrubs do not obstruct the outdoor air discharge outlet.
- 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.
- 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.

Inspecting the unit

1. Inspect the unit immediately after receiving it for possible damage during transit.
2. If damage is evident, do the following:
   a. Note the extent of any damage on the carrier's receipt.
   b. Make a separate written request for the carrier's agent to inspect the unit.
   c. Contact your local distributor for more information.

Rigging and handling the unit

CAUTION

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

CAUTION

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

To rig and handle the unit, do the following:

- Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation.
- Use the slotted openings in the base rails if moving or lifting the unit with a forklift.
- Use Figure 6 and Table 13 to determine the required capacity of lifting gear to use.

Figure 6: Center of gravity

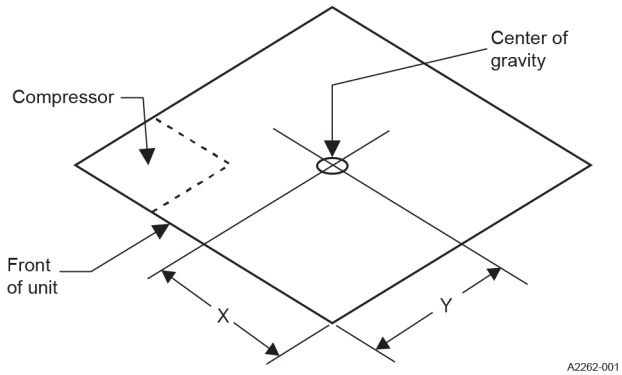


Table 13: Weights and dimensions

Model	Weight (lb)		Center of gravity (in.)	
	Shipping	Operating	X	Y
PH3E36N00S4	428	423	29	18
PH3E48N00S4	487	482	30	18
PH3E60N00S4	504	499	29	18

- Rig the unit by attaching chain or cable slings to the lifting holes provided in the base rails.
- Use spreader bars across the top of the unit. The length of the spreader bars must exceed the unit's longest width.

Understanding installation and operation limitations

Adhere to the following:

- Install the unit in accordance with the following national and local safety codes:
  - National Electrical Code (NEC) ANSI/NFPS No. 70, latest edition or Canadian Electrical Code (CEC) Part 1, C22.1, latest edition
  - Local plumbing and wastewater codes and other applicable local codes

  ⓘ **Note:** If it is necessary to add components to a unit to meet local codes, installation is done at the dealer's or the customer's expense.
- Observe the unit limitations shown in Table 14.
- Observe the application limitations shown in Table 15.
- Observe the physical data for the unit shown in Table 16.
- Observe the electrical data for the unit shown in Table 21, Table 22, and Table 23.
- Make sure that the size of the unit for proposed installation is based on heat loss or heat gain calculations made in accordance with industry-recognized procedures such as the procedures of the Air Conditioning Contractors of America. Refer to *Manual J*.

Unit limitations

Table 14: Unit limitations

Model	Voltage (V-phase-Hz)	Unit limitations		
		Applied voltage (V)		Outdoor DB temperature (°F)
		Minimum	Maximum	Maximum
PH3E36N00S4 PH3E48N00S4 PH3E60N00S4	460-3-60	432	504	125

Application limitations

Table 15: Application limitations

Model	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
PH3E36N00S4 PH3E48N00S4 PH3E60N00S4	55	0	125	75	57	50	72	80

Physical data

Table 16: Physical data

Model		PH3E36N00S4	PH3E48N00S4	PH3E60N00S4
Nominal tonnage		**3.0**	**4.0**	**5.0**
Refrigerant information	**Refrigerant type**	R-454B	R-454B	R-454B
	Refrigerant charge (lb-oz)	7-5	10-14	11-5
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	50	55
Operating weight (lb)		423	482	499
Compressor type		Scroll	Scroll	Scroll
Outdoor coil data	**Face area (sq ft)**	17.6	20.3	26.4
	Rows	2	2	2
	Fins per inch	22	22	22
	Tube diameter (mm)	7	7	7
	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
	Refrigerant control	TXV	TXV	TXV
Outdoor fan data	**Fan diameter (in.)**	26	26	26
	Type	Propeller	Propeller	Propeller
	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	3550	3850	4100
Direct drive indoor blower data	**Blower size (in.)**	11 x 10	11 x 10	11 x 10
	Type	Centrifugal	Centrifugal	Centrifugal
	Motor (hp)	1/2	1	1
	RPM (maximum)	1400	1400	1400
	Frame size (in.)	48	48	48
Filter size		B	B	B

ⓘ **Note:** You must size field-supplied external filters so as not to exceed 300 ft/min air velocity through disposable filters. See Installing the air filter. All three-phase models are shipped with an air filter frame kit and filters that you can install in the field. Refer to the instructions supplied with the kit for replacement filter sizes. Filter size A is 20 in. x 20 in. Filter size B is 20 in. x 30 in.

Becoming familiar with the unit dimensions

- Make sure that you are familiar with the unit dimensions before you begin the installation. See Figure 7 and Table 17.

Unit dimensions and access locations

Figure 7: Unit dimensions and access locations

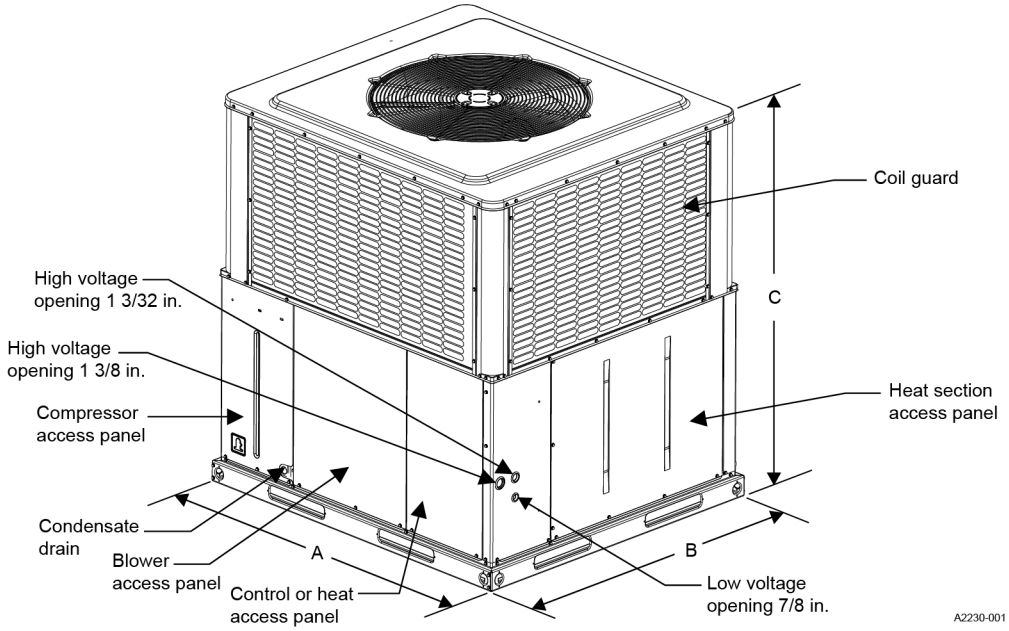


Table 17: Unit dimensions

Model	Dimensions (in.)		
	A	B	C
PH3E36N00S4	51 1/4	45 3/4	47
PH3E48N00S4	51 1/4	45 3/4	50
PH3E60N00S4	51 1/4	45 3/4	55

Installing a 6HK electric heat kit

You have the option to install an electric heat kit from the 6HK series for all unit models. For the electric heat kits you can use for each unit model and associated electrical data, see Table 21, Table 22, and Table 23 as relevant.

Important:

- Install the 6HK electric heat kit before you install the unit. You connect the wiring for the 6HK electric heat kit as part of the procedures outlined in Connecting the wiring. You set the blower speed for the 6HK electric heat kit as part of the procedures outlined in Configuring the unit.
- If you do not install a 6HK electric heat kit, you must mark the unit rating plate appropriately to indicate that no electric heat kit is installed.

To install a 6HK electric heat kit, do the following:

- Follow the installation procedure in the *Installation Manual* for the 6HK series of electric heat kits.

Installing the unit

There are two installation options for the unit: ground installation or roof installation. You must follow all requirements for the specific type of installation.

Important: If the unit is received with unpainted, uninsulated covers installed on the rear duct openings, you must discard those covers.

Designing and installing the ductwork

You may need to design and install ductwork, depending on the specific installation, for example, in a new construction.

To design and install the ductwork, do the following:

- Design and size ductwork according to the methods of the Air Conditioning Contractors of America (ACCA), as outlined in their *Manual D*.
- Always consider filter size, type, and pressure drop during duct system design. Correct filter sizing is very important.
- Use a closed return duct system. This does not preclude use of economizers or ventilation air intake.

Using an existing duct system

- Check that the ductwork meets requirements and is correctly sized, and adjust the ductwork if needed. See Designing and installing the ductwork for more information about requirements.

Adapting the unit for downflow application

You can adapt the unit for downflow application if needed.

To adapt the unit for downflow application, do the following:

1. Remove the duct covers from the bottom return and supply air duct openings. Save the four screws securing each duct cover to use in Step 3.
2. If the unit has unpainted, uninsulated covers installed on the rear duct openings, discard those covers. You must use the insulated duct covers from the bottom duct openings.
3. Install the duct covers removed in Step 1 to the rear supply and return air duct openings. Secure the duct covers with the four screws removed in Step 1.
4. Seal the duct covers with silicone caulk.

Setting the unit on the ground

Before you begin:
Make sure that the location you have selected for the unit is suitable.

For ground installation, you must use a level equipment pad or concrete slab. The thickness and size of the equipment pad or concrete slab must meet local codes and support the weight of the unit. Do not tie the equipment pad or concrete slab to the building foundation.

To set the unit on the ground, do the following:

1. Position the equipment pad or concrete slab so the unit is level.
2. Set the unit on the equipment pad or concrete slab.

Setting the unit on a roof

Before you begin:
Make sure that the location you have selected for the unit is suitable.

For roof installation, you must use a solid, level roof curb or an appropriate angle iron frame.

CAUTION

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

To set the unit on the roof, do the following:

1. Position the roof curb or iron frame so the unit is level.
2. Set the unit on the roof curb or iron frame.

Connecting the unit to the ductwork

WARNING

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

CAUTION

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

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.

NOTICE

Be sure to note supply and return openings.

To connect the unit to the ductwork, do the following:

- Use flexible duct connectors in the supply and return ductwork to minimize the transmission of vibration and noise.

- Observe the information about bottom and rear supply and return air duct openings in Figure 8, Table 18, Figure 9, and Table 19.

Bottom duct dimensions

Figure 8: Bottom duct dimensions (in.)

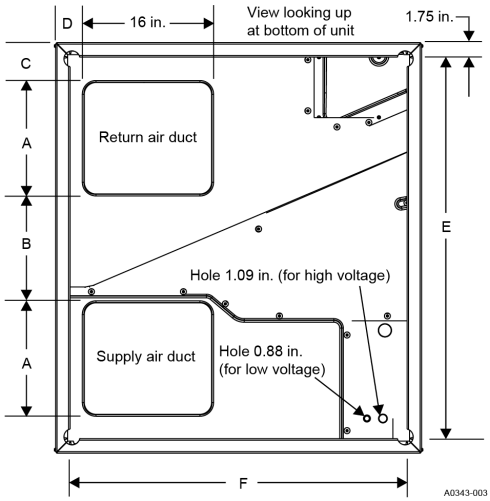


Table 18: Bottom duct dimensions

Model	A (in.)	B (in.)	C (in.)	D (in.)	E (in.)	F (in.)
PH3E36N00S4, PH3E48N00S4, and PH3E60N00S4	14	13.5	5	3.5	47.5	42

Rear duct dimensions

Figure 9: Rear duct dimensions (in.)

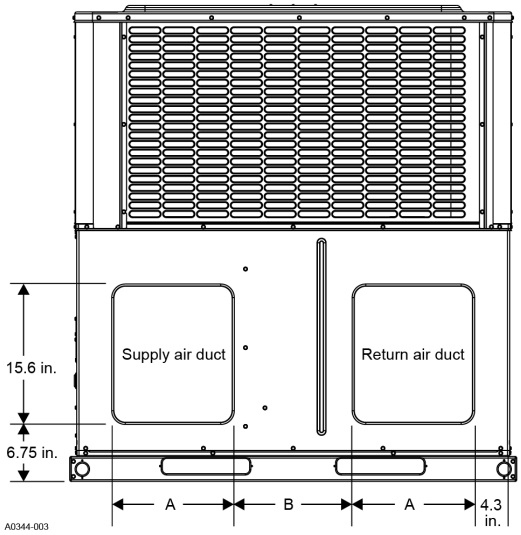


Table 19: Rear duct dimensions

Model	A (in.)	B (in.)
PH3E36N00S4, PH3E48N00S4, and PH3E60N00S4	13.6	14
Note: See Figure 7 for side hole sizes of electrical lines.		

Installing the air filter

Three-phase models are shipped with an air filter frame kit. You must install an air filter or install the air filter frame kit provided with the unit.

Important:

- One air filter is typically used, but this depends on the specific installation.
- Make sure that the air filter size is correct.
- If using a disposable filter, ensure that the air velocity does not exceed 300 ft/min. To calculate the air velocity in feet per minute, divide the airflow CFM by the filter area in square feet. For example, for a 4 ton unit with a 1600 CFM airflow and a 20 in x 30 in. flat filter, the air velocity calculation is 1600 CFM ÷ 4.17 sq. ft = 384 ft/min. This air velocity is greater than the 300 ft/min allowed. A 20 in. x 30 in. pleated filter has a larger surface area such as 7.2 sq ft, in which case the air velocity calculation is 1600 CFM ÷ 7.2 sq ft = 222 ft/min.
- It is essential to always use air filters and keep air filters clean. When air filters become dirty, insufficient air is delivered by the blower, decreasing the unit's efficiency and increasing operating costs and deterioration of the unit and controls.

To install the air filter, do the following:

- Secure an air filter in the return air ductwork or inside the conditioned space at the return air opening, **or** install the air filter frame kit using the installation procedure in the *Installation Manual* provided with the kit.

Installing a condensate trap

You must install a condensate trap for the unit. The plumbing must conform to local codes.

CAUTION

Hand tighten only.

To install a condensate trap, do the following:

- Install a condensate trap in the condensate drain.

Connecting the wiring

Follow all requirements when connecting the unit wiring. See Wiring diagrams, Table 21, Table 22, and Table 23 as needed.

Completing the power and control wiring

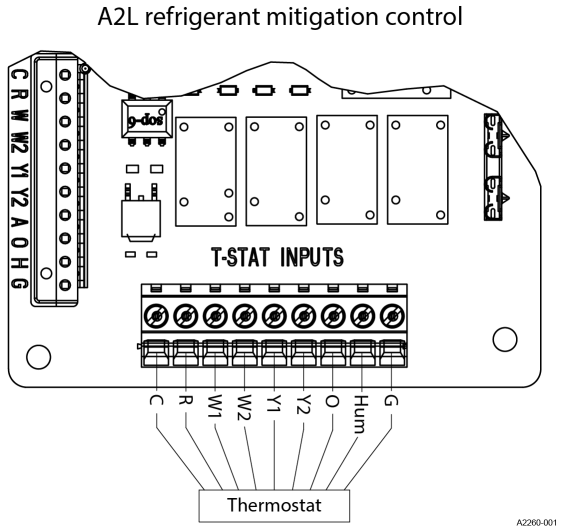
Make sure that all field wiring to the unit conforms to provisions of the current NEC ANSI/NFPA No. 70 or CEC and/or local ordinances. The unit must be electrically grounded in accordance with local codes or, in their absence, with the NEC/CEC. See Table 21 or Table 22 for unit electrical data as needed.

Important: If a 6HK electric heat kit is installed, refer to the *Installation Manual* for the 6HK electric heat kit for additional information about connecting the wiring for the 6HK electric heat kit as needed.

To complete the power and control wiring, do the following:

- See Figure 7, which shows where wiring enters the unit.
- Use Figure 10 and Figure 11, which show typical field wiring, as a guide, and refer to the appropriate unit wiring diagram for control circuit and power wiring information. See Wiring diagrams.

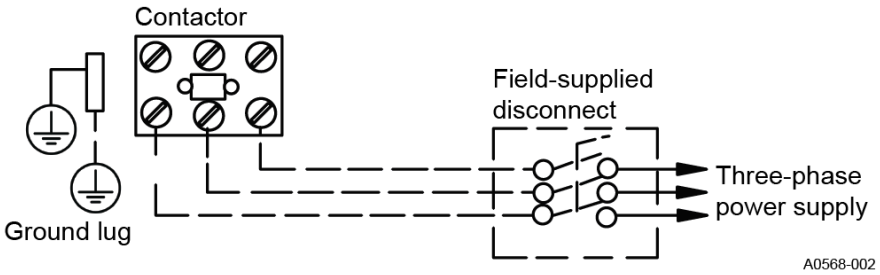
Figure 10: Typical field control wiring diagram for heat pump models



ⓘ **Note:**

- Use a minimum wire size of 18 AWG wire for all field-installed control wiring.
- Set the heat anticipator at 0.35 A for all unit models.

Figure 11: Typical field power wiring diagram



ⓘ **Note:** Use the relevant electrical data table to size the disconnect switch. See Table 21 or Table 22.

NOTICE

In some applications, the service disconnects on the electric heat kits must be rotated 180° so the up position of the disconnect is the ON position. This service disconnect orientation change is required by UL1995 (5th edition), Article 26.20 (in reference to all circuit breakers).

- Observe the voltage tolerances that must be maintained at the compressor terminals during starting and running conditions as outlined on the unit rating plate and in Table 14.
- Provide the wiring entering the unit cabinet with mechanical strain relief.
- Install a fused disconnect switch for the unit.

  ⓘ **Note:** The fused disconnect switch is field provided.

- If you need to replace any of the wire supplied with the unit, make sure that the replacement wire is the type shown on the wiring diagrams. See Wiring diagrams.

- Make sure that the electrical service is 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.

Connecting the thermostat

Important: Do not use a power-stealing thermostat.

To connect the thermostat, do the following:

1. 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.
2. Use sealant behind the thermostat to prevent air infiltration.
3. Install the thermostat in accordance with the installation instructions for the thermostat provided by the manufacturer.
4. Use color-coded insulated wires that are No. 18 AWG minimum to connect the thermostat to the unit. See Figure 10.

Installing a single-point wiring kit

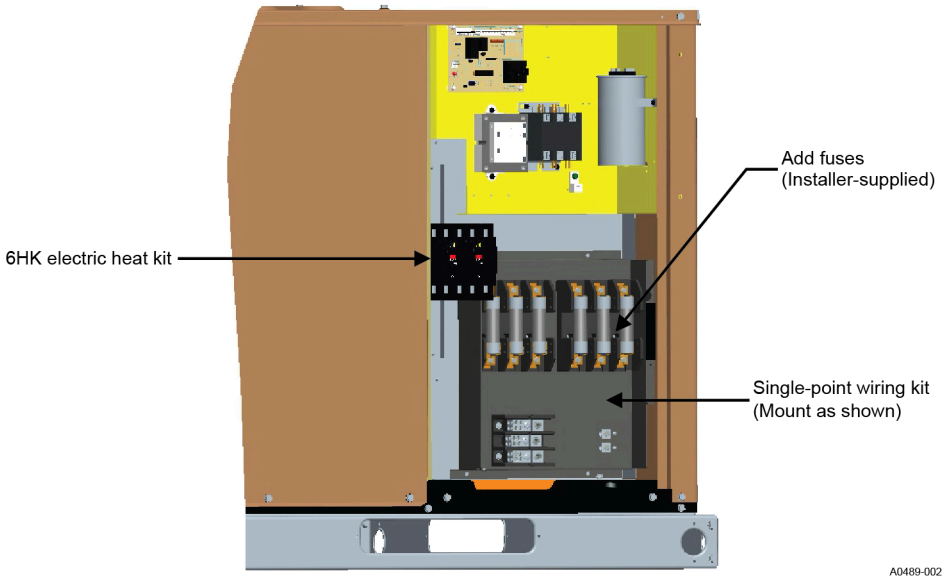
If you have installed a 6HK electric heat kit and you want to use single-source power wiring, you must install a three phase single-point wiring kit. The single-point wiring kit allows one appropriately sized electrical circuit to power the electric heat kit and the unit. Use Table 20 to check which single-point wiring kit to use for the unit model.

Table 20: Single-point wiring kit

Model	Voltage (V-phase-Hz)	Electric heat kit model	Single-point wiring kit part number	Unit fuse size (A)	Electric heat kit fuse size (A)
PH3E36N00S4	460-3-60	6HK06501046	S1-2SPWK036	15	15
		6HK06501546	S1-2SPWK036	15	25
PH3E48N00S4		6HK06501046	S1-2SPWK036	15	15
		6HK06501546	S1-2SPWK036	15	25
		6HK06502046	S1-2SPWK036	15	30
PH3E60N00S4		6HK06501046	S1-2SPWK036	20	15
		6HK06501546	S1-2SPWK036	20	25
		6HK06502046	S1-2SPWK036	20	30
		6HK06502546	S1-2SPWK037	20	35

See Figure 12 for an illustration of how to install a single-point wiring kit and connect the wiring.

Figure 12: Installing and connecting a single-point wiring kit



Note:

- For single circuit electric heat kits, remove the wires for the second circuit from the single-point block.
- The wire gauge varies depending on the specific electric heat kit model.

To install a single-point wiring kit, do the following:

- Follow the installation procedure in the *Installation Manual* for the single-point wiring kit.

Electrical data for 460-3-60 single source power

Table 21: Electrical data for 460-3-60 single source power

Model	Compressor			Outdoor fan motor	Blower motor	Electric heat option				Total unit		Unit less heater	
	RLA	LRA	MCC	FLA	FLA	Electric heat kit model	Electric heat kit (kW)	Stages	Electric heat kit (A)	MCA (A)	MOP (A)	MCA (A)	MOP (A)
PH3E36	5.8	44.3	9.0	0.87	2.3	none	—	—	—	10.4	15	10.4	15
						6HK06501046	8.8	1	11.1	24.3	25	10.4	15
						6HK06501546	13.2	1	16.6	31.2	35	10.4	15
PH3E48	6.0	49.4	9.4	0.87	4.3	none	—	—	—	12.7	15	12.7	15
						6HK06501046	8.8	1	11.1	26.5	30	12.7	15
						6HK06501546	13.2	1	16.6	33.4	35	12.7	15
						6HK06502046	17.6	1	22.1	40.3	45	12.7	15
PH3E60	7.8	69.0	11.0	0.87	3.7	none	—	—	—	14.3	20	14.3	20
						6HK06501046	8.8	1	11.1	28.2	30	14.3	20
						6HK06501546	13.2	1	16.6	35.1	40	14.3	20
						6HK06502046	17.6	1	22.1	42.0	45	14.3	20
						6HK06502546	22.0	1	27.7	48.9	50	14.3	20

Note:

- 460-3-60 indicates 460 V, three phase, 60 Hz.
- MCA indicates minimum circuit ampacity.
- MOP indicates maximum overcurrent protection device. This must be a HACR circuit breaker or time delay fuse. The HACR circuit breaker or time delay fuse must be field installed. The maximum overcurrent protection must be in accordance with the UL 60335-2-40 standard (fourth edition).
- Single-source power MCA and MOP requirements are given in this table for reference if the unit is installed with a field-installed single-point power modification.
- If an electric heat kit is installed and single-point wiring is required, a single-point wiring kit is required.

Electrical data for 460-3-60 multi source power

Table 22: Electrical data for 460-3-60 multi source power

Model	Compressor			Outdoor fan motor	Blower motor	Electric heat option				Circuit 1 (unit less electric heat kit)		Circuit 2 (electric heat kit)	
						Electric heat kit model	Electric heat kit (kW)	Stages	Electric heat kit (A)				
	RLA	LRA	MCC	FLA	FLA					MCA (A)	MOP (A)	MCA (A)	MOP (A)
PH3E36	5.8	44.3	9.0	0.87	2.3	none	—	—	—	10.4	15	—	—
						6HK06501046	8.8	1	11.1	10.4	15	13.8	15
						6HK06501546	13.2	1	16.6	10.4	15	20.7	25
PH3E48	6.0	49.4	9.4	0.87	4.3	none	—	—	—	12.7	15	—	—
						6HK06501046	8.8	1	11.1	12.7	15	13.8	15
						6HK06501546	13.2	1	16.6	12.7	15	20.7	25
						6HK06502046	17.6	1	22.1	12.7	15	27.7	30
PH3E60	7.8	69.0	11.0	0.87	3.7	none	—	—	—	14.3	20	—	—
						6HK06501046	8.8	1	11.1	14.3	20	13.8	15
						6HK06501546	13.2	1	16.6	14.3	20	20.7	25
						6HK06502046	17.6	1	22.1	14.3	20	27.7	30
						6HK06502546	22.0	1	27.7	14.3	20	34.5	35

Note:
- 460-3-60 indicates 460 V, three phase, 60 Hz.
- MCA indicates minimum circuit ampacity.
- MOP indicates maximum overcurrent protection device. This must be a HACR circuit breaker or time delay fuse.

Electric heat performance data for 460-3-60

Table 23: Electric heat performance data for 460-3-60

Electric heat kit model	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

Note:
- 460-3-60 indicates 460 V, three phase, 60 Hz.
- For electric heat kit model numbers in this table that include 6HK0, 0 indicates no service disconnect.

Starting up the unit

1. Check the electrical supply voltage being supplied. Make sure that it is within the specified range on the unit rating 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. Make sure that the unit is operating correctly.

Note: See Unit components and operation for more information about the unit if needed. See Troubleshooting if needed.

Configuring the unit

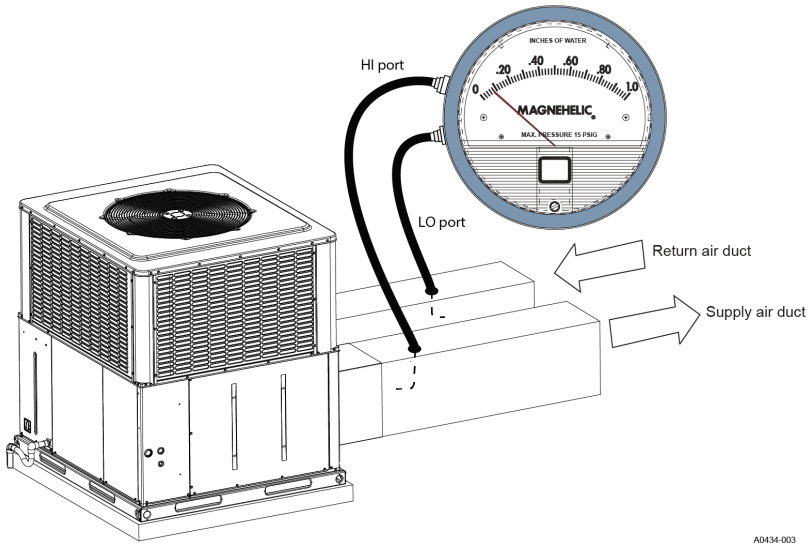
You must configure unit settings correctly at the time of installation to ensure correct system operation. For unit airflow data, see Table 25, Table 26, and Table 27.

Measuring the external static pressure

Before you begin:
Make sure that the unit is in cooling mode.

You must use a manometer as part of this procedure. Figure 13 shows how to use a manometer to measure external static pressure.

Figure 13: Measuring the external static pressure



To measure the external static pressure, do the following:

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 number and add the two numbers together. This is the total external static pressure.

Configuring settings for heat pump cooling and heating airflow

Before you begin:
Measure the external static pressure.

The unit has a direct drive, five-speed standard ECM blower motor, with the blower speed tap connections located on the motor plug in the blower compartment.

To configure settings for heat pump cooling and heating airflow, do the following:

1. Use Table 25 to compare the CFM data for the energized blower motor cooling speed tap with the measured external static pressure.
2. Adjust the blower motor cooling speed tap as necessary to obtain the required cooling airflow, generally in the range of 350 CFM to 400 CFM per ton. To do so, connect the yellow cool speed wires coming from the equipment header of the mitigation control board and from the demand defrost control board to the required speed tap. See Figure 3.

Configuring settings for continuous fan airflow

To operate the unit in continuous fan mode, set the wall thermostat fan switch to the on position. In normal operation, the fan (GRN) output from the equipment header of the mitigation control board drives the continuous fan airflow. See Figure 3. In the event of a detected R-454B leakage, the fan (GRN) output also drives the A2L mitigation airflow. In the factory-set position, the green blower speed wire coming from the fan output pin is connected to motor speed tap 1 to provide sufficiently high airflow to promptly remove any leaked R-454B from the unit. In certain circumstances, it may be necessary to adjust the factory set blower speed for continuous fan operation by moving the green blower speed wire to a different speed tap. However, this is not necessarily best practice because it can lead to a lower A2L mitigation airflow that may prolong the time for the unit to remove leaked R-454B in the event of a refrigerant leak. You must give due consideration before moving the speed tap.

Important: Make sure that the continuous fan speed tap is not placed at a higher tap number than the heating or cooling speed tap, because the five speed taps of the motor follow a hierarchical order. For example, when the thermostat sends a G and Y call simultaneously, the motor operates with the torque of whichever tap is higher.

To configure settings for continuous fan airflow, do the following:

- Connect the green blower speed wire coming from the mitigation control board to the appropriate motor speed tap.

Configuring settings for electric heating airflow

1. Check the required minimum blower speed for the electric heat kit installed for the unit model in Table 26.
2. Set the W blower speed at or above the required minimum blower speed.

Configuring settings for the defrost cycle

The demand defrost control board includes preloaded defrost curve options for the defrost cycle. See Defrost operation and Demand defrost control board. Table 24 shows the available defrost cycle settings. You can adjust the defrost cycle settings using the defrost curve jumper if required. The factory setting for the defrost curve jumper is position 2, which is suitable for most installations. If your specific installation requires a more aggressive defrost cycle, you can move the defrost curve jumper to position 4.

Table 24: Defrost cycle settings

Model	Defrost curve jumper position	Description
All PH3 models	1	Not currently used
	2	Factory setting. Used for most installations. Provides the optimum balance between defrost performance and system performance
	3	Not currently used
	4	Used for installations where an aggressive defrost cycle is required

To configure settings for the defrost cycle, do the following:

- On the demand defrost control board, set the **DEFROST CURVE** jumper to position **2** or position **4** as required.

Airflow performance data for side duct application

Table 25: Airflow performance data for 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
PH3E36N00S4	Low (1)	1550	1510	1470	1440	1400	1350	1310	1270	1160
	Low/Medium (2)	1180	1130	1090	1040	990	930	860	780	670
	Medium (3)	1320	1280	1240	1200	1150	1110	1060	990	860
	Medium/High (4)	1440	1400	1360	1320	1280	1240	1190	1150	1010
	High (5)	1550	1510	1470	1440	1400	1350	1310	1270	1160
PH3E48N00S4	Low (1)	2010	1980	1950	1910	1870	1840	1800	1760	1680
	Low/Medium (2)	1520	1480	1450	1400	1360	1320	1280	1240	1150
	Medium (3)	1620	1580	1550	1510	1470	1430	1390	1350	1270
	Medium/High (4)	1820	1790	1760	1720	1680	1640	1600	1570	1490
	High (5)	2010	1980	1950	1910	1870	1840	1800	1760	1680
PH3E60N00S4	Low (1)	2090	2060	2020	1990	1950	1910	1880	1840	1770
	Low/Medium (2)	1700	1670	1630	1590	1550	1520	1480	1440	1370
	Medium (3)	1870	1840	1810	1770	1730	1690	1650	1620	1540
	Medium/High (4)	2020	1990	1960	1920	1880	1850	1810	1770	1700
	High (5)	2090	2060	2020	1990	1950	1910	1880	1840	1770

Note:

- Airflow is tested with dry coil conditions, without air filters, at 230 V.
- Applications above 0.8 in. W.C. external static pressure are not recommended.
- A 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 according to AHRI Standard 210/240.
- The differences between side duct airflows and bottom duct airflows are insignificant.

Electric heat minimum supply air data

Table 26: Electric heat minimum supply air

Model	Voltage (V-phase-Hz)	Minimum blower speed for electric heat			
		Electric heat kit (kW)			
		10	15	20	25
PH3E36N00S4	460-3-60	Medium high (4)	Medium high (4)	—	—
PH3E48N00S4	460-3-60	Medium low (2)	Medium low (2)	Medium (3)	--
PH3E60N00S4	460-3-60	Medium low (2)	Medium low (2)	Medium low (2)	Medium (3)

Additional static resistance data

Table 27: Additional static resistance

Model	CFM	Wet indoor coil	Economizer	Air filter frame kit
PH3E36N00S4	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
PH3E48N00S4	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
PH3E60N00S4	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

Note:

- 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 in. W.C., the unit delivers less CFM during full economizer operation.
- The filter pressure drop is based on standard filter media tested at velocities not exceeding 300 ft/min.

Securing the unit panels

Before you begin:
If the air filter is located inside the unit, make sure that you have installed the air filter before you secure the unit panels.

- Secure all of the unit panels in place.

Instructing the user

The unit requires regular maintenance, so it is important to instruct the user about maintenance.

WARNING

Before performing any maintenance procedure, shut off all power to the unit to avoid personal injury.

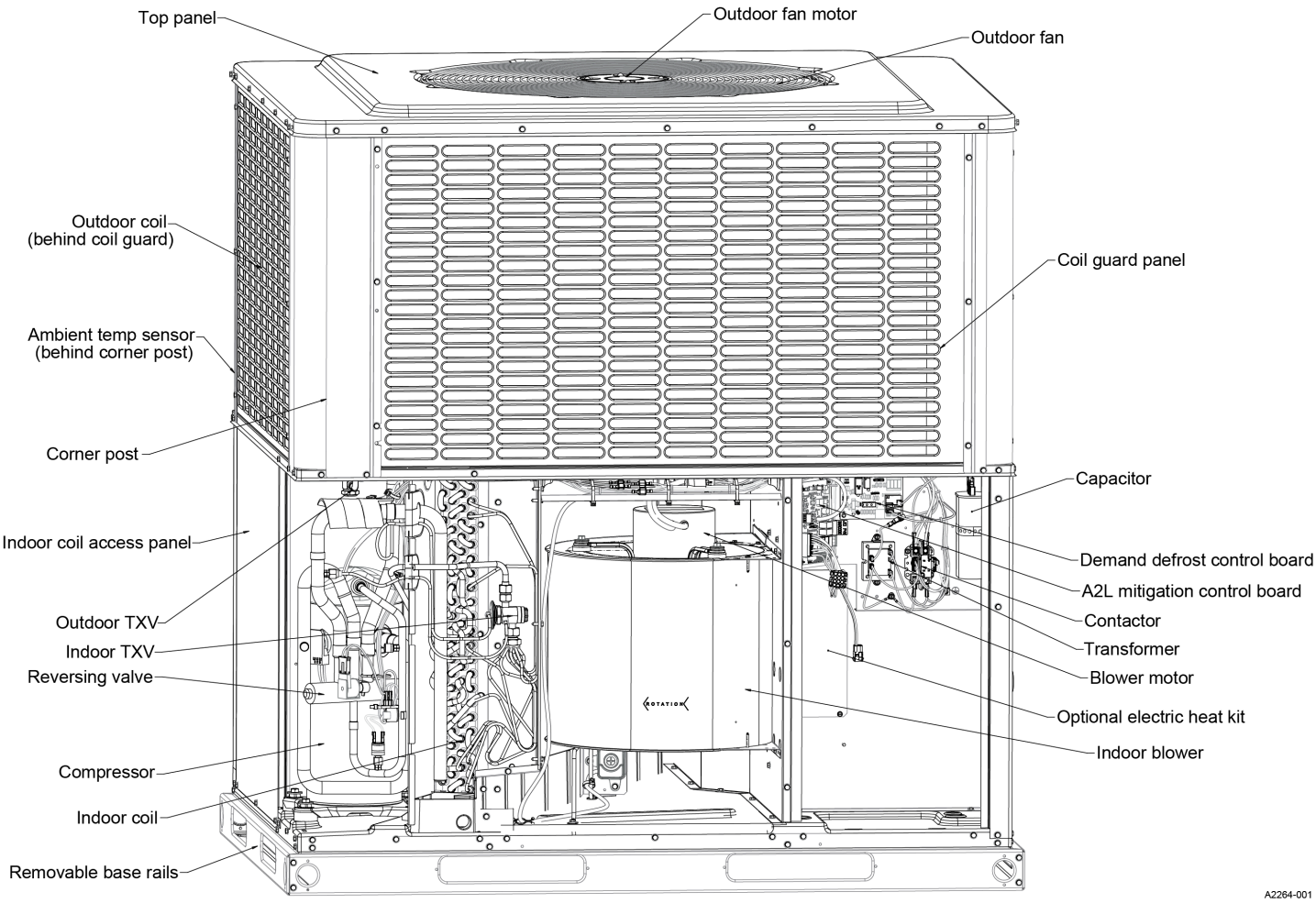
- Instruct the user to refer to *Maintaining your system* in the *User's Information Manual* for the unit for detailed information about maintenance and procedures.
- Direct the user to their limited warranty certificate in the *User's Information Manual*. Complete the following information fields in the limited warranty certificate for user reference:
  - Product Model Number
  - Unit Serial Number
  - Installation Date
  - Participating Dealer

Unit components and operation

It is important to be familiar with the different unit components and understand how they operate.

Unit components

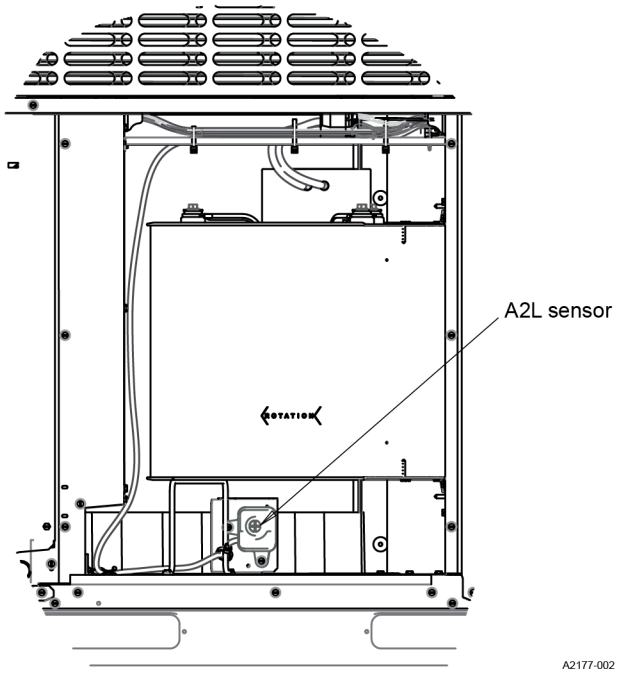
Figure 14: Unit components



A2L components

All PH3 units include an A2L sensor and a mitigation control board because they contain over 1.776 kg (3.915 lb) of refrigerant and require an RDS. Figure 15 shows the location of the A2L sensor. See A2L refrigerant safety guidance for more information.

Figure 15: A2L sensor location



Compressor

It is important to be aware of the following:

- The unit compressor is specifically designed to operate with R-454B refrigerant and cannot be interchanged with a different type of compressor.
- The unit compressor uses polyolester (POE) oil. 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, for example, filter drier, pressure switch, metering device, or coil
- The unit is shipped with compressor mountings, which are factory-adjusted and ready for operation.

⚠ CAUTION

Do not loosen compressor mounting bolts.

Phasing

⚠ CAUTION

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

Three-phase scroll compressors operate in only one direction. If the scroll compressor 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. Check the compressor rotation. If the scroll compressor motor is experiencing out of phase rotation, change the incoming line connection phasing to obtain the correct rotation.

Demand defrost control board

PH3 units have a demand defrost control board that includes the following:

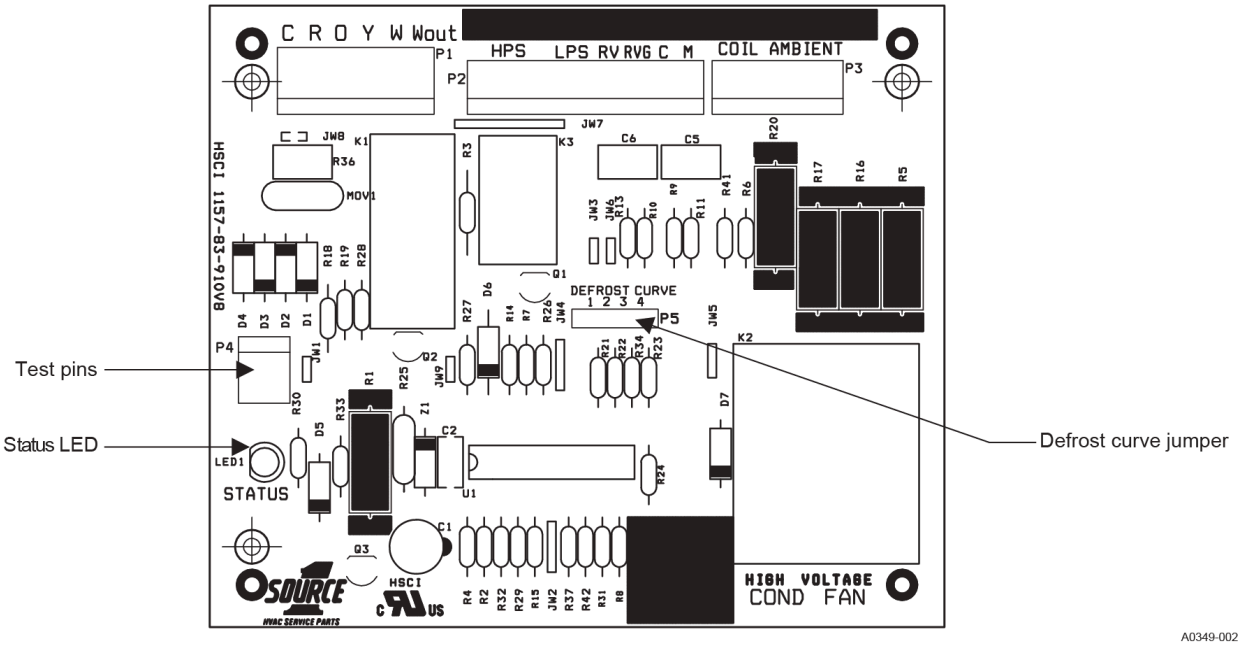
- **Status LED**: Indicates system status and fault codes but not A2L-related codes. See Table 28.

  ⓘ **Note:** The mitigation control board in the RDS indicates A2L-related status codes and fault codes. See Table 8.

- **Defrost curve selection jumper**: Used to select one of the preloaded defrost curve options for the defrost cycle.
- **Test pins**: Used for testing functions during installation, service, and troubleshooting if needed.

Figure 16 shows the demand defrost control board.

Figure 16: Demand defrost control board



Cooling operation

The following cooling sequence of operation is based on using a single-stage air heat pump thermostat:

1. When the fan switch on the thermostat is in the on position, the thermostat sends a 24 V signal to G on the mitigation control board and the indoor blower motor operates at the G-speed airflow. When the fan switch on the thermostat is in the auto position, the indoor blower motor operates only when there is a call for cooling or heating by the thermostat.
2. On a call for cooling, the thermostat sends a 24 V signal 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 switches to the cooling position. When the fan switch on the thermostat is in the auto position, the indoor blower motor is energized at the Y-speed airflow.
3. When the thermostat ends the call for cooling, 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 the G-speed airflow. If the fan switch is in the auto position, the indoor blower motor ramps down after a 60 s delay.

Heating operation

You have the option to install an electric heat kit for all unit models for supplementary electric heat. See Installing a 6HK electric heat kit. The following heating sequence of operation is based on using a single-stage heat pump thermostat. When the thermostat calls for heating, the following occurs:

1. When the fan switch on the thermostat is in the on position, the thermostat sends a 24 V signal to G on the mitigation control board and the indoor blower motor operates at the G-speed airflow. When the fan switch on the thermostat is in the auto position, the indoor blower motor operates only when there is a call for heating by the thermostat.

2. On a call for heating, the thermostat sends a 24 V signal to Y on the demand defrost control board. When 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 motor is energized at the Y-speed airflow.
3. For units equipped with an electric heat kit, when the heat pump cannot meet the demand for heating, the W terminal on the thermostat sends a 24 V signal through the demand defrost control board terminals W to Wout. The 24-V signal energizes the W-speed airflow and the first stage of electric heat. See Table .
4. When the thermostat ends the call for heating, the 24 V W signal is removed and the electric heat is de-energized, and the 24 V Y signal is removed and contactor coil M is de-energized. When the fan switch on the thermostat is in the on position, the indoor blower continues to run. When the fan switch on the thermostat is in the auto position, the indoor blower motor ramps down after a 60 s delay.

Defrost operation

The demand defrost control board implements a temperature differential (”delta-T”) demand defrost algorithm. See Demand defrost control board and Configuring settings for the defrost cycle. The heat pump is allowed to operate in heating mode until the combination of outdoor ambient and outdoor coil temperatures indicate 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. After 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.

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 sends a 24 V signal from the Wout terminal to energize the first stage of electric heat, if the unit is equipped with a 6HK electric heat kit.

Important: You can start the defrost cycle manually for troubleshooting if required. See Starting the defrost cycle.

Heat pump safety controls

The unit includes the following heat pump safety controls:

- **High-pressure switch**: The high-pressure switch prevents the pressure in the refrigeration system from becoming too high.
- **Loss of charge switch**: The loss of charge switch protects against loss of charge due to a leak in the refrigeration system.

If the high-pressure switch or the loss of charge switch opens, the unit shuts off for a 5 min anti-short cycle delay time. When the anti-short cycle delay time is complete, a 6 h elapsed run timer begins. If a second opening of a safety switch occurs during this 6 h period, the compressor locks out. See Resetting a lockout.

Electric heat safety control

The 6HK electric heat kits use normally closed auto-resetting primary switches and normally closed fusible link backup devices. If the fusible link opens, replace the fusible link with the appropriate OEM part and investigate and correct the cause.

Servicing the unit

You can access all serviceable unit components 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 7 and Figure 14 for an illustration.

See Table 12 for the minimum clearances you must maintain for the unit.

CAUTION

This system uses R-454B refrigerant. No other refrigerant may be used in this system. Gauge sets, hoses, refrigerant containers, and recovery systems must be designed to handle R-454B. If you are unsure, consult the equipment manufacturer. Failure to use R-454B compatible servicing equipment may result in property damage or injury.

WARNING

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

Sourcing replacement parts

Contact your local BHC Group Heating & Cooling parts distribution center for authorized replacement parts.

Troubleshooting

If troubleshooting is needed, follow all safety requirements.

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.

Using unit control board diagnostics

PH3 units have two control boards that display status and fault codes:

- **Mitigation control board**: The LED labeled as red on the mitigation control board in the RDS indicates A2L-related status codes and fault codes. See Figure 3 for an illustration of the mitigation control board and Table 8 for an overview of the status and fault codes. To display and clear stored fault codes, follow the procedure in Displaying and clearing stored RDS fault codes.
- **Demand defrost control board**: The status LED on the demand defrost control board indicates system status codes and fault codes. See Figure 16 for an illustration of the demand defrost control board and Table 28 for an overview of the status and fault codes. To display and clear stored fault codes, follow the procedure in Displaying and clearing stored demand defrost control board fault codes.

Understanding demand defrost control board status and fault codes

Table 28 provides an overview of the demand defrost control board status and fault codes.

Table 28: Demand defrost control board status and fault codes

Status LED	Condition
Off	No power to demand defrost control board
Steady	Compressor operation active
Slow heartbeat	Normal operation with no thermostat calls
Fast heartbeat	Normal operation. Anti-short cycle delay timer active
2 flashes	High-pressure switch fault, not in lockout yet
3 flashes	System in high-pressure switch lockout, last mode of operation was normal compressor
4 flashes	System in high-pressure switch lockout, last mode of operation was defrost
5 flashes	System in loss of charge switch lockout, last mode of operation was normal compressor
6 flashes	Low voltage (less than 19.2 VAC) preventing further relay outputs for more than 2 s
7 flashes	Low voltage (less than 16 VAC) stopped current relay outputs for more than 2 s
8 flashes	Coil temperature sensor failure, open or shorted
9 flashes	Outdoor ambient sensor failure, open or shorted
10 flashes	Demand defrost control board failure

Displaying and clearing stored demand defrost control board fault codes

The demand defrost control board stores the five most recent fault codes for 30 days. Figure 16 shows the location of the test pins on the demand defrost control board.

To display and clear stored demand defrost control board fault codes, do the following:

1. Make sure that there are no active thermostat calls.
2. On the demand defrost control board, short the test pins together for 2 s to 5 s while Y is de-energized. If stored fault codes are present, the fault codes display.
3. To clear stored fault codes, short the test pins together for more than 5 s while Y is de-energized.

Bypassing the anti-short cycle delay timer

The unit is equipped with an anti-short cycle delay timer to prevent the compressor from short cycling after a power or thermostat signal interruption. You can bypass the anti-short cycle delay timer if required. See Heat pump safety controls for more information about how the anti-short cycle delay timer operates. Demand defrost control board shows the location of the test pins on the demand defrost control board.

To bypass the anti-short cycle delay timer, do the following:

- On the demand defrost control board, short the test pins together for more than 2 s and less than 5 s while Y is energized.

Starting the defrost cycle

You can start the defrost cycle manually for troubleshooting if required. See Defrost operation for more information about the defrost cycle. Demand defrost control board shows the location of the test pins on the demand defrost control board.

To start the defrost cycle, do the following:

- On the demand defrost control board, short the test pins together for more than 5 s while Y is energized. When you remove the short, the defrost cycle terminates normally during the test mode.

Resetting a lockout

If a system fault causes the compressor to lock out, you must reset the lockout when the fault is corrected. Demand defrost control board shows the location of the test pins on the demand defrost control board.

To reset a lockout, do the following:

1. On the demand defrost control board, remove power from the 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.

Checking the refrigerant charge

If you suspect there is a refrigerant circuit problem, check the refrigerant charge.

Important:

- The unit is critically charged. Several ounces of refrigerant are lost each time you connect a refrigerant gauge to the unit. **Do not** connect a refrigerant gauge to the unit to check the refrigerant charge unless you suspect there is a refrigerant circuit problem.
- See A2L refrigerant safety guidance and follow procedures as required. See Charging after refrigerant circuit repair work.

To check the refrigerant charge, do the following:

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-454B temperature pressure chart, convert 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. Obtain an ambient dry bulb temperature reading.
6. Compare readings taken to the unit charging chart.

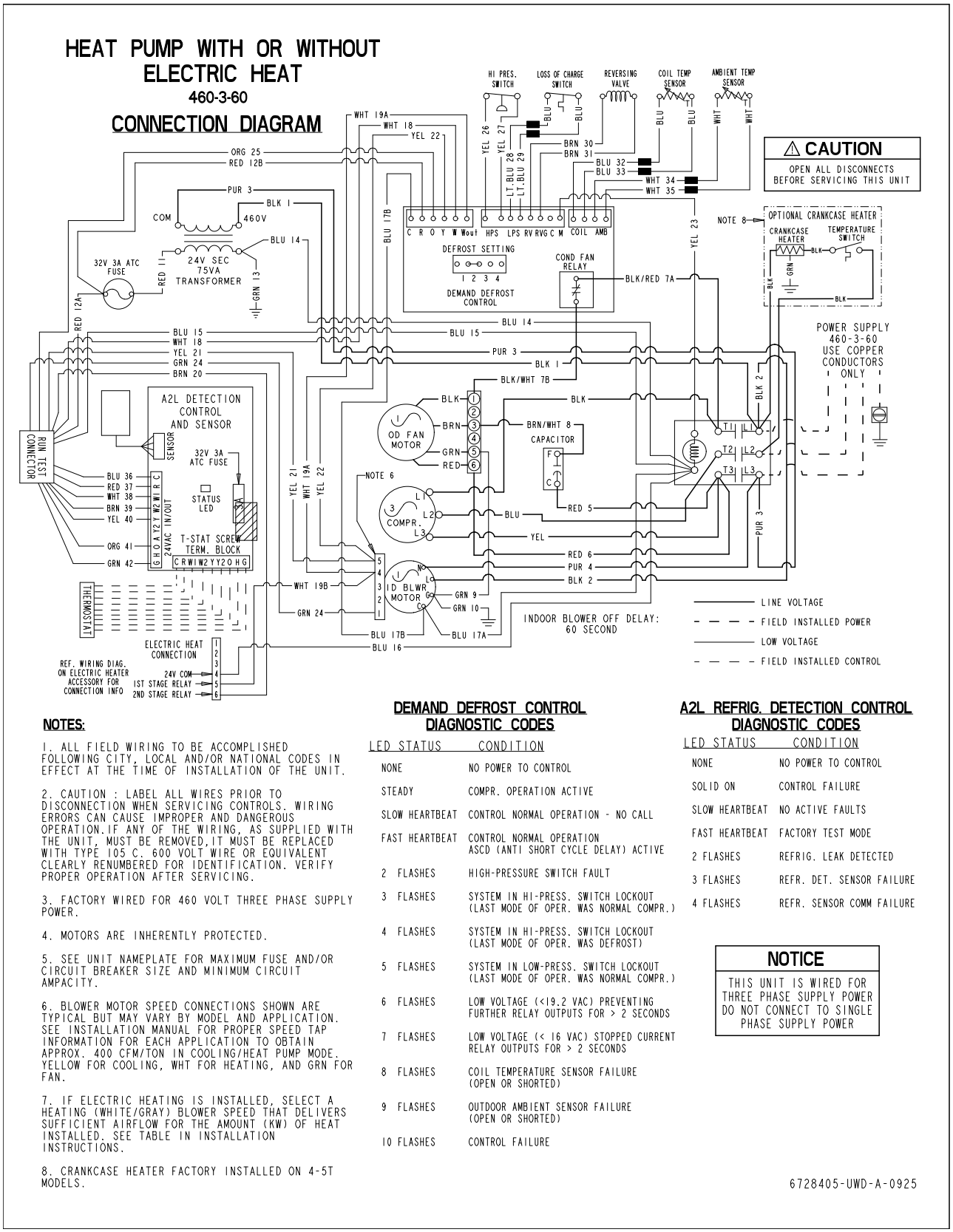
   Important: You can follow the charging chart to check and adjust unit charge if there is no hot work or refrigerant circuit repair involved; otherwise, read the A2L refrigerant safety guidance in its entirety before charging the unit. Whenever applicable, it is preferred to accurately charge the rating plate charge amount into the unit after satisfactory vacuuming.

Third-party trademarks

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

Wiring diagrams

Figure 17: Connection wiring diagram



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. BLOWER MOTOR SPEED CONNECTIONS SHOWN ARE TYPICAL BUT MAY VARY BY MODEL AND APPLICATION. SEE INSTALLATION MANUAL FOR PROPER SPEED TAP INFORMATION FOR EACH APPLICATION TO OBTAIN APPROX. 400 CFM/TON IN COOLING/HEAT PUMP MODE. YELLOW FOR COOLING, WHT FOR HEATING, AND GRN FOR FAN.

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. CRANKCASE HEATER FACTORY INSTALLED ON 4-5T MODELS.

DEMAND DEFROST CONTROL DIAGNOSTIC CODES

LED STATUS	CONDITION
NONE	NO POWER TO CONTROL
STEADY	COMPR. OPERATION ACTIVE
SLOW HEARTBEAT	CONTROL NORMAL OPERATION - NO CALL
FAST HEARTBEAT	CONTROL NORMAL OPERATION ASCD (ANTI SHORT CYCLE DELAY) ACTIVE
2 FLASHES	HIGH-PRESSURE SWITCH FAULT
3 FLASHES	SYSTEM IN HI-PRESS. SWITCH LOCKOUT (LAST MODE OF OPER. WAS NORMAL COMPR.)
4 FLASHES	SYSTEM IN HI-PRESS. SWITCH LOCKOUT (LAST MODE OF OPER. WAS DEFROST)
5 FLASHES	SYSTEM IN LOW-PRESS. SWITCH LOCKOUT (LAST MODE OF OPER. WAS NORMAL COMPR.)
6 FLASHES	LOW VOLTAGE (<19.2 VAC) PREVENTING FURTHER RELAY OUTPUTS FOR > 2 SECONDS
7 FLASHES	LOW VOLTAGE (< 16 VAC) STOPPED CURRENT RELAY OUTPUTS FOR > 2 SECONDS
8 FLASHES	COIL TEMPERATURE SENSOR FAILURE (OPEN OR SHORTED)
9 FLASHES	OUTDOOR AMBIENT SENSOR FAILURE (OPEN OR SHORTED)
10 FLASHES	CONTROL FAILURE

A2L REFRIG. DETECTION CONTROL DIAGNOSTIC CODES

LED STATUS	CONDITION
NONE	NO POWER TO CONTROL
SOLID ON	CONTROL FAILURE
SLOW HEARTBEAT	NO ACTIVE FAULTS
FAST HEARTBEAT	FACTORY TEST MODE
2 FLASHES	REFRIG. LEAK DETECTED
3 FLASHES	REFR. DET. SENSOR FAILURE
4 FLASHES	REFR. SENSOR COMM FAILURE

NOTICE

THIS UNIT IS WIRED FOR THREE PHASE SUPPLY POWER DO NOT CONNECT TO SINGLE PHASE SUPPLY POWER

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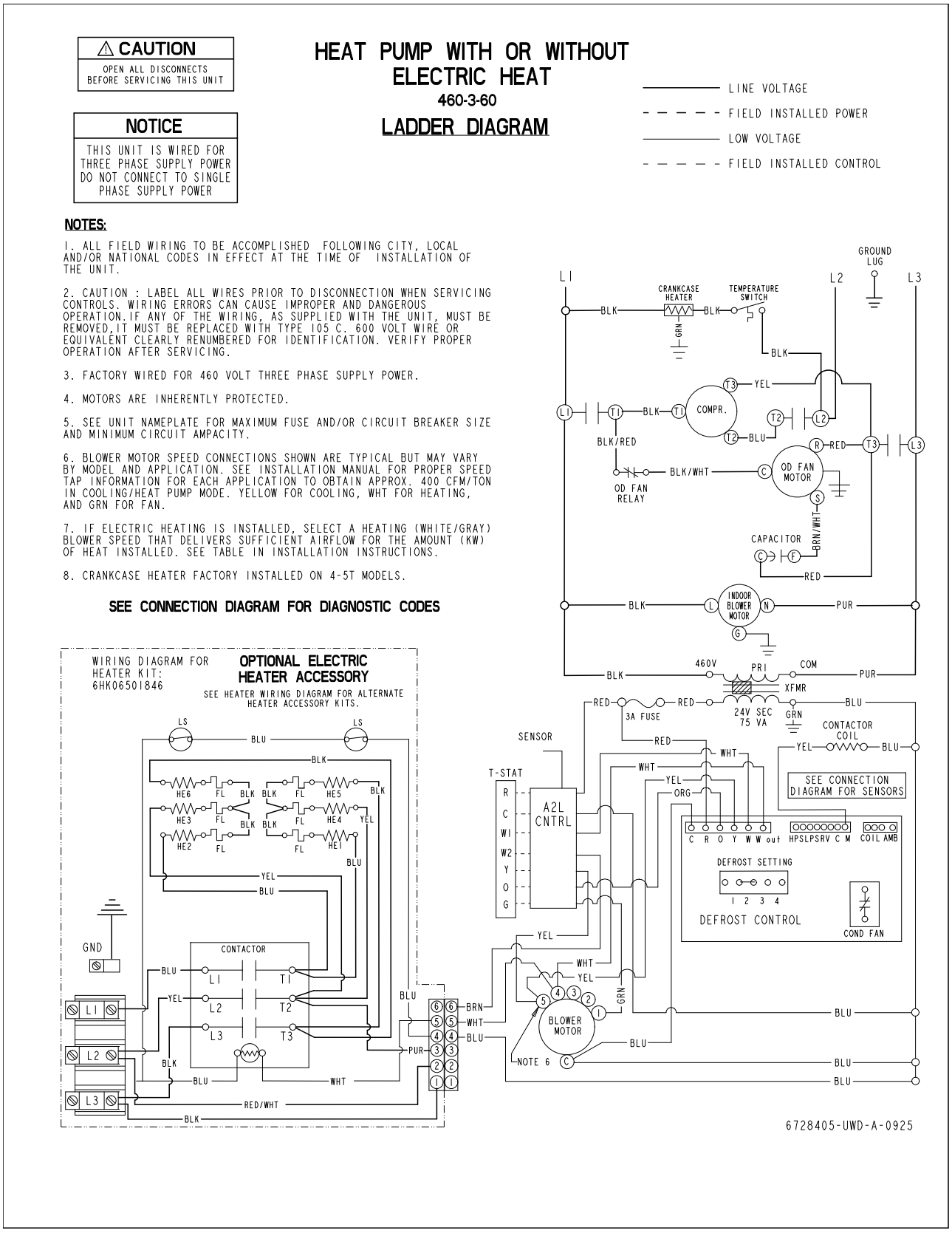
Figure 18: Ladder wiring diagram



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		Company name		Start-up technician	

Owner information

Name		Address		Daytime phone	
City		State or province		Zip or postal code	

Equipment data

Unit model number		Unit serial number	

General information (Check all that apply)

◯ Residential	◯ New construction	◯ Roof level	◯ Down flow
◯ Commercial	◯ Retrofit	◯ Grade level	◯ Side flow

Unit location and connections (Check all that apply)

☐ Unit is level and installed on: ☐ Slab ☐ Roof curb ☐ Duct connections are complete: ☐ Supply ☐ Return

☐ Condensate drain correctly connected per the installation instructions ☐ Condensate trap has been primed with water

Filters

☐ Filters installed Number of filters [ ] Filter size [ ] ◯ Filter located inside ◯ Filter located outside

Additional kits and accessories installed (Check all that apply)

☐ Refrigerant safety kit ☐ Low ambient kit ☐ Anti-recycle timer ☐ Crankcase heater ☐ Filter frame kit

☐ Transformer kit ☐ Economizer ☐ Roof curb kit ☐ Burglar bar kit ☐ Hail guard kit

☐ Manual fresh air damper kit ☐ Motorized fresh air damper kit

Electrical connections and inspection (Check all that apply)

◯ Single phase ◯ Three phase ◯ 208 VAC ◯ 230 VAC ◯ 460 VAC ◯ 575 VAC

☐ Inspect wires and electrical connections ☐ Transformer wired correctly for primary supply voltage ☐ Ground connected

☐ Low voltage present at control board R and C Measured voltage R and C outdoor unit control board [ ]

☐ Line voltage present at disconnect Measured voltage L1 to L2 [ ] L2 to L3 [ ] L1 to L3 [ ]

Compressor amperes L1 [ ] L2 [ ] L3 [ ] Total amperes L1 [ ] L2 [ ] L3 [ ]

◯ Single-stage compressor ◯ Two-stage compressor

Airflow setup

Blower type and set-up	◯ Constant airflow ECM	COOL	◯ A	◯ B	◯ C	◯ D	
		HEAT	◯ A	◯ B	◯ C	◯ D	
		COOL BLOWER DELAY	◯ A	◯ B	◯ C	◯ D	
		COOL ADJUST (D = A)	◯ A	◯ B	◯ C	◯ D	
		HUMIDISTAT	◯ NO	◯ YES			
		MODEL ID SET	◯ YES				
	◯ Standard ECM	COOL	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
		HEAT	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
		CONT. FAN	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5

Supply static (in. W.C.)		Supply air dry bulb temperature		Outside air dry bulb temperature	
Return static (in. W.C.)		Return air dry bulb temperature		Return air wet bulb temperature	
Total external static pressure		Temperature drop		Supply air wet bulb temperature	

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Refrigerant charge and metering device

◯ R-410A ◯ R-454B	Data plate - lb-oz	Suction line temperature	Discharge pressure
◯ TXV	Discharge line temperature	Suction pressure	Liquid line temperature
	Discharge superheat	Suction superheat	

Electric heat (supplemental and emergency heat)

Electric heat kit model number		Serial number		Rated kW
◯ Single phase ◯ Three phase	Measured amperage	Heater 1	Heater 2	Heater 3
		Heater 4	Heater 5	Heater 6
Number of elements	Measured voltage	Heater 1	Heater 2	Heater 3
		Heater 4	Heater 5	Heater 6
Heating return air dry bulb temperature		Heating supply air dry bulb temperature		Air temperature rise

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

- ☐ If the unit includes an A2L sensor and a refrigerant detection system (RDS), operate the unit through field testing the A2L sensor and taking A2L mitigation actions, noting and correcting any problems
- ☐ 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 user's information 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

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