

INSTALLATION MANUAL

**SINGLE PACKAGE
HEAT PUMP / GAS HEAT**
MODELS: PHG4 SERIES
2 TO 5 TONS – 208/230 V - 1 PHASE



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SECTION I: GENERAL INFORMATION

These are electric heat pump/gas heating units designed for outdoor installation. Only gas piping, electric power, and duct connections are required at the point of installation.

The gas-fired heaters have spark ignition.

The refrigerant system is fully charged with R-410A refrigerant, and is tested and factory sealed.

SECTION II: SAFETY



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

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

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

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

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

WARNING

*Improper installation may create a condition where the operation of the product could cause personal injury or property damage. Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. **Failure to carefully read and follow all instructions in this manual can result in furnace malfunction, death, personal injury, and/or property damage.** Only a qualified contractor, installer, or service agency should install this product.*

CAUTION

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

⚠ WARNING

Before you perform service or maintenance operations on the unit, disconnect electrical power to the 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.

⚠ WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

1. Do not try to light any appliance.
2. Do not touch any electrical switch. Do not use any phone in your building.
3. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
4. If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

⚠ CAUTION

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

Due to system pressure, moving parts, and electrical components, installation and servicing of air conditioning equipment can be hazardous. Only qualified, trained service personnel must install, repair, or service this equipment. Untrained 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 whenever working on air conditioning equipment. Follow all other applicable safety precautions and codes including ANSI Z223.1 or CSA-B149.1- latest edition.

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

INSPECTION

As soon as a unit is received, it must be inspected for possible damage during transit. If damage is evident, the extent of the damage must be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent must be made in writing.

SECTION III: MODEL NUMBER NOMENCLATURE

PHG	4	A	24	50	2	X	1	A
1	2	3	4	5	6	7	8	9
1. Model Family PHG - packaged heat pump with gas heat, PCG - packaged A/C with gas heat PCE - packaged A/C with electric heat PHE - packaged heat pump with electric heat					5. Gas Heating Input BTU/Hr x 1000 050 = 50,000 BTU/Hr. input, blank = electric heat			
2. Nominal Cooling Efficiency 4 = 14 SEER, 6 = 16 SEER, etc.					6. Voltage-Phase-Frequency 2 = 208/230-1-60, 3=208/230-3-60, 4 = 460-3-60			
3. Cabinet Size A = small 35 x 51, B = large 45 x 51					7. NOx Approval X = low-NOx, blank = not low-NOx			
4. Nominal Air Conditioning Cooling Capacity BTUx1000 24 = 24,000 BTU, etc.					8. Generation Level 1 = first generation			
Examples: PHG4B421002X1A is a dual fuel, 14 SEER, 3-1/2 ton, large cabinet, single-stage heat, 100,000 BTU gas heat, 230 volt, single phase, low-NOx model (first generation, first release)					9. Revision Level A = original release, B = second release			

SECTION IV: INSTALLATION**INSTALLATION SAFETY INFORMATION**

Read all the instructions before you install the unit. This is an outdoor combination heating and cooling unit. The installer must give this document to the consumer and instruct the consumer to retain it for future reference.

- Refer to the unit rating plate for the approved type of gas for this product.
- Install this unit only in a location and position as specified on page 4 of these instructions.
- Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when checking all connections, as specified on page 10 of these instructions.

- Always install the furnace to operate within the furnace's intended temperature rise range with the duct system and within the allowable external static pressure range. These are specified on the unit name/rating plate and in Table 7 of these instructions.
- This equipment is not to be used for temporary heating of buildings or structures under construction.

⚠ WARNING**FIRE OR EXPLOSION HAZARD**

Failure to follow the safety warning exactly could result in serious injury, death, or property damage.

Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury, or loss of life.

LIMITATIONS

These units must be installed in accordance with the following:

In U.S.A.:

- National Electrical Code, ANSI/NFPA No. 70 - Latest Edition
- National Fuel Gas Code, ANSI Z223.1 - Latest Edition
- Gas-Fired Central Furnace Standard, ANSI Z21.47a. - Latest Edition
- Local building codes
- Local gas utility requirements

In Canada:

- Canadian Electrical Code, CSA C22.1
- Installation Codes, CSA - B149.1
- Local plumbing and waste water codes
- Other applicable local codes

See the unit application data found in this document.

After installation, gas fired units must be adjusted to obtain a temperature rise within the range specified on the unit rating plate.

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

The size of the unit for proposed installation must be based on heat loss/heat gain calculation made according to the methods of Air Conditioning Contractors of America (ACCA).

This furnace is not to be used for temporary heating of buildings or structures under construction.

Table 1: Unit Limitations

Model	Unit Voltage	Unit Limitations		
		Applied Voltage		Outdoor DB Temperature
		Minimum	Maximum	Maximum (°F)
PHG4A24	208/230-1-60	187	252	125
PHG4A30	208/230-1-60	187	252	125
PHG4B36	208/230-1-60	187	252	125
PHG4B42	208/230-1-60	187	252	125
PHG4B48	208/230-1-60	187	252	125
PHG4B60	208/230-1-60	187	252	125

Table 2: Application Limitations

Packaged Equipment Series	Air Temperature at Outdoor Coil (°F)				Air Temperature at Indoor Coil (°F)			
	Minimum		Maximum		Minimum		Maximum	
	DB Cool	DB Heat	DB Cool	DB Heat	WB Cool	DB Heat	WB Cool	DB Heat
14 SEER HP	55	-10	125	75	57	50	72	80

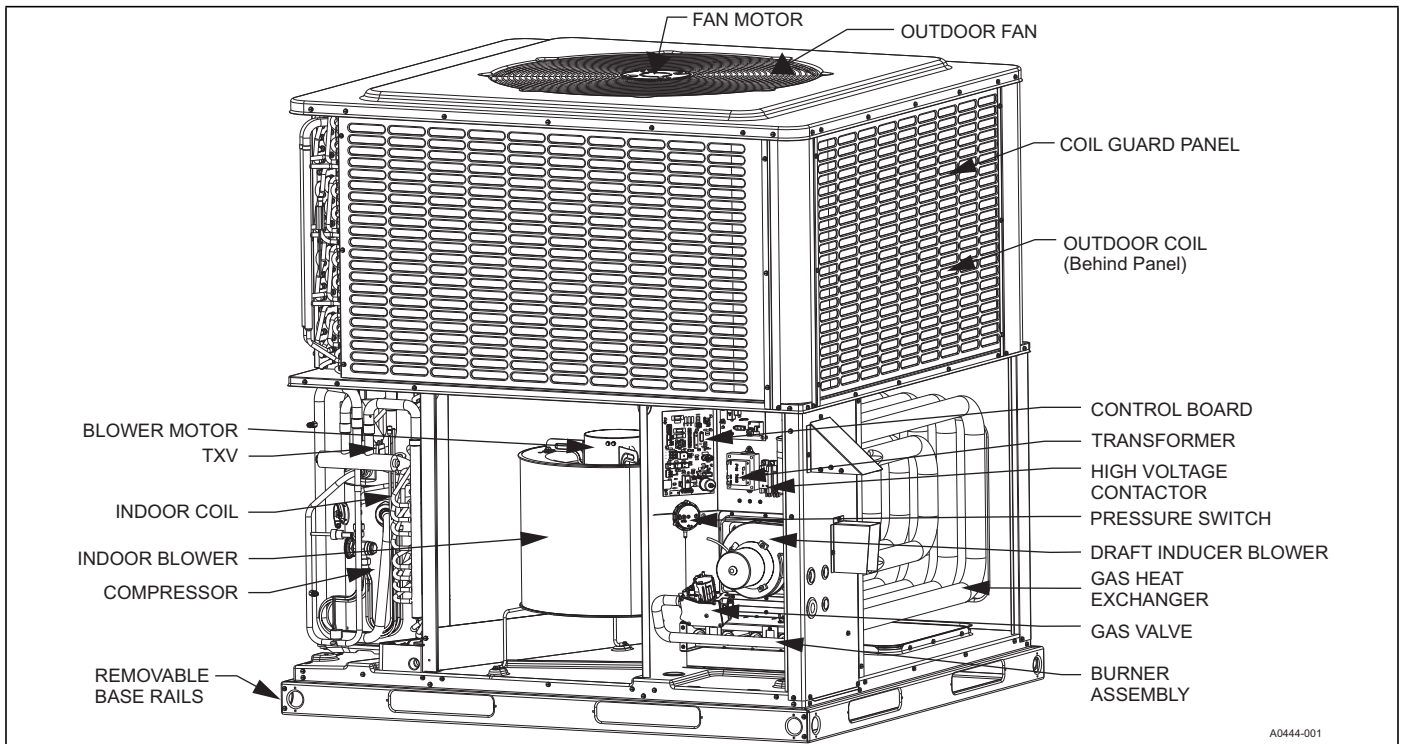


FIGURE 1: Component Location

LOCATION

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

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

⚠ WARNING

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

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

⚠ WARNING

Excessive exposure of this furnace to contaminated combustion air may result in equipment damage or personal injury. Typical contaminants include: permanent wave solution, chlorinated waxes and cleaners, chlorine based swimming pool chemicals, water softening chemicals, carbon tetrachloride, Halogen type refrigerants, cleaning solvents (for example, perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, antistatic fabric softeners for clothes dryers, and masonry acid washing materials.

CLEARANCES

⚠ WARNING

Do not permit overhanging structures or shrubs to obstruct outdoor air discharge outlet, combustion air inlet, or vent outlets.

All units require particular clearances for proper operation and service. The installer must make provisions for adequate combustion and ventilation air in accordance with the following:

- Section 5.3 of Air for Combustion and Ventilation of the National Fuel Gas Code
- ANSI Z223.1 – Latest Edition (in U.S.A.)
- Sections 7.2, 7.3, or 7.4 of Gas Installation Codes
- CSA-B149.1 (in Canada) - Latest Edition
- Applicable provisions of local building codes

See Table 5 for clearances required for combustible construction, servicing, and proper unit operation.

RIGGING AND HANDLING

⚠ CAUTION

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

⚠ CAUTION

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

Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the lifting holes provided in the base rails. Spreader bars whose length exceeds the largest dimension across the unit **MUST** be used across the top of the unit.

⚠ CAUTION

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

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

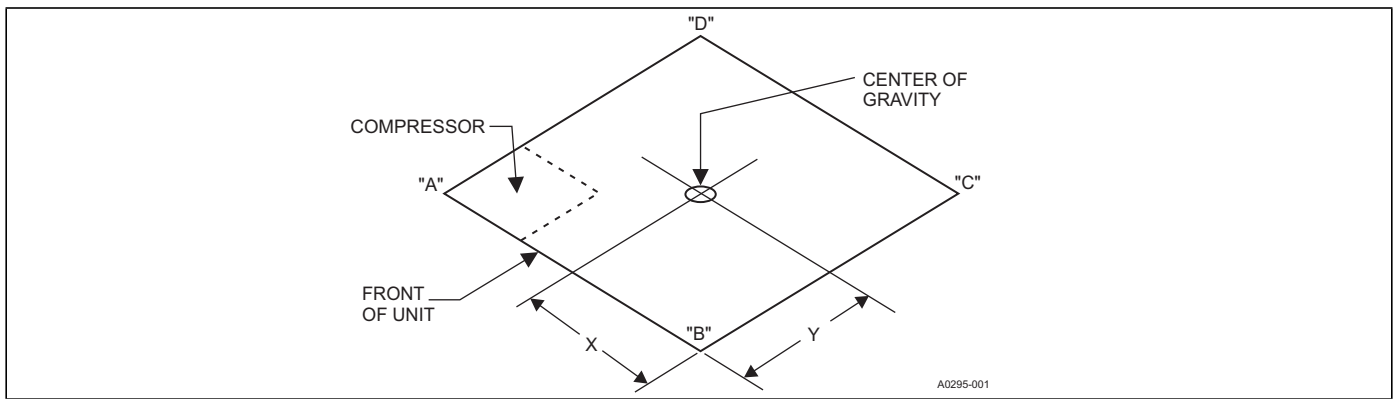


FIGURE 2: Dimensions and 4 Point Load Weights

Table 3: Weights, Dimensions, and 4 Point Load Weights

Model	Weight (lb)		Center of Gravity		4 Point Load Location (lb)			
	Shipping	Operating	X	Y	A	B	C	D
PHG4A24050	399	394	28	15	131	101	86	76
PHG4A24075	409	404	28	15	135	103	86	80
PHG4A30050	454	449	28	15	155	108	96	90
PHG4A30075	458	453	28	15	161	102	90	100
PHG4B36065	503	498	29	14	176	122	104	96
PHG4B36100	510	505	29	14	178	123	109	95
PHG4B42065	537	532	29	14	190	132	112	98
PHG4B42100	539	534	29	14	191	133	109	101
PHG4B48065	556	551	28	14	199	137	106	109
PHG4B48100	564	559	28	14	194	141	117	107
PHG4B48125	569	564	29	14	193	146	126	99
PHG4B60065	582	577	29	14	199	151	127	100
PHG4B60100	586	581	28	14	201	152	123	105
PHG4B60125	593	588	27	15	202	151	125	110

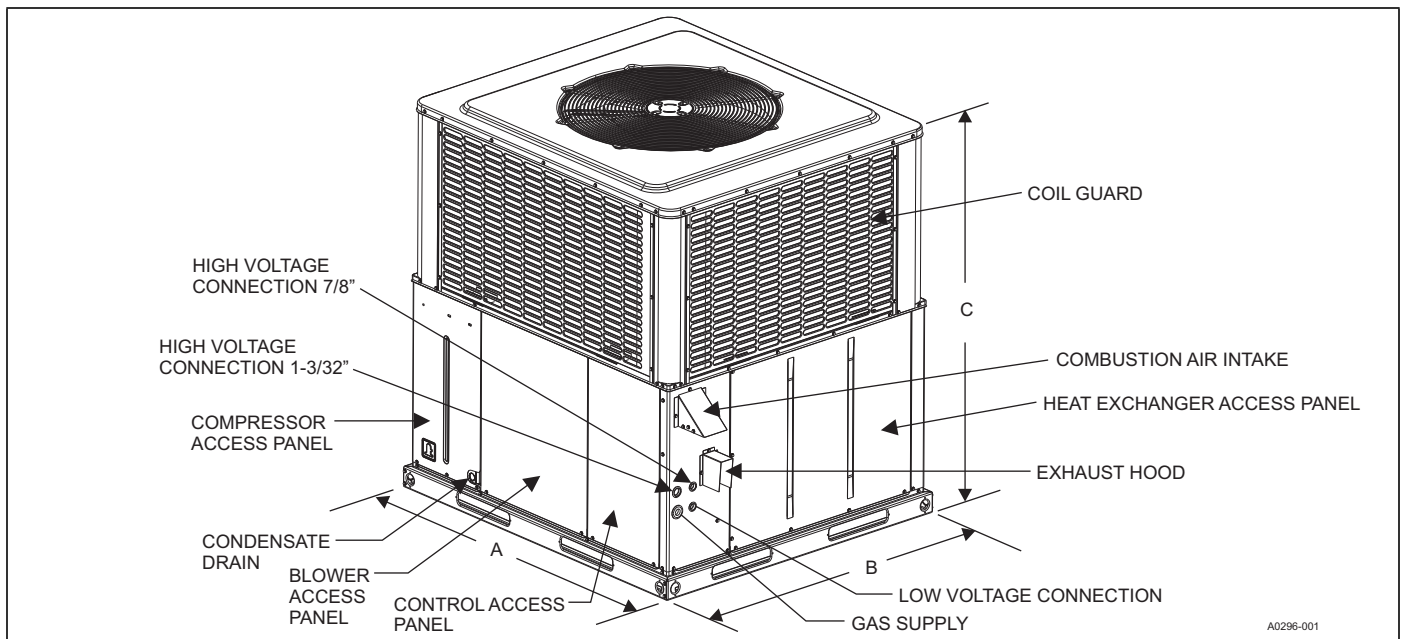


FIGURE 3: Unit Dimensions and Access Locations

Table 4: Unit Dimensions and Access Locations

Model	Dimensions (in.)		
	A	B	C
PHG4A24	51-1/4	35-3/4	47
PHG4A30	51-1/4	35-3/4	49
PHG4B36	51-1/4	45-3/4	49
PHG4B42	51-1/4	45-3/4	49
PHG4B48	51-1/4	45-3/4	53
PHG4B60	51-1/4	45-3/4	55

Table 5: Unit Clearances^{1 2}

Direction	Distance (in.)	Direction	Distance (in.)
Top ³	36	Power Entry (Right Side)	36
Side Opposite Ducts	36	Left Side	24
Duct Panel	0	Bottom ⁴	1

1. A 1 in. clearance must be provided between any combustibile material and the supply air duct work.
2. The products of combustion must not be allowed to accumulate within a confined space and recirculate.
3. Units must be installed outdoors. Overhanging structures or shrubs must not obstruct the outdoor air discharge outlet.
4. Units can be installed on combustibile materials made from wood or class A, B, or C roof covering materials if factory base rails are left in place as shipped.

DUCTWORK

NOTICE

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

These units are adaptable to downflow use as well as rear supply and return air duct openings.

To convert to downflow:

1. Remove the duct covers from the bottom return and supply air duct openings.
2. Install the duct covers (removed in step one) to the rear supply and return air duct openings.
3. Seal the duct covers with silicone caulk.

Duct work must be designed and sized according to the methods of the Air Conditioning Contractors of America (ACCA). Refer to ACCA Manual D.

Use a closed return duct system. This does not preclude use of economizers or ventilation air intake. It is best practice to use flexible joints in the supply and return duct work to minimize the transmission of vibration and noise.

NOTICE

Be sure to note supply and return openings.

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

FILTERS

Proper filter size is very important. Filter size, type, and pressure drop must always be considered during duct system design.

Single phase units are shipped without a filter or filter racks. It is the responsibility of the installer to secure a filter in the return air ductwork or install a filter/frame kit.

A filter rack and high velocity filters are standard on three phase units.

Do not operate the unit without a filter. Inspect filters monthly and clean if necessary. When filters become dirt laden, insufficient air is delivered by the blower, decreasing the unit's efficiency and increasing operating costs and wear-and-tear on the unit and controls.

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

CONDENSATE DRAIN

A condensate trap must be installed in the condensate drain. The plumbing must conform to local codes.

CAUTION

You must tighten the condensate trap by hand.

Use Teflon tape or pipe thread compound if needed.

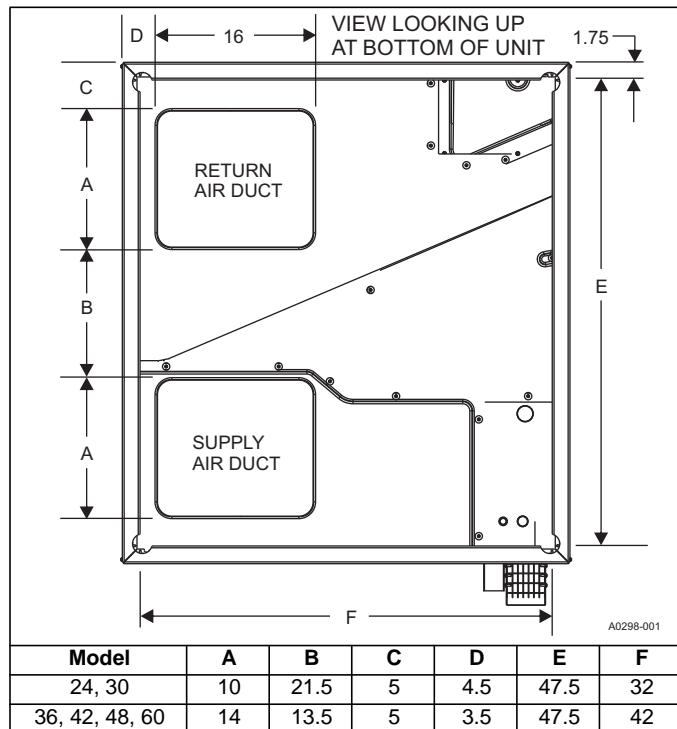


FIGURE 4: Bottom Duct Dimensions (in.)

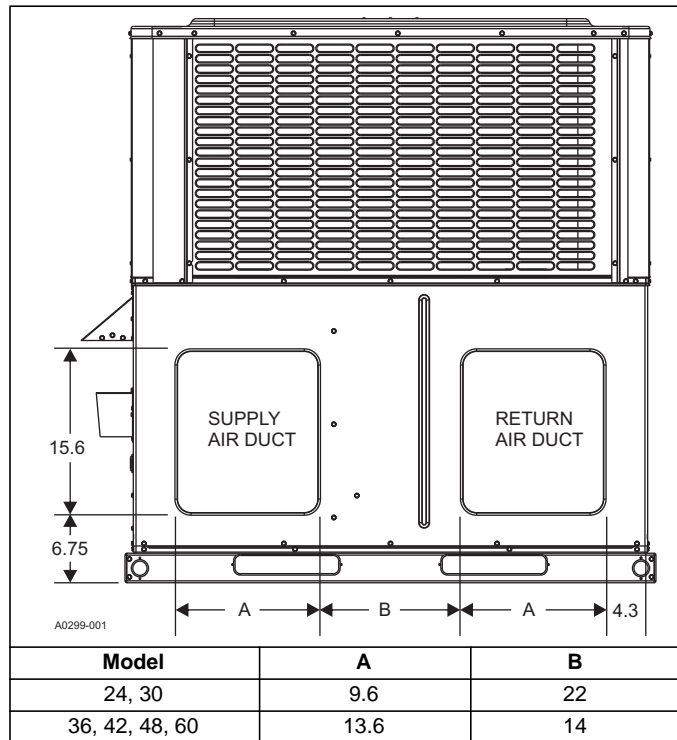


FIGURE 5: Rear Duct Dimensions (in.)

SERVICE ACCESS

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

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

See Figure 3 for the location of these access locations and Table 5 for minimum clearances.

⚠ CAUTION

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

⚠ WARNING

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

See Figure 14 for the R-410A Quick Reference Guide.

THERMOSTAT

Locate the room thermostat on an inside wall approximately 60 in. above the floor where it is not subject to drafts, sun exposure, or heat from electrical fixtures or appliances. Use sealant behind the thermostat to prevent air infiltration. Follow manufacturer instructions enclosed with the thermostat for general installation procedures. Use color coded insulated wires (minimum 18 AWG) to connect the thermostat to the unit. See Figure 6. Do not use power stealing thermostats. The thermostat must be a heat pump thermostat that can control fossil fuel backup heat.

POWER AND CONTROL WIRING

Field wiring to the unit must conform to the 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. Voltage tolerances that must be maintained at the compressor terminals during starting and running conditions are indicated on the unit Rating Plate and in Table 1.

The wiring entering the cabinet must be provided with mechanical strain relief.

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

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

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

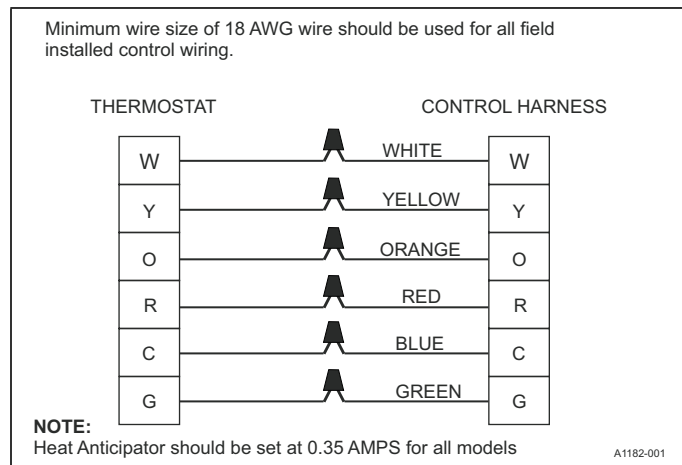


FIGURE 6: Typical Field Control Wiring Diagram for Gas Heat - AC Models

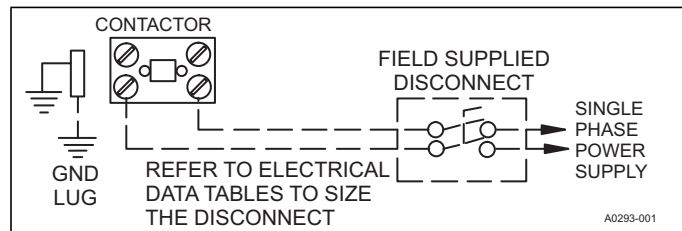


FIGURE 7: Typical Field Power Wiring Diagram

Table 6: Electrical Data - PHG4

Model	Voltage	Compressor			OD Fan Motor	Supply Blower Motor	MCA ¹ (Amps)	Max Fuse ² / Breaker ³ Size (Amps)
		RLA	LRA	MCC	FLA	FLA		
24050	208/230-1-60	10.0	62.0	16.0	0.7	2.6	15.8	25
24075	208/230-1-60	10.0	62.0	16.0	0.7	3.8	17.0	25
30050	208/230-1-60	14.0	73.0	22.0	0.6	2.6	20.7	30
30075	208/230-1-60	14.0	73.0	22.0	0.6	3.8	21.9	35
36065	208/230-1-60	17.0	79.0	26.0	1.7	3.8	26.8	40
36100	208/230-1-60	17.0	79.0	26.0	1.7	5.4	28.4	45
42065, 42100	208/230-1-60	18.0	112.0	28.0	1.7	5.4	29.6	45
48065, 48100, 48125	208/230-1-60	22.0	117.0	34.0	1.7	5.4	34.6	50
60065, 60100, 60125	208/230-1-60	24.0	144.0	38.0	1.7	7.0	38.7	60

1. Minimum Circuit Ampacity
2. Maximum Over Current Protection per standard UL 1995
3. Fuse or HACR circuit breaker size field installed

Table 7: Physical Data

MODELS	PHG4A24		PHG4A30		PHG4B36		PHG4B42		PHG4B48			PHG4B60		
NOMINAL TONNAGE	2.0		2.5		3.0		3.5		4.0			5.0		
COMPONENT														
AHRI Cooling Performance														
Gross capacity @ AHRI A point (MBH)	24.1		30.1		36.4		42.3		48.2			59.9		
AHRI net capacity (MBH)	23.8		29.6		35.8		41.5		47.0			58.0		
EER	11.0		11.0		11.0		11.0		11.0			11.0		
SEER	14.0		14.0		14.0		14.0		14.0			14.0		
Nominal CFM	800		1000		1200		1400		1600			2000		
System power (kW)	1.8		2.2		2.8		3.2		3.7			4.7		
Refrigerant type	R410A		R410A		R410A		R410A		R410A			R410A		
Refrigerant charge (lb-oz)	8-5		9-8		11-13		13-0		12-13			15-8		
AHRI Heat Pump Heating Performance														
47 F capacity rating (MBH)	22.0		27.2		33.8		38.0		45.5			56.0		
System power (kW/COP)	3.7		3.6		3.6		3.6		3.7			3.6		
17 F capacity rating (MBH)	12.0		14.8		19.6		22.0		25.4			31.7		
HSPF (BTU/Watts-hr.)	8.0		8.0		8.0		8.0		8.0			8.0		
AHRI Gas Heat Performance														
Heating model	50	75	50	75	65	100	65	100	65	100	125	65	100	125
Heat input (KBTU)	50.0	75.0	50.0	75.0	65.0	100.0	65.0	100.0	65.0	100.0	125.0	65.0	100.0	125.0
Heat output (KBTU)	40	60	40	60	52	80	52	80	52	80	100	52	80	100
AFUE %	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0
No. of burners	2	3	2	3	2	3	2	3	2	3	4	2	3	4
No. of stages	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Temperature rise range (°F)	40-70		40-70		40-70		40-70		40-70			40-70		
Maximum static pressure W.C.	0.5		0.5		0.5		0.5		0.5			0.5		
Maximum outlet air temp. (°F)	180		180		180		180		180			180		
Gas piping connection (in.)	1/2		1/2		1/2		1/2		1/2			1/2		
Dimensions (in.)														
Length	51-1/4		51-1/4		51-1/4		51-1/4		51-1/4			51-1/4		
Width	35-3/4		35-3/4		45-3/4		45-3/4		45-3/4			45-3/4		
Height	47		49		49		49		53			55		
Operating Weight (lb)	394	404	449	453	498	505	532	534	551	559	564	577	581	588
Compressors														
Type	Scroll		Scroll		Scroll		Scroll		Scroll			Scroll		
Outdoor Coil Data														
Face area (sq ft)	15.1		16.9		19.4		19.4		23.8			26.3		
Rows	2		2		2		2		2			2		
Fins per inch	22		22		22		22		22			22		
Tube diameter	3/8		3/8		3/8		3/8		3/8			3/8		
Circuitry type	Interlaced		Interlaced		Interlaced		Interlaced		Interlaced			Interlaced		
Refrigerant control	TXV		TXV		TXV		TXV		TXV			TXV		
Indoor Coil Data														
Face area (sq ft)	4.6		4.6		TXV		6.3		6.3			6.3		
Rows	3		3		3		3		3			4		
Fins per inch	16		16		16		16		16			16		
Tube diameter	3/8		3/8		3/8		3/8		3/8			3/8		
Circuitry type	Interlaced		Interlaced		Interlaced		Interlaced		Interlaced			Interlaced		
Refrigerant control	TXV		TXV		TXV		TXV		TXV			TXV		
Outdoor Fan Data														
Fan diameter (in.)	24		24		26		26		26			26		
Type	Prop		Prop		Prop		Prop		Prop			Prop		
Drive type	Direct		Direct		Direct		Direct		Direct			Direct		
No. of speeds	1		1		1		1		1			1		
Motor HP each	1/10		1/8		1/3		1/3		1/3			1/3		
RPM	850		850		850		850		850			850		
Nominal total CFM	2400		2400		3200		3200		4200			4200		
Direct Drive Indoor Fan Data														
Fan size (in.)	11 x 8		11 x 8		11 x 10		11 x 10		11 x 10			11 x 10		
Type	Centrifugal		Centrifugal		Centrifugal		Centrifugal		Centrifugal			Centrifugal		
Motor HP each	1/3	1/2	1/3	1/2	1/2	3/4	3/4		3/4			1		
RPM	1200 Max		1200 Max		1200 Max		1200 Max		1200 Max			1200 Max		
Frame size	48		48		48		48		48			48		
Filters														
Filter size	A		A		B		B		B			B		
Quantity - size	Field-supplied external filters must be sized so as not to exceed 300 FPM air velocity through disposable filters. For internal filter use, a filter rack kit is available. Consult the instructions supplied with the kit for replacement filter sizes. Filter sizes: A=20x20, B=20x30.													

COMPRESSORS

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

⚠ CAUTION

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

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

⚠ CAUTION

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

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

⚠ CAUTION

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

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

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

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

⚠ CAUTION

Do not loosen compressor mounting bolts.

GAS HEAT

These single stage gas-fired heaters have direct spark ignition.

GAS PIPING

Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas, and the length of run. National Fuel Gas Code Z223.1 or CSA B149.1 must be followed in all cases unless superseded by local codes or gas company requirements. See Tables 8 and 9.

The BTU content of the gas may differ with locality. Check the value with the local gas utility.

NOTICE

There may be a local gas utility requirement specifying a minimum diameter for gas piping. All units require a 1/2 inch pipe connection at the gas valve.

GAS CONNECTION

The gas supply line must be routed through the 1-5/8 in. hole located on the right side of the unit. See Figure 3 for the location. The unit is supplied with a rubber grommet that fits in this hole and is used to seal around the gas pipe.

Note: The rubber grommet must be installed to prevent leakage of air and water into the heating/controls compartment.

Gas piping requirements:

- A drip leg and a ground joint union must be installed in the gas piping.
- When required by local codes, a manual shut-off valve must be installed outside of the unit.
- Use wrought iron or steel pipe for all gas lines. Apply pipe thread sealant sparingly to male threads only.

Table 8: Natural Gas Pipe Sizing Chart¹

Length (ft)	Nominal Inches Iron Pipe Size			
	1/2 in.	3/4 in.	1 in.	1-1/4 in.
10	132	278	520	1,050
20	92	190	350	730
30	73	152	285	590
40	63	130	245	500
50	56	115	215	440
60	50	105	195	400
70	46	96	180	370
80	43	90	170	350
90	40	84	160	320
100	38	79	150	305

1. Maximum capacity of pipe in cubic feet of gas per hour (based upon a pressure drop of 0.3 in. W.C. and 0.6 specific gravity gas)

Table 9: Propane (LP) Gas Pipe Sizing Chart¹

Length (ft)	Nominal Inches Iron Pipe Size			
	1/2 in.	3/4 in.	1 in.	1-1/4 in.
10	275	567	1071	2,205
20	189	393	732	1496
30	152	315	590	1212
40	129	267	504	1039
50	114	237	448	913
60	103	217	409	834
70	96	196	378	771
80	89	185	346	724
90	83	173	322	677
100	78	162	307	630

1. Maximum capacity of pipe in thousands of BTU per hour (based upon a pressure drop of 0.5 in. W.C.)

⚠ CAUTION

If flexible stainless steel tubing is allowed by the authority having jurisdiction, wrought iron or steel pipe must be installed at the gas valve and extend a minimum of two (2) inches outside of the unit casing.

⚠ WARNING

Natural gas may contain some propane. Propane is an excellent solvent and quickly dissolves white lead or most standard commercial compounds. Therefore, a special pipe thread sealant must be applied when wrought iron or steel pipe is used. Shellac base compounds such as gaskoloc or stalastic, and compounds such as Rectorseal # 5, Clyde's or John Crane may be used.

- All piping must be cleaned of dirt and scale by hammering on the outside of the pipe and blowing out the loose dirt and scale. Before initial start-up, ensure that all of the gas lines external to the unit have been purged of air.

- The gas supply must be a separate line and installed in accordance with all applicable safety codes. After the gas connections have been completed, open the main shut-off valve admitting normal gas pressure to the gas valve. Check all joints for leaks with soap solution or other material suitable for the purpose. NEVER USE AN OPEN FLAME.

- The furnace and its equipment shutoff valve must be disconnected from the gas supply system during any pressure testing of that system at test pressures in excess of 1/2 psi (3.48 kPa).
- The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve before conducting any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.48 kPa).

⚠ WARNING

FIRE OR EXPLOSION HAZARD
Failure to follow the safety warning exactly could result in serious injury, death, or property damage. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury, or loss of life.

HIGH ALTITUDE GAS CONVERSION

This furnace is constructed at the factory for natural gas-fired operation at altitudes up to 2,000 ft above sea level. For installations located above 2,000 ft, the gas input rate to the burners must be reduced by 4% per 1,000 ft above sea level. It may be necessary to change to smaller orifices at high altitude. See the following table for the correct orifice size to use.

Table 10: High Altitude Gas Orifice Sizing

Gas Type	Cabinet Size	Elevation Above Sea Level (ft)								
		0–2000 (Factory)	2001–3000	3001–4000	4001–5000	5001–6000	6001–7000	7001–8000	8001–9000	9001–10000
Natural Gas Orifice Sizes	B	36	37	38	38	39	40	41	41	42
	A	42	42	43	43	43	44	44	45	46
LP Gas Orifice Sizes	B	51	51	52	52	52	52	53	53	53
	A	54	54	55	55	55	55	55	56	56

FLUE VENT AND AIR INTAKE HOOD

The flue vent hood and air intake hoods are shipped loose. These hoods must be installed to ensure proper unit operation. The hoods must be fastened to the outside of the side gas control/electrical compartment with the screws provided. See Figure 8.

⚠ WARNING

Flue hood surfaces may be hot.

⚠ CAUTION

The flue exhaust hood must be properly installed and within the recommended clearances. Further communications and action must be given to the home or building owners to eliminate any unauthorized human contact around this area during the heating cycle. Flue hood surfaces and the immediate area reach high temperatures during the heating cycle.

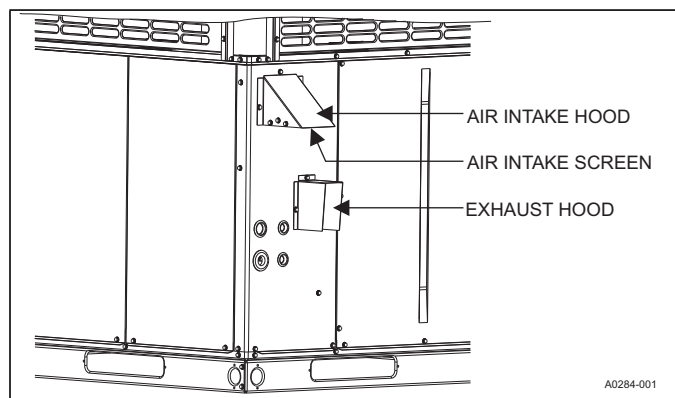


FIGURE 8: Flue Vent Outlet Air Hood

Table 11: Natural Gas Application Data - PHG4

Available on Models	Input (MBH) ¹ High Fire	Output (MBH) High Fire	Gas Rate ² Cubic Feet per Hour High Fire/Low Fire	Number of Burners	Temperature Rise °F at Full Input ³	
					Minimum	Maximum
2, 2-1/2 tons	50	41	46	2	40	70
3, 3-1/2, 4, 5 tons	65	53	60	2	40	70
2, 2-1/2 tons	75	61	70	3	40	70
3, 3-1/2, 4, 5 tons	100	81	93	3	40	70
4, 5 tons	125	101	116	4	40	70

1. Heating capacity valid for elevations up to 2000 ft above sea level. For elevations above 2,000 ft, rated capacity must be reduced by 4% for each 1,000 ft above sea level.
 2. Based on 1075 BTU/ft³.
 3. The airflow must be adequate to obtain a temperature rise within the range shown. Continuous return air temperature must not be below 55°F.

Table 12: Propane¹ (LP) Gas Application Data - PHG4

Available on Models	Input Capacity (MBH) ² High Fire/Low Fire	Output Capacity (MBH) High Fire/Low Fire	Gas Rate ³ Cubic Feet per Hour High Fire/Low Fire	Number of Burners	Temperature Rise °F at Full Input ⁴	
					Minimum	Maximum
2, 2-1/2 tons	50	41	20	2	40	70
3, 3-1/2, 4, 5 tons	65	53	26	2	40	70
2, 2-1/2 tons	75	61	30	3	40	70
3, 3-1/2, 4, 5 tons	100	81	40	3	40	70
4, 5 tons	125	101	50	4	40	70

1. Propane applications are accomplished by field installation of a Propane Conversion Accessory, Model 1NP0701 for 2 to 3.5 ton units and Model 1NP0702 for 4 ton and 5 ton units.
2. Heating capacity valid for elevations up to 2,000 ft above sea level. For elevations above 2,000 ft, rated capacity must be reduced by 4% for each 1,000 ft above sea level.
3. Based on 2500 BTU/ft³.
4. The airflow must be adequate to obtain a temperature rise within the range shown. Continuous return air temperature must not be below 55°F.

SECTION V: AIRFLOW PERFORMANCE

Table 13: Airflow Performance - Side Duct Application

Model	Motor Speed	External Static Pressure (in. W.C.)								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0
		SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
PHG4A24050	Low (1)	732	667	624	567	517	470	415	369	277
	Low/Medium (2)	818	771	723	674	628	579	530	482	386
	Medium (3)	823	774	721	676	631	583	533	505	448
	Medium/High (4)	994	948	906	865	823	778	739	700	622
	High (5)	1148	1108	1071	1035	996	960	925	901	853
PHG4A24075	Low (1)	887	847	802	750	705	664	613	563	463
	Low/Medium (2)	978	941	898	850	803	759	713	667	575
	Medium (3)	1171	1114	1074	1039	993	949	906	864	780
	Medium/High (4)	1349	1297	1265	1224	1185	1146	1107	1063	975
	High (5)	1487	1462	1392	1331	1318	1281	1241	1201	1121
PHG4A30050	Low (1)	700	657	599	554	512	461	411	365	273
	Low/Medium (2)	906	868	825	779	735	692	650	608	524
	Medium (3)	992	951	911	868	826	787	747	712	642
	Medium/High (4)	1075	1032	1000	958	918	874	837	800	726
	High (5)	1136	1089	1053	1018	978	941	903	869	801
PHG4A30075	Low (1)	1076	1020	984	943	903	859	819	779	699
	Low/Medium (2)	1102	1048	1010	974	934	890	850	810	730
	Medium (3)	1191	1140	1112	1076	1038	1000	958	919	841
	Medium/High (4)	1201	1225	1187	1151	1118	1080	1041	1002	924
	High (5)	1370	1329	1283	1271	1209	1176	1143	1109	1041
PHG4B36065	Low (1)	1225	1174	1131	1090	1046	993	941	888	782
	Low/Medium (2)	1259	1209	1166	1126	1084	1032	980	928	824
	Medium (3)	1314	1271	1229	1186	1144	1097	1049	998	896
	Medium/High (4)	1348	1306	1259	1222	1179	1133	1086	1036	936
	High (5)	1506	1471	1403	1389	1345	1305	1262	1216	1124
PHG4B36100	Low (1)	1342	1302	1260	1217	1178	1134	1082	1034	938
	Low/Medium (2)	1425	1368	1332	1293	1251	1208	1163	1113	1013
	Medium (3)	1554	1503	1465	1423	1386	1346	1302	1257	1167
	Medium/High (4)	1658	1599	1588	1530	1495	1454	1414	1373	1291
	High (5)	1743	1697	1650	1604	1557	1511	1463	1418	1328
PHG4B42065	Low (1)	1315	1266	1229	1194	1156	1117	1080	1036	948
	Low/Medium (2)	1436	1382	1342	1304	1262	1220	1179	1131	1035
	Medium (3)	1458	1406	1365	1327	1286	1244	1203	1155	1059
	Medium/High (4)	1573	1523	1484	1445	1408	1367	1327	1279	1183
	High (5)	1743	1697	1650	1604	1557	1511	1463	1418	1328
PHG4B42100	Low (1)	1436	1382	1342	1304	1262	1220	1179	1131	1035
	Low/Medium (2)	1544	1492	1455	1416	1376	1336	1294	1248	1156
	Medium (3)	1573	1523	1484	1445	1408	1367	1327	1279	1183
	Medium/High (4)	1681	1640	1599	1557	1517	1478	1436	1393	1307
	High (5)	1743	1697	1650	1604	1557	1511	1463	1418	1328

Continued on next page. See notes at end of table.

Table 13: Airflow Performance - Side Duct Application (Continued)

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
PHG4B48065	Low (1)	1046	1009	980	946	915	878	844	779	649
	Low/Medium (2)	1295	1250	1213	1172	1133	1087	1045	964	802
	Medium (3)	1620	1564	1517	1466	1418	1360	1308	1206	1002
	Medium/High (4)	1798	1722	1669	1620	1572	1527	1480	1413	1280
	High (5)	2146	2085	2025	1960	1872	1862	1798	1735	1609
PHG4B48100	Low (1)	1620	1564	1517	1466	1418	1360	1308	1206	1002
	Low/Medium (2)	1694	1630	1580	1530	1482	1430	1380	1292	1116
	Medium (3)	1798	1722	1669	1620	1572	1527	1480	1413	1280
	Medium/High (4)	1835	1758	1703	1653	1604	1558	1511	1442	1304
	High (5)	2146	2085	2025	1960	1872	1862	1798	1735	1609
PHG4B48125	Low (1)	1620	1564	1517	1466	1418	1360	1308	1206	1002
	Low/Medium (2)	1798	1722	1669	1620	1572	1527	1480	1413	1280
	Medium (3)	1922	1863	1804	1754	1724	1658	1612	1559	1453
	Medium/High (4)	2001	1952	1890	1839	1820	1742	1696	1651	1561
	High (5)	2146	2085	2025	1960	1872	1862	1798	1735	1609
PHG4B60065	Low (1)	1073	1043	1009	988	963	941	917	892	842
	Low/Medium (2)	1329	1292	1250	1223	1192	1165	1136	1105	1043
	Medium (3)	2054	1998	1934	1890	1843	1801	1757	1710	1616
	Medium/High (4)	2195	2144	2098	2049	2003	1955	1883	1868	1838
	High (5)	2445	2388	2306	2293	2235	2178	2129	2077	1973
PHG4B60100	Low (1)	1730	1682	1628	1592	1552	1517	1479	1439	1359
	Low/Medium (2)	1858	1807	1749	1710	1667	1629	1589	1546	1460
	Medium (3)	2054	1998	1934	1890	1843	1801	1757	1710	1616
	Medium/High (4)	2195	2144	2098	2049	2003	1955	1883	1868	1838
	High (5)	2445	2388	2306	2293	2235	2178	2129	2077	1973
PHG4B60125	Low (1)	2063	2008	1943	1899	1851	1809	1763	1717	1625
	Low/Medium (2)	2130	2084	2032	1983	1927	1951	1860	1815	1725
	Medium (3)	2195	2144	2098	2049	2003	1955	1883	1868	1838
	Medium/High (4)	2275	2252	2169	2154	2112	2065	1989	1976	1950
	High (5)	2445	2388	2306	2293	2235	2178	2129	2077	1973

1. Airflow tested with dry coil conditions, without air filters, at 230 V.
2. Applications above 0.8 in. W.C. external static pressure are not recommended.
3. Brushless DC high efficiency standard ECM blower motor used for all indoor blower assemblies
4. Minimal variations in airflow performance data result from operating at 208 V. Data above may be used in those cases.
5. Heating applications tested at 0.50 in. W.C. esp, and cooling applications tested at 0.30 in. W.C. esp per standards.

Table 14: Airflow Performance - Bottom 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
PHG4A24050	Low (1)	754	710	665	611	560	491	445	391	283
	Low/Medium (2)	867	815	773	720	677	622	559	505	397
	Medium (3)	951	908	868	828	781	735	686	631	521
	Medium/High (4)	1024	982	942	902	861	817	775	721	613
	High (5)	1204	1159	1121	1085	1051	1013	975	938	864
PHG4A24075	Low (1)	899	869	827	782	734	685	630	575	465
	Low/Medium (2)	1033	960	924	879	834	787	735	685	585
	Medium (3)	1186	1133	1095	1056	1016	975	935	891	803
	Medium/High (4)	1357	1322	1284	1248	1211	1174	1127	1087	1007
	High (5)	1480	1439	1404	1367	1369	1299	1264	1226	1150
PHG4A30050	Low (1)	726	676	622	575	520	467	410	376	308
	Low/Medium (2)	928	886	841	795	745	706	658	607	505
	Medium (3)	1021	983	942	900	855	811	770	729	647
	Medium/High (4)	1109	1071	1029	995	949	908	864	826	750
	High (5)	1170	1134	1096	1061	1020	978	938	899	821
PHG4A30075	Low (1)	1076	1042	1009	969	930	890	849	808	726
	Low/Medium (2)	1104	1063	1025	987	947	908	869	830	752
	Medium (3)	1205	1170	1136	1098	1060	1025	985	943	859
	Medium/High (4)	1285	1251	1213	1179	1141	1104	1065	1027	951
	High (5)	1406	1375	1341	1306	1271	1236	1198	1163	1093

Continued on next page. See notes at end of table.

Table 14: Airflow Performance - Bottom Duct Application (Continued)

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
PHG4B36065	Low (1)	1231	1186	1146	1103	1069	1030	977	912	781
	Low/Medium (2)	1270	1225	1189	1140	1098	1046	1008	960	866
	Medium (3)	1317	1286	1245	1198	1151	1110	1064	1024	943
	Medium/High (4)	1358	1317	1275	1238	1197	1148	1105	1057	961
	High (5)	1517	1475	1447	1400	1357	1318	1275	1232	1146
PHG4B36100	Low (1)	1340	1299	1264	1224	1182	1182	1097	1049	953
	Low/Medium (2)	1409	1368	1334	1291	1253	1201	1173	1128	1038
	Medium (3)	1527	1492	1470	1419	1385	1343	1299	1250	1152
	Medium/High (4)	1663	1585	1594	1601	1521	1480	1440	1400	1320
	High (5)	1711	1677	1643	1600	1560	1503	1466	1425	1343
PHG4B42065	Low (1)	1332	1295	1263	1222	1185	1148	1110	1063	967
	Low/Medium (2)	1457	1419	1376	1340	1299	1253	1215	1160	1051
	Medium (3)	1451	1412	1371	1339	1296	1257	1211	1165	1072
	Medium/High (4)	1568	1524	1491	1464	1425	1383	1345	1296	1200
	High (5)	1711	1677	1643	1600	1560	1503	1466	1425	1343
PHG4B42100	Low (1)	1455	1414	1379	1335	1294	1254	1212	1160	1056
	Low/Medium (2)	1566	1532	1492	1455	1416	1372	1333	1280	1174
	Medium (3)	1565	1530	1491	1458	1419	1381	1336	1290	1198
	Medium/High (4)	1675	1641	1606	1578	1535	1495	1455	1412	1326
	High (5)	1711	1677	1643	1600	1560	1503	1466	1425	1343
PHG4B48065	Low (1)	1032	999	970	938	910	879	843	808	737
	Low/Medium (2)	1272	1236	1204	1165	1129	1081	1037	968	829
	Medium (3)	1611	1574	1518	1494	1439	1405	1357	1266	1083
	Medium/High (4)	1892	1777	1771	1701	1639	1617	1565	1489	1336
	High (5)	2131	2058	1998	1949	1892	1840	1788	1728	1608
PHG4B48100	Low (1)	1598	1548	1502	1454	1410	1362	1307	1251	1139
	Low/Medium (2)	1663	1612	1568	1522	1476	1422	1370	1297	1152
	Medium (3)	1789	1733	1670	1650	1596	1578	1535	1483	1379
	Medium/High (4)	1931	1814	1808	1736	1673	1650	1597	1519	1362
	High (5)	2131	2058	1998	1949	1892	1840	1788	1728	1608
PHG4B48125	Low (1)	1598	1548	1502	1454	1410	1362	1307	1251	1139
	Low/Medium (2)	1766	1703	1656	1611	1566	1518	1469	1419	1319
	Medium (3)	1912	1875	1805	1787	1750	1713	1672	1636	1564
	Medium/High (4)	2105	2014	2006	1931	1898	1845	1793	1739	1631
	High (5)	2131	2058	1998	1949	1892	1840	1788	1728	1608
PHG4B60065	Low (1)	1026	999	989	950	907	907	886	862	816
	Low/Medium (2)	1263	1230	1192	1165	1167	1101	1099	1071	1015
	Medium (3)	1987	1933	1861	1817	1820	1715	1725	1651	1504
	Medium/High (4)	2114	2050	2047	1974	1899	1889	1920	1866	1758
	High (5)	2369	2308	2249	2183	2126	2088	2034	1990	1902
PHG4B60100	Low (1)	1655	1612	1596	1531	1461	1462	1429	1391	1316
	Low/Medium (2)	1766	1720	1667	1629	1632	1539	1537	1498	1421
	Medium (3)	1987	1933	1861	1817	1820	1715	1725	1651	1504
	Medium/High (4)	2114	2050	2047	1974	1899	1889	1920	1866	1758
	High (5)	2369	2308	2249	2183	2126	2088	2034	1990	1902
PHG4B60125	Low (1)	1973	1924	1905	1826	1743	1744	1703	1660	1574
	Low/Medium (2)	2024	1983	1937	1889	1886	1843	1799	1759	1679
	Medium (3)	2123	2075	2019	1970	1978	1862	1849	1804	1714
	Medium/High (4)	2191	2154	2117	2075	2002	1995	2028	1974	1866
	High (5)	2369	2308	2249	2183	2126	2088	2034	1990	1902

1. Airflow tested with dry coil conditions, without air filters, at 230 V.
2. Applications above 0.8 in. W.C. external static pressure are not recommended.
3. Brushless DC high efficiency standard ECM blower motor used for all indoor blower assemblies
4. Minimal variations in airflow performance data result from operating at 208 V. Data above may be used in those cases.
5. Heating applications tested at 0.50 in. W.C. esp, and cooling applications tested at 0.30 in. W.C. esp per standards.

Table 15: Additional Static Resistance

Size (Tons)	CFM	Wet Indoor Coil	Economizer ¹	Filter/Frame Kit
24 (2.0)	500	0.01	0.00	0.01
	600	0.01	0.00	0.02
	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
30 (2.5)	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
36 (3.0)	700	0.01	0.00	0.04
	800	0.02	0.01	0.06
	900	0.03	0.01	0.08
	1000	0.04	0.01	0.10
	1100	0.05	0.01	0.13
	1200	0.06	0.02	0.16
	1300	0.07	0.03	0.17
	1400	0.08	0.04	0.18
42 (3.5)	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
48 (4.0)	1100	0.02	0.02	0.04
	1200	0.03	0.02	0.04
	1300	0.04	0.02	0.05
	1400	0.05	0.03	0.05
	1500	0.06	0.04	0.06
	1600	0.07	0.04	0.07
	1700	0.07	0.04	0.08
	1800	0.08	0.04	0.09
	1900	0.09	0.05	0.10
2000	0.09	0.05	0.11	
60 (5.0)	1100	0.02	0.02	0.04
	1200	0.03	0.02	0.04
	1300	0.04	0.02	0.05
	1400	0.05	0.03	0.05
	1500	0.06	0.04	0.06
	1600	0.07	0.04	0.07
	1700	0.07	0.04	0.08
	1800	0.08	0.04	0.09
	1900	0.09	0.05	0.10
	2000	0.09	0.05	0.11

1. The pressure drop through the economizer is greater for 100% outdoor air than for 100% return air. If the resistance of the return air duct is less than 0.25 IWG, the unit delivers less CFM during full economizer operation.
2. Filter pressure drop based on standard filter media tested at velocities not to exceed 300 ft/min.

SECTION VI: OPERATION

The unit is controlled by a conventional heating/cooling thermostat. If an electronic thermostat is used, ensure it has a common connection. DO NOT use a power-stealing thermostat.

NOTICE

This unit REQUIRES the use of a thermostat to control fossil fuel (dual fuel) operation.

COOLING SEQUENCE OF OPERATIONS

When the thermostat calls for COOL, the thermostat terminals G, O, and Y are energized, which signals the reversing valve solenoid to switch to cooling mode and signals the compressor, outdoor fan, and indoor blower to run.

With a call for Y, the circulating fan is energized at cooling speed.

When the thermostat is satisfied, terminals G and Y are de-energized, de-energizing the compressor and outdoor fan. Most room thermostats keep the O terminal energized until they are switched from the COOL position to the OFF position.

After a cool fan off delay timing of 60 seconds, the circulating fan is de-energized.

Safety Controls

The control circuit includes the following safety controls:

- High Pressure Switch (HPS): This switch protects against excessive discharge pressures due to a blocked outdoor coil or an outdoor motor failure (opens at 650 ± 25 psig and closes at 450 ± 25 psig).
- Loss of Charge Switch (LCS): This switch protects against loss of charge due to a leak in the system.

The above pressure switches are specifically designed to operate with R-410A systems. R-22 pressure switches must not be used as replacements for the R-410A pressure switches.

WARNING

The ability to properly perform maintenance on this equipment requires certain expertise, mechanical skills, tools, and equipment. If you do not possess these, do not attempt to perform any maintenance other than those procedures recommended in this Installation Manual. Failure to heed this warning could result in serious injury and possible damage to this equipment.

CIRCULATING FAN

When the thermostat calls for FAN, the thermostat terminal G is energized, signaling the circulating fan to run at the G-Speed airflow.

If a call for COOL occurs (Y), the circulating fan switches to run at the Y-Speed airflow.

If a call for HEAT occurs (W), the circulating fan switches to W-Speed after a 30-second delay.

When the thermostat ends the call for FAN, the thermostat terminal G is de-energized, de-energizing the circulating fan.

HEATING SEQUENCE OF OPERATIONS

This dual fuel package unit has two stages of heat. Primary heating is performed by the heat pump section. Secondary heating, supplemental heating, and back up heating is performed by the gas heating section. The gas heating section is also used to temper the indoor discharge air during heat pump defrost operation. The system is not designed to run heat pump heating and gas heating at the same time. However, the unit functions this way if the incorrect indoor thermostat is used or if the incorrect indoor thermostat settings are selected. If the heat pump and gas heating sections are run at the same time, HI LIMIT trips may occur. A Y call without an O call from the indoor thermostat is primary (heat pump) heat. A W call from the indoor thermostat is secondary or emergency (gas) heat. The indoor thermostat must lock out the heat pump section on a call for supplemental heat or emergency heat.

HEAT PUMP HEATING SEQUENCE OF OPERATION

1. When the fan switch on the thermostat is in the ON position, the 24 V at G brings on the indoor blower motor at the GSPD. When the fan switch on the thermostat is in the AUTO position, the blower operates when there is a call for heating by the thermostat.
2. On a call for heating, the thermostat sends 24 V to Y on the defrost control board. After the anti-short cycle period is complete, the 24 V signal energizes contactor coil M and power is supplied to the compressor and outdoor fan motor. The reversing valve remains in the heating position. When the fan switch on the thermostat is in the AUTO position, the indoor blower is energized at the YSPD.
3. When the heating demand is satisfied, the M contactor is de-energized when the 24 V Y signal is removed. When the fan switch on the thermostat is in the ON position, the indoor blower continues to run. When the fan switch is in the AUTO position, the indoor blower motor ramps down after a 60-second delay.

DEFROST OPERATION

The demand defrost control implements a temperature differential (delta-T) demand defrost algorithm. The heat pump operates in heating mode until the combination of outdoor ambient and outdoor coil temperatures indicates that defrosting is necessary. When the coil temperature is below the initiate point for the ambient temperature continuously for 4-1/2 minutes, the heat pump is put into a defrost cycle. This 4-1/2 minute 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 minutes after the initiation of the previous defrost. After the 40-minute inhibit time has expired, temperature conditions must call for defrost continuously for 4-1/2 minutes 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 hours and 4 minutes of accumulated compressor run-time to recirculate lubricants, unless the coil temperature is above 40°F and the ambient temperature is above 50°F. All defrost timing occurs only while the compressor is on. Defrost curve selection maybe switched to pin 4 if a more aggressive defrost cycle is necessary.

During the defrost mode, the reversing valve is energized, the outdoor fan is de-energized, the compressor is energized, and the defrost control provides a 24 V signal from the W out terminal to energize gas heat.

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

Table 16: Demand Defrost Selection

Unit	Pin Position
024 — 060	2
024 — 060	4*

*For extreme environments as necessary only

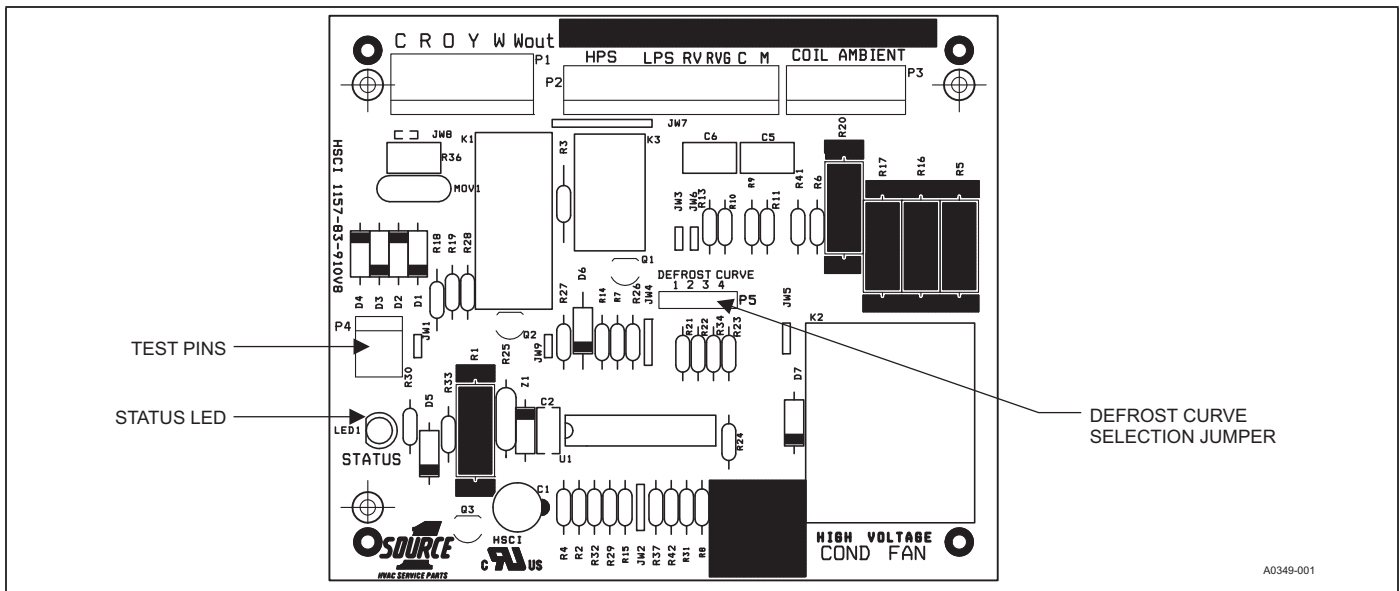


FIGURE 9: Demand Defrost Control

Heat Pump Safety Switch Operation

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

To reset the lockout function:

1. Remove power from the control's thermostat 1st stage (Y) input for longer than 2 seconds.
2. Remove power from R for more than 2 seconds.

3. Short the TEST pins together for more than 2 seconds while Y is energized.
4. Short the TEST pins together for more than 5 seconds while Y is de-energized.

Table 17: Test Pins

Test Pin Shorted	With Y Call	Without Y Call
Greater than 2 s	Bypass ASCD	Display error codes
Greater than 5 s	Forced defrost	Clear error codes

Table 18: Fault Codes

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

GAS HEATING SEQUENCE OF OPERATION

Pressure Switch Proving

The control board energizes the induced draft motor and waits for the pressure switch to close. When the pressure switch closes, the control begins the pre-purge period. If the call for heat is removed, the control de-energizes the inducer without post-purge and returns to standby.

If the pressure switch does not close within 5 seconds of the inducer energizing, the control board flashes 3 on the LED. If the pressure switch does not close within 60 seconds of the inducer energizing, the control shuts off the inducer for 60 seconds, then energizes the inducer for another 60 seconds in an attempt to close the pressure switch. This cycle continues indefinitely until the pressure switch is proved closed or the call for heat ends.

Pre-Purge

The control board monitors the pressure switch and ensures it remains closed during pre-purge. If the pressure switch opens, the control goes back to pressure switch proving mode. The control waits for a 15-second pre-purge period, then begins the ignition trial.

Ignition Trial Period

The control board energizes the gas valve and spark outputs for a 5-second ignition trial. The control de-energizes the spark when flame is sensed and enters a flame stabilization period.

If flame is not established within the ignition trial period, the control de-energizes the spark and gas valve and begins an inter-purge period before attempting another ignition trial.

If the call for heat is removed during an ignition trial period, the control immediately de-energizes spark and gas. The control runs the inducer motor through a post-purge period before de-energizing.

If the pressure switch opens during an ignition trial period, the control immediately de-energizes spark and gas. The control begins pressure switch proving before an inter-purge and reignition attempt.

Heat Blower On Delay

The control board waits for 30 seconds and then energizes the indoor blower heat speed. The blower on delay time begins at the start of the flame proving period in the trial for ignition.

If the thermostat demand for heat is removed, the control de-energizes the gas valve, energizes the blower on heat speed, and initiates a post-purge and heat blower off delay.

Main Burner Operation

The control board keeps the main gas valve and induced draft motor energized while continuously monitoring the call for heat, pressure switch, and flame status.

If the call for heat (W) is removed, the control de-energizes the gas valve and begins post purge and heat blower off delay.

If the pressure switch opens, the control de-energizes the gas valve and begins pressure switch proving mode.

If flame is removed, the control de-energizes the gas valve within 2.0 seconds and counts the flame loss. If flame has been lost less than 5 times, the control attempts re-ignition after a 15-second inter-purge period. If flame has been lost more than 5 times within the same call for heat, the control board locks out and flashes 8 on the LED.

Post Purge

The control board runs the induced draft motor for a 15-second post-purge period, and then de-energizes the inducer. If a call for heat occurs during the post-purge period, the control finishes the post purge, and immediately begins the next ignition sequence.

Heat Blower Off Delay

After a heating sequence, the control board de-energizes the indoor blower motor after a delay time as selected by a movable shunt (60, 90, 120, or 180 seconds). Blower off timing begins when the thermostat is satisfied and removes (W) the call for heat. The control returns to standby when the blower off delay is complete.

If the thermostat call for heat returns before the blower off delay is complete, the control begins an ignition sequence with pre-purge while the blower off delay continues.

Lockout

While in lockout, the control board keeps the main gas valve and induced draft motor de-energized.

Lockouts due to failed ignition or flame losses can be reset by removing the call for heat (W) for more than 1 second or removing power from the control for over 0.25 seconds. The control automatically resets lockout after 60 minutes.

Lockouts due to detected internal control faults reset after 60 minutes or power interruption. Cooling operations are available during a heating lockout.

High Temperature Limit Switch

Any time the high temperature limit switch is open for less than 5 minutes, the control board runs the indoor blower motor on heat speed, runs the inducer, de-energizes the gas valve, and flashes 4 on the LED. When the high temperature switch closes, the control restarts the ignition sequence, beginning with pre-purge.

If the limit switch has been open for more than 5 minutes, the control de-energizes the inducer, continues to operate the indoor blower motor on heat speed, and flashes 11 on the LED.

Rollout Switch

If the limit circuit is open for more than 15 minutes, the control board flashes 5 on the LED. The blower output is energized during an open rollout condition.

If the rollout switch is reset, the control remains locked out until power is removed or a call for heat (W) is removed.

Rollout switch lockout does not reset automatically.

Power Interruptions

Power interruptions of any duration do not cause lockout or any operation requiring manual intervention.

Flame Present with Gas Off

If flame is sensed for longer than 4.0 seconds during a period when the gas valve should be closed, the control enters lockout and flashes 1 on the LED. The control energizes the inducer blower while the flame is sensed.

GAS VALVE FAULT

If the main valve output is sensed to be energized for more than 1 second when commanded to be off, the control de-energizes the induced draft motor (if flame is not present) to attempt to open the pressure switch to de-energize the gas valve. If the main gas valve is still sensed as energized after the inducer has been off for 10 seconds, the control re-energizes the inducer to vent the unburned gas. The control enters a hard lockout and flashes 10 on the LED.

The only way to recover from a hard lockout is to remove and reapply 24 VAC power to the control board.

Safety Controls

The control circuit includes the following safety controls:

- **Limit Switch (LS)** - This control is located inside the blower compartment and protrudes into the heat exchanger compartment. The limit switch is set to open at a temperature selected to prevent the outlet air temperature from exceeding the maximum shown on the unit rating plate. It resets automatically. The limit switch operates when a high temperature condition occurs. The limit switch shuts down the ignition control, closes the main gas valve, and energizes the blower.
- **Pressure Switch (PS)** - If the draft motor fails, the pressure switch prevents the ignition control and gas valve from being energized.
- **Flame Sensor** - The flame sensor is located on the left-most burner. If an ignition control fails to detect a signal from the flame sensor indicating that the flame is properly ignited, the main gas valve closes.
- **Rollout Switch (RS)** - This switch is located on the burner assembly. In the event of a sustained main burner flame rollout, the control closes the main gas valve. This switch is reset manually.

NOTICE

You must manually reset the rollout switch to operate the furnace.

GAS HEATING FAULT CODES

The gas heating section has built-in self-diagnostic capability. A blinking LED light on the control board can flash red, green, or amber to indicate various conditions. The control continuously monitors its own operation and the operation of the system. If a fault occurs, the LED light indicates the fault code.

The slow flash speed is 2 seconds on and 2 seconds off. The other flash codes listed below have the following timing: the LED light turns on for 1/3 second and off for 1/3 second. This pattern is repeated the number of times equal to the code. There is a two-second pause between codes. For example, the 6 Red Flashes fault code means the LED light flashes on and off six times and then remains off for 2 seconds. This pattern repeats as long as the fault condition remains. The continuous flash codes listed below mean the LED light flashes on and off continuously with no breaks or longer pauses.

Slow Green Flash: Indicates normal operation with no thermostat calls. Standby mode

Slow Amber Flash: Indicates normal operation with a call for heat

LED Steady Off: If the LED light does not flash at all, check for power to the control board and check for an open fuse on the control board. If the control board is properly powered and the fuse is not open, the control board may need to be replaced.

Steady On Any Color: Indicates a possible control failure. Turn the power to the furnace off and back on. If the fault code recurs, the control board must be replaced. The control board is not field-repairable.

Rapid Amber Flash: Indicates the flame sense current is below 1.5 VDC. Check and clean the flame sensor. Check for proper gas flow. Verify that the current is greater than 1.5 VDC at the flame current test pad.

4 Amber Flashes: Indicates the control is receiving a Y signal from the thermostat without a G signal. The furnace operates normally during heating and cooling, but this fault code is displayed to alert the user that there is a wiring problem. Verify that the G wire from the thermostat is connected properly.

1 Red Flash: Indicates flame was sensed when there was no call for heat. The control turns on both the inducer motor and supply air blower. Check for a leaking or slow-closing gas valve.

2 Red Flashes: Indicates the pressure switch is closed when it should be open. The control confirms the pressure switch contacts are open at the beginning of each heat cycle. The control prevents the ignition sequence from continuing if the pressure switch contacts are closed when they should be open. Check for a faulty pressure switch or miswiring.

3 Red Flashes: Indicates the pressure switch contacts are open when they should be closed. Check for the following:

- Faulty inducer
- Blocked vent
- Broken pressure switch hose
- Disconnected pressure switch or inducer wires
- Faulty pressure switch

4 Red Flashes: Indicates the main limit or rollout switch has opened its contacts, which are normally closed. The control turns on the supply air blower and inducer. Check for the following:

- Dirty filter
- Improperly sized duct system
- Incorrect blower speed setting
- Incorrect firing rate
- Loose limit switch or rollout switch wiring
- Faulty blower motor

If the limit switch does not close within 5 minutes, the control operates as if the blower is not functioning. The control starts a hard lockout and flashes the 11 Red Flashes fault code. If the limit switch does not close after 15 minutes, the control operates as if a manual-reset rollout switch has opened, and flashes the 5 Red Flashes fault code. See the 5 Red Flashes and 11 Red Flashes descriptions below. If the main limit switch opens five times within a single call for heat, the control flashes the 4 Red Flashes fault code and enters a one-hour soft lockout.

5 Red Flashes: Indicates the limit circuit has been open for more than 15 minutes, usually meaning that a manual-reset rollout switch has opened. Check for proper combustion air, proper inducer operation, primary heat exchanger failure, or a burner problem. The control enters a hard lockout. After the problem is corrected, you must turn the power off and back on to reset the control.

6 Red Flashes: Indicates that while the unit was operating, the pressure switch opened four times during the call for heat. Check for a faulty inducer, blocked vent, or faulty pressure switch. The furnace locks out for 1 hour and then restarts.

7 Red Flashes: Indicates the flame could not be established during three attempts for ignition. Check that the gas valve switch is in the On position. Check for the following:

- Low gas pressure or no gas pressure
- Faulty gas valve
- Dirty or faulty flame sensor
- Faulty hot surface ignitor
- Loose wires
- Burner problem

The furnace locks out for 1 hour and then restarts.

8 Red Flashes: Indicates the flame has been lost five times (four recycles) during the heating cycle. Check for low gas pressure, a dirty or faulty flame sensor, or a faulty gas valve. The furnace locks out for 1 hour and then restarts.

9 Red Flashes: Indicates reversed line voltage polarity, a grounding problem, or reversed low voltage transformer wires. Check the polarity at the furnace and branch. Check the furnace grounding. Check that the flame probe is not shorted to chassis. The furnace does not start the ignition sequence until this problem is corrected.

10 Red Flashes: Indicates the gas valve is energized with no call for heat. The main blower and inducer blower run and no ignition sequence starts as long as this condition exists. Check the gas valve and gas valve wiring.

11 Red Flashes: Indicates the limit circuit has remained open for more than 5 minutes and less than 15 minutes. This condition is usually caused by a failed blower motor or blower wheel. The control enters a hard lockout. After the problem is corrected, you must turn the power off and back on to reset the control.

Soft Lockout: The control includes a soft lockout that resets automatically after 1 hour. This provides protection for an unoccupied structure if a temporary condition causes a furnace malfunction, for example, if a temporary interruption in gas supply prevents the furnace from lighting. In this case, the control keeps trying to light each hour and resumes normal operation if the gas supply is restored.

Hard Lockout: Some fault conditions cause a hard lockout, and you must turn the power to the control off and back on to reset the control. The control does not automatically restart.

START-UP

Prestart Checklist

Complete the following checks before starting the unit:

- Check the type of gas being supplied. Ensure that it is the same as that listed on the unit nameplate.
- Make sure that the vent outlet air hood and air intake hood have been properly installed.

Operating Instructions

Before you begin, read the information on the unit safety label.

1. Set the thermostat to the OFF position.
2. Turn off all electrical power to the unit.

WARNING

DO NOT try to light the burners by hand. This unit is equipped with an ignition device that automatically lights the burners.

3. Remove the access panel.
4. Turn the gas valve switch to the OFF position.
5. Wait five minutes to clear out any gas. If you then smell gas, STOP! Follow B in the information on the unit safety label. If you don't smell gas, go to the next step.
6. Turn the gas valve switch to the ON position.
7. Replace the control access panel.
8. Turn on all electrical power to the unit.
9. Set the thermostat to the required setting.
10. If the unit does not operate, follow the instructions in the Turning Off Gas to Unit section and call your service technician or gas supplier.

Turning Off Gas to Unit

1. Set the thermostat to the OFF position.
2. Turn off all electrical power to the unit if service is to be performed.
3. Remove the control access panel.
4. Turn the gas valve switch to the OFF position. DO NOT FORCE.
5. Replace the control access panel.

Post Start Checklist

After the entire control circuit has been energized and the heating section is operating, make the following checks:

- Check for gas leaks in the unit piping as well as the supply piping.
- Check for correct manifold gas pressures. See the CHECKING GAS HEAT INPUT section.
- Check the supply gas pressure. It must be within the limits shown on the rating nameplate. Supply pressure must be checked with all gas appliances in the building at full fire. At no time must the standby gas line pressure exceed 13.5 in., nor the operating pressure drop below 4.5 in. for natural gas units. If gas pressure is outside these limits, contact the local gas utility for corrective action.

MANIFOLD GAS PRESSURE ADJUSTMENT

Small adjustments to the gas flow may be made by turning the pressure regulator adjusting screw on the automatic gas valve. See Figure 10.

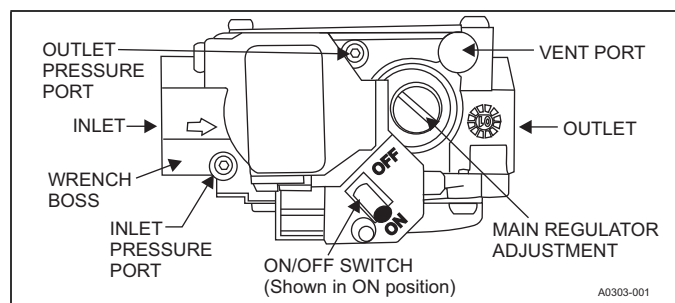


FIGURE 10: Gas Valve

Adjust as follows:

1. Remove the cap from the valve body. See Figure 10 for location.
2. To decrease the gas pressure, turn the adjusting screw counter-clockwise.
3. To increase the gas pressure, turn the adjusting screw clockwise.

NOTICE

*The correct manifold pressure for natural gas furnaces is 3.5 IWG.
The correct manifold pressure for propane (LP) is 10.0 IWG.*

AIRFLOW SETTINGS

Cooling Airflow Settings

This unit is equipped with a five-speed blower motor. Select the required cooling airflow by connecting the required motor speed tap wire to the yellow Cool speed wire coming from the control board. Select the speed to deliver approximately 350 CFM to 400 CFM per ton of A/C cooling capacity. Use of airflow outside of this range may cause diminished air conditioning performance, lower overall energy efficiency, and higher electric utility bills. See Table 19 for default cooling blower settings.

Table 19: Default Blower Speeds

Model Number	Default Blower Speeds		
	Heat (White Wire)	Cool (Yellow Wire)	Continuous Fan (Red Wire)
PHG4A24075	Medium (3)	High (5)	Low (1)
PHG4A30075	Medium Low (2)	High (5)	Low (1)
PHG4A36100	Medium (3)	High (5)	Low (1)
PHG4A42065	Medium Low (2)	High (5)	Low (1)
PHG4A42100	Medium (3)	High (5)	Low (1)
PHG4B48100	Medium Low (2)	High (5)	Low (1)
PHG4B48125	Medium Low (2)	High (5)	Low (1)
PHG4B60125	Medium Low (2)	High (5)	Low (1)

Continuous Fan Airflow Settings

The default blower speed for continuous fan operation is Low speed. To operate the furnace in continuous fan mode, set the wall thermostat Fan switch to On. To select the required continuous fan airflow, connect the required motor speed tap wire to the red Fan Speed wire coming from the control board.

The default position is with the red (Low) blower speed wire connected to the red Fan Speed wire coming from the control board. In certain circumstances, it may be necessary to move the continuous fan speed to a different speed tap. However, this is not best practice because it causes higher electrical energy usage and higher electric utility bills.

Gas Heating Airflow Settings

See Table 19 for the default heating blower speed. The unit is equipped with a five-speed blower motor. See Table 19 for the default heating blower speed for each model.

In certain circumstances, it may be necessary to move the heating blower speed to a different motor speed tap. Not all of the five motor speeds are appropriate for gas heating operation. The use of heating airflow at a speed other than the default speed causes diminished heating performance and may cause the furnace temperature limit controls to shut down the furnace.

Adjustment of Temperature Rise

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts approximately 6 ft from the furnace, where they are not affected by radiant heat.

The temperature rise (or temperature difference between the return air and the heated air from the furnace) must lie within the range shown on the rating plate and the data in Table 7.

After the temperature rise has been determined, calculate the CFM as follows:

$$\text{Degrees F Temp Rise} = \frac{\text{BTUH Output}}{1.08 \times \text{CFM}}$$

OR

$$\text{CFM} = \frac{\text{BTUH Output}}{1.08 \times \text{Degrees F Temp Rise}}$$

DIRECT DRIVE BLOWER

All units have direct drive, multi speed standard ECM blower motors.

EXTERNAL STATIC PRESSURE SETUP

To measure external static pressure:

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

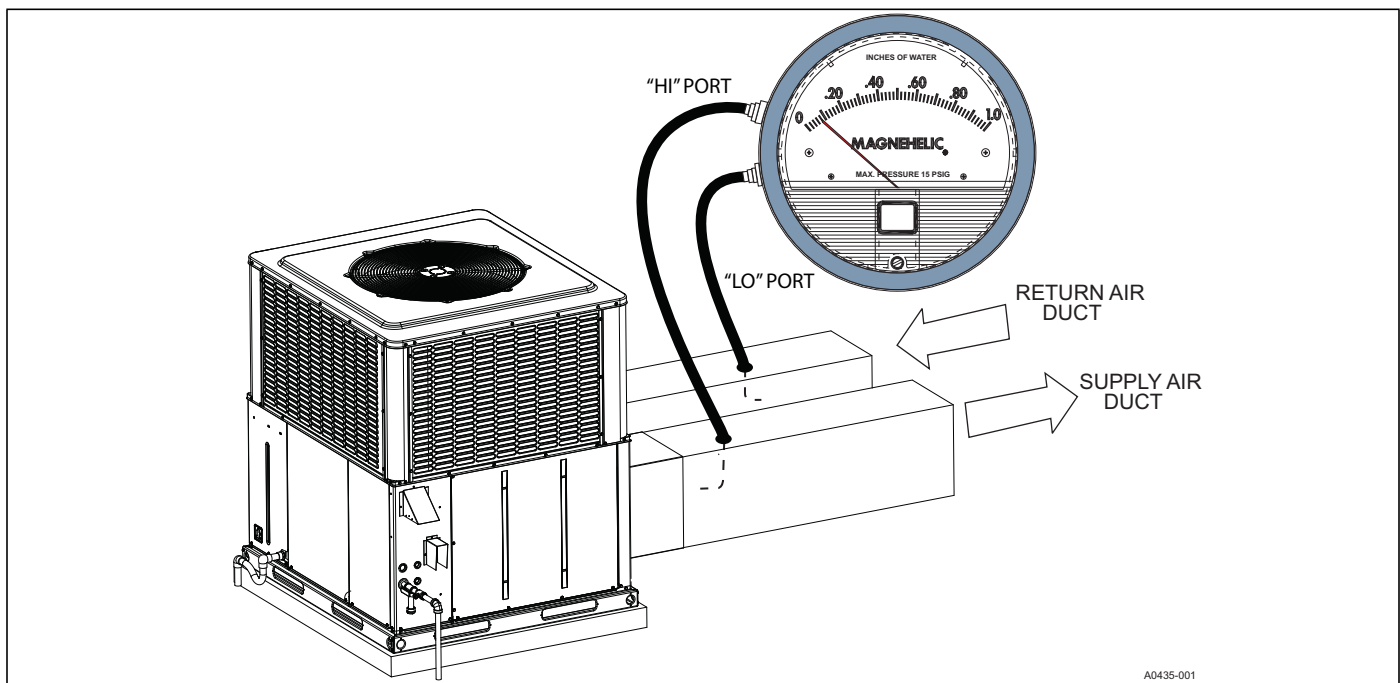


FIGURE 11: Measuring External Static Pressure

CHECKING GAS HEAT INPUT

Natural Gas

1. Turn off all other gas appliances connected to the gas meter.
2. With the furnace turned on, measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter usually has a 1/2 cubic foot or 1 cubic foot test dial.
3. Using the number of seconds for each revolution and the size of the test dial increment, find the cubic feet of gas consumed per hour in Table 20.

If the actual input is not within 5% of the furnace rating, with allowance being made for the permissible range of the regulator setting, replace the orifice spuds with spuds of the proper size.

NOTICE

To find the BTU input, multiply the number of cubic feet of gas consumed per hour by the BTU content of the gas in your particular locality. Contact your gas company for this information since it varies widely from city to city.

Table 20: Gas Rate Cubic Feet Per Hour¹

Seconds for One Revolution	Size of Test Dial	
	1/2 Cubic Foot	1 Cubic Foot
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129
30	60	120
32	56	113
34	53	106
36	50	100
38	47	95
40	45	90
42	43	86
44	41	82
46	39	78
48	37	75
50	36	72
52	35	69
54	34	67
56	32	64
58	31	62
60	30	60

1. **EXAMPLE:** By actual measurement, it takes 38 seconds for the hand on the 1-cubic foot dial to make a revolution with just a 100,000 BTUH furnace running. Using this information, locate 38 seconds in the first column of Table 20. Read across to the 1 Cubic Foot column, where you see that 95 cubic feet of gas per hour are consumed by the furnace at that rate. Multiply 95 x 1050 (or the BTU rating of the gas obtained from the local gas company). The result is 99,750 BTUH, which is close to the 100,000 BTUH rating of the furnace.

SECTION VII: TYPICAL WIRING DIAGRAMS

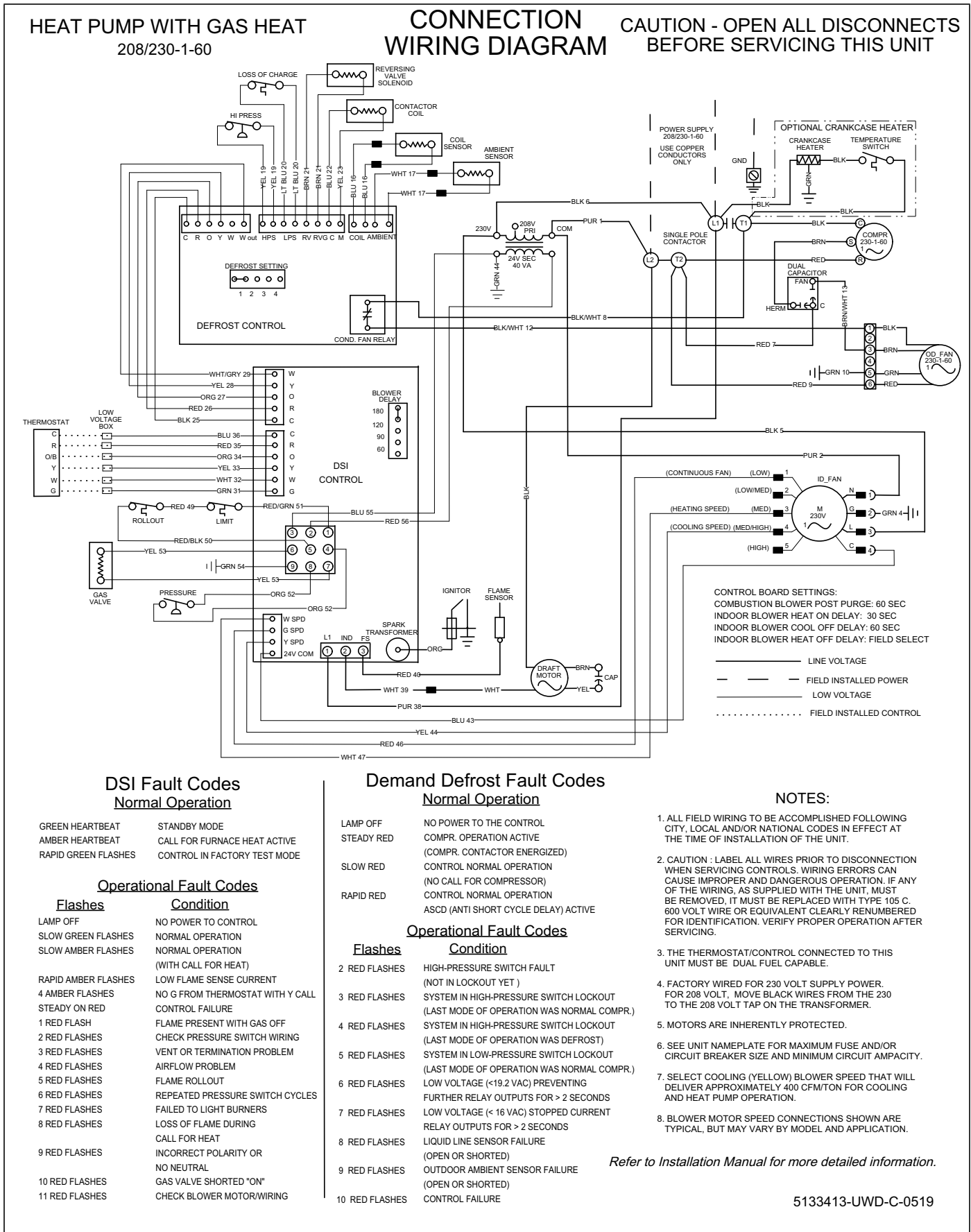


FIGURE 12: Connection Wiring Diagram

HEAT PUMP WITH GAS HEAT
208/230-1-60

LADDER WIRING DIAGRAM

CAUTION - OPEN ALL DISCONNECTS BEFORE SERVICING THIS UNIT

DSI Fault Codes
Normal Operation

GREEN HEARTBEAT	STANDBY MODE
AMBER HEARTBEAT	CALL FOR FURNACE HEAT ACTIVE
RAPID GREEN FLASHES	CONTROL IN FACTORY TEST MODE

Operational Fault Codes

Flashes	Condition
LAMP OFF	NO POWER TO CONTROL
SLOW GREEN FLASHES	NORMAL OPERATION
SLOW AMBER FLASHES	NORMAL OPERATION (WITH CALL FOR HEAT)
RAPID AMBER FLASHES	LOW FLAME SENSE CURRENT
4 AMBER FLASHES	NO G FROM THERMOSTAT WITH Y CALL
STEADY ON RED	CONTROL FAILURE
1 RED FLASH	FLAME PRESENT WITH GAS OFF
2 RED FLASHES	CHECK PRESSURE SWITCH WIRING
3 RED FLASHES	VENT OR TERMINATION PROBLEM
4 RED FLASHES	AIRFLOW PROBLEM
5 RED FLASHES	FLAME ROLLOUT
6 RED FLASHES	REPEATED PRESSURE SWITCH CYCLES
7 RED FLASHES	FAILED TO LIGHT BURNERS
8 RED FLASHES	LOSS OF FLAME DURING CALL FOR HEAT
9 RED FLASHES	INCORRECT POLARITY OR NO NEUTRAL
10 RED FLASHES	GAS VALVE SHORTED "ON"
11 RED FLASHES	CHECK BLOWER MOTOR WIRING

Demand Defrost Fault Codes
Normal Operation

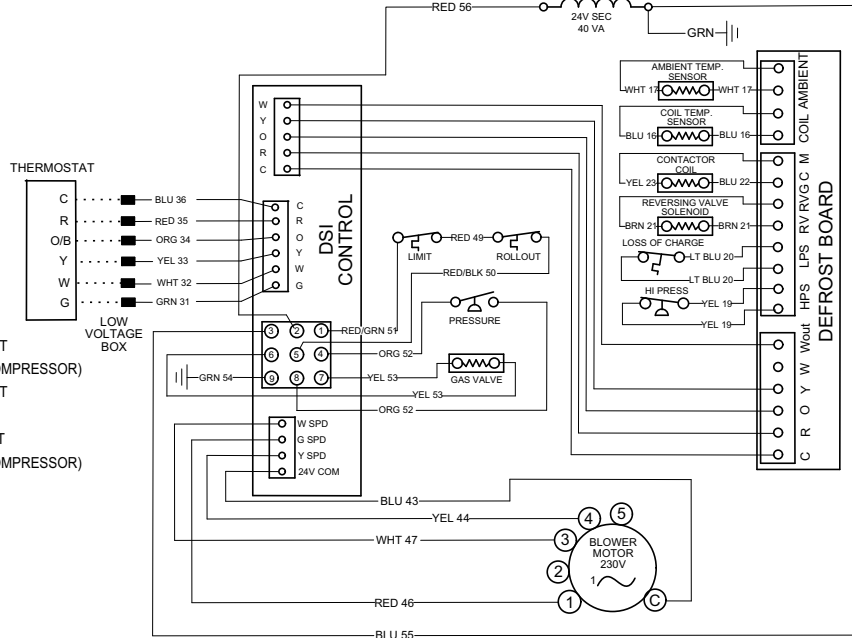
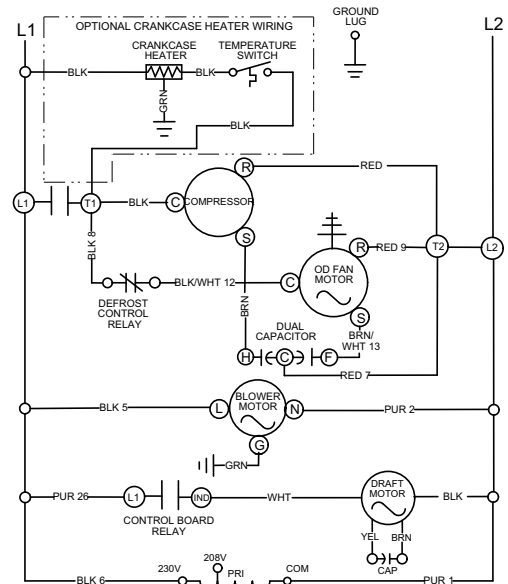
LAMP OFF	NO POWER TO THE CONTROL
STEADY RED	COMPR. OPERATION ACTIVE (COMPR. CONTACTOR ENERGIZED)
SLOW RED	CONTROL NORMAL OPERATION (NO CALL FOR COMPRESSOR)
RAPID RED	CONTROL NORMAL OPERATION ASCD (ANTI SHORT CYCLE DELAY) ACTIVE

Operational Fault Codes

Flashes	Condition
2 RED FLASHES	HIGH-PRESSURE SWITCH FAULT (NOT IN LOCKOUT YET)
3 RED FLASHES	SYSTEM IN HIGH-PRESSURE SWITCH LOCKOUT (LAST MODE OF OPERATION WAS NORMAL COMPRESSOR)
4 RED FLASHES	SYSTEM IN HIGH-PRESSURE SWITCH LOCKOUT (LAST MODE OF OPERATION WAS DEFROST)
5 RED FLASHES	SYSTEM IN LOW-PRESSURE SWITCH LOCKOUT (LAST MODE OF OPERATION WAS NORMAL COMPRESSOR)
6 RED FLASHES	LOW VOLTAGE (<19.2 VAC) PREVENTING FURTHER RELAY OUTPUTS FOR > 2 SECONDS
7 RED FLASHES	LOW VOLTAGE (< 16 VAC) STOPPED CURRENT RELAY OUTPUTS FOR > 2 SECONDS
8 RED FLASHES	LIQUID LINE SENSOR FAILURE (OPEN OR SHORTED)
9 RED FLASHES	OUTDOOR AMBIENT SENSOR FAILURE (OPEN OR SHORTED)
10 RED FLASHES	CONTROL FAILURE

Refer to Installation Manual for more detailed information.

- ALL FIELD WIRING TO BE ACCOMPLISHED FOLLOWING CITY, LOCAL AND/OR NATIONAL CODES IN EFFECT AT THE TIME OF INSTALLATION OF THE UNIT.
- 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.
- THE THERMOSTAT/CONTROL CONNECTED TO THIS UNIT MUST BE DUAL FUEL CAPABLE.



NOTES:

- FACTORY WIRED FOR 230 VOLT SUPPLY POWER. FOR 208 VOLT, MOVE BLACK WIRES FROM THE 230 TO THE 208 VOLT TAP ON THE TRANSFORMER.
- MOTORS ARE INHERENTLY PROTECTED.
- SEE UNIT NAMEPLATE FOR MAXIMUM FUSE AND/OR CIRCUIT BREAKER SIZE AND MINIMUM CIRCUIT AMPACITY.
- SELECT COOLING (YELLOW) BLOWER SPEED THAT WILL DELIVER APPROXIMATELY 400 CFM/TON FOR COOLING AND HEAT PUMP OPERATION.
- BLOWER MOTOR SPEED CONNECTIONS SHOWN ARE TYPICAL, BUT MAY VARY BY MODEL AND APPLICATION.

5133413-UWD-C-0519

FIGURE 13: Ladder Wiring Diagram

R-410A QUICK REFERENCE GUIDE

Refer to Installation Instructions for specific installation requirements

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

FIGURE 14: R-410A Quick Reference Guide

SECTION VIII: START UP SHEET

Residential Package Dual Fuel Start-Up Sheet
Proper start-up is critical to customer comfort and equipment longevity

Start-Up Date <input style="width:80%;" type="text"/>	Company Name <input style="width:80%;" type="text"/>	Start-Up Technician <input style="width:80%;" type="text"/>
---	--	---

Owner Information

Name <input style="width:80%;" type="text"/>	Address <input style="width:80%;" type="text"/>	Daytime Phone <input style="width:80%;" type="text"/>
City <input style="width:80%;" type="text"/>	State or Province <input style="width:80%;" type="text"/>	Zip or Postal Code <input style="width:80%;" type="text"/>

Equipment Data

Unit Model # <input style="width:80%;" type="text"/>	Unit Serial # <input style="width:80%;" type="text"/>
--	---

General Information (Check all that apply)

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

Unit Location and Connections (Check all that apply)

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

Filters

<input type="checkbox"/> Filters installed	Number of filters <input style="width:40px;" type="text"/>	Filter size <input style="width:40px;" type="text"/>	<input type="radio"/> Filter located inside	<input type="radio"/> Filter located outside
--	--	--	---	--

Additional Kits & Accessories Installed (Check all that apply)

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

Electrical Connections & Inspection (Check all that apply)

<input type="radio"/> Single phase	<input type="radio"/> Three phase	<input type="radio"/> 208 volts AC	<input type="radio"/> 230 volt AC	<input type="radio"/> 460 volts AC	<input type="radio"/> 575 volts AC
<input type="checkbox"/> Inspect wires and electrical connections		<input type="checkbox"/> Transformer wired properly for primary supply voltage		<input type="checkbox"/> Ground connected	
<input type="checkbox"/> Low voltage present at control board "R & C"			Measured voltage "R" and "C" outdoor unit control board <input style="width:60px;" type="text"/>		
<input type="checkbox"/> Line voltage present at disconnect		Measured voltage "L1 to L2" <input style="width:60px;" type="text"/>	"L2 to L3" <input style="width:60px;" type="text"/>	"L1 to L3" <input style="width:60px;" type="text"/>	
Compressor amperes "L1" <input style="width:40px;" type="text"/>	"L2" <input style="width:40px;" type="text"/>	"L3" <input style="width:40px;" type="text"/>	Total amperes "L1" <input style="width:40px;" type="text"/>	"L2" <input style="width:40px;" type="text"/>	"L3" <input style="width:40px;" type="text"/>
<input type="radio"/> Single stage compressor		<input type="radio"/> Two stage compressor			

Air Flow Setup / Cooling

Blower Type & Set-Up	<input type="radio"/> ECM	COOL	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
		ADJUST	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
		DELAY	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
	<input type="radio"/> Standard ECM	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
	<input type="radio"/> PSC	<input type="radio"/> Low	<input type="radio"/> Medium Low	<input type="radio"/> Medium	<input type="radio"/> Medium High	<input type="radio"/> High
Supply static (inches of water column) <input style="width:40px;" type="text"/>	Supply air dry bulb temperature <input style="width:40px;" type="text"/>	Outside air dry bulb temperature <input style="width:40px;" type="text"/>				
Return static (inches of water column) <input style="width:40px;" type="text"/>	Return air dry bulb temperature <input style="width:40px;" type="text"/>	Return air wet bulb temperature <input style="width:40px;" type="text"/>				
Total external static pressure <input style="width:40px;" type="text"/>	Temperature drop <input style="width:40px;" type="text"/>	Supply air wet bulb temperature <input style="width:40px;" type="text"/>				

Refrigerant Charge and Metering Device

<input type="radio"/> R-410A <input type="radio"/> R-22	Data plate - lbs / Oz <input type="text"/>	Suction line temperature <input type="text"/>	Discharge pressure <input type="text"/>
<input type="radio"/> TXV <input type="radio"/> Fixed Orifice	Discharge line temperature <input type="text"/>	Suction pressure <input type="text"/>	Liquid line temperature <input type="text"/>
TXV# / Orifice size <input type="text"/>		Superheat <input type="text"/>	Subcooling <input type="text"/>

YorkGuard VI Defrost Control Board

Fill in the information ie.. "ON", "OFF", "YES", "NO", or the appropriate "Value" for the selected pin settings

Part Number <input type="text"/>	Version Number (located on the Chip on the Defrost Board) <input type="text"/>			
Low Temp Cut Out <input type="text"/>	Balance Point <input type="text"/>	Defrost Curve <input type="text"/>	Y2 Lock <input type="text"/>	FFUEL <input type="text"/>
Switch Point <input type="text"/>	Hot Heat Pump <input type="text"/>	Bonnet Sensor Present <input type="text"/>	Compressor Delay <input type="text"/>	

Supplementary Heating Indoor Blower Set-Up	<input type="radio"/> ECM HEAT <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D		
	<input type="radio"/> Standard ECM <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5		
	<input type="radio"/> PSC <input type="radio"/> Low <input type="radio"/> Medium Low <input type="radio"/> Medium <input type="radio"/> Medium High <input type="radio"/> High		
<input type="radio"/> Single Stage <input type="radio"/> Two Stage <input type="radio"/> Natural Gas <input type="radio"/> Propane LP (Requires LP Conversion Kit)			
LP Gas Conversion Kit # <input type="text"/>	LP Conversion Kit Installed By <input type="text"/>	Inlet Gas Pressure (w.c.) <input type="text"/>	
Manifold Pressure at 100% Firing Rate (w.c.) <input type="text"/>	Measured BTU/H (Clock Gas Meter Nat Gas) <input type="text"/>	Rated BTU/H <input type="text"/>	
Manifold Pressure / Low Fire Rate (w.c.) <input type="text"/>	Return Air Dry Bulb Temp <input type="text"/>	Supply Air Dry Bulb Temp <input type="text"/>	Temp Rise <input type="text"/>
<input type="checkbox"/> Burner Flame Inspection - Blue flames extending directly into the primary heat exchanger cells			

Clean Up Job Site

<input type="checkbox"/> Job site has been cleaned, indoor and outdoor debris removed from job site
<input type="checkbox"/> Tools have been removed from unit
<input type="checkbox"/> All panels have been installed

Unit Operation and Cycle Test

<input type="checkbox"/> Operate the unit through continuous fan cycles from the thermostat, noting and correcting any problems
<input type="checkbox"/> Operate the unit through cooling cycles from the thermostat, noting and correcting any problems

Owner Education

<input type="checkbox"/> Provide owner with the owner's manual
<input type="checkbox"/> Explain operation of system to equipment owner
<input type="checkbox"/> Explain thermostat use and programming (if applicable) to owner
<input type="checkbox"/> Explain the importance of regular filter replacement and equipment maintenance

Comments and Additional Job Details