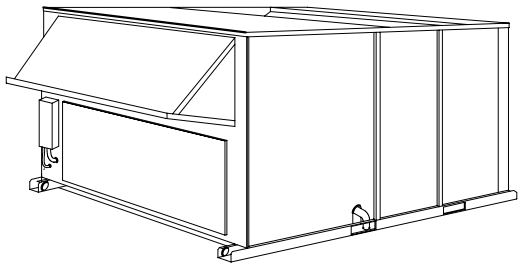
Installation Instructions

PGH Series – 3 Phase
12 to 15 Ton



PACKAGED ROOFTOP GAS HEATING/ELECTRIC COOLING UNITS

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CONTENTS

SAFETY CONSIDERATIONS

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

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

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

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

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

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

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

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

⚠ WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK HAZARD

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

1. Improper installation, adjustment, alteration, service, or maintenance can cause property damage, personal injury, or loss of life. Refer to the User's Information Manual provided with this unit for more details.
2. 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, or 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.

⚠ WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could cause death and/or property damage.

Disconnect gas piping from unit when leak testing at pressure greater than 0.5 psig. Pressures greater than 0.5 psig will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig, it *must* be replaced before use. When pressure testing field-supplied gas piping at pressures of 0.5 psig or less, a unit connected to such piping must be isolated by manually closing the gas valve(s).

INSTALLATION

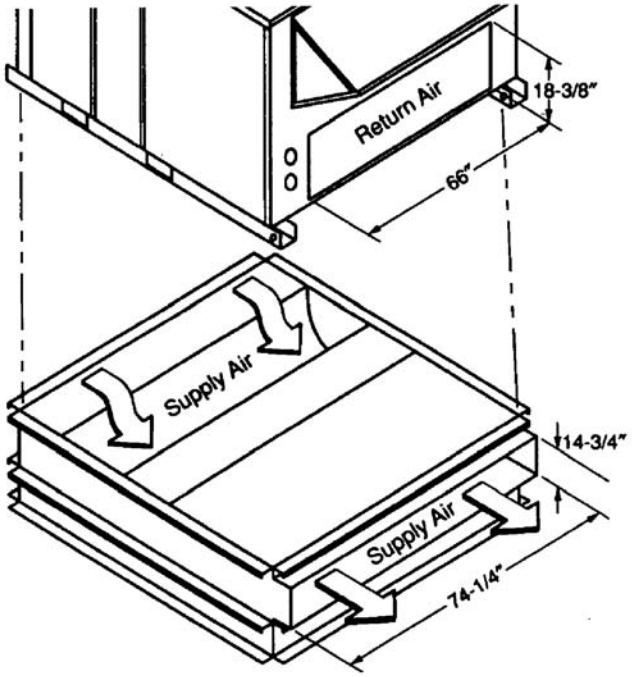
IMPORTANT: Units have high ambient operating limits. If limits are exceeded, the unit will automatically lock the compressor out of operation. Manual reset will be required to restart the compressor.

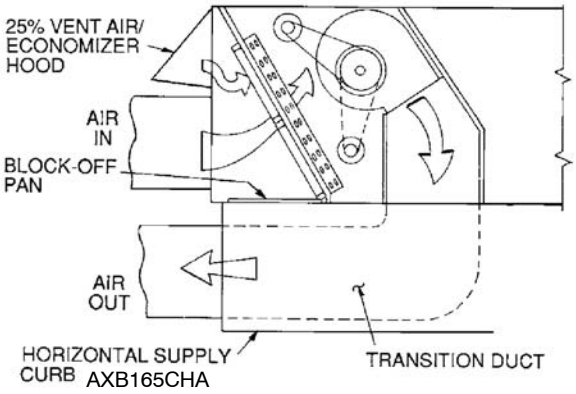
PROVIDE UNIT SUPPORT

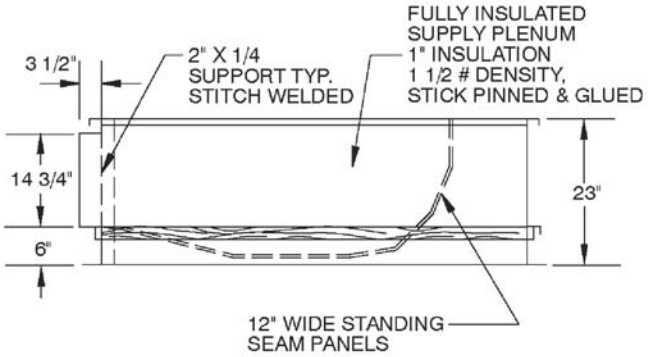
Roofcurb

Assemble or install accessory roof curb or horizontal adapter roof curb in accordance with instructions shipped with this accessory. Install insulation, cant strips, roofing, and counter flashing. Ductwork can be installed to roof curb or horizontal adapter roof curb before unit is set in place. Curb or adapter roof curb should be level. This is necessary to permit unit drain to function properly. Unit leveling tolerance is ± $^1/_{16}$ in. per linear ft in any direction. Refer to Accessory Roof Curb or Horizontal Adapter Roof Curb Installation Instructions for additional information as required. When accessory roof curb or horizontal adapter roof curb is used, unit may be installed on class A, B, or C roof covering material.

FIGURE 1 | **Horizontal Supply/ Return Adapter Installation -- PGH155-180**



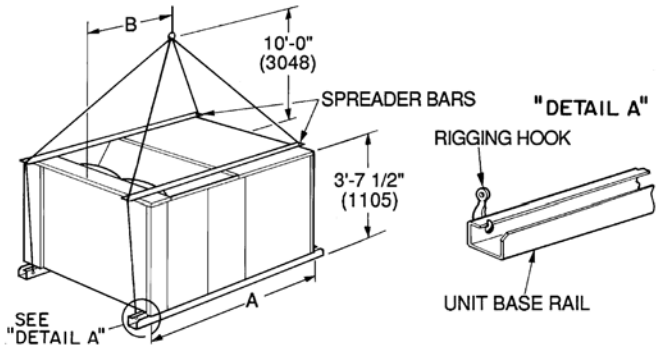




NOTE: AXB165CHA is a fully factory preassembled horizontal adapter and includes an insulated transition duct. The pressure drop through the adapter curb is negligible.
For horizontal return applications: The power exhaust and barometric relief dampers must be installed in the return air duct.

ACCESSORY PACKAGE NO.	CURB HEIGHT	DESCRIPTION
AXB165CHA	1′-11″ (584)	Pre-Assembled, Horizontal Adapter Roof Curb

FIGURE 2 | **Rigging Details**



NOTES:
1. Dimensions in ( ) are in millimeters.
2. Refer to Fig. 4 for unit operating weights.
3. Remove boards at ends of unit and runners prior to rigging.
4. Rig by inserting hooks into unit base rails as shown. Use corner post from packaging to protect coil from damage. Use bumper boards for spreader bars.
5. Weights do not include optional economizer. Add 90 lb for economizer weight.
6. Add 75 lb (34 kg) for crating on PGH155 and 180 units.
7. Add 150 lb (68 kg) for copper condenser coil. Add 280 lb (127 kg) for copper condenser and evaporator coils.

UNIT	MAXIMUM SHIPPING WEIGHT		DIMENSIONS			
			A		B	
PGH	lb	kg	ft-in.	mm	ft-in.	mm
155	1725	782	6-11 1/2	2121	4-0	1219
180	1800	816	6-11 1/2	2121	3-2	964

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

Alternate Unit Support

When the curb cannot be used, support unit with sleepers using unit curb support area. If sleepers cannot be used, support long sides of unit with a minimum of 3 equally spaced 4-in. x 4-in. pads on each side.

RIG AND PLACE UNIT

Inspect unit for transportation damage. File any claim with transportation agency.

Do not drop unit; keep upright. Use spreader bars over unit to prevent sling or cable damage. Rollers may be used to move unit across a roof. Level by using unit frame as a reference; leveling tolerance is $\pm\ ^1/_{16}$ in. per linear ft in any direction. See Fig. 2 for additional information. Unit operating weight is shown in Table 1.

Four lifting holes are provided in ends of unit base rails as shown in Fig. 2. Refer to rigging instructions on unit.

Positioning

Maintain clearance, per Fig. 3, around and above unit to provide minimum distance from combustible materials, proper airflow, and service access.

Do not install unit in an indoor location. Do not locate air inlets near exhaust vents or other sources of contaminated air. For proper unit operation, adequate combustion and ventilation air must be provided in accordance with Section 5.3 (Air for Combustion and Ventilation) of the National Fuel Gas Code, ANSI Z223.1 (American National Standards Institute).

Although unit is weatherproof, guard against water from higher level runoff and overhangs.

Locate mechanical draft system flue assembly at least 4 ft from any opening through which combustion products could enter the building, and at least 4 ft from any adjacent building. When unit is located adjacent to public walkways, flue assembly must be at least 7 ft above grade.

B. Roof Mount

Check building codes for weight distribution requirements. Unit operating weight is shown in Table 1.

FIGURE 3 | **Base Unit Dimensions PGH155 - 180**

UNIT PGH	STD UNIT WEIGHT		ECONOMIZER WEIGHT		CORNER A		CORNER B		CORNER C		CORNER D		DIM A		DIM B		DIM C	
	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	ft-in.	mm	ft-in.	mm	ft-in.	mm
155	1725	782	90	41	427	194	390	177	438	199	470	213	3-3	991	3-5	1051	1-10	559
180	1800	816	90	41	417	189	399	181	481	218	503	228	3-2	961	3-6	1070	1-10	559

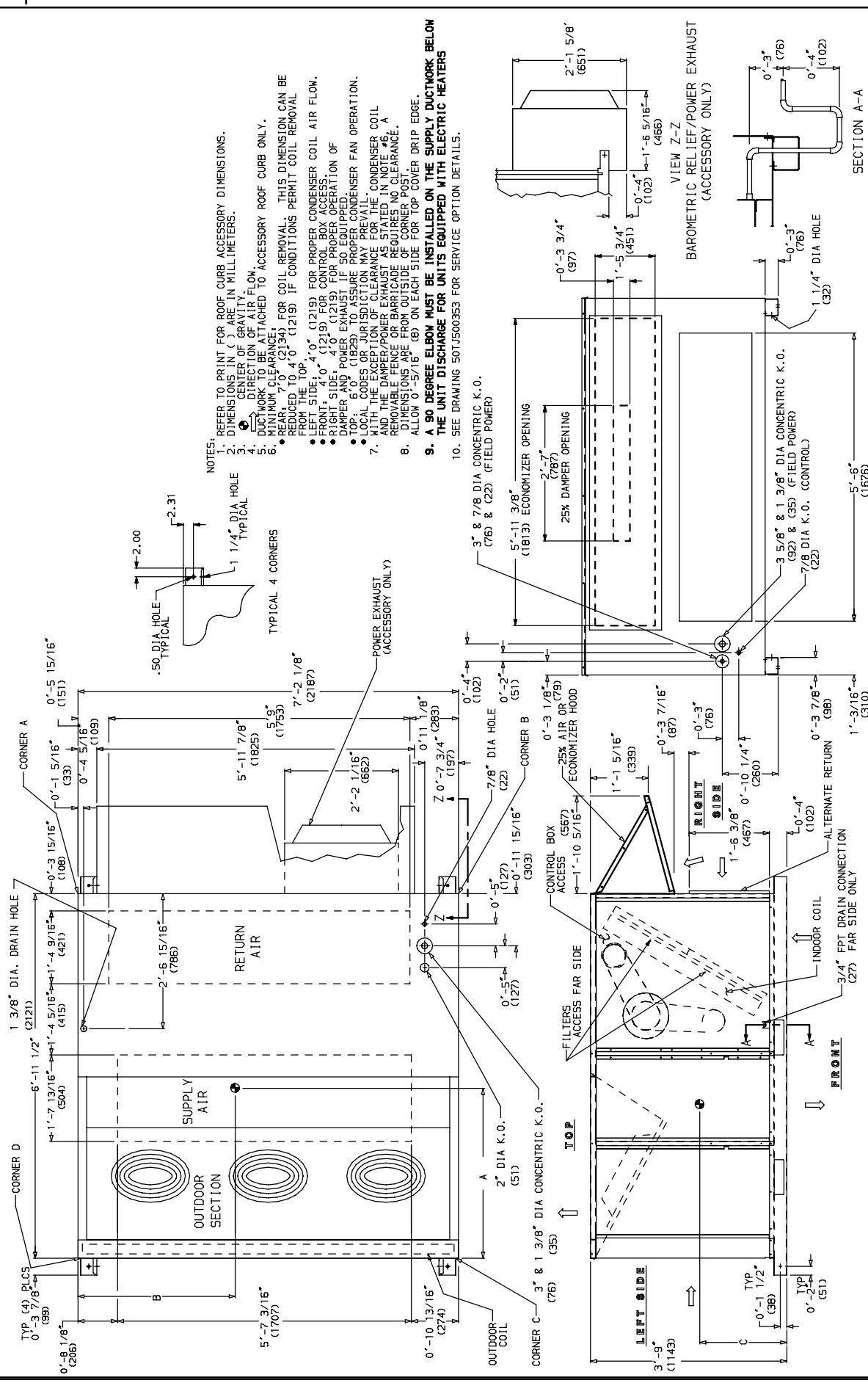


Table 1 – Physical Data – PGH155–180

UNIT PGH		155		180	
		208/230	460	208/230	460
NOMINAL CAPACITY (tons)		12		15	
UNIT OPERATING WEIGHT Al/Al*		1725		1800	
Cu/Cu*		2005		2080	
Economizer		90		90	
Roof Curb†		200		200	
COMPRESSOR					
Quantity...Model (Ckt 1, Ckt 2)		2...ZR72KC		1...ZR94KC, 1...ZR72KC	
Number of Refrigerant Circuits		2		2	
Crankcase Heater Watts		70		70	
Loading (% of Full Capacity)		0, 53, 100		0, 60, 100	
Oil (oz) (Ckt 1, Ckt 2)		60,60		85,60	
REFRIGERANT TYPE		R-22			
Expansion Device		TXV			
Operating Charge (lb oz)					
Circuit 1**		20.7		19.5	
Circuit 2		13.4		13.45	
CONDENSER COIL		Cross-Hatched $^{3}/_{8}$-in. Copper Tubes, Aluminum Lanced, Aluminum Pre-Coated, or Copper Plate Fins			
Rows...Fins/in.		4...15		4...15	
Total Face Area (sq ft)		21.7		21.7	
CONDENSER FAN		Propeller Type			
Nominal Cfm		10,500		10,500	
Quantity...Diameter (in.)		3...22		3...22	
Motor Hp...Rpm		$^{1}/_{2}$...1050		$^{1}/_{2}$...1050	
Watts Input (Total)		1100		1100	
EVAPORATOR COIL		Cross-Hatched $^{3}/_{8}$-in. Copper Tubes, Aluminum Lanced or Copper Plate Fins, Face Split			
Rows...Fins/in.		4...15		4...15	
Total Face Area (sq ft)		17.5		17.5	
EVAPORATOR FAN		Centrifugal Type			
Quantity...Size (in.)		2...12 X 12		2...12 x 12	
Type Drive		Belt		Belt	
Nominal Cfm		5200		6000	
Std Motor Hp		2.9		5	
Opt Motor Hp		3.7		—	
Motor Nominal Rpm		1725		1745	
Std Maximum Continuous Bhp		3.13		6.13	
Opt Maximum Continuous Bhp		4.26		—	
Motor Frame Size		56H		184T	
Fan Rpm Range	**Low-Med. Static**	895-1147		873-1021	
	High Static	1040-1315		1025-1200	
Motor Bearing Type		Ball		Ball	
Maximum Allowable Rpm		1550		1550	
Motor Pulley Pitch Dia.	**Low-Med. Static**	3.1/4.1		4.9/5.9	
	High Static	3.7/4.7		4.9/5.9	
Nominal Motor Shaft Diameter (in.)		$^{7}/_{8}$		$1^{1}/_{8}$	
Fan Pulley Pitch Diameter (in.)	**Low-Med. Static**	6.0		9.4	
	High Static	6.0		8.0	
Nominal Fan Shaft Diameter (in.)		$1^{3}/_{16}$		$1^{7}/_{16}$	
Belt, Quantity...Type... Length (in.)	**Low-Med. Static**	1...BX...45		1...BX...50	
	High Static	1...BX...45		1...BX...48	
Pulley Center Line Distance (in.)		14.5-16.0		13.3-14.8	
Speed Change per Full Turn of Movable Pulley Flange (Rpm)	**Low-Med. Static**	45		37	
	High Static	45		44	
Movable Pulley Maximum Full Turns From Closed Position		6		4††	
Factory Speed		3.5		3.5	
Factory Speed Setting (Rpm)	**Low-Med. Static**	987		965	
	High Static	1155		1134	

Table 1 – Physical Data – PGH155-180

FURNACE SECTION	Low Heat/High Heat	Low Heat/High Heat
Rollout Switch Cutout Temp (F)***	190	190
Burner Orifice Diameter (in...drill size)		
Natural Gas	0.1285...30/ 0.136...29	0.1285...30/ 0.136...29
Thermostat Heat Anticipator Setting		
Stage 1 (amps)	0.98 | 0.8	0.98 | 0.8
Stage 2 (amps)	0.44 | 0.44	0.44 | 0.44
Gas Input Btuh Stage 1	172,000/230,000	206,000/275,000
Stage 2	225,000/300,000	270,000/360,000
Efficiency (Steady State) (%)	81	81
Temperature Rise Range	15-45/30-60	15-45/20-50
Manifold Pressure (in. wg)		
Natural Gas	3.3	3.3
Gas Valve Quantity	1	1
Gas Valve Pressure (in. wg)	5.5-13.5	5.5-13.5
(psig)	0.235-0.487	0.235-0.487
Field Gas Connection Size (in.-FPT)	3/4	3/4
HIGH-PRESSURE SWITCH (psig)		
Cutout	426	
Reset (Auto.)	320	
LOW-PRESSURE SWITCH (psig)		
Cutout	27	
Reset (Auto.)	44	
FREEZE PROTECTION THERMOSTAT (F)		
Opens	30 ± 5	
Closes	45 ± 5	
OUTDOOR-AIR INLET SCREENS	Cleanable	
Quantity...Size (in.)	2...20 x 25 x 1	
	1...20 x 20 x 1	
RETURN-AIR FILTERS	Throwaway	
Quantity...Size (in.)	4...20 x 20 x 2	
	4...16 x 20 x 2	

LEGEND

Al — Aluminum
Bhp — Brake Horsepower
Cu — Copper
TXV — Thermostatic Expansion Valve

*Evaporator coil fin material/condenser coil fin material.
†Weight of 14-in. roof curb.
**Circuit 1 uses the lower portion of condenser coil and lower portion of evaporator coils, and Circuit 2 uses the upper portion of both coils.
††Pulley has 6 turns. Due to belt and pulley, moveable pulley cannot be set to 0 to 1 1/2 turns open.
***Rollout switch is manual reset.

FIELD FABRICATE DUCTWORK

Secure all ducts to building structure. Use flexible duct connectors between unit and ducts as required. Insulate and weatherproof all external ductwork, joints, and roof openings with counter flashing and mastic in accordance with applicable codes.

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

MAKE UNIT DUCT CONNECTIONS

Unit is shipped for thru-the-bottom duct connections. Ductwork openings are shown in Fig. 3. Duct connections are shown in Fig. 4. Field-fabricated concentric ductwork may be connected as shown in Fig. 5 and 6. Attach all ductwork to roof curb and roof curb basepans.

INSTALL FLUE HOOD AND WIND BAFFLE

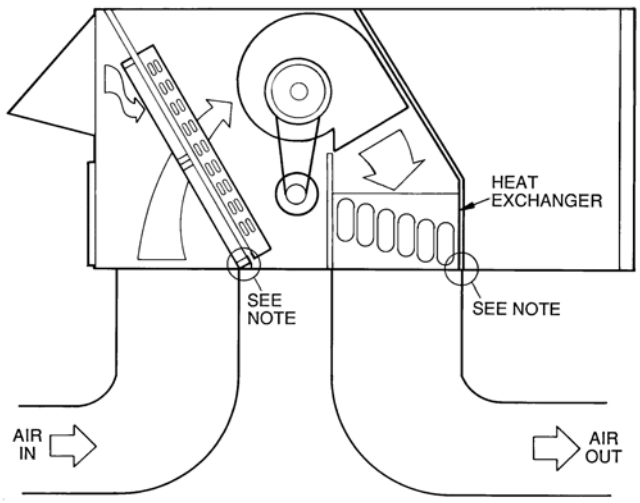
Flue hood and wind baffle are shipped secured under main control box. To install, secure flue hood to access panel. See Fig. 7. The wind baffle is then installed over the flue hood.

NOTE: When properly installed, flue hood will line up with combustion fan housing. See Fig. 8.

TRAP CONDENSATE DRAIN

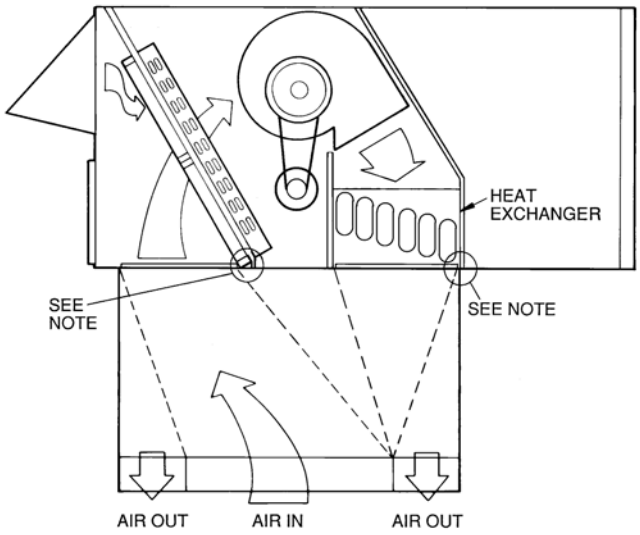
See Fig. 9 for drain location. One $^{3}/_{4}$-in. half coupling is provided inside unit evaporator section for condensate drain connection. An $8^{1}/_{2}$-in. x $^{3}/_{4}$-in. diameter and 2-in. x $^{3}/_{4}$-in. diameter pipe nipple, coupled to standard $^{3}/_{4}$-in. diameter elbows, provide a straight path down through hole in unit base rails (see Fig. 10). A trap at least 4-in. deep must be used.

FIGURE 4 Air Distribution , Thru-the-Bottom



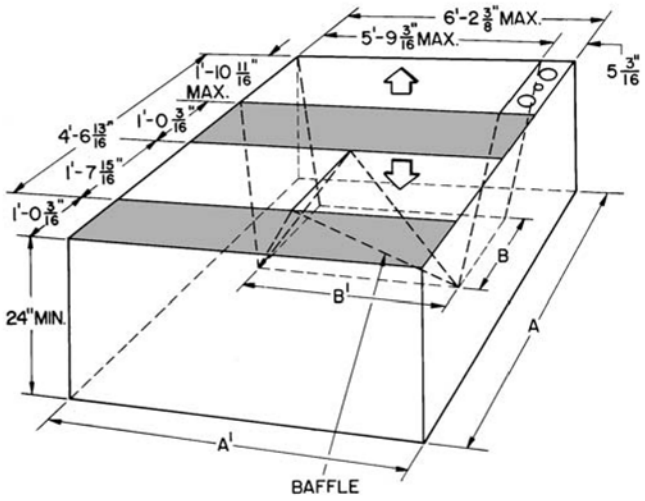
NOTE: Do not drill in this area; damage to basepan may result in water leak.

FIGURE 5 Concentric Duct Air Distribution



NOTE: Do not drill in this area; damage to basepan may result in water leak.

FIGURE 6 Concentric Duct Details



Shaded area indicates block-off panels.

NOTE: Dimensions A, A′ and B, B′ are obtained from field-supplied ceiling diffuser.

FIGURE 7 **Flue Hood Location**

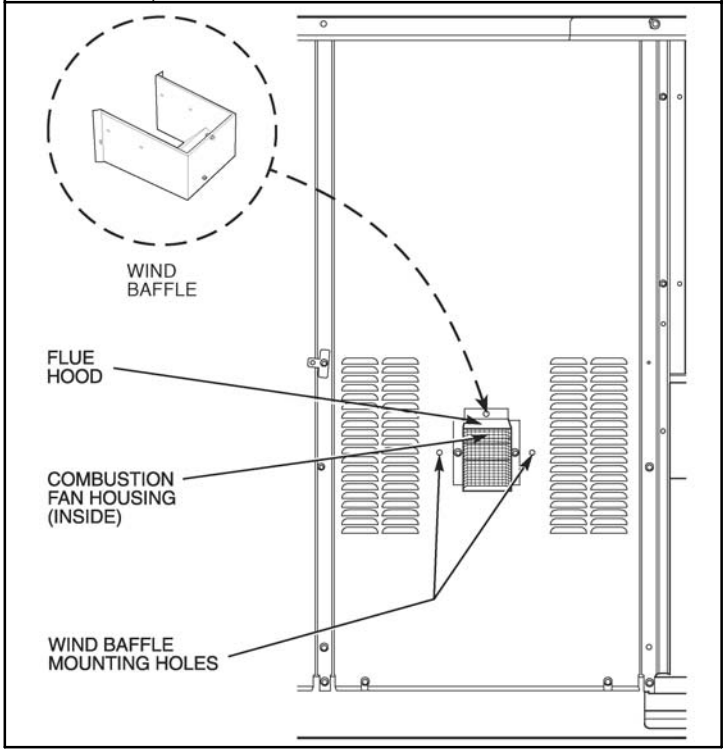
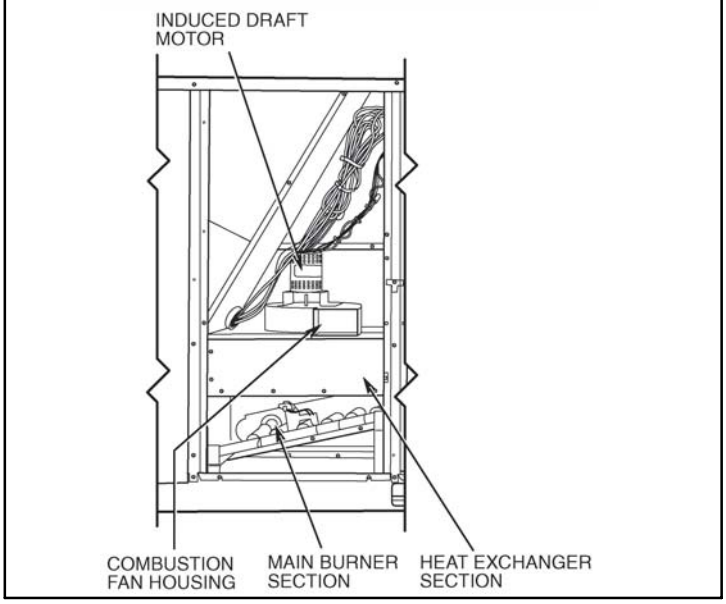


FIGURE 8 **Combustion Fan Housing Location**



ORIFICE CHANGE

This unit is factory assembled for heating operation using natural gas at an elevation from sea level to 2000 ft. This unit uses orifice type LH32RFnnn, where "nnn" indicates the orifice size based on drill size diameter in thousands of an inch.

High Elevation (Above 2000 ft)

Use accessory high altitude kit when installing this unit at an elevation of 2000 to 7000 ft. For elevations above 7000 ft, refer to Table 2 to identify the correct orifice size for the elevation. See Table 3 for the number of orifices required for each unit size. Purchase these orifices from your local dealer. Follow instructions in accessory Installation Instructions to install the correct orifices.

FIGURE 9 **Condensate Drain Details (PGH155 Shown)**

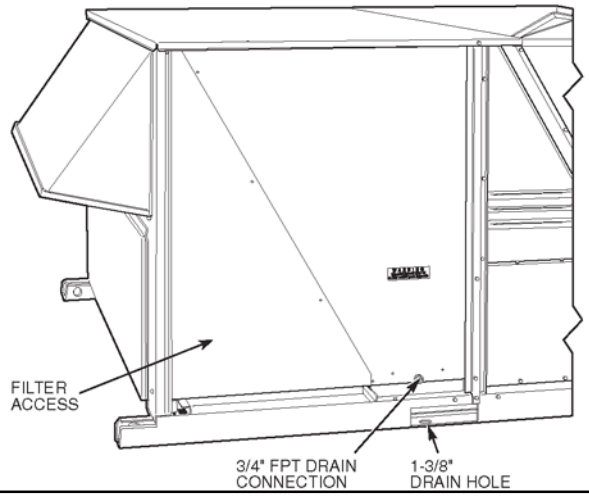


FIGURE 10 **Condensate Drain Piping Details**

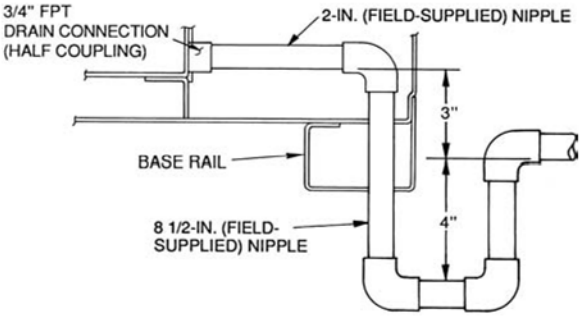


Table 2 — Altitude Compensation*

ELEVATION (ft)	NATURAL GAS ORIFICE†	
	Low Heat	High Heat
0-1,999	30	29
2,000	30	29
3,000	31	30
4,000	31	30
5,000	31	30
6,000	31	30
7,000	32	31
8,000	32	31
9,000	33	31
10,000	35	32

*As the height above sea level increases, there is less oxygen per cubic foot of air. Therefore, heat input rate should be reduced at higher altitudes. Includes a 4% input reduction per each 1000 ft.
†Orifices available through your dealer.

Table 3 — Orifice Quantity

UNIT	ORIFICE QUANTITY
PGH155 Low Heat	5
PGH180 Low Heat, PGH155 High Heat	6
PGH180 High Heat	7

Conversion To Propane Gas

Use accessory propane conversion kit when converting this unit for use with Propane usage for elevations up to 7000 ft. For elevations above 7000 ft, refer to Table 4 to identify the correct orifice size for the elevation. See Table 3 for the number of

orifices required for each unit size. Purchase these orifices from your local dealer. Follow instructions in accessory Installation Instructions to install the correct orifices.

Table 4 — Propane Conversion*

ELEVATION (ft)	PROPANE ORIFICE†
0-1,999	36
2,000	37
3,000	38
4,000	38
5,000	39
6,000	40
7,000	41
8,000	41
9,000	42
10,000	43

*As the height above sea level increases, there is less oxygen per cubic foot of air. Therefore, heat input rate should be reduced at higher altitudes. Includes a 4% input reduction per each 1000 ft.
†Orifices available through your dealer.

INSTALL GAS PIPING

Unit is equipped for use with natural gas. Installation must conform with local building codes or, in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1.

Install field-supplied manual gas shutoff valve with a $^1/_8$-in. NPT pressure tap for test gage connection at unit. Field gas piping must include sediment trap and union. See Fig. 11.

⚠ CAUTION

UNIT EQUIPMENT DAMAGE HAZARD

Failure to follow this caution can result in equipment damage.

Don not pressure test gas supply while connected to unit. Always disconnect union before servicing.

IMPORTANT: Natural gas pressure at unit gas connection must not be less than 5.5 in. wg or greater than 13.5 in. wg.

Size gas-supply piping for 0.5-in. wg maximum pressure drop. Do not use supply pipe smaller than unit gas connection.

FIGURE 11 Field Gas Piping

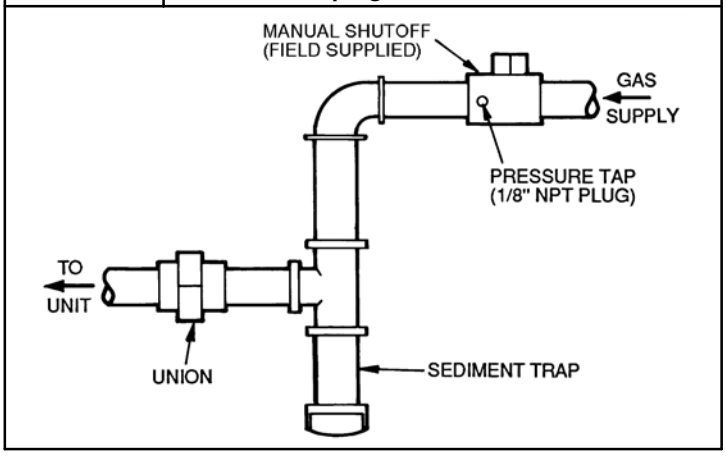
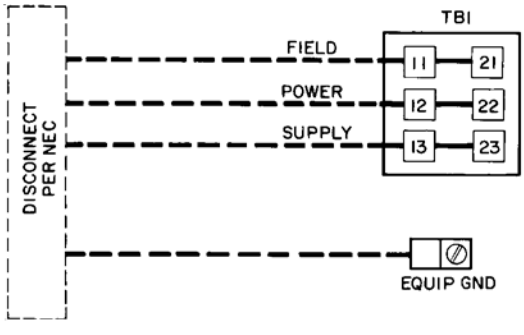


FIGURE 12 Field Power Wiring Connections



LEGEND

EQUIP GND	— Equipment Ground
kcmil	— Thousand Circular Mils
NEC	— National Electrical
TB	— Terminal Block

Make Electrical Connections

Field Power Supply

Unit is factory wired for voltage shown on nameplate.

When installing units, provide a disconnect of adequate size per NEC (National Electrical Code) requirements (Table 2).

All field wiring must comply with NEC and local requirements.

Route power lines through control box access panel or unit basepan (Fig. 3) to connections as shown on unit wiring diagram and Fig. 12.

Field wiring must conform to temperature limitations for type "T" wire. All field wiring must comply with NEC and local requirements.

Transformer no. 1 is wired for 230-v unit. If 208/230-v unit is to be run with 208-v power supply, the transformer must be rewired as follows:

1. Remove cap from red (208 v) wire.
2. Remove cap from orange (230 v) spliced wire.
3. Replace orange wire with red wire.
4. Recap both wires.

IMPORTANT: BE CERTAIN UNUSED WIRES ARE CAPPED. Failure to do so may damage the transformers.

Operating voltage to compressor must be within voltage range indicated on unit nameplate. On 3-phase units, voltages between phases must be balanced within 2% and the current must be balanced within 10%.

Operating voltage to compressor must be within voltage range indicated on unit nameplate. On 3-phase units, voltages between phases must be balanced within 2%.

Unit failure as a result of operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.

Field Control Wiring

Install an approved accessory thermostat assembly according to the installation instructions included with accessory. Locate thermostat assembly on a solid interior wall in the conditioned space to sense average temperature.

Route thermostat cable or equivalent single leads of colored wire from subbase terminals through conduit in unit to low-voltage connections as shown on unit label wiring diagram and in Fig. 13.

NOTE: For wire runs up to 50 ft, use no. 18 AWG (American Wire Gage) insulated wire (35 C minimum). For 50 to 75 ft, use no. 16 AWG insulated wire (35 C minimum). For over 75 ft, use no. 14 AWG insulated wire (35 C minimum). All wire larger than no. 18 AWG cannot be directly connected at the thermostat and will require a junction box and splice at the thermostat.

Set heat anticipator settings as follows:

VOLTAGE	W1	W2
208/230	0.98	0.44
460	0.80	0.44

Settings may be changed slightly to provide a greater degree of comfort for a particular installation.

Optional Non-Fused Disconnect

On units with the optional non-fused disconnect, incoming power will be wired into the disconnect switch. Refer to Fig. 15 for wiring for 100 and 200 amp disconnect switches. Units with an MOCP (maximum overcurrent protection) under 100 will use the 100 amp disconnect switch. Units with an MOCP over 100 will use the 200 amp disconnect switch. Refer to the applicable disconnect wiring diagram.

To prevent breakage during shipping, the disconnect handle and shaft are shipped and packaged inside the unit control box. Install the disconnect handle before unit operation. To install the handle and shaft, perform the following procedure:

1. Open the control box door and remove the handle and shaft from shipping location.
2. Loosen the Allen bolt located on the disconnect switch. The bolt is located on the square hole and is used to hold the shaft in place. The shaft cannot be inserted until the Allen bolt is moved.
3. Insert the disconnect shaft into the square hole on the disconnect switch. The end of the shaft is specially cut and the shaft can only be inserted in the correct orientation.
4. Tighten the Allen bolt to lock the shaft into position.
5. Close the control box door.
6. Attach the handle to the external access door with the two screws provided. When the handle is in the ON position, the handle will be vertical. When the handle is in the OFF position, the handle will be horizontal.
7. Turn the handle to the OFF position and close the door. The handle should fit over the end of the shaft when the door is closed.
8. The handle must be in the OFF position to open the control box door.

Optional Convenience Outlet

On units with optional convenience outlet, a 115-v GFI (ground fault interrupt) convenience outlet receptacle is provided for field wiring. Field wiring should be run through the $^{7}/_{8}$-in. knockout provided in the basepan near the return air opening.

FIGURE 13 **Field Control Thermostat Wiring**

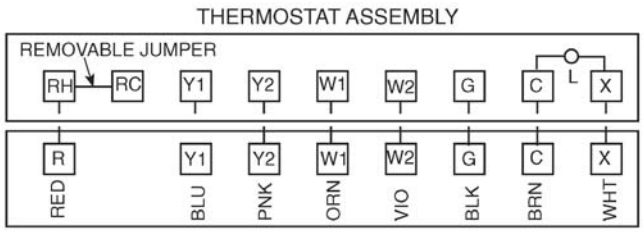
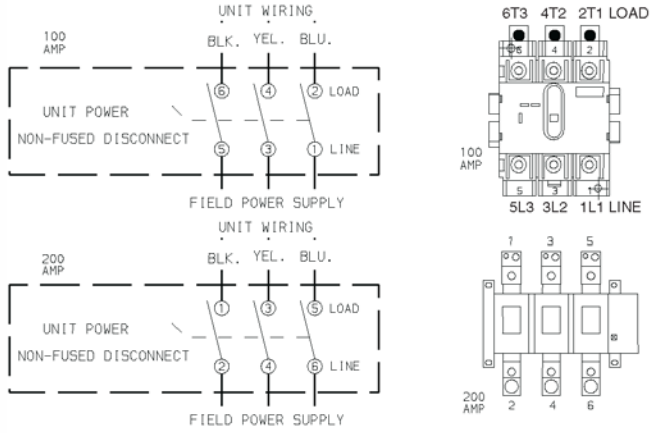


FIGURE 14 **Optional Non-Fused Disconnect Wiring**



NOTE: The disconnect takes the place of TB-1 as shown on the unit wiring diagram label and the component arrangement label.

Table 5 — Electrical Data

UNIT PGH	NOMINAL VOLTAGE (3 Ph, 60 Hz)	VOLTAGE RANGE		COMPRESSOR No. 1		COMPRESSOR No. 2		OFM			IFM		POWER EXHAUST		COMBUSTION FAN MOTOR	POWER SUPPLY	
		Min	Max	RLA	LRA	RLA	LRA	Qty	Hp	FLA (ea)	Hp	FLA	FLA	LRA	FLA	MCA	MOCP*
155 Standard IFM	208/230	187	253	20.7	156	20.7	156	3	0.5	1.7	2.9	8.8/8.4	— 4.6	— 18.8	0.57 0.57	60/60 65/65	80/80 80/80
	460	414	506	10	75	10	75	3	0.5	0.8	2.9	4.2	— 2.3	— 6.0	0.30 0.30	29 31	35 40
155 Optional IFM	208/230	187	253	20.7	156	20.7	156	3	0.5	1.7	3.7	10.5/11.0	— 4.6	— 18.8	0.57 0.57	62,/63 67/67	80/80 80/80
	460	414	506	10	75	10	75	3	0.5	0.8	3.7	4.8	— 2.3	— 6.0	0.30 0.30	30 32	35 40
180	208/230	187	253	32.1	195	20.7	156	3	0.5	1.7	5.0	15.8/15.8	— 4.6	— 18.8	0.57 0.57	82/82 86/86	110/110 110/110
	460	414	506	16.4	95	10	75	3	0.5	0.8	5.0	7.9	— 2.3	— 6.0	0.30 0.30	41 43	50 50

LEGEND

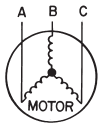
FLA – Full Load Amps
HACR – Heating, Air Conditioning and Refrigeration
IFM – Indoor–Fan Motor
LRA – Locked Rotor Amps
MCA – Minimum Circuit Amps
MOCP – Maximum Overcurrent Protection
NEC – National Electrical Code
OFM – Outdoor–Fan Motor
RLA – Rated Load Amps

1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. Canadian units may be fuse or circuit breaker.
2. **Unbalanced 3-Phase Supply Voltage**
   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percent voltage imbalance.

% Voltage Imbalance

$$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3} = \frac{1371}{3} = 457$$

Determine maximum deviation from average voltage.
(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v

Maximum deviation is 7 v.

Determine percent of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{7}{457} = 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

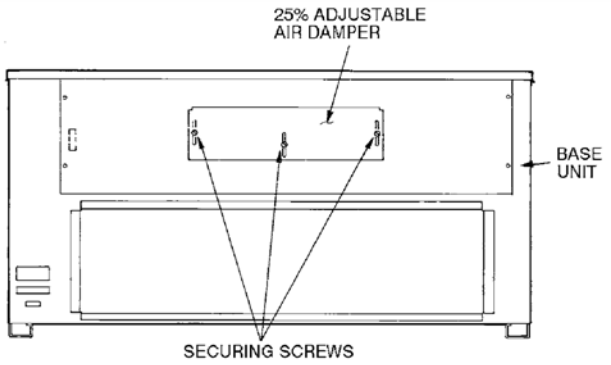
IMPORTANT:If the supply voltage phase imbalance is more than 2%,contact your local electric utility company immediately.

MAKE OUTDOOR-AIR INLET ADJUSTMENTS

Manual Outdoor-Air Damper

All units (except those equipped with a factory-installed economizer) have a manual outdoor-air damper to provide ventilation air. Damper can be preset to admit up to 25% outdoor air into return-air compartment. To adjust, loosen securing screws and move damper to desired setting. Then retighten screws to secure damper (Fig. 15).

FIGURE 15 | **25% Outdoor Air Section Details**



INSTALL OUTDOOR-AIR HOOD

The outdoor-air hood is common to 25% air ventilation and economizer. If economizer is factory installed, all electrical connections have been made and adjusted at the factory. Assemble and install hood in the field.

IMPORTANT:If the unit is equipped with the optional economizer component, move the outdoor-air temperature sensor prior to installing the outdoor-air hood. See the Optional economizer section for more information.

NOTE: The hood top panel, upper and lower filter retainers, hood drain pan, and filter support bracket are secured opposite the outdoor coil end of the unit. The screens, hood side panels, remaining section of filter support bracket, seal strip, and all other hardware are in a package located inside the return-air filter access panel (Fig. 16).

1. Attach seal strip to upper filter retainer. See Fig. 17
2. Assemble hood top panel, side panels, upper filter retainer, and drain pan (see Fig. 18).
3. Secure lower filter retainer and support bracket to unit. See Fig. 18. Leave screws loose on size 180 units.

4. Slide baffle (size 180) behind lower filter retainer and tighten screws.
5. Loosen sheet metal screws for top panel of base unit located above outdoor-air inlet opening, and remove screws for hood side panels located on the sides of the outdoor-air inlet opening.
6. Match notches in hood top panel to unit top panel screws. Insert hood flange between top panel flange and unit. Tighten screws.
7. Hold hood side panel flanges flat against unit, and install screws removed in Step 5.
8. Insert outdoor-air inlet screens and spacer in channel created by lower filter retainer and support bracket.
9. Attach remaining section of filter support bracket.

FIGURE 16 **Outdoor Air Hood Component Location**

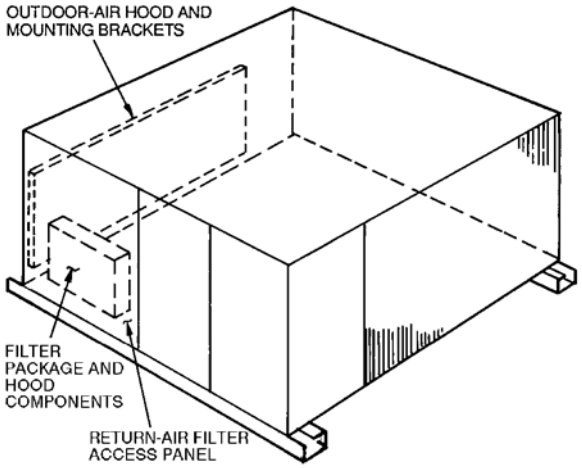
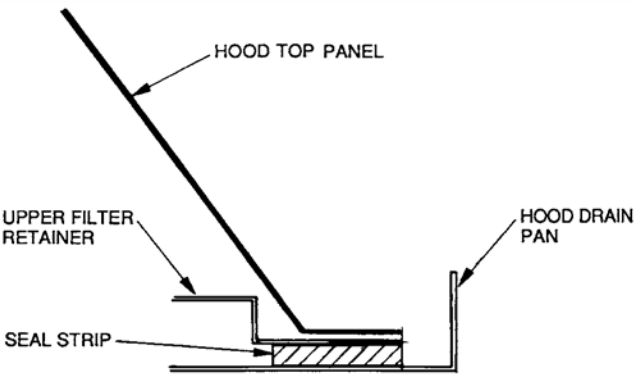


FIGURE 17 **Seal Strip Location**



INSTALL ALL ACCESSORIES

After all the factory-installed options have been adjusted, install all field-installed accessories. Refer to the accessory installation instructions included with each accessory.

Adjust Factory-Installed Options

Optional Economizer

See Figs. 19 and 20 for economizer component locations.

NOTE:These instructions are for installing the optional economizer only. Refer to the accessory economizer installation instructions when field installing an economizer accessory.

To complete installation of the optional economizer, perform the following procedure.

1. Remove the economizer hood. Refer to Step 8 — Install Outdoor-Air Hood on page 10 for information on removing and installing the outdoor-air hood.
2. Relocate outdoor air temperature sensor from shipping position to operation position on economizer. See Fig. 20.

IMPORTANT:Failure to relocate the sensor will result in the economizer not operating properly.

3. Re-install economizer hood.
4. Install all economizer accessories. economizer wiring is shown in Fig. 22.

Outdoor air leakage is shown in Table 6. Return air pressure drop is shown in Table 7.

FIGURE 18 **Outdoor Air Hood Details**

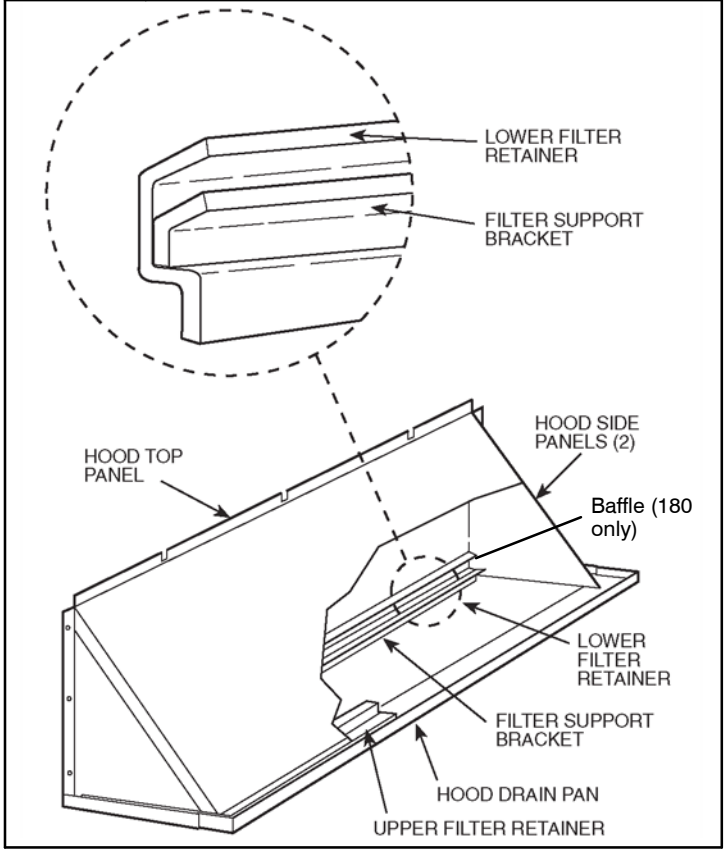


Table 6 – Outdoor Air Damper Leakage

	DAMPER STATIC PRESSURE (in. wg)					
	0.2	0.4	0.6	0.8	1.0	1.2
LEAKAGE (cfm)	35	53	65	75	90	102

Table 7 – Return Air Pressure Drop

CFM					
4500	5000	5400	6000	7200	7500
0.040	0.050	0.060	0.070	0.090	0.100

FIGURE 19 **Economizer Component Locations (End View)**

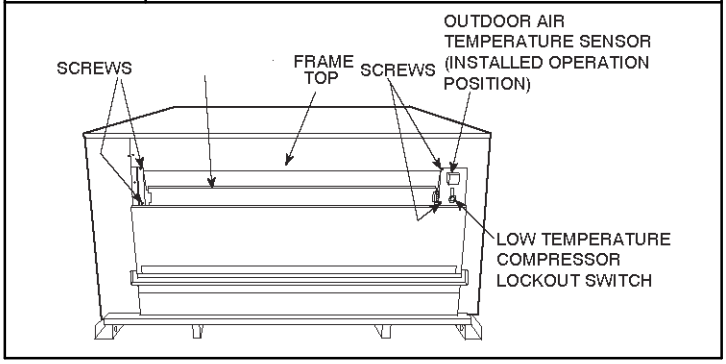
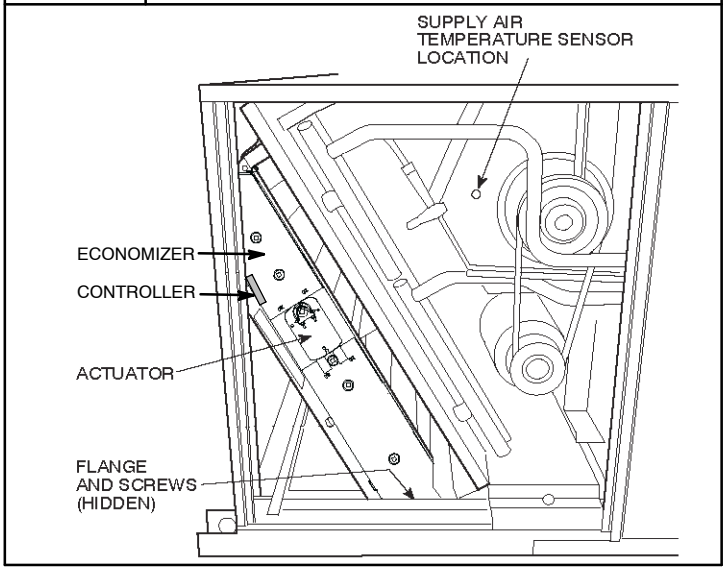


FIGURE 20 **Economizer Component Locations (Side View)**



Economizer Standard Sensors

Outdoor Air Temperature (OAT) Sensor

The outdoor air temperature sensor (HH57AC074) is a 10 to 20 mA device used to measure the outdoor-air temperature. The outdoor-air temperature is used to determine when the economizer can be used for free cooling. The sensor must be field-relocated. See Fig. 19. The operating range of temperature measurement is 40 to 100 F.

Supply Air Temperature (SAT) Sensor

The supply air temperature sensor is a 3 K thermistor located at the inlet of the indoor fan. See Fig. 20. This sensor is factory installed. The operating range of temperature measurement is 0° to 158 F. See Table 8 for sensor temperature/resistance values.

The temperature sensor looks like an eyelet terminal with wires running to it. The sensor is located in the “crimp end” and is sealed from moisture.

Low Temperature Compressor Lockout Sensor

The economizer is equipped with an ambient temperature lockout switch located in the outdoor air stream which is used to lockout the compressors below a 42 F ambient temperature. See Fig. 25.

Table 8 – SUPPLY AIR SENSOR TEMPERATURE/ RESISTANCE VALUES

TEMPERATURE (F)	RESISTANCE (ohms)
–58	200,250
–40	100,680
–22	53,010
–4	29,091
14	16,590
32	9,795
50	5,970
68	3,747
77	3,000
86	2,416
104	1,597
122	1,080
140	746
158	525
176	376
185	321
194	274
212	203
230	153
248	116
257	102
266	89
284	70
302	55

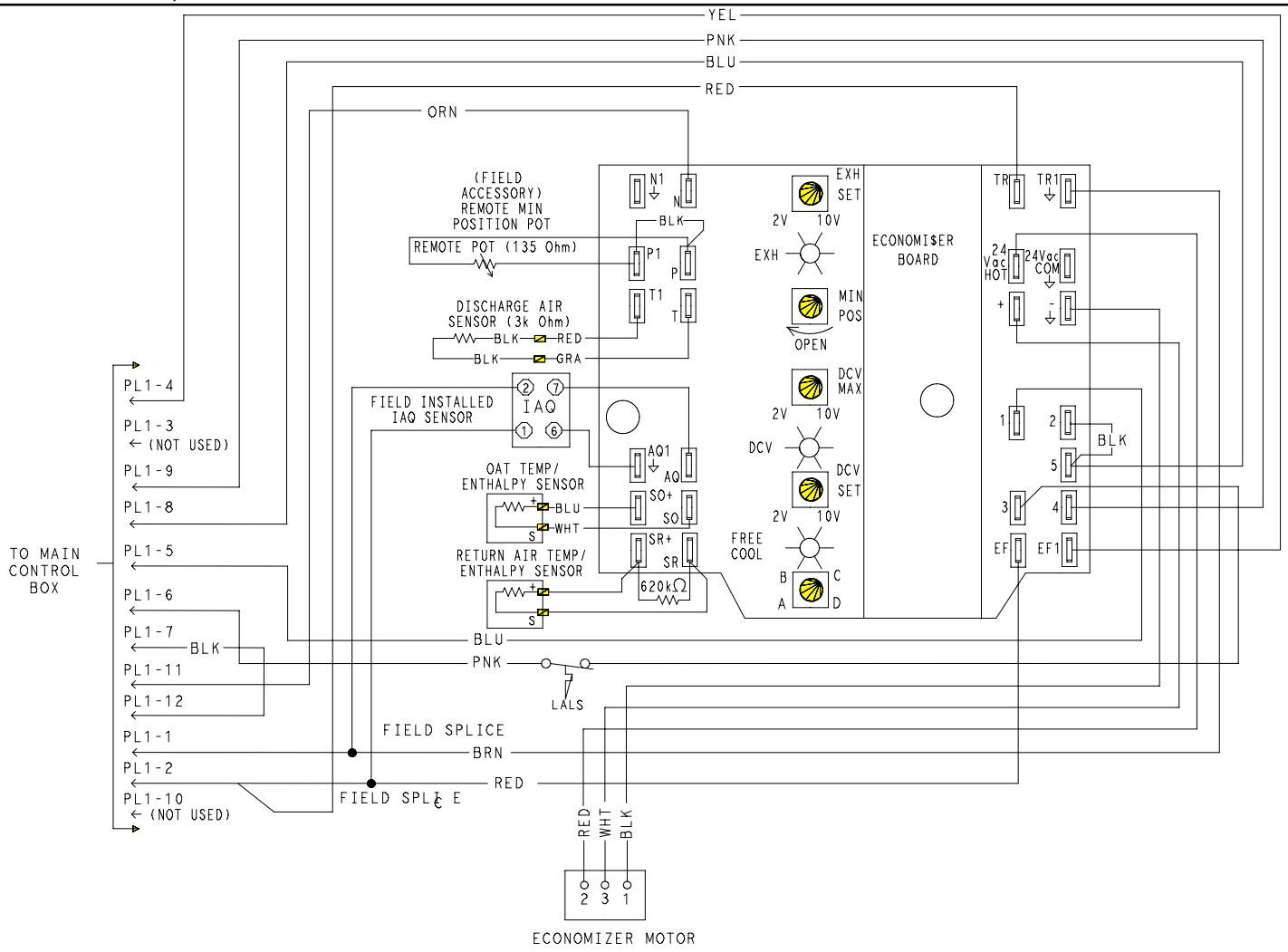
Economizer Control Modes

Determine the economizer control mode before set up of the control. Some modes of operation may require different sensors. Refer to Table 9. The economizer is supplied from the factory with a supply–air temperature sensor and an outdoor– air temperature sensor. This allows for operation of the economizer with outdoor air dry bulb changeover control. Additional accessories can be added to allow for different types of changeover control and operation of the economizer and unit.

Outdoor Dry Bulb Changeover

The standard controller is shipped from the factory configured for outdoor dry bulb changeover control. The outdoor air and supply air temperature sensors are included as standard. For this control mode, the outdoor temperature is compared to an adjustable set point selected on the control. If the outdoor-air temperature is above the set point, the economizer will adjust the outdoor-air dampers to minimum position. If the outdoor-air temperature is below the set point, the position of the outdoor-air dampers will be controlled to provide free cooling using outdoor air. When in this mode, the LED next to the free cooling set point potentiometer will be on. The changeover temperature set point is controlled by the free cooling set point potentiometer located on the control. See Fig. 22. The scale on the potentiometer is A, B, C, and D. See Fig. 23 for the corresponding temperature changeover values.

FIGURE 21 **Economizer Wiring**



LEGEND

DCV-	Demand Controlled Ventilation
IAQ-	Indoor Air Quality
LALS-	Low Temperature Compressor Lockout Switch
OAT-	Outdoor-Air Temperature
POT-	Potentiometer

Potentiometer Default Settings:

Power Exhaust	Middle
Minimum Pos.	Fully Closed
DCV Max.	Middle
DCV Set	Middle
Enthalpy	C Setting

NOTES:

1. 620 ohm, 1 watt 5% resistor should be removed only when using differential enthalpy or dry bulb.
2. If a separate field-supplied 24 v transformer is used for the IAQ sensor power supply, it cannot have the secondary of the transformer grounded.
3. For field-installed remote minimum position POT, remove black wire jumper between P and P1 and set control minimum position POT to the minimum position.

FIGURE 22 **Economizer Controller Potentiometer and LED Locations**

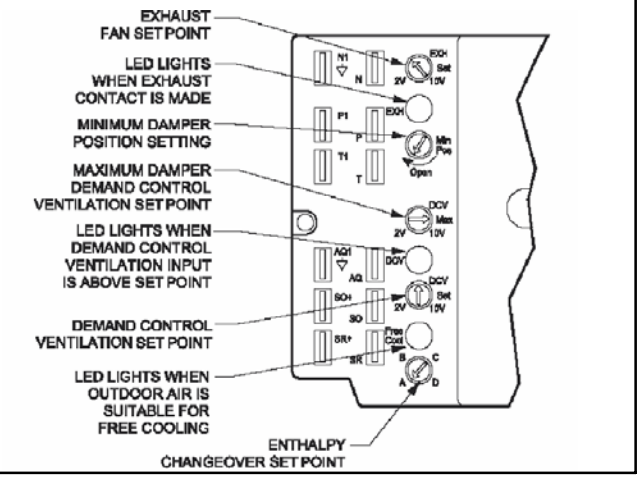


FIGURE 23 **Outdoor Air Temperature Changeover Set Points**

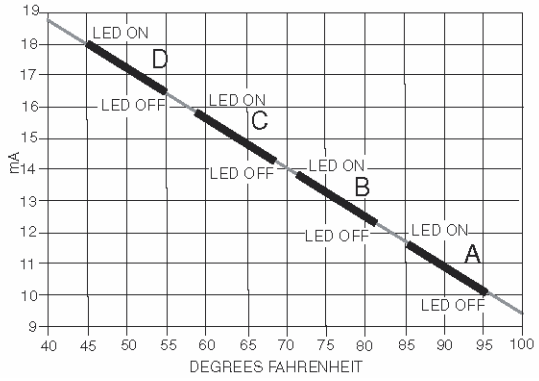


Table 9 – ECONOMIZER SENSOR USAGE

APPLICATION	ECONOMIZER WITH OUTDOOR AIR DRY BULB SENSOR	ECONOMIZER WITH SINGLE ENTHALPY SENSOR
	Accessories Required	Accessories Required
Outdoor Air Dry Bulb	None. The outdoor air dry bulb sensor is factory installed.	DNTEMPSN002A00*
Differential Dry Bulb	DNTEMPSN002A00*	(2) DNTEMPSN002A00*
Single Enthalpy	HH57AC078	None. The single enthalpy sensor is factory installed.
Differential Enthalpy	HH57AC078 and DNENTDIF004A00*	DNENTDIF004A00*

*DNENTDIF004A00 and DNTEMPSN002A00 accessories are used on many different base units. As such, these kits may contain parts that will not be needed for installation.

†33ZCSENCO2 is an accessory CO_2 sensor.

**33ZCASPCO2 is an accessory aspirator box required for duct–mounted applications.

Differential Dry Bulb Control

For differential dry bulb control the standard outdoor dry bulb sensor is used in conjunction with an additional accessory return air sensor (part number DNTEMPSN002A00). The accessory sensor must be mounted in the return airstream. See Fig. 24.

In this mode of operation, the outdoor-air temperature is compared to the return-air temperature and the lower temperature airstream is used for cooling. When using this mode of changeover control, turn the free cooling/enthalpy set point potentiometer fully clockwise to the D setting. See Fig. 25.

Outdoor Enthalpy Changeover

For enthalpy control, accessory enthalpy sensor (part number HH57AC078) is required. Replace the standard outdoor dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. See Fig. 22. When the outdoor air enthalpy rises above the outdoor enthalpy changeover set point, the outdoor-air damper moves to its minimum position. The outdoor enthalpy changeover set point is set with the outdoor enthalpy set point potentiometer on the economizer controller. The set points are A, B, C, and D. See Fig. 25. The factory-installed 620-ohm jumper must be in place across terminals SR and SR+ on the economizer controller. See Fig. 21 and 22.

Differential Enthalpy Control

For differential enthalpy control, the economizer controller uses two enthalpy sensors (HH57AC078 and CRENTDIF004A00), one in the outside air and one in the return airstream on the economizer frame. The economizer controller compares the outdoor air enthalpy to the return air enthalpy to determine economizer use. The controller selects the lower enthalpy air (return or outdoor) for cooling. For example, when the outdoor air has a lower enthalpy than the return air and is below the set point, the economizer opens to bring in outdoor air for free cooling.

Replace the standard outside air dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. See Fig. 19. Mount the return air enthalpy sensor in the return airstream. See Fig. 24. The outdoor enthalpy changeover set point is set with the outdoor enthalpy set point potentiometer on the economizer controller. When using this mode of changeover control, turn the enthalpy set point potentiometer fully clockwise to the D setting.

NOTE: Remove 620-ohm resistor if differential enthalpy sensor is installed.

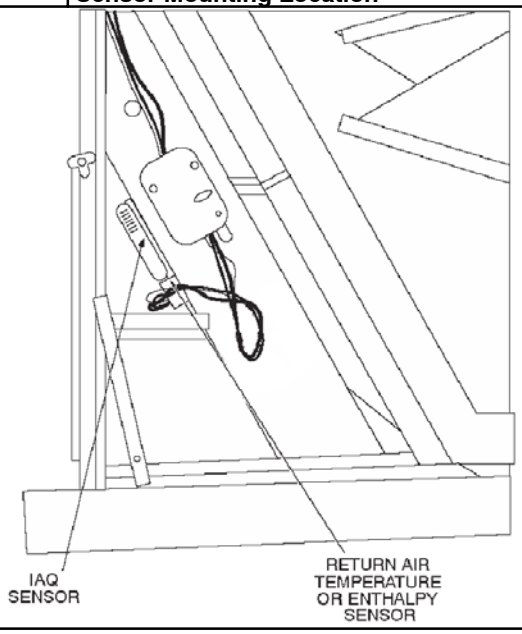
Indoor Air Quality (IAQ) Sensor Input

The IAQ input can be used for demand control ventilation control based on the level of CO_2 measured in the space or return air duct.

Mount the accessory IAQ sensor according to manufacturer specifications. The IAQ sensor should be wired to the AQ and AQ1 terminals of the controller. Adjust the DCV potentiometers to correspond to the DCV voltage output of the indoor air quality sensor at the user-determined set point. See Fig. 27.

If a separate field-supplied transformer is used to power the IAQ sensor, the sensor must not be grounded or the economizer control board will be damaged.

FIGURE 24 Return Air Temperature or Enthalpy Sensor Mounting Location



Exhaust Set Point Adjustment

The exhaust set point will determine when the exhaust fan runs based on damper position (if accessory power exhaust is installed). The set point is modified with the Exhaust Fan Set Point (EXH SET) potentiometer. See Fig. 26. The set point represents the damper position above which the exhaust fan will be turned on. When there is a call for exhaust, the economizer controller provides a 45 ± 15 second delay before exhaust fan activation to allow the dampers to open. This delay allows the damper to reach the appropriate position to avoid unnecessary fan overload.

Minimum Position Control

There is a minimum damper position potentiometer on the economizer controller. See Fig. 26. The minimum damper position maintains the minimum airflow into the building during the occupied period.

When using demand ventilation, the minimum damper position represents the minimum ventilation position for VOC (volatile organic compound) ventilation requirements. The maximum demand ventilation position is used for fully occupied ventilation.

When demand ventilation control is not being used, the minimum position potentiometer should be used to set the occupied ventilation position. The maximum demand ventilation position should be turned fully clockwise.

Adjust the minimum position potentiometer to allow the minimum amount of outdoor air, as required by local codes, to enter the building. Make minimum position adjustments with at least 10° F temperature difference between the outdoor and return-air temperatures.

FIGURE 25 **Enthalpy Changeover Settings**

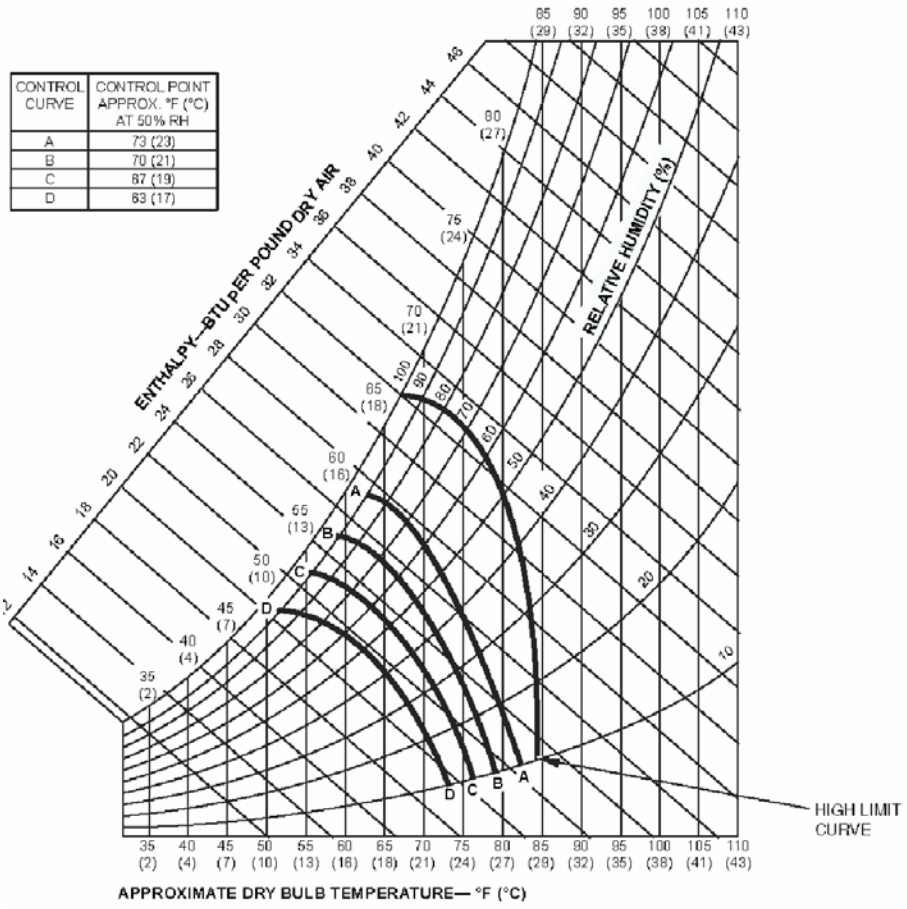


FIGURE 26 **Economizer Control**

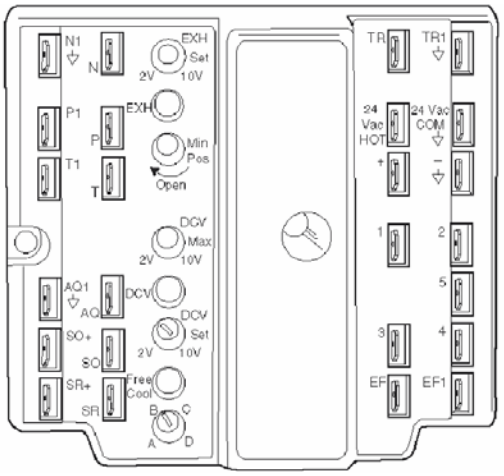
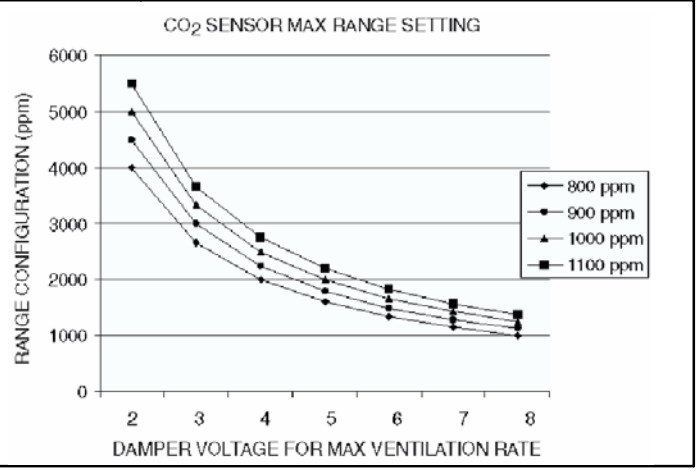


FIGURE 27 **CO_2 Sensor Maximum Range Setting**



To determine the minimum position setting, perform the following procedure:

1. Calculate the appropriate mixed-air temperature using the following formula:

$$(T_O \times \frac{OA}{100}) + (TR \times \frac{RA}{100}) = T_M$$

T_O = Outdoor-Air Temperature
OA = Percent of Outdoor Air
T_R = Return-Air Temperature
RA = Percent of Return Air
T_M = Mixed-Air Temperature

As an example, if local codes require 10% outdoor air during occupied conditions, outdoor-air temperature is 60 F, and return-air temperature is 75 F.

(60 x .10) + (75 x .90) = 73.5 F

2. Disconnect the supply-air sensor from terminals T and T1.
3. Ensure that the factory-installed jumper is in place across terminals P and P1. If remote damper positioning is being used, make sure that the terminals are wired according to Fig. 26 and that the minimum position potentiometer is turned fully clockwise.
4. Connect 24 vac across terminals TR and TR1.
5. Carefully adjust the minimum position potentiometer until the measured mixed-air temperature matches the calculated value.
6. Reconnect the supply-air sensor to terminals T and T1.

Remote control of the economizer damper is desirable when requiring additional temporary ventilation. If a field-supplied remote potentiometer (Honeywell part number S963B1128) is wired to the economizer controller, the minimum position of the damper can be controlled from a remote location.

To control the minimum damper position remotely, remove the factory-installed jumper on the P and P1 terminals on the economizer controller. Wire the field-supplied potentiometer to the P and P1 terminals on the economizer controller. See Fig. 16.

Damper Movement

Damper movement from full open to full closed (or vice versa) takes $2^1/_2$ minutes.

Thermostats

The economizer control works with conventional thermostats that have a Y1 (cool stage 1), Y2 (cool stage 2), W1 (heat stage 1), W2 (heat stage 2), and G (fan). The economizer control does not support space temperature sensors. Connections are made at the thermostat terminal connection board located in the main control box.

Occupancy Control

The factory default configuration for economizer control is occupied mode. This is implemented by the RED jumper at TB2-9 to TB2-10. When unoccupied mode is desired, remove the RED jumper and install a field-supplied timeclock function between TB2-9 and TB2-10. See Fig. 21. When the timeclock contacts are closed, the economizer control will be in occupied mode. When the timeclock contacts are open (removing the 24-v signal from terminal N), the economizer will be in unoccupied mode.

Demand Controlled Ventilation (DCV)

When using the economizer for demand controlled ventilation, there are some equipment selection criteria which should be considered. When selecting the heat capacity and cool capacity of the equipment, the maximum ventilation rate must be evaluated for design conditions. The maximum damper position must be calculated to provide the desired fresh air.

Typically the maximum ventilation rate will be about 5 to 10% more than the typical cfm required per person, using normal outside air design criteria.

A proportional anticipatory strategy should be taken with the following conditions: a zone with a large area, varied occupancy, and equipment that cannot exceed the required ventilation rate at design conditions. Exceeding the required ventilation rate means the equipment can condition air at a maximum ventilation rate that is greater than the required ventilation rate for maximum occupancy. A proportional-anticipatory strategy will cause the fresh air supplied to increase as the room CO_2 level increases even though the CO_2 set point has not been reached. By the time the CO_2 level reaches the set point, the damper will be at maximum ventilation and should maintain the set point.

In order to have the CO_2 sensor control the economizer damper in this manner, first determine the damper voltage output for minimum or base ventilation. Base ventilation is the ventilation required to remove contaminants during unoccupied periods. The following equation may be used to determine the percent of outside-air entering the building for a given damper position. For best results there should be at least a 10 degree difference in outside and return-air temperatures.

$$(T_O \times \frac{OA}{100}) + (TR \times \frac{RA}{100}) = T_M$$

T_O = Outdoor-Air Temperature
OA = Percent of Outdoor Air
T_R = Return-Air Temperature
RA = Percent of Return Air
T_M = Mixed-Air Temperature

Once base ventilation has been determined, set the minimum damper position potentiometer to the correct position.

The same equation can be used to determine the occupied or maximum ventilation rate to the building. For example, an output of 3.6 volts to the actuator provides a base ventilation rate of 5% and an output of 6.7 volts provides the maximum ventilation rate of 20% (or base plus 15 cfm per person). Use Fig. 27 to determine the maximum setting of the CO_2 sensor. For example, a 1100 ppm set point relates to a 15 cfm per person design. Use the 1100 ppm curve on Fig. 27 to find the point when the CO_2 sensor output will be 6.7 volts. Line up the point on the graph with the left side of the chart to determine that the range configuration for the CO_2 sensor should be 1800 ppm. The economizer controller will output the 6.7 volts from the CO_2 sensor to the actuator when the CO_2 concentration in the space is at 1100 ppm. The DCV set point may be left at 2 volts since the CO_2 sensor voltage will be ignored by the economizer controller until it rises above the 3.6 volt setting of the minimum position potentiometer.

Once the fully occupied damper position has been determined, set the maximum damper demand control ventilation potentiometer to this position. Do not set to the maximum position as this can result in over-ventilation to the space and potential high-humidity levels.

CO_2 Sensor Configuration

The CO_2 sensor has preset standard voltage settings that can be selected anytime after the sensor is powered up. See Table 10.

Use setting 1 or 2 for equipment. See Table 10.

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.
2. Press Mode twice. The STDSET Menu will appear.
3. Use the Up/Down button to select the preset number. See Table 10.
4. Press Enter to lock in the selection.
5. Press Mode to exit and resume normal operation.

The custom settings of the CO_2 sensor can be changed anytime after the sensor is energized. Follow the steps below to change the non-standard settings:

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.
2. Press Mode twice. The STDSET Menu will appear.
3. Use the Up/Down button to toggle to the NONSTD menu and press Enter.
4. Use the Up/Down button to toggle through each of the nine variables, starting with Altitude, until the desired setting is reached.
5. Press Mode to move through the variables.
6. Press Enter to lock in the selection, then press Mode to continue to the next variable.

Dehumidification of Fresh Air with DCV Control

Information from ASHRAE indicates that the largest humidity load on any zone is the fresh air introduced. For some applications, a field-supplied energy recovery unit can be added to reduce the moisture content of the fresh air being brought into the building when the enthalpy is high. In most cases, the normal heating and cooling processes are more than adequate to remove the humidity loads for most commercial applications.

If normal rooftop heating and cooling operation is not adequate for the outdoor humidity level, an energy recovery unit and/or a dehumidification option should be considered.

Table 10 – CO_2 Sensor Standard Settings

Setting	Equipment	Output	Ventilation Rate (cfm/Person)	Analog Output	CO_2 Control Range (ppm)	Optional Relay Setpoint (ppm)	Relay Hysteresis (ppm)
1	Interface w/Standard Building Control System	Proportional	Any	0–10V 4–20 mA	0–2000	1000	50
2		Proportional	Any	2–10V 7–20 mA	0–2000	1000	50
3		Exponential	Any	0–10V 4–20 mA	0–2000	1100	50
4	Economizer	Proportional	15	0–10V 4–20 mA	0–1100	1100	50
5		Proportional	20	0–10V 4–20 mA	0–900	900	50
6		Exponential	15	0–10V 4–20 mA	0–1100	1100	50
7		Exponential	20	0–10V 4–20 mA	0–900	900	50
8	Health & Safety	Proportional	—	0–10V 4–20 mA	0–9999	5000	500
9	Parking/Air Intakes/ Loading Docks	Proportional	—	0–10V 4–20 mA	0–2000	700	50

START-UP

Use the following information and Start-Up Checklist on last page to check out unit PRIOR to start-up.

UNIT PREPARATION

Check that unit has been installed in accordance with these installation instructions and all applicable codes.

COMPRESSOR MOUNTING

Compressors are internally spring mounted. Do not loosen or remove compressor holddown bolts.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

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

Disconnect gas piping from unit when leak testing at pressure greater than 1/2 psig. Pressures greater than 1/2 psig will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than 1/2 psig, it *must* be replaced before use. When pressure testing field–supplied gas piping at pressures of 1/2 psig or less, a unit connected to such piping must be isolated by manually closing the gas valve.

REFRIGERANT SERVICE PORTS

Each refrigerant system has a total of 3 Schrader-type service gage ports. One port is located on the suction line, one on the compressor discharge line, and one on the liquid line. In addition, Schrader-type valves are located underneath the low-pressure switches. Be sure that caps on the ports are tight.

COMPRESSOR ROTATION

It is important to be certain the compressors are rotating in the proper direction. To determine whether or not compressors are rotating in the proper direction:

1. Connect service gages to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

1. Note that the evaporator fan is probably also rotating in the wrong direction.
2. Turn off power to the unit.
3. Reverse any two of the incoming power leads.
4. Turn on power to the compressor.

The suction and discharge pressure levels should now move to their normal start-up levels.

NOTE: When compressors are rotating in the wrong direction, the unit will have increased noise levels and will not provide heating and cooling.

After a few minutes of reverse operation, the scroll compressor internal overload protection will open, which will activate the unit's lockout and requires a manual reset. Reset is accomplished by turning the thermostat on and off.

INTERNAL WIRING

Check all electrical connections in unit control boxes; tighten as required.

CRANKCASE HEATER

Crankcase heater(s) is energized as long as there is power to the unit and the compressor is not operating.

IMPORTANT: Unit power must be on for 24 hours prior to start-up. Otherwise, damage to compressor may result.

EVAPORATOR FAN

Fan belt and variable pulleys are factory-installed. See Tables 11-16 for fan performance data. Be sure that fans rotate in the proper direction. See Table 17 for air quantity limits. See Table 19 for static pressure information for accessories and options. See Table 20 for fan rpm at various motor pulley settings. See Table 18 for evaporator fan motor data. To alter fan performance, see Evaporator Fan Performance Adjustment section on page 29.

NOTE: A $3^1/_2$-in. bolt and threaded plate are included in the installer's packet. They can be added to the motor support channel below the motor mounting plate to aid in raising the fan motor.

CONDENSER-FANS AND MOTORS

Condenser fans and motors are factory set. Refer to Condenser-Fan Adjustment section on page 31 as required. Be sure that fans rotate in the proper direction.

RETURN-AIR FILTERS

Check that correct filters are installed in filter tracks (see Table 1). Do not operate unit without return-air filters.

OUTDOOR-AIR INLET SCREENS

Outdoor-air inlet screens must be in place before operating unit.

GAS HEAT

Verify gas pressures before turning on heat as follows:

1. Turn off manual gas stop.
2. Connect pressure gage to supply gas pressure tap (see Fig. 36).
3. Connect pressure gage to manifold pressure tap on gas valve.
4. Turn on manual gas stop and set thermostat to HEAT position. After the unit has run for several minutes, verify that incoming pressure is 5.5 in. wg or greater, and that the manifold pressure is 3.3 in. wg. If manifold pressure must be adjusted, refer to Gas Valve Adjustment section on page 32.
5. After unit has been in operation for 5 minutes, check temperature rise across the heat exchangers. See unit informative plate for correct rise limits of the heat supplied. Air quantities may need to be adjusted to bring the actual rise to within the allowable limits.

FIGURE 28 **Fan Performance Using Accessory Power Exhaust**

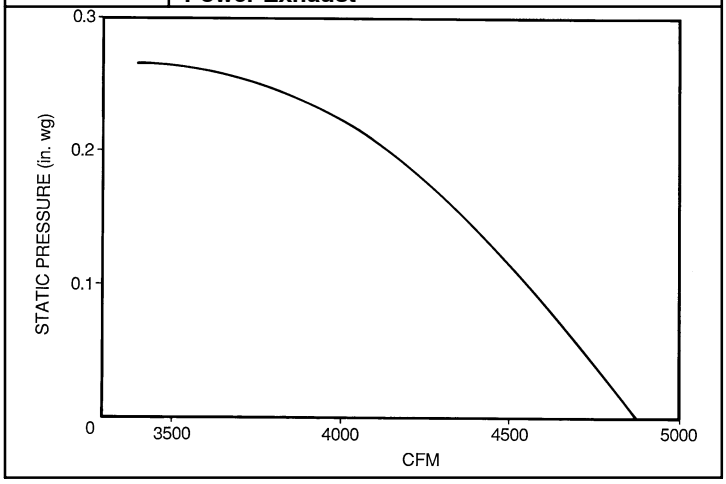


Table 11 — Fan Performance — PGH155 (Low Heat Units with Standard Indoor Fan Motor)*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	649	895	0.94	665	967	1.03	747	1150	1.25	821	1342	1.49	892	1527	1.72
4000	675	1014	1.08	696	1097	1.18	776	1292	1.42	849	1495	1.68	919	1689	1.92
4250	701	1141	1.24	725	1236	1.35	804	1442	1.61	877	1656	1.88	945	1859	2.14
4500	726	1274	1.40	754	1382	1.54	832	1599	1.81	903	1824	2.09	970	2037	2.36
4750	751	1415	1.58	783	1538	1.73	859	1765	2.02	929	2001	2.32	995	2224	2.60
5000	775	1563	1.76	811	1702	1.94	886	1940	2.24	954	2188	2.55	1019	2419	2.84
5250	798	1719	1.96	839	1875	2.16	911	2125	2.47	979	2384	2.80	1042	2625	3.09
5500	822	1884	2.17	866	2060	2.39	937	2321	2.72	1003	2592	3.05	—	—	—
5750	844	2058	2.39	893	2256	2.64	962	2528	2.97	1026	2810	3.32	—	—	—
6000	867	2243	2.62	920	2464	2.90	987	2748	3.24	—	—	—	—	—	—
6250	889	2438	2.86	946	2687	3.17	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	997	1756	2.01	1030	1988	2.30	1094	2236	2.61	1156	2497	2.94	1214	2769	3.27
4000	1023	1931	2.23	1054	2173	2.53	1116	2431	2.86	1176	2702	3.19	—	—	—
4250	1048	2114	2.46	1076	2366	2.77	1137	2634	3.10	—	—	—	—	—	—
4500	1073	2304	2.70	1098	2566	3.02	—	—	—	—	—	—	—	—	—
4750	1096	2504	2.94	1119	2775	3.28	—	—	—	—	—	—	—	—	—
5000	1119	2712	3.20	—	—	—	—	—	—	—	—	—	—	—	—
5250	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6250	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower
FIOP — Factory-Installed Option
Watts — Input Watts to Motor

*Standard low-medium static drive range is 895 to 1147 rpm. Alternate high-static drive range is 1040 to 1315. Other rpms require a field-supplied drive.

NOTES:

1. Maximum continuous bhp for the standard motor is 3.13. The maximum continuous watts is 2700. Do not adjust motor rpm such that motor maximum bhp and/or watts is exceeded at the maximum operating cfm.
2. Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table.
3. Interpolation is permissible. Do not extrapolate.
4. Fan performance is based on wet coils, clean filters, and casing losses. See Table 19 for accessory/FIOP static pressure information.
5. Extensive motor and drive testing on these units ensures that the full bhp and watts range of the motor can be utilized with confidence. Using fan motors up to the watts or bhp rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
6. Use of a field-supplied motor may affect wiring size.

Table 12 — Fan Performance — PGH155 (Low Heat Units with Optional Indoor Fan Motor)*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	649	895	0.94	665	967	1.03	747	1150	1.25	821	1342	1.49	892	1527	1.72
4000	675	1014	1.08	696	1097	1.18	776	1292	1.42	849	1495	1.68	919	1689	1.92
4250	701	1141	1.24	725	1236	1.35	804	1442	1.61	877	1656	1.88	945	1859	2.14
4500	726	1274	1.40	754	1382	1.54	832	1599	1.81	903	1824	2.09	970	2037	2.36
4750	751	1415	1.58	783	1538	1.73	859	1765	2.02	929	2001	2.32	995	2224	2.60
5000	775	1563	1.76	811	1702	1.94	886	1940	2.24	954	2188	2.55	1019	2419	2.84
5250	798	1719	1.96	839	1875	2.16	911	2125	2.47	979	2384	2.80	1042	2625	3.09
5500	822	1884	2.17	866	2060	2.39	937	2321	2.72	1003	2592	3.05	1065	2841	3.36
5750	844	2058	2.39	893	2256	2.64	962	2528	2.97	1026	2810	3.32	1087	3069	3.63
6000	867	2243	2.62	920	2464	2.90	987	2748	3.24	1049	3042	3.60	1108	3308	3.91
6250	889	2438	2.86	946	2687	3.17	1011	2981	3.52	1072	3286	3.88	1130	3559	4.20

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	997	1756	2.01	1030	1988	2.30	1094	2236	2.61	1156	2497	2.94	1214	2769	3.27
4000	1023	1931	2.23	1054	2173	2.53	1116	2431	2.86	1176	2702	3.19	1233	2984	3.53
4250	1048	2114	2.46	1076	2366	2.77	1137	2634	3.10	1196	2914	3.44	1251	3206	3.79
4500	1073	2304	2.70	1098	2566	3.02	1157	2844	3.36	1214	3133	3.70	1268	3433	4.05
4750	1096	2504	2.94	1119	2775	3.28	1177	3062	3.62	1232	3360	3.97	1285	3666	4.32
5000	1119	2712	3.20	1140	2993	3.54	1196	3288	3.89	1249	3592	4.24	1301	3905	4.59
5250	1142	2931	3.46	1159	3220	3.81	1214	3523	4.16	1266	3832	4.51	1316	4148	4.86
5500	1163	3160	3.74	1179	3457	4.08	1231	3765	4.43	1282	4077	4.78	1331	4395	5.14
5750	1184	3399	4.01	1197	3702	4.36	1248	4014	4.71	1297	4328	5.06	1345	4644	5.41
6000	1205	3649	4.30	1215	3957	4.65	1265	4270	5.00	1312	4581	5.34	1359	4893	5.69
6250	1225	3910	4.60	1233	4219	4.94	1281	4531	5.29	1327	4837	5.63	1372	5141	5.97

LEGEND

Bhp — Brake Horsepower
FIOP — Factory-Installed Option
Watts — Input Watts to Motor

*Standard low-medium static drive range is 895 to 1147 rpm. Alternate high-static drive range is 1040 to 3610. Other rpms require a field- supplied drive.

NOTES:

1. Field-supplied motor.
2. Maximum continuous bhp for the optional motor is 4.26. The maximum continuous watts is 3610. Do not adjust motor rpm such that motor maximum bhp and/or watts is exceeded at the maximum operating cfm.
3. Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table.
4. Interpolation is permissible. Do not extrapolate.
5. Fan performance is based on wet coils, clean filters, and casing losses. See Table 19 for accessory/FIOP static pressure information.
6. Extensive motor and drive testing on these units ensures that the full bhp and watts range of the motor can be utilized with confidence. Using fan motors up to the watts or bhp rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
7. Use of a field-supplied motor may affect wiring size.

Table 13 — Fan Performance — PGH180 (Low Heat Units)*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
4500	753	1307	1.53	761	1330	1.56	840	1572	1.84	912	1822	2.14	980	2080	2.44
4800	747	1384	1.62	790	1515	1.78	866	1765	2.07	936	2023	2.37	1002	2289	2.68
5100	741	1465	1.72	820	1718	2.01	893	1977	2.32	961	2243	2.63	1025	2516	2.95
5700	810	1911	2.24	882	2182	2.56	950	2459	2.88	1014	2741	3.21	1075	3029	3.55
6000	844	2164	2.54	914	2444	2.87	980	2730	3.20	1042	3021	3.54	1100	3317	3.89
6300	879	2439	2.86	947	2729	3.20	1010	3023	3.55	1070	3322	3.90	1127	3626	4.25
6600	915	2737	3.21	980	3035	3.56	1041	3338	3.91	1099	3645	4.28	1155	3957	4.64
6900	950	3057	3.59	1013	3364	3.95	1072	3675	4.31	1129	3991	4.68	1183	4311	5.06
7200	986	3401	3.99	1047	3717	4.36	1104	4037	4.74	1159	4361	5.11	1211	4689	5.50
7500	1022	3770	4.42	1081	4095	4.80	1136	4423	5.19	1189	4755	5.58	1241	5091	5.97

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
4500	1044	2345	2.75	1105	2619	3.07	1163	2899	3.40	1218	3187	3.74	1271	3481	4.08
4800	1065	2561	3.00	1124	2841	3.33	1180	3127	3.67	1235	3420	4.01	1287	3720	4.36
5100	1086	2795	3.28	1144	3082	3.61	1199	3375	3.96	1252	3674	4.31	1304	3979	4.67
5700	1132	3324	3.90	1187	3624	4.25	1240	3929	4.61	1291	4241	4.97	1341	4558	5.35
6000	1157	3619	4.24	1210	3925	4.60	1262	4239	4.97	1312	4557	5.34	1361	4880	5.72
6300	1182	3935	4.62	1234	4249	4.98	1285	4569	5.36	1334	4894	5.74	—	—	—
6600	1208	4274	5.01	1259	4595	5.39	1309	4922	5.77	—	—	—	—	—	—
6900	1235	4636	5.44	1285	4964	5.82	—	—	—	—	—	—	—	—	—
7200	1262	5021	5.89	—	—	—	—	—	—	—	—	—	—	—	—
7500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	2.2			2.4			2.6			2.8			3.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
4500	1322	3781	4.43	1372	4088	4.79	1419	4400	5.16	1466	4719	5.53	1511	5042	5.91
4800	1337	4025	4.72	1386	4337	5.09	1433	4655	5.46	1479	4978	5.84	—	—	—
5100	1353	4290	5.03	1401	4607	5.40	1448	4930	5.78	—	—	—	—	—	—
5700	1388	4881	5.72	—	—	—	—	—	—	—	—	—	—	—	—
6000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6600	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6900	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

FIOP — Factory-Installed Option

Watts — Input Watts to Motor

*Standard low-medium static drive range is 873 to 1021 rpm. Alternate high-static drive range is 1025 to 1200. Other rpms require a field- supplied drive.

NOTES:

1. Maximum continuous bhp for the standard motor is 6.13. The maximum continuous watts is 5180. Do not adjust motor rpm such that motor maximum bhp and/or watts is exceeded at the maximum operating cfm.
2. Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table.
3. Interpolation is permissible. Do not extrapolate.
4. Fan performance is based on wet coils, clean filters, and casing losses. See Table 19 for accessory/FIOP static pressure information.
5. Extensive motor and drive testing on these units ensures that the full bhp and watts range of the motor can be utilized with confidence. Using fan motors up to the watts or bhp rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
6. Use of a field-supplied motor may affect wiring size.

Table 14 — Fan Performance — PGH155 (High Heat Units with Standard Indoor Fan Motor)*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	628	888	0.93	684	1027	1.08	761	1234	1.30	835	1454	1.53	906	1584	1.79
4000	660	1015	1.09	717	1168	1.25	793	1388	1.48	865	1620	1.73	935	1756	2.01
4250	691	1151	1.25	749	1317	1.43	823	1550	1.68	894	1793	1.95	963	1937	2.24
4500	721	1295	1.43	780	1474	1.62	853	1719	1.89	923	1973	2.17	989	2126	2.47
4750	751	1448	1.62	810	1641	1.83	882	1896	2.12	951	2159	2.41	1016	2326	2.72
5000	781	1610	1.82	841	1817	2.06	911	2081	2.36	978	2353	2.66	1041	2536	2.98
5250	810	1783	2.04	871	2003	2.29	939	2277	2.61	1005	2556	2.93	1066	2757	3.25
5500	839	1967	2.27	900	2200	2.54	967	2482	2.87	1031	2768	3.20	—	—	—
5750	868	2163	2.52	929	2410	2.81	994	2699	3.15	—	—	—	—	—	—
6000	896	2373	2.78	958	2634	3.09	—	—	—	—	—	—	—	—	—
6250	924	2596	3.06	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	975	1829	2.07	1041	2091	2.36	1099	2343	2.65	1161	2521	2.97	1219	2801	3.30
4000	1002	2010	2.30	1066	2279	2.60	1124	2540	2.90	1183	2738	3.23	—	—	—
4250	1028	2198	2.54	1090	2474	2.86	1147	2743	3.17	—	—	—	—	—	—
4500	1053	2395	2.79	1114	2675	3.11	—	—	—	—	—	—	—	—	—
4750	1077	2601	3.05	—	—	—	—	—	—	—	—	—	—	—	—
5000	1101	2816	3.31	—	—	—	—	—	—	—	—	—	—	—	—
5250	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6250	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

FIOP — Factory-Installed Option

Watts — Input Watts to Motor

*Standard low-medium static drive range is 895 to 1147 rpm. Alternate high-static drive range is 1040 to 1315. Other rpms require a field-supplied drive.

NOTES:

1. Maximum continuous bhp for the standard motor is 3.13. The maximum continuous watts is 2700. Do not adjust motor rpm such that motor maximum bhp and/or watts is exceeded at the maximum operating cfm.
2. Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table.
3. Interpolation is permissible. Do not extrapolate.
4. Fan performance is based on wet coils, clean filters, and casing losses. See Table 19 for accessory/FIOP static pressure information.
5. Extensive motor and drive testing on these units ensures that the full bhp and watts range of the motor can be utilized with confidence. Using fan motors up to the watts or bhp rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
6. Use of a field-supplied motor may affect wiring size.

Table 15 — Fan Performance — PGH155 (High Heat Units with Optional Indoor Fan Motor)*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	628	888	0.93	684	1027	1.08	761	1234	1.30	835	1454	1.53	906	1584	1.79
4000	660	1015	1.09	717	1168	1.25	793	1388	1.48	865	1620	1.73	935	1756	2.01
4250	691	1151	1.25	749	1317	1.43	823	1550	1.68	894	1793	1.95	963	1937	2.24
4500	721	1295	1.43	780	1474	1.62	853	1719	1.89	923	1973	2.17	989	2126	2.47
4750	751	1448	1.62	810	1641	1.83	882	1896	2.12	951	2159	2.41	1016	2326	2.72
5000	781	1610	1.82	841	1817	2.06	911	2081	2.36	978	2353	2.66	1041	2536	2.98
5250	810	1783	2.04	871	2003	2.29	939	2277	2.61	1005	2556	2.93	1066	2757	3.25
5500	839	1967	2.27	900	2200	2.54	967	2482	2.87	1031	2768	3.20	1090	2991	3.54
5750	868	2163	2.52	929	2410	2.81	994	2699	3.15	1056	2990	3.48	1114	3237	3.83
6000	896	2373	2.78	958	2634	3.09	1021	2929	3.43	1081	3225	3.78	1137	3497	4.13
6250	924	2596	3.06	986	2872	3.38	1047	3172	3.74	1106	3473	4.09	1160	3769	4.44

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	975	1829	2.07	1041	2091	2.36	1099	2343	2.65	1161	2521	2.97	1219	2801	3.30
4000	1002	2010	2.30	1066	2279	2.60	1124	2540	2.90	1183	2738	3.23	1240	3023	3.57
4250	1028	2198	2.54	1090	2474	2.86	1147	2743	3.17	1205	2962	3.50	1260	3251	3.84
4500	1053	2395	2.79	1114	2675	3.11	1170	2951	3.43	1226	3194	3.78	1279	3487	4.12
4750	1077	2601	3.05	1136	2885	3.38	1191	3168	3.71	1245	3435	4.06	1297	3731	4.41
5000	1101	2816	3.31	1158	3104	3.65	1212	3392	3.99	1265	3683	4.34	1315	3981	4.69
5250	1124	3042	3.59	1179	3332	3.93	1232	3626	4.28	1283	3940	4.63	1332	4239	4.98
5500	1146	3279	3.88	1200	3570	4.22	1252	3870	4.58	1301	4203	4.92	1348	4501	5.27
5750	1168	3528	4.17	1220	3819	4.51	1271	4125	4.87	1318	4471	5.22	1364	4769	5.57
6000	1189	3789	4.47	1239	4080	4.81	1289	4389	5.18	1335	4742	5.52	1380	5038	5.87
6250	1210	4062	4.78	1258	4351	5.12	1307	4664	5.49	1351	5015	5.83	1394	5307	6.17

LEGEND

Bhp — Brake Horsepower
FIOP — Factory-Installed Option
Watts — Input Watts to Motor

*Standard low-medium static drive range is 895 to 1147 rpm. Alternate high-static drive range is 1040 to 1315. Other rpms require a field-supplied drive.

NOTES:

1. Field-supplied motor.
2. Maximum continuous bhp for the optional motor is 4.26. The maximum continuous watts is 3610. Do not adjust motor rpm such that motor maximum bhp and/or watts is exceeded at the maximum operating cfm.
3. Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table.
4. Interpolation is permissible. Do not extrapolate.
5. Fan performance is based on wet coils, clean filters, and casing losses. See Table 19 for accessory/FIOP static pressure information.
6. Extensive motor and drive testing on these units ensures that the full bhp and watts range of the motor can be utilized with confidence. Using fan motors up to the watts or bhp rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
7. Use of a field-supplied motor may affect wiring size.

Table 16 — Fan Performance — PGH180 (High Heat Units)*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
4500	753	1307	1.53	786	1404	1.65	861	1644	1.93	932	1893	2.22	997	2150	2.52
4800	747	1384	1.62	818	1603	1.88	890	1852	2.17	958	2108	2.47	1022	2373	2.78
5100	775	1571	1.84	850	1822	2.14	920	2079	2.44	986	2344	2.75	1048	2616	3.07
5700	849	2054	2.41	918	2323	2.73	982	2598	3.05	1044	2879	3.38	1102	3166	3.71
6000	886	2329	2.73	952	2607	3.06	1015	2891	3.39	1074	3180	3.73	1130	3474	4.08
6300	924	2628	3.08	987	2915	3.42	1047	3207	3.76	1105	3504	4.11	1160	3807	4.46
6600	962	2951	3.46	1023	3246	3.81	1081	3547	4.16	1136	3853	4.52	1190	4163	4.88
6900	1000	3298	3.87	1059	3603	4.23	1115	3912	4.59	1168	4225	4.96	1220	4543	5.33
7200	1038	3672	4.31	1095	3986	4.67	1149	4303	5.05	1201	4625	5.42	1251	4950	5.81
7500	1077	4072	4.78	1131	4394	5.15	1184	4720	5.54	1234	5050	5.92	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
4500	1060	2414	2.83	1119	2685	3.15	1175	2964	3.48	1230	3250	3.81	1282	3542	4.15
4800	1082	2644	3.10	1140	2922	3.43	1195	3207	3.76	1248	3498	4.10	1299	3795	4.45
5100	1106	2894	3.39	1163	3178	3.73	1216	3470	4.07	1268	3767	4.42	1319	4071	4.77
5700	1157	3459	4.06	1211	3757	4.41	1262	4061	4.76	1312	4371	5.13	1360	4686	5.50
6000	1184	3774	4.43	1236	4080	4.79	1287	4391	5.15	1335	4707	5.52	1382	5029	5.90
6300	1212	4114	4.83	1263	4427	5.19	1312	4745	5.57	1359	5067	5.94	—	—	—
6600	1241	4478	5.25	1290	4798	5.63	1338	5122	6.01	—	—	—	—	—	—
6900	1270	4866	5.71	—	—	—	—	—	—	—	—	—	—	—	—
7200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)														
	2.2			2.4			2.6			2.8			3.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
4500	1332	3841	4.50	1381	4145	4.86	1428	4456	5.23	1473	4772	5.60	1518	5095	5.98
4800	1349	4100	4.81	1397	4409	5.17	1443	4725	5.54	1488	5046	5.92	—	—	—
5100	1367	4380	5.14	1414	4695	5.51	1460	5016	5.88	—	—	—	—	—	—
5700	1407	5007	5.87	—	—	—	—	—	—	—	—	—	—	—	—
6000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6600	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6900	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

FIOP — Factory-Installed Option

Watts — Input Watts to Motor

*Standard low-medium static drive range is 873 to 1021 rpm. Alternate high-static drive range is 1025 to 1200. Other rpms require a field-supplied drive.

NOTES:

1. Maximum continuous bhp for the standard motor is 6.13. The maximum continuous watts is 5180. Do not adjust motor rpm such that motor maximum bhp and/or watts is exceeded at the maximum operating cfm.
2. Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table.
3. Interpolation is permissible. Do not extrapolate.
4. Fan performance is based on wet coils, clean filters, and casing losses. See Table 19 for accessory/FIOP static pressure information.
5. Extensive motor and drive testing on these units ensures that the full bhp and watts range of the motor can be utilized with confidence. Using fan motors up to the watts or bhp rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
6. Use of a field-supplied motor may affect wiring size.

Table 17 — Air Quantity Limits

UNIT PGH	MINIMUM CFM	MAXIMUM CFM
155	3600	6,000
180	4500	7,500

Table 18 — Evaporator Fan Motor Specifications

UNIT PGH	NOMINAL Hp	VOLTAGE	MAX WATTS	EFF.	MAX BHP	MAX BkW	MAX AMPS
155 (Standard Motor)	2.9	208	2700	85.8%	3.13	2.34	9.46
	2.9	230	2700	85.8%	3.13	2.34	8.6
	2.9	460	2700	85.8%	3.13	2.34	4.3
155 (Optional Motor)	3.7	208	3610	85.8%	4.26	3.27	10.5
	3.7	230	3610	85.8%	4.26	3.27	10.5
	3.7	460	3610	85.8%	4.26	3.27	4.8
180	5	208	5180	87.5%	6.13	4.57	15.8
	5	230	5180	87.5%	6.13	4.57	15.8
	5	460	5180	87.5%	6.13	4.57	7.9

LEGEND

BHP — Brake Horsepower

Table 19 — Accessory/FIOP economizer Static Pressure (in. wg)

UNIT PGH	UNIT VOLTAGE	CFM	ECONOMIZER PRESSURE DROP
155, 180	All	3,750	.03
		4,000	.03
		5,000	.05
		6,000	.07
		7,500	.10

LEGEND

FIOP — Factory-Installed Option

NOTES:

1. The factory-assembled horizontal adapter substantially improves fan performance. See Fig. 33.
2. The static pressure must be added to external static pressure. The sum and the evaporator entering-air cfm should then be used in conjunction with the Fan Performance table to determine blower rpm, bhp, and watts.

Table 20 — Fan Rpm and Motor Pulley Settings*

UNIT PGH	NUMBER OF TURNS OPEN												
	0	1/2	1	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6
155†	1147	1124	1101	1078	1055	1032	1010	987	964	941	918	895	††
155**	1315	1292	1269	1246	1223	1200	1178	1155	1132	1109	1086	1063	1040
180†	††	††	††	††	1021	1002	984	965	947	928	910	891	873
180**	††	††	††	††	1200	1178	1156	1134	1112	1091	1069	1047	1025

*Approximate fan rpm shown.
†Indicates standard drive package.
**Indicates alternate drive package.
††Due to belt and pulley style, pulley cannot be set to this number of turns open.

OPERATING SEQUENCE

Cooling, Units With Economizer

When thermostat calls for cooling, terminals G and Y1 are energized. The indoor (evaporator) fan contactor (IFC), compressor contactor no. 1 (C1) and outdoor-fan contactor (OFC) are energized, and evaporator-fan motor, compressor no. 1, and both condenser fans start. The condenser-fan motors run continuously while unit is cooling. If the thermostat calls for a second stage of cooling by energizing Y2, compressor contactor no. 2 (C2) is energized and compressor no. 2 starts.

When the thermostat is satisfied, C1 and C2 are deenergized and the compressors and outdoor (condenser) fan motors (OFM) shut off. After a 30-second delay, the indoor (evaporator) fan motor (IFM) shuts off. If the thermostat fan selector switch is in the ON position, the evaporator-fan motor will run continuously.

Heating, Units Without Economizer

When the thermostat calls for heating, terminal W1 is energized. In order to prevent thermostat short-cycling, the unit is locked into the Heating mode for at least 1 minute when W1 is energized. The induced-draft motor (IDM) is then energized and the burner ignition sequence begins. The indoor (evaporator) fan motor (IFM) is energized 45 seconds after a flame is ignited. On units equipped for two stages of heat, when additional heat is needed, W2 is energized and the high-fire solenoid on the main gas valve (MGV) is energized. When the thermostat is satisfied and W1 and W2 are deenergized, the IFM stops after a 45-second time-off delay.

Cooling, Units with Economizer

When free cooling is not available, the compressors will be controlled by the zone thermostat. When free cooling is available, the outdoor-air damper is modulated by the economizer control to provide a 50 to 55 F supply-air temperature into the zone. As the supply-air temperature fluctuates above 55 or below 50 F, the dampers will be modulated (open or close) to bring the supply-air temperature back within the set point limits.

For economizer operation, there must be a thermostat call for the fan (G). This will move the damper to its minimum position during the occupied mode.

Above 50 F supply-air temperature, the dampers will modulate from 100% open to the minimum open position. From 50 F to 45 F supply-air temperature, the dampers will maintain at the minimum open position. Below 45 F the dampers will be completely shut. As the supply-air temperature rises, the dampers will come back open to the minimum open position once the supply-air temperature rises to 48 F.

If optional power exhaust is installed, as the outdoor-air damper opens and closes, the power exhaust fan will be energized and deenergized.

If field-installed accessory CO_2 sensors are connected to the economizer control, a demand controlled ventilation strategy will begin to operate. As the CO_2 level in the zone increases above the CO_2 set point, the minimum position of the damper will be increased proportionally. As the CO_2 level decreases because of the increase in fresh air, the outdoor-air damper will be proportionally closed. Damper position will follow the higher demand condition from DCV mode or free cooling mode.

Damper movement from full closed to full open (or vice versa) will take between $1^1/_2$ and $2^1/_2$ minutes.

If free cooling can be used as determined from the appropriate changeover command (switch, dry bulb, enthalpy curve, differential dry bulb, or differential enthalpy), a call for cooling (Y1 closes at the thermostat) will cause the control to modulate the dampers open to maintain the supply air temperature set point at 50 to 55 F.

As the supply-air temperature drops below the set point range of 50 to 55 F, the control will modulate the outdoor-air dampers closed to maintain the proper supply-air temperature.

Heating, Units With Economizer

When the room thermostat calls for heat, the heating controls are energized as described in the Heating, Units Without Economizer section. When the indoor fan is running, the economizer damper moves to the minimum position. When the indoor fan is off, the economizer damper is fully closed.

SERVICE

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

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

CLEANING

Inspect unit interior at beginning of each heating and cooling season and as operating conditions require. Remove unit top panel and/or side panels for access to unit interior.

Main Burner

At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames.

Flue Gas Passageways

The flue collector box and heat exchanger cells may be inspected by removing heat exchanger access panel (Fig. 3), flue box cover, and main burner assembly (Fig. 29). Refer to Main Burners section on page 32 for burner removal sequence. If cleaning is required, remove heat exchanger baffles and clean tubes with a wire brush.

Use caution with ceramic heat exchanger baffles. When installing retaining clip, be sure the center leg of the clip extends inward toward baffle. See Fig. 30.

Combustion-Air Blower

Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically

during heating season. For the first heating season, inspect blower wheel bi-monthly to determine proper cleaning frequency.

To inspect blower wheel, remove heat exchanger access panel. Shine a flashlight into opening to inspect wheel. If cleaning is required, remove motor and wheel assembly by removing screws holding motor mounting plate to top of combustion fan housing. The motor and wheel assembly will slide up and out of the fan housing. Remove the blower wheel from the motor shaft and clean with a detergent or solvent. Replace motor and wheel assembly.

Evaporator Coil

Clean as required with commercial coil cleaner.

FIGURE 29 Typical Gas Heating Section

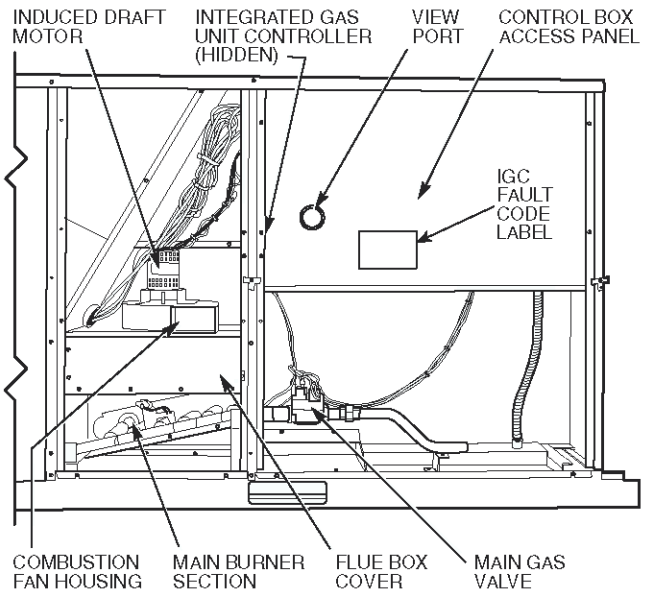
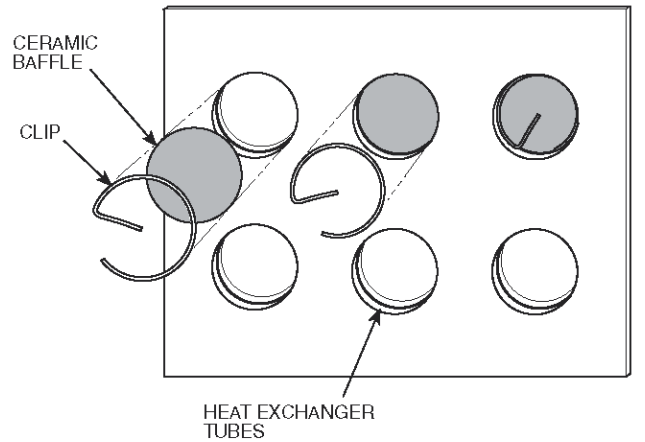


FIGURE 30 Removing Heat Exchanger Ceramic Baffles and Clips



NOTE: One baffle and clip will be in each upper tube of the heat exchanger.

Condenser Coil

Clean condenser coil annually and as required by location and outdoor-air conditions. Inspect coil monthly — clean as required.

Condensate Drain

Check and clean each year at start of cooling season. In winter, keep drains and traps dry.

Filters

Clean or replace at start of each heating and cooling season, or more often if operating conditions require. Refer to Table 1 for type and size.

Outdoor-Air Inlet Screens

Clean screens with steam or hot water and a mild detergent. Do not use throwaway filters in place of screens.

LUBRICATION

Compressors

Each compressor is charged with the correct amount of oil at the factory. Conventional white oil (Sontex 200LT) is used. White oil is compatible with 3GS oil, and 3GS oil may be used if the addition of oil is required. See compressor nameplate for original oil charge. A complete recharge should be four ounces less than the original oil charge. When a compressor is exchanged in the field it is possible that a major portion of the oil from the replaced compressor may still be in the system. While this will not affect the reliability of the replacement compressor, the extra oil will add rotor drag and increase power usage. To remove this excess oil, an access valve may be added to the lower portion of the suction line at the inlet of the compressor. The compressor should then be run for 10 minutes, shut down and the access valve opened until no oil flows. This should be repeated twice to make sure the proper oil level has been achieved.

Fan Shaft Bearings

For size 155 units, bearings are permanently lubricated. No field lubrication is required. For size 180 units, lubricate bearings at least every 6 months with suitable bearing grease. Extended grease line is provided for far side fan bearing (opposite drive side). Typical lubricants are given below:

MANUFACTURER	LUBRICANT
Texaco	Regal AFB-2*
Mobil	Mobilplex EP No. 1
Sunoco	Prestige 42
Texaco	Multifak 2

*Preferred lubricant because it contains rust and oxidation inhibitors.

Condenser and Evaporator-Fan Motor Bearings

The condenser and evaporator-fan motors have permanently sealed bearings, so no field lubrication is necessary.

EVAPORATOR FAN PERFORMANCE ADJUSTMENT (Fig. 31 to 33)

Fan motor pulleys are factory set for speed shown in Table 1.

To change fan speeds:

1. Shut off unit power supply.
   a. Size 155 only: Loosen belt by loosening carriage nuts holding motor mount assembly to fan scroll side plates (A and B).

b. Size 180 only: Loosen nuts on the 2 carriage bolts in the mounting base. Install jacking bolt and plate under motor base (bolt and plate are shipped in installer's packet). Using bolt and plate, raise motor to top of slide and remove belt. Secure motor in this position by tightening the nuts on the carriage bolts.

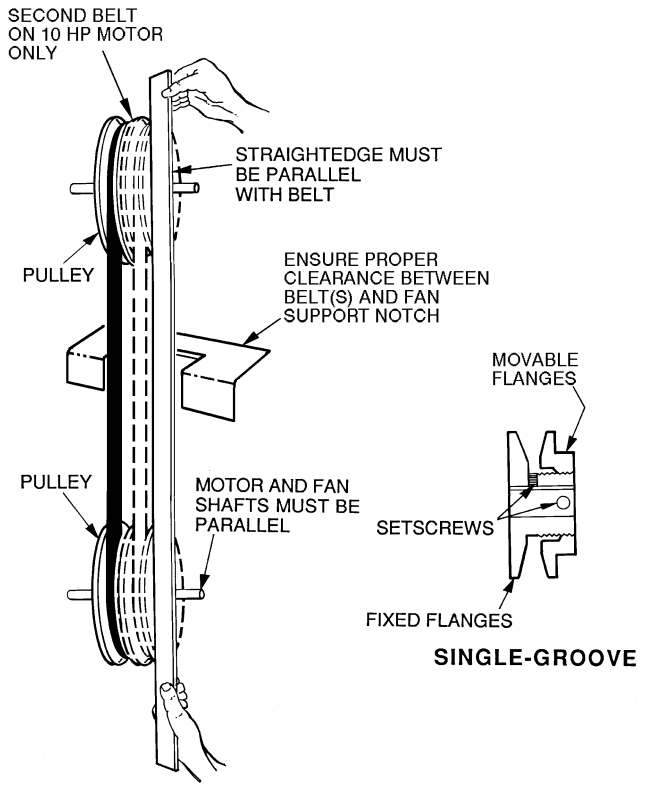
2. Loosen movable-pulley flange setscrew (see Fig. 31).
3. Screw movable flange toward fixed flange to increase speed and away from fixed flange to decrease speed. Increasing fan speed increases load on motor. Do not exceed maximum speed specified in Table 1.

   See Table 17 for air quantity limits.
4. Set movable flange at nearest keyway of pulley hub and tighten setscrew. (See Table 1 for speed change for each full turn of pulley flange.)
5. Replace and tighten belts (see Belt Tension Adjustment section on page 31).

To align fan and motor pulleys:

1. Loosen fan pulley setscrews.
2. Slide fan pulley along fan shaft.
3. Make angular alignment by loosening motor from mounting plate.

FIGURE 31 **Evaporator Fan Alignment and Adjustment**



EVAPORATOR FAN SERVICE AND REPLACEMENT

A. PGH155 Units (See Fig. 33)

NOTE: To remove belts only, follow Steps 1-6.

1. Remove filter and supply-air section panels.
2. Remove unit top panel.
3. Loosen carriage nuts A and B holding motor mount assembly to fan scroll side plates.
4. Loosen screw C.
5. Rotate motor mount assembly (with motor attached) as far as possible away from evaporator coil.
6. Remove belt.
7. Rotate motor mount assembly back past original position toward evaporator coil.
8. Remove motor mounting nuts D and E (both sides).
9. Lift motor up through top of unit.
10. Reverse above procedure to reinstall motor.
11. Check and adjust belt tension as necessary.

B. PGH180 Units (See Fig. 33)

The PGH180 units use a fan motor mounting system that features a slide-out motor mounting plate. To replace or service the motor, slide out the bracket.

1. Remove the evaporator-fan access panel and the heating control access panel.
2. Remove the center post (located between the evaporator fan and heating control access panels) and all screws securing it.
3. Loosen nuts on the 2 carriage bolts in the motor mounting base.
4. Using jacking bolt under motor base, raise motor to top of slide and remove belt. Secure motor in this position by tightening the nuts on the carriage bolts.
5. Remove the belt drive.
6. Remove jacking bolt and tapped jacking bolt plate.
7. Remove the 2 screws that secure the motor mounting plate to the motor support channel.
8. Remove the 3 screws from the end of the motor support channel that interfere with the motor slide path.
9. Slide out the motor and motor mounting plate.
10. Disconnect wiring connections and remove the 4 mounting bolts.
11. Remove the motor.
12. To install the new motor, reverse Steps 1-11.

FIGURE 32 **PGH155 Indoor Fan Motor Section**

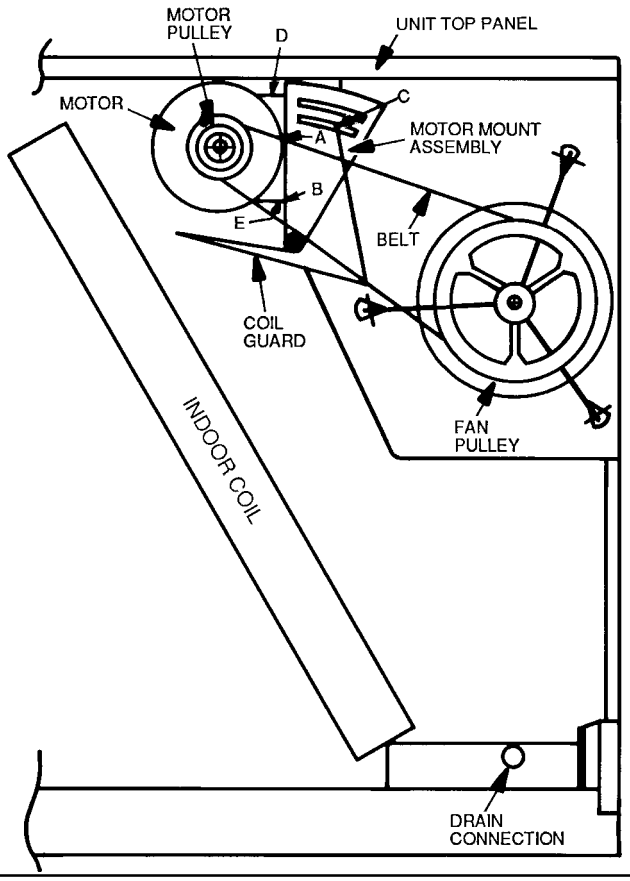
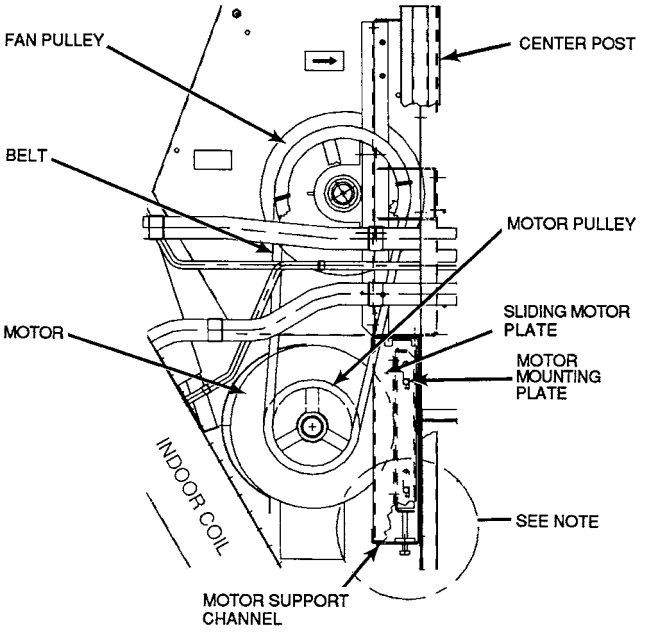


FIGURE 33 **PGH180 Indoor Fan Motor Section**



NOTE: A $3^1/_2$-in. bolt and threaded plate are included in the installer's packet. They can be added to the motor support channel below the motor mounting plate to aid in raising the motor.

BELT TENSION ADJUSTMENT

To adjust belt tension:

1. Loosen fan motor bolts.
2. a. Size 150 units:

   Move motor mounting plate up or down for proper belt tension ($^1/_2$ in. deflection with one finger).

   b. Size 180 units:

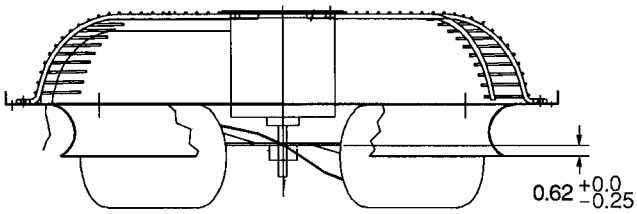
   Turn motor jacking bolt to move motor mounting plate up or down for proper belt tension ($^3/_8$ in. deflection at midspan with one finger [9 lb force]).
3. Tighten nuts.
4. Adjust bolts and nut on mounting plate to secure motor in fixed position.

CONDENSER-FAN ADJUSTMENT

PGH180, 210, 300 UNITS (Fig. 34)

1. Shut off unit power supply.
2. Remove access panel(s) closest to the fan to be adjusted.
3. Loosen fan hub setscrews.
4. Adjust fan height on shaft using a straightedge placed across the fan orifice.
5. Tighten setscrews and replace panel(s).
6. Turn on unit power.

FIGURE 34 **Outdoor Fan Adjustment – PGH180, 210, 300**



NOTE: Dimensions are in inches.

POWER FAILURE

Dampers have a spring return. In event of power failure, dampers will return to fully closed position until power is restored. *Do not manually operate economizer motor.*

REFRIGERANT CHARGE

Amount of refrigerant charge is listed on unit nameplate and in Table 1. Refer to GTAC II; Module 5; Charging, Recovery, Recycling, and Reclamation section for charging methods and procedures. Unit panels must be in place when unit is operating during charging procedure.

NOTE: Do not use recycled refrigerant as it may contain contaminants.

No Charge

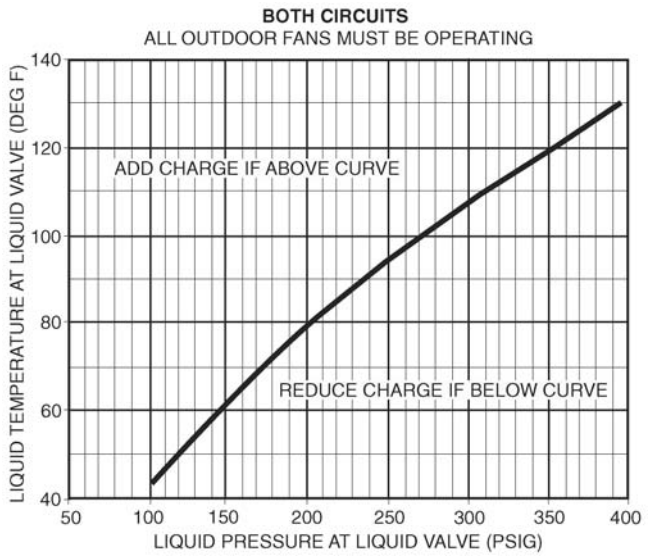
Use standard evacuating techniques. After evacuating system, weigh in the specified amount of refrigerant (refer to Table 1).

Low Charge Cooling

Using cooling charging chart (see Fig. 35), add or remove refrigerant until conditions of the chart are met. Note that charging chart is different from those normally used. An accurate pressure gage and temperature-sensing device is required. Charging is accomplished by ensuring the proper amount of liquid subcooling. Measure liquid line pressure at

the liquid line service valve using pressure gage. Connect temperature sensing device to the liquid line near the liquid line service valve and insulate it so that outdoor ambient temperature does not affect reading.

FIGURE 35 | **Cooling Charging Chart**



To Use the Cooling Charging Chart

Use the above temperature and pressure readings, and find the intersection point on the cooling charging chart. If intersection point on chart is above line, add refrigerant. If intersection point on chart is below line, carefully recover some of the charge. Recheck suction pressure as charge is adjusted.

NOTE: Indoor-air cfm must be within normal operating range of unit. All outdoor fans must be operating.

The TXV (thermostatic expansion valve) is set to maintain between 15 and 20 degrees of superheat at the compressors. The valves are factory set and should not require re-adjustment.

GAS VALVE ADJUSTMENT

Natural Gas

The gas valve opens and closes in response to the thermostat or limit control.

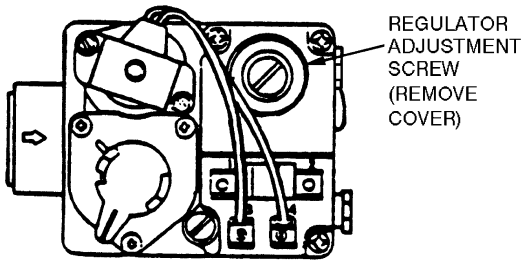
When power is supplied to valve terminals D1 and C2, the main valve opens to its preset position.

The regular factory setting is stamped on the valve body (3.3 in. wg).

To adjust regulator:

1. Set thermostat at setting for no call for heat.
2. Turn main gas valve to OFF position.
3. Remove $^1/_8$-in. pipe plug from manifold or gas valve pressure tap connection. Install a suitable pressure-measuring device.
4. Set main gas valve to ON position.
5. Set thermostat at setting to call for heat.
6. Remove screw cap covering regulator adjustment screw (see Fig. 36).
7. Turn adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure.
8. Once desired pressure is established, set thermostat setting for no call for heat, turn off main gas valve, remove pressure-measuring device, and replace $^1/_8$-in. pipe plug and screw cap.

FIGURE 36 | **Gas Valve**



MAIN BURNERS

For all applications, main burners are factory set and should require no adjustment.

Main Burner Removal

1. Shut off (field-supplied) manual main gas valve.
2. Shut off power to unit.
3. Remove unit control box access panel, burner section access panel, and center post (Fig. 3).
4. Disconnect gas piping from gas valve inlet.
5. Remove wires from gas valve.
6. Remove wires from rollout switch.
7. Remove sensor wire and ignitor cable from IGC board.
8. Remove 2 screws securing manifold bracket to basepan.
9. Remove 2 screws that hold the burner support plate flange to the vestibule plate.
10. Lift burner assembly out of unit.

Cleaning and Adjustment

1. Remove burner rack from unit as described in Main Burner Removal section on page 32.
2. Inspect burners, and if dirty, remove burners from rack.
3. Using a soft brush, clean burners and crossover port as required.
4. Adjust spark gap. See Fig. 37.
5. Reinstall burners on rack.
6. Reinstall burner rack as described above.

FILTER DRIER

Replace whenever refrigerant system is exposed to atmosphere.

PROTECTIVE DEVICES

Compressor Protection – Overcurrent

Each compressor has internal line break motor protection.

Crankcase Heater

All units are equipped with a 70-watt crankcase heater to prevent absorption of liquid refrigerant by oil in the crankcase when the compressor is idle. The crankcase heater is energized whenever there is main power to the unit and the compressor is not energized.

IMPORTANT: After prolonged shutdown or servicing, energize the crankcase heaters for 24 hours before starting the compressors.

Overtemperature

Each compressor has an internal protector to protect it against excessively high discharge gas temperatures.

Compressor Lockout

If any of the safeties (high-pressure, low-pressure, freeze protection thermostat, compressor internal thermostat) trip, or if there is loss of power to the compressors, the cooling lockout (CLO) will lock the compressors off. To reset, manually move the thermostat setting.

Evaporator Fan Motor Protection

On size 155 units, an internal protector with auto-reset is included in the indoor fan motor as a protection against overcurrent.

On 180 size unts, a manual reset, calibrated trip, magnetic circuit breaker protects against overcurrent. Do not bypass connections or increase the size of the breaker to correct trouble. Determine the cause and correct it before resetting the breaker.

Condenser-Fan Motor Protection

Each condenser-fan motor is internally protected against overtemperature.

High and Low-Pressure Switches

If either switch trips, or if the compressor overtemperature switch activates, that refrigerant circuit will be automatically locked out by the CLO. To reset, manually move the thermostat setting.

Freeze Protection Thermostat (FPT)

An FPT is located on the top and bottom of the evaporator coil. They detect frost build-up and turn off the compressor, allowing the coil to clear. Once the frost has melted, the compressor can be reenergized by resetting the compressor lockout.

Relief Devices

All units have relief devices to protect against damage from excessive pressures (i.e., fire). These devices protect the high and low side.

Control Circuit, 24-V

This control circuit is protected against overcurrent by a 3.2 amp circuit breaker. Breaker can be reset. If it trips, determine cause of trouble before resetting. See Fig. 38 for typical wiring diagram.

Replacement Parts

A complete list of replacement parts may be obtained from your distributor upon request.

Diagnostic IGC Control LEDs

The unit control boards have LEDs for diagnostic purposes. Refer to Troubleshooting section on page 38.

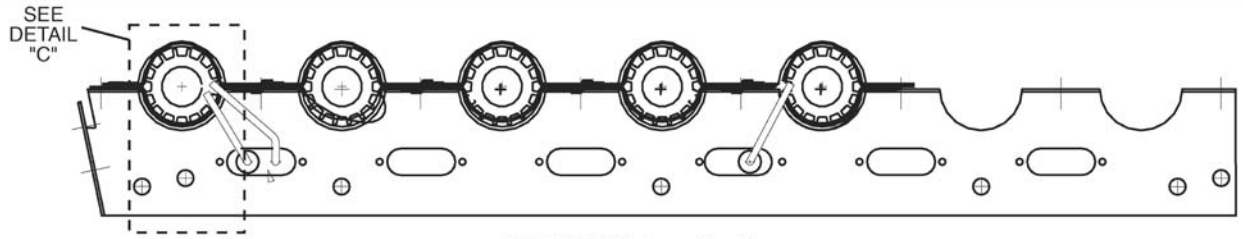
Optional Hinged Access Doors

When the optional service package is ordered or the if the hinged access doors option is ordered, the unit will be provided with external and internal hinged access doors to facilitate service.

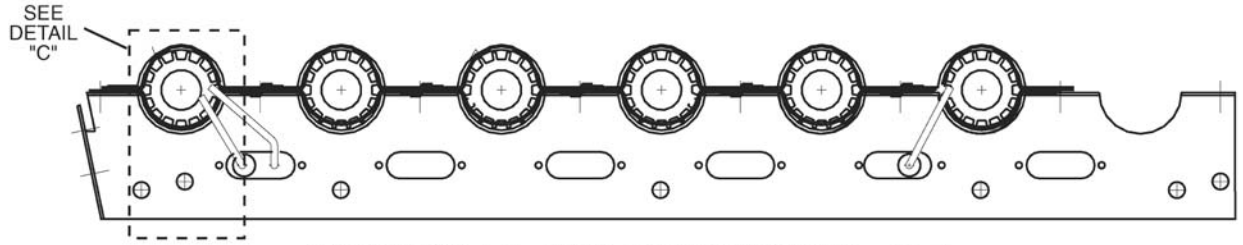
Four external hinged access doors are provided. All external doors are provided with 2 large $^1/_4$ turn latches with folding bail-type handles. (Compressor access doors have one latch.) A single door is provided for filter and drive access. One door is provided for control box access. The control box access door is interlocked with the non-fused disconnect which must be in the OFF position to open the door. Two doors are provided for access to the compressor compartment.

Two internal access doors are provided inside the filter/drive access door. The filter access door (on the left) is secured by 2 small $^1/_4$ turn latches with folding bail-type handles. This door must be opened prior to opening the drive access door. The drive access door is shipped with 2 sheet metal screws holding the door closed. Upon initial opening of the door, these screws may be removed and discarded. The door is then held shut by the filter access door, which closes over it.

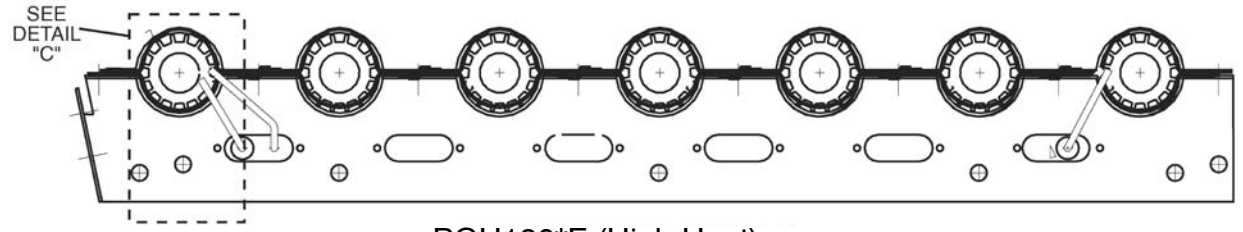
FIGURE 37 | **Spark Gap Adjustment**



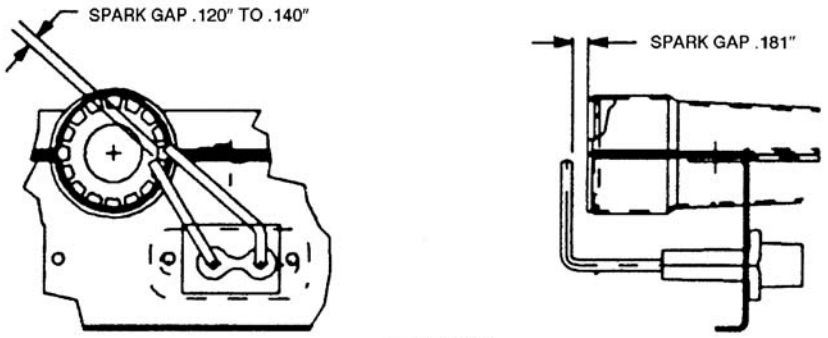
PGH155*D (Low Heat)



PGH180*D (Low Heat) PGH155*F (High Heat)



PGH180*F (High Heat)



DETAIL "C"

FIGURE 38 | **Typical Wiring Schematic, PGH180 – 208/230v Shown**

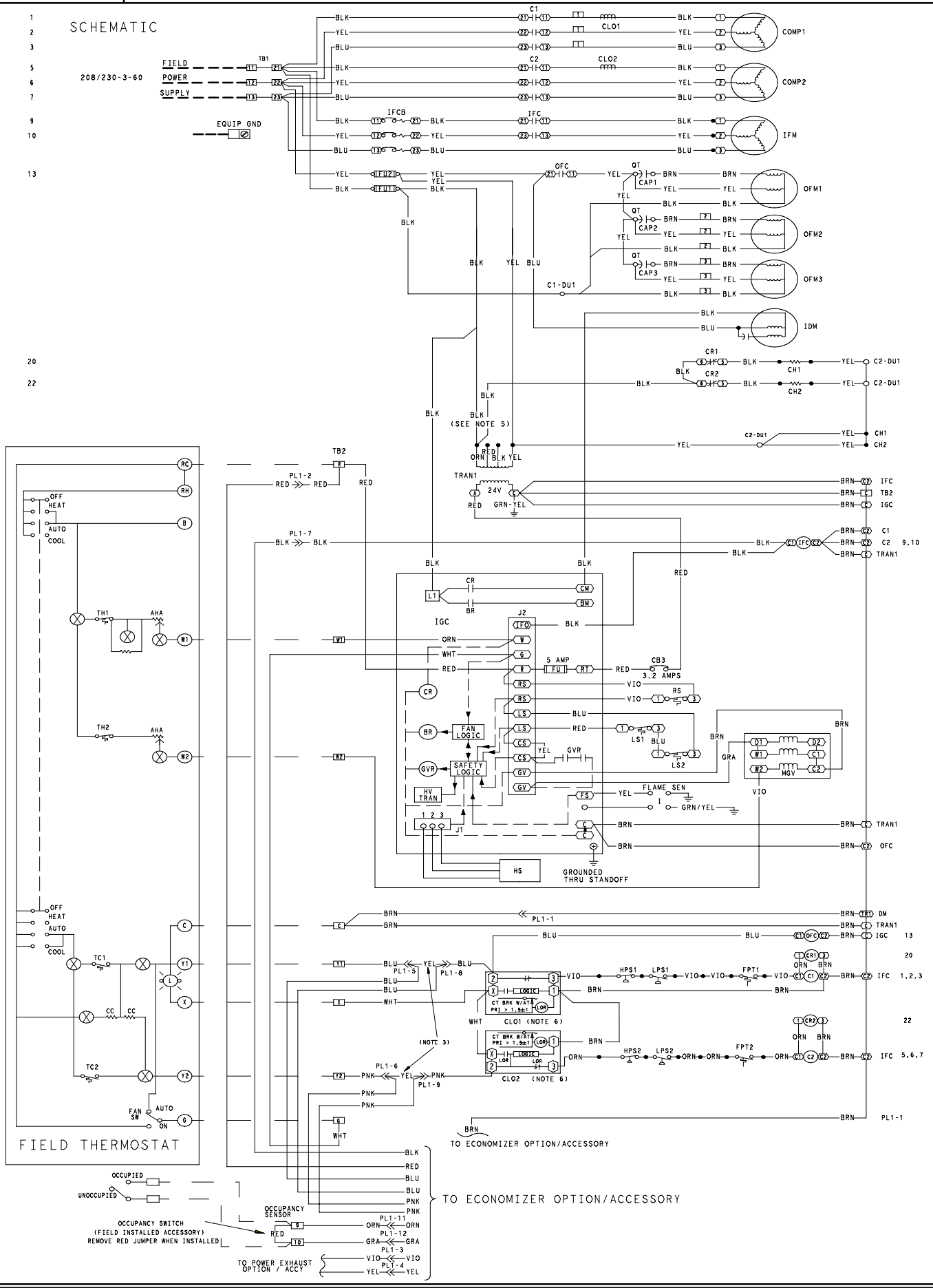
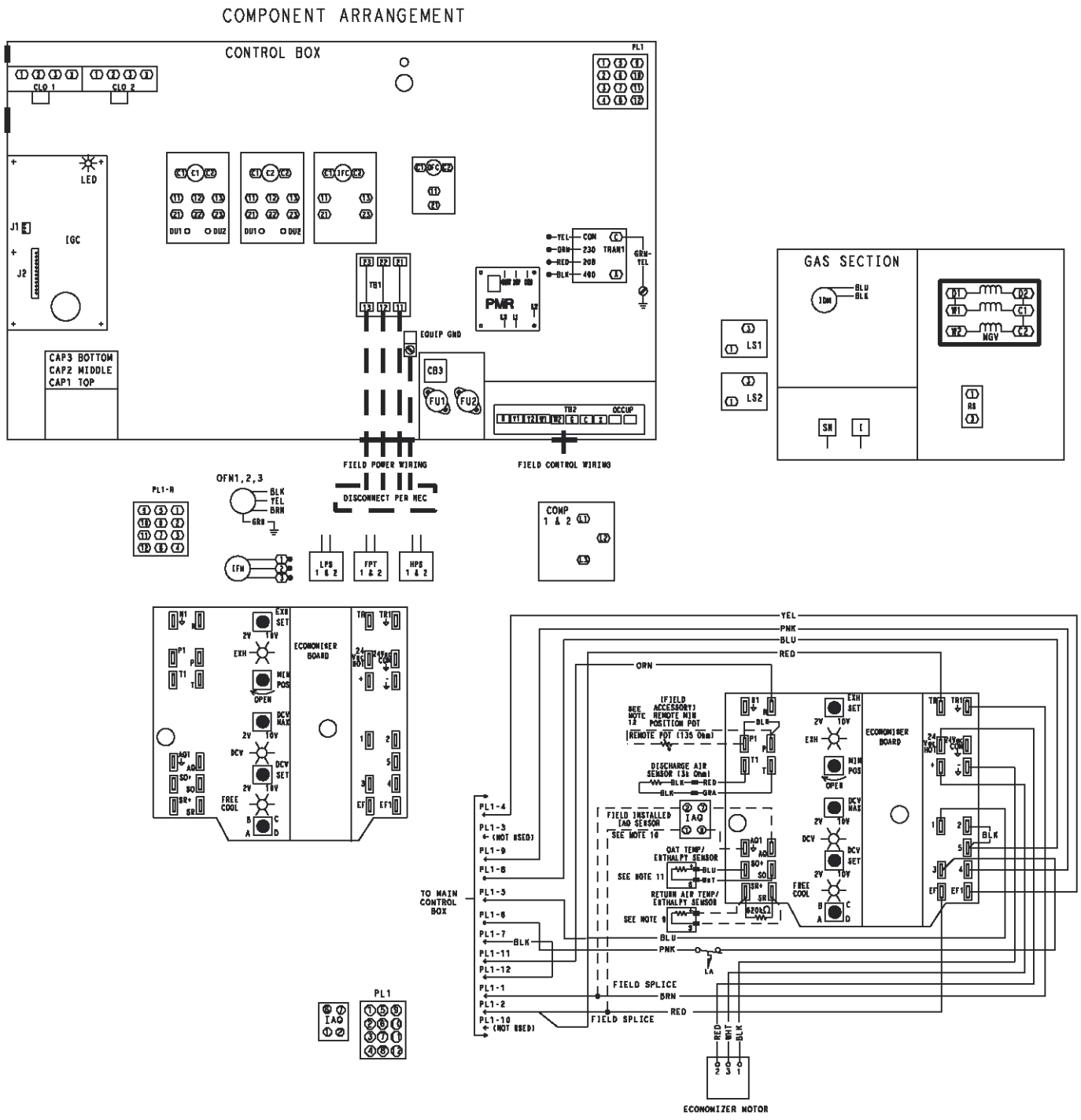


FIGURE 39	Typical Component Arrangement, PGH180 Shown



LEGENDS AND NOTES FOR FIGS. 38 and 39

LEGEND

AHA	—	Adjustable, Heat Anticipator
BRK W/AT	—	Breaks with Amp Turns
C	—	Contactor, Compressor
CAP	—	Capacitor
CB	—	Circuit Breaker
CC	—	Cooling Compensator
CH	—	Crankcase Heater
CLO	—	Compressor Lockout
COMP	—	Compressor Motor
CTD	—	Compressor Time Delay
DB	—	Defrost Board
DFT	—	Defrost Thermostat
DM	—	Damper Motor
DR	—	Defrost Relay
DU	—	Dummy Terminal
EQUIP	—	Equipment
FL	—	Fuse Link
FPT	—	Freeze Protection Thermostat
FU	—	Fuse
GND	—	Ground
HC	—	Heater Contactor
HPS	—	High-Pressure Switch
HR	—	Heat Relay
HTR	—	Heater
IAQ	—	Indoor Air Quality Sensor
IFC	—	Indoor-Fan Contactor
IFCB	—	Indoor-Fan Circuit Breaker
IFM	—	Indoor-Fan Motor
IP	—	Internal Protector
L	—	Light
LALS	—	Low Temperature Compressor Lockout Switch
LPS	—	Low-Pressure Switch
LS	—	Limit Switch
NEC	—	National Electric Code
OAT	—	Outdoor Air Temperature Sensor
OCCUP	—	Occupancy Sensor
OFC	—	Outdoor Fan Contactor
OFM	—	Outdoor Fan Motor
OP	—	Overcurrent Protector
PL	—	Plug Assembly
QT	—	Quadruple Terminal
RVR	—	Reversing Valve Relay
RVS	—	Reversing Valve Solenoid
TB	—	Terminal Block
TC	—	Thermostat Cooling
TH	—	Thermostat Heating
TRAN	—	Transformer


Terminal (Marked)


Terminal (Unmarked)


Terminal Block


Splice

Factory Wiring

Field Wiring

Option/Accessory Wiring

To indicate common potential only; not to represent wiring.


Economizer Motor

Remote POT Field Accessory


OAT Sensor


Disch Air Sensor


RAT Accessory Sensor


Low Ambient Lockout Switch

NOTES:

1. Compressor and/or fan motor(s) thermally protected three-phase motors protected against primary single phasing conditions.
2. If any of the original wire furnished must be replaced, it must be replaced with Type 90° C or its equivalent.
3. TRAN1 is wired for 230-v operation. If unit is 208-v, disconnect the black wires from the ORN TRAN wire and reconnect to the RED TRAN wire, apply wirenuts to wires.
4. CB1,2 must trip amps are equal to or less than 156% FLA, IFCB 140%.
5. The CLO locks out the compressor to prevent short cycling on compressor overload and safety devices; before replacing CLO, check these devices.
6. Jumpers are omitted when unit is equipped with economizer.
7. Number(s) indicates the line location of used contacts. A bracket over (2) numbers signifies a single pole, double throw contact. An underlined number signifies a normally closed contact. Plain (no line) number signifies a normally open contact.
8. Remove jumper between RC & RN.
9. 620 Ohm, 1 watt, 5% resistor should be removed only when using differential enthalpy or dry bulb.
10. If a separate field-supplied 24-v transformer is used for the IAQ sensor power supply, it cannot have the secondary of the transformer grounded.
11. OAT sensor is shipped inside unit and must be relocated in the field for proper operation.
12. For field-installed remote minimum position POT, remove black wire jumper between P and P1 and set control minimum position POT to the minimum position.

TROUBLESHOOTING

Unit Troubleshooting

Refer to Table 21–22 and fig. 38 for unit troubleshooting information.

Economizer Troubleshooting

See Table 23 for economizer logic.

A functional view of the economizer is shown in Fig. 41. Typical settings, sensor ranges, and jumper positions are also shown.

Preparation

This procedure is used to prepare the economizer for troubleshooting. No troubleshooting or testing is done by performing the following procedure.

NOTE:This procedure requires a 9-v battery, 1.2 kilo-ohm resistor, and a 5.6 kilo-ohm resistor which are not supplied with the economizer.

IMPORTANT:Be sure to record the positions of all potentiometers before starting troubleshooting.

1. Disconnect power at TR and TR1. All LEDs should be off. Exhaust fan contacts should be open.
2. Disconnect device at P and P1.
3. Jumper P to P1.
4. Disconnect wires at T and T1. Place 5.6 kilo-ohm resistor across T and T1.
5. Jumper TR to 1.
6. Jumper TR to N.
7. If connected, remove sensor from terminals S_O and +. Connect 1.2 kilo-ohm 4074EJM checkout resistor across terminals S_O and +.
8. Put 620-ohm resistor across terminals S_R and +.
9. Set minimum position, DCV set point, and exhaust potentiometers fully CCW (counterclockwise).
10. Set DCV maximum position potentiometer fully CW (clockwise).
11. Set enthalpy potentiometer to D.
12. Apply power (24 vac) to terminals TR and TR1.

Differential Enthalpy

To check differential enthalpy:

1. Make sure economizer preparation procedure has been performed.
2. Set the enthalpy potentiometer to A (fully CCW). The Free Cool LED should be lit.
3. Set the enthalpy potentiometer to D (fully CW). The Free Cool LED should turn off.
4. Remove 620-ohm resistor across S_O and +. The Free Cool LED should turn off.
5. Return economizer settings and wiring to normal after completing troubleshooting.

Single Enthalpy

To check single enthalpy:

1. Make sure economizer preparation procedure has been performed.
2. Set the enthalpy potentiometer to A (fully CCW). The Free Cool LED should be lit.
3. Set the enthalpy potentiometer to D (fully CW). The Free Cool LED should turn off.
4. Return economizer settings and wiring to normal after completing troubleshooting.

DCV (Demand Controlled Ventilation) and Power Exhaust

To check DCV and Power Exhaust:

1. Make sure economizer preparation procedure has been performed.
2. Ensure terminals AQ and AQ1 are open. The LED for both DCV and Exhaust should be off. The actuator should be fully closed.
3. Connect a 9-v battery to AQ (positive node) and AQ1 (negative node). The LED for both DCV and Exhaust should turn on. The actuator should drive to between 90 and 95% open.
4. Turn the Exhaust potentiometer CW until the Exhaust LED turns off. The LED should turn off when the potentiometer is approximately 90%. The actuator should remain in position.
5. Turn the DCV set point potentiometer CW until the DCV LED turns off. The DCV LED should turn off when the potentiometer is approximately 9 v. The actuator should drive fully closed.
6. Turn the DCV and Exhaust potentiometers CCW until the Exhaust LED turns on. The exhaust contacts will close 30 to 120 seconds after the Exhaust LED turns on.
7. Return economizer settings and wiring to normal after completing troubleshooting.

DCV Minimum and Maximum Position

To check the DCV minimum and maximum position:

1. Make sure economizer preparation procedure has been performed.
2. Connect a 9-v battery to AQ (positive node) and AQ1 (negative node). The DCV LED should turn on. The actuator should drive to between 90 and 95% open.
3. Turn the DCV Maximum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
4. Turn the DCV Maximum Position potentiometer to fully CCW. The actuator should drive fully closed.
5. Turn the Minimum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
6. Turn the Minimum Position Potentiometer fully CW. The actuator should drive fully open.
7. Remove the jumper from TR and N. The actuator should drive fully closed.
8. Return economizer settings and wiring to normal after completing troubleshooting.

Supply-air Input

To check supply-air input:

1. Make sure economizer preparation procedure has been performed.
2. Set the Enthalpy potentiometer to A. The Free Cool LED turns on. The actuator should drive to between 20 and 80% open.
3. Remove the 5.6 kilo-ohm resistor and jumper T to T1. The actuator should drive fully open.
4. Remove the jumper across T and T1. The actuator should drive fully closed.

5. Return economizer settings and wiring to normal after completing troubleshooting.

Economizer Troubleshooting Completion

This procedure is used to return the economizer to operation. No troubleshooting or testing is done by performing the following procedure.

1. Disconnect power at TR and TR1.
2. Set enthalpy potentiometer to previous setting.
3. Set DCV maximum position potentiometer to previous setting.
4. Set minimum position, DCV set point, and exhaust potentiometers to previous settings.
5. Remove 620-ohm resistor from terminals S_R and +.
6. Remove 1.2 kilo-ohm checkout resistor from terminals S_O and +. If used, reconnect sensor from terminals S_O and +.
7. Remove jumper from TR to N.
8. Remove jumper from TR to 1.
9. Remove 5.6 kilo-ohm resistor from T and T1. Reconnect wires at T and T1.
10. Remove jumper from P to P1. Reconnect device at P and P1.
11. Apply power (24 vac) to terminals TR and TR1.

Table 21 — Heating Service Analysis

PROBLEM	CAUSE	REMEDY
Burners Will Not Ignite.	Misaligned spark electrodes.	Check flame ignition and sensor electrode positioning. Adjust as needed.
	No gas at main burners.	Check gas line for air; purge as necessary. After purging gas line of air, allow gas to dissipate for at least 5 minutes before attempting to relight unit.
		Check gas valve.
	Water in gas line.	Drain water and install drip leg to trap water.
	No power to furnace.	Check power supply, fuses, wiring, and circuit breaker.
	No 24 v power supply to control circuit.	Check transformer. Transformers with internal overcurrent protection require a cool-down period before resetting. Check 24-v circuit breaker; reset if necessary.
	Miswired or loose connections.	Check all wiring and wire nut connections.
	Burned-out heat anticipator in thermostat.	Replace thermostat.
	Broken thermostat wires.	Run continuity check. Replace wires if necessary.
Inadequate Heating.	Dirty air filter.	Clean or replace filter as necessary.
	Gas input to unit too low.	Check gas pressure at manifold. Clock gas meter for input. If too low, increase manifold pressure or replace with correct orifices.
	Unit undersized for application.	Replace with proper unit or add additional unit.
	Restricted airflow.	Clean filter, replace filter, or remove any restrictions.
	Blower speed too low.	Install alternate motor, if applicable, or adjust pulley to increase fan speed.
	Limit switch cycles main burners.	Check rotation of blower, thermostat heat anticipator settings, and temperature rise of unit. Adjust as needed.
	Too much outdoor air.	Adjust minimum position.
		Check economizer operation.
Poor Flame Characteristics.	Incomplete combustion (lack of combustion air) results in: Aldehyde odors, CO, sooting flame, or floating flame.	Check all screws around flue outlets and burner compartment. Tighten as necessary.
		Cracked heat exchanger.
		Overfired unit — reduce input, change orifices, or adjust gas line or manifold pressure.
		Check vent for restriction. Clean as necessary.
		Check orifice to burner alignment.
Burners Will Not Turn Off.	Unit is locked into Heating mode for a one minute minimum.	Wait until mandatory one minute time period has elapsed or power to unit.

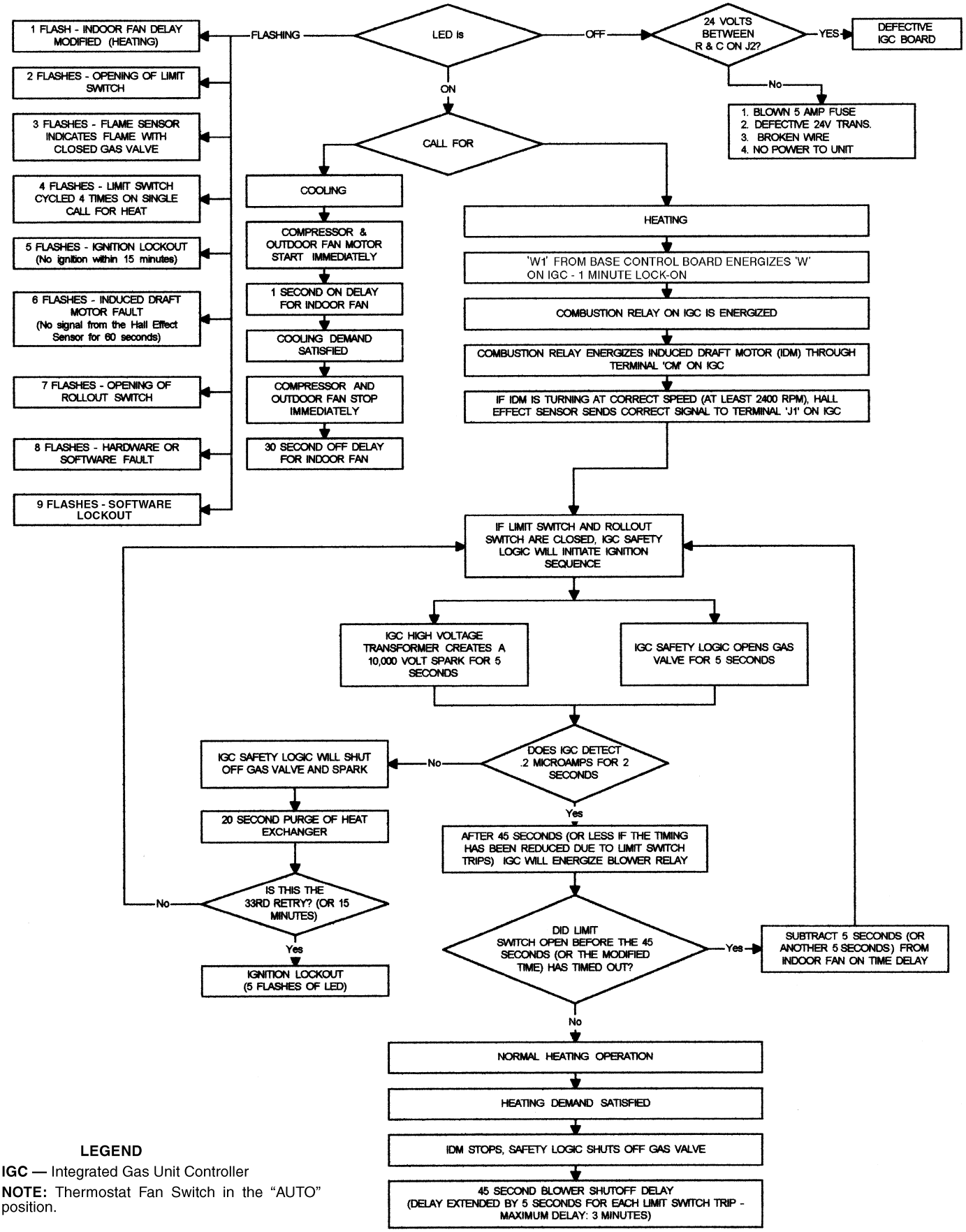
Table 22 — Cooling Service Analysis

PROBLEM	CAUSE	REMEDY
Compressor and Condenser Fan Will Not Start.	Power failure.	Call power company.
	Fuse blown or circuit breaker tripped.	Replace fuse or reset circuit breaker.
	Defective thermostat, contactor, transformer, or control relay.	Replace component.
	Insufficient line voltage.	Determine cause and correct.
	Incorrect or faulty wiring.	Check wiring diagram and rewire correctly.
	Thermostat setting too high.	Lower thermostat setting below room temperature.
Compressor Will Not Start but Condenser Fan Runs.	Faulty wiring or loose connections in compressor circuit.	Check wiring and repair or replace.
	Compressor motor burned out, seized, or internal overload open.	Determine cause. Replace compressor.
	Defective overload.	Determine cause and replace.
	Compressor locked out	Determine cause for safety trip and reset lockout.
	One leg of 3-phase power dead.	Replace fuse or reset circuit breaker. Determine cause.
Compressor Cycles (other than normally satisfying thermostat).	Refrigerant overcharge or undercharge.	Recover refrigerant, evacuate system, and recharge to nameplate.
	Defective compressor.	Replace and determine cause.
	Insufficient line voltage.	Determine cause and correct.
	Blocked condenser.	Determine cause and correct.
	Defective overload.	Determine cause and replace.
	Defective thermostat.	Replace thermostat.
	Faulty condenser-fan motor.	Replace.
	Restriction in refrigerant system.	Locate restriction and remove.
Compressor Operates continuously.	Dirty air filter.	Replace filter.
	Unit undersized for load.	Decrease load or increase unit size.
	Thermostat set too low.	Reset thermostat.
	Low refrigerant charge.	Locate leak, repair, and recharge.
	Air in system.	Recover refrigerant, evacuate system, and recharge.
	Condenser coil dirty or restricted.	Clean coil or remove restriction.
Excessive Head Pressure.	Dirty air filter.	Replace filter.
	Dirty condenser coil.	Clean coil.
	Refrigerant overcharged.	Recover excess refrigerant.
	Faulty TXV.	1. Check TXV bulb mounting and secure tightly to suction line. 2. Replace TXV if stuck open or closed.
	Air in system.	Recover refrigerant, evacuate system, and recharge.
	Condenser air restricted or air short-cycling.	Determine cause and correct.
Head Pressure Too Low.	Low refrigerant charge.	Check for leaks, repair, and recharge.
	Restriction in liquid tube.	Remove restriction.
Excessive Suction Pressure.	High heat load.	Check for source and eliminate.
	Faulty TXV.	1. Check TXV bulb mounting and secure tightly to suction line. 2. Replace TXV if stuck open or closed.
	Refrigerant overcharged.	Recover excess refrigerant.
Suction Pressure Too Low.	Dirty air filter.	Replace filter.
	Low refrigerant charge.	Check for leaks, repair, and recharge.
	Metering device or low side restricted.	Remove source of restriction.
	Faulty TXV.	1. Check TXV bulb mounting and secure tightly to suction line. 2. Replace TXV if stuck open or closed.
	Insufficient evaporator airflow.	Increase air quantity. Check filter and replace if necessary.
	Temperature too low in conditioned area.	Reset thermostat.
	Field-installed filter drier restricted.	Replace.

LEGEND

TXV — Thermostatic Expansion Valve

FIGURE 40 | **IGC Control (Heating and Cooling)**



LEGEND

IGC — Integrated Gas Unit Controller

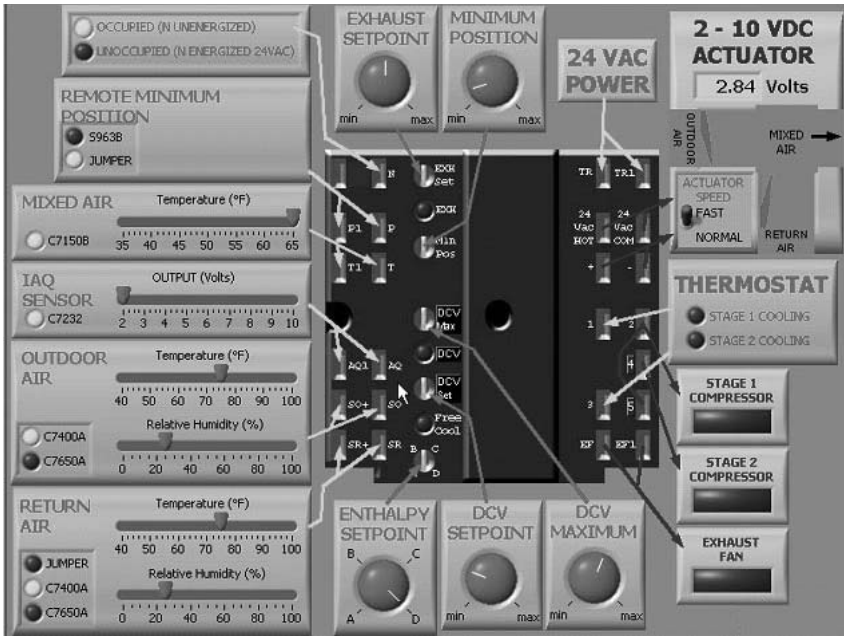
NOTE: Thermostat Fan Switch in the "AUTO" position.

TABLE 23 — ECONOMIZER INPUT/OUTPUT LOGIC

INPUTS					OUTPUTS			
Demand Control Ventilation (DCV)	Enthalpy*		Y1	Y2	Compressor		N Terminal†	
	Outdoor	Return			Stage 1	Stage 2	Occupied	Unoccupied
							Damper	
Below set (DCV LED Off)	High (Free Cooling LED Off)	Low	On	On	On	On	Minimum position	Closed
			On	Off	On	Off		
			Off	Off	Off	Off		
	Low (Free Cooling LED On)	High	On	On	On	Off	Modulating** (between min. position and full-open)	Modulating** (between closed and full-open)
			On	Off	Off	Off		
			Off	Off	Off	Off	Minimum position	Closed
Above set (DCV LED On)	High (Free Cooling LED Off)	Low	On	On	On	On	Modulating†† (between min. position and DCV maximum)	Modulating†† (between closed and DCV maximum)
			On	Off	On	Off		
			Off	Off	Off	Off		
	Low (Free Cooling LED On)	High	On	On	On	Off	Modulating***	Modulating†††
			On	Off	Off	Off		
			Off	Off	Off	Off		

*For single enthalpy control, the module compares outdoor enthalpy to the ABCD set point.
† Power at N terminal determines Occupied/Unoccupied setting: 24 vac (Occupied), no power (Unoccupied).
** Modulation is based on the supply-air sensor signal.
†† Modulation is based on the DCV signal.
***Modulation is based on the greater of DCV and supply-air sensor signals, between minimum position and either maximum position (DCV) or fully open (supply-air signal).
††† Modulation is based on the greater of DCV and mixed air sensor signals, between closed and either maximum position (DCV) or fully open (supply-air signal).

FIGURE 41 **Economizer Functional View**



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

MODEL NO.: _____ DATE: _____

SERIAL NO.: _____ TECHNICIAN: _____

I. PRE-START-UP

- ☐ VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT
- ☐ VERIFY PROPER ADJUSTMENT OF INDOOR FAN MOTOR ADJUSTMENT BOLT
- ☐ VERIFY INSTALLATION OF OUTDOOR-AIR HOOD
- ☐ VERIFY INSTALLATION OF FLUE HOOD AND WIND BAFFLE
- ☐ VERIFY THAT CONDENSATE CONNECTION IS INSTALLED PER INSTRUCTIONS
- ☐ VERIFY THAT ALL ELECTRICAL CONNECTIONS AND TERMINALS ARE TIGHT
- ☐ CHECK GAS PIPING FOR LEAKS
- ☐ CHECK THAT AIR INLET FILTERS ARE CLEAN AND IN PLACE
- ☐ VERIFY THAT UNIT IS LEVEL
- ☐ CHECK FAN WHEEL AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE, AND VERIFY SET SCREW IS TIGHT
- ☐ VERIFY THAT FAN SHEAVES ARE ALIGNED AND BELTS ARE PROPERLY TENSIONED
- ☐ VERIFY THAT SCROLL COMPRESSOR IS ROTATING IN THE CORRECT DIRECTION
- ☐ VERIFY THAT CRANKCASE HEATERS HAVE BEEN ENERGIZED FOR AL LEAST 24 HOURS

II. START-UP

ELECTRICAL

SUPPLY VOLTAGE L1-L2 _____ L2-L3 _____ L3-L1 _____

COMPRESSOR AMPS - COMPRESSOR NO. 1 L1 _____ L2 _____ L3 _____

INDOOR-FAN AMPS - COMPRESSOR NO. 2 L1 _____ L2 _____ L3 _____

SUPPLY FAN AMPS _____ EXHAUST FAN AMPS _____

TEMPERATURES

OUTDOOR-AIR TEMPERATURE _____ F DB (Dry-Bulb)

RETURN-AIR TEMPERATURE _____ F DB _____ F WB (Wet-Bulb)

COOLING SUPPLY AIR _____ F

GAS HEAT SUPPLY AIR _____ F

PRESSURES (COOLING MODE)

GAS INLET PRESSURE _____ IN. WG

GAS MANIFOLD PRESSURE STAGE NO. 1 _____ IN. WG STAGE NO. 2 _____ IN. WG

REFRIGERANT SUCTION CIRCUIT NO. 1 _____ PSIG CIRCUIT NO. 2 (180 ONLY) _____ PSIG

REFRIGERANT DISCHARGE CIRCUIT NO. 1 _____ PSIG CIRCUIT NO. 2 (180 ONLY) _____ PSIG

- ☐ VERIFY REFRIGERANT CHARGE USING CHARGING CHARTS

GENERAL

- ☐ ECONOMIZER MINIMUM VENT AND CHANGEOVER SETTINGS TO JOB REQUIREMENTS