Model Series PGBL, CRGBL, RPBL, RPDBL

Packaged Blower/Furnace Systems

INSTALLATION/OPERATION/MAINTENANCE
Form I-PGBL/CRGBL/RPBL (Version B)
Obsoletes Form I-PGBL/RGBL/RPBL (Version A)

REZNOR® Thomas&Betts

FOR YOUR SAFETY

If you smell gas:
1. Open windows.
2. Don't touch electrical switches.
3. Extinguish any open flame.
4. Immediately call your gas supplier.

FOR YOUR SAFETY

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.

WARNING: Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury or death. Read the installation, operation, and maintenance instructions thoroughly before installing or servicing this equipment.

WARNING: Gas-fired appliances are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, in atmospheres containing chlorinated or halogenated hydrocarbons, or in applications with airborne silicone substances. See Hazard Levels, page 2.

GENERAL

Installation should be done by a qualified agency in accordance with the instructions in this manual and in compliance with all codes and requirements of authorities having jurisdiction. The instructions in this manual apply to the packaged systems listed below.

Model Series Designation	Characteristics		
	Installation	Vent	Thermal Efficiency
PGBL 	Indoor	Power	80%
CRGBL 	Outdoor	Gravity	
RPBL 		Power	
RPDBL 			

1. Approval and Installation Codes

The models covered in this manual are design certified or approved duct furnaces that are factory assembled with air handing components, creating a unified packaged furnace/blower system. The packaged systems listed on page 1 are design-certified to ANSI and CSA Standards by the Canadian Standards Association. All models are approved for installation in the United States. All models except Model CRGBL are approved for installation in Canada. All furnaces are approved for use with either natural gas or propane. The type of gas for which the furnace is equipped and the correct firing rate are shown on the rating plate attached to the furnace. Electrical characteristics are shown on both the motor nameplate and the system rating plates.

These units must be installed in accordance with local building codes. In the absence of local codes, in the United States, the unit must be installed in accordance with the National Fuel Gas Code NFPA54/ ANSI Z223.1 (latest edition). A Canadian installation must be in accordance with the CSA B149.1 Natural Gas and Propane Installation Code. These codes are available from CSA Information Services, 1-800-463-6727. Local authorities having jurisdiction should be consulted before installation to verify local codes and installation procedure requirements.

Special Installations (Aircraft Hangars/ Garages)

Installations in aircraft hangars should be in accordance with NFPA No. 409 (latest edition), Standard for Aircraft Hangars; in public garages in accordance with NFPA No. 88A (latest edition), Standard for Parking Structures; and for repair garages in accordance with NFPA No. 88B (latest edition), Standard for Repair Garages. In Canada, installations in aircraft hangars should be in accordance with the requirements of the enforcing authorities, and in public garages in accordance with CSA B149.1 codes.

WARNING: To ensure safety, follow the lighting instructions located on the outlet box cover in the furnace section of the packaged system.

2. Warranty

Refer to limited warranty information sheet in the "Owner's Envelope".

Warranty is void if.....

a. **Packaged furnaces are used in atmospheres containing flammable vapors or atmospheres containing chlorinated or halogenated hydrocarbons or any contaminant (silicone, aluminium oxide, etc.) that adheres to the spark ignition flame sensing probe.**

b. **Wiring is not in accordance with the diagram furnished with the heater.**

c. **Unit is installed without proper clearances to combustible materials or without proper ventilation and air for combustion. (See Paragraphs 5 and 6.)**

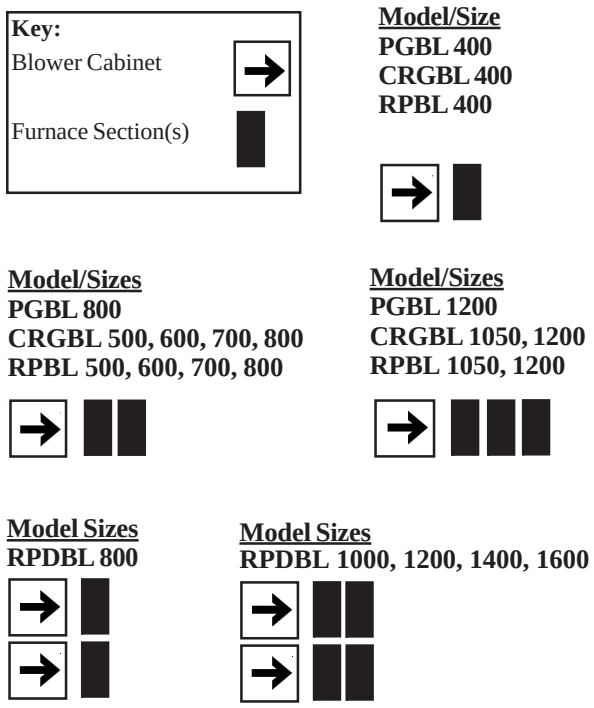
d. **Furnace air throughput is not adjusted within the range specified on the rating plate.**

HAZARD INTENSITY LEVELS of Warnings found in this Manual

1. **DANGER:** Failure to comply will result in severe personal injury or death and/or property damage.
2. **WARNING:** Failure to comply could result in severe personal injury or death and/or property damage.
3. **CAUTION:** Failure to comply could result in minor personal injury and/or property damage.

3. Package Arrangements and Dimensions

FIGURE 1A - Package Arrangements by Model and Size



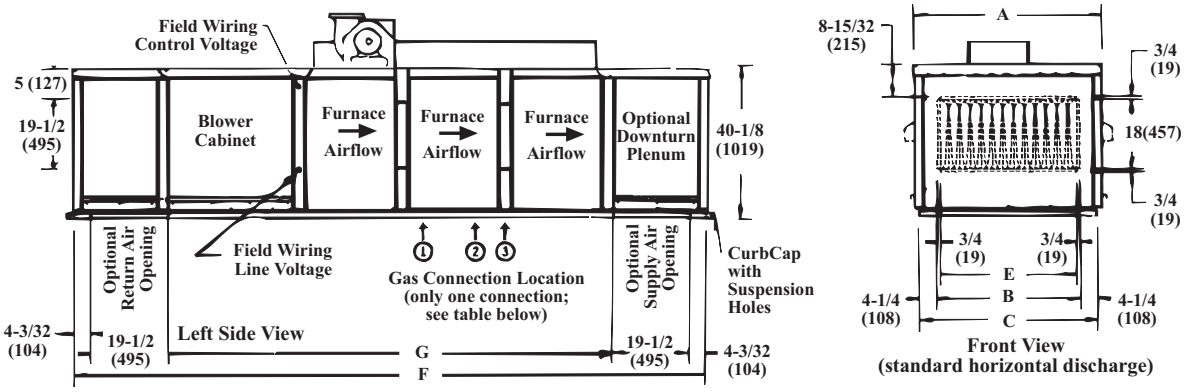
Downturn Note: To provide complete information, the drawings and dimensions illustrate both the indoor and outdoor system with and without an optional downturn plenum cabinet. Indoor installations requiring vertical discharge will most often have a field-fabricated downturn nozzle instead of the factory-installed plenum cabinet.

Dimension Key for Figure 1B, PGBL Dimensions (page 3)

A	Width of Cabinet	
B	Width of Optional Downturn Plenum Opening; Width of Standard Horizontal Air Inlet Opening; Discharge Air and Width of Optional Return Air (Bottom) Opening	
C	Width of the Curb Cap	
E	Width of Standard Horizontal Discharge Air Opening	
F	Overall Length of Inside of Curb Cap	(Dimensions with downturn apply to Option AQ5 or AQ8; do not apply to field-attached cooling coil cabinet with downturn plenum.)
G	Distance between Optional Return Air Bottom Opening and Optional Downturn Plenum Discharge Air Opening	
N	Length of Flue Collection Box	
P	Distance from Control Side to Vent Connection Centerline	
R	Distance from the Discharge End of the Cabinet Top to Vent Connection Centerline	

FIGURE 1B - Dimensions of Indoor Model PGBL (inches ±1/8/mm ±3)

(See Key to Dimensions on page 2.)

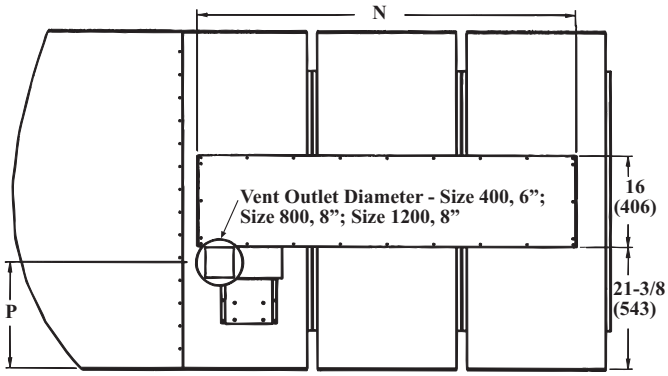


PGBL		A	B	C	E
400, 800, 1200	inches	58-7/8	47-5/8	56-1/8	45-1/2
	mm	1495	1210	1426	1156

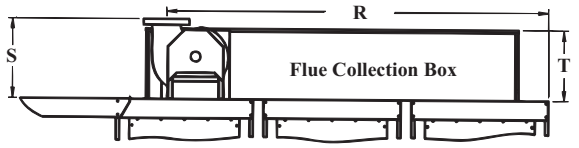
Air Openings:		Dimensions
Standard Horizontal Air Inlet	inches	19-1/2 x B
	mm	495 x B
Optional Return Air Opening	inches	19-1/2 x B
	mm	495 x B
Standard Horizontal	inches	18 x E
	mm	457 x E
Optional Discharge Air Opening (with Downturn Plenum)	inches	19-1/2 x B
	mm	495 x B

Top View of Furnace Sections

(Vent Dimensions N, P, R, S, T)

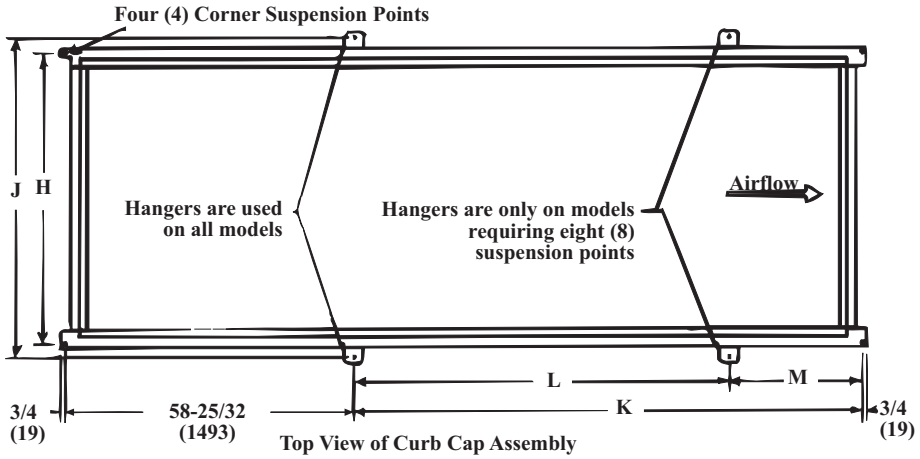


Top Left Side View



Approximate Gas Connection Location		
Size	Drawing Location	Approximate Distance from inside Curb Cap on Blower End of System
400	1	7 ft + 5 to 6 inches (2.3 meters)
800	2	8 ft + 7 to 8 inches (2.7 meters)
1200	3	9 ft + 2 to 3 inches (2.8 meters)
The gas line is manifolded requiring only one supply connection. The gas connection is at curb cap "height" on the control side of the system.		

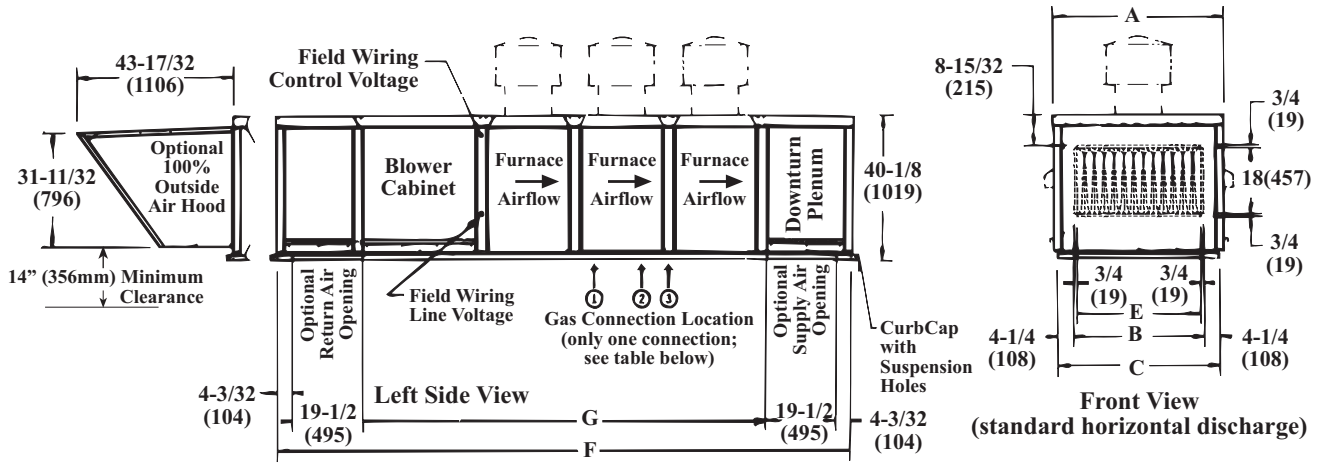
Suspension Dimensions H, J, K, L, M



Size	with Downturn Opt AQ5 or AQ8		Suspension Dimensions F	G	H	J	K	L	M	No. of Hangers	Vent Dimensions N	P	R	S	T
400	No	inches	83-1/2	-	54-3/8	59-1/2	27-1/8	-	-	6	14-1/16	17-15/16	7-15/16	8-7/8	8-3/4
		mm	2121	-	1381	1513	689	-	-		357	456	202	225	222
	Yes	inches	107-1/2	60-5/16	54-3/8	59-1/2	51-1/4	-	-	6	14-1/16	17-15/16	31-15/16	8-7/8	8-3/4
		mm	2731	1532	1381	1513	1302	-	-		357	456	811	225	222
800	No	inches	109-1/2	-	54-3/8	59-1/2	53-1/4	-	-	6	40-1/16	18-1/2	41-5/16	13-3/4	12-1/4
		mm	2781	-	1381	1513	1353	-	-		1018	470	1049	349	311
	Yes	inches	133-1/2	86-5/16	54-3/8	59-1/2	-	50-1/4	27	8	40-1/16	18-1/2	65-5/16	13-3/4	12-1/4
		mm	3391	2192	1381	1513	-	1277	686		1018	470	1659	349	311
1200	No	inches	135-1/2	-	54-3/8	59-1/2	79-1/4	-	-	6	66-1/16	18-1/2	67-5/16	13-3/4	12-1/4
		mm	3442	-	1381	1513	2013	-	-		1678	470	1710	349	311
	Yes	inches	159-1/2	112-5/16	54-3/8	59-1/2	-	76-1/4	27-1/8	8	66-1/16	18-1/2	91-5/16	13-3/4	12-1/4
		mm	4051	2853	1381	1513	-	1937	689		1678	470	2319	349	311

3. Package Arrangements and Dimensions (cont'd)

FIGURE 1C - Dimensions, Outdoor Models CRGBL and RPBL (inches ± 1/8; mm ± 3)



Dimension Key:				
A	Width of Cabinet	**F**	Overall Length of Inside of Curb Cap	
B	Width of Optional Downturn Plenum Discharge Air Opening; Width of Standard Horizontal Air Inlet Opening; and Width of Optional Return Air (Bottom) Opening	**G**	Distance between Optional Return Air Bottom Opening and Optional Downturn Plenum Discharge Air Opening	
		H	Inside diameter of the vent cap collar	CRGBL only
C	Width of the Curb Cap	**J**	Approximate height between top of unit and bottom of vent cap	
E	Width of Standard Horizontal Discharge Air Opening	**K**	Approximate height of the vent cap	

Model	Size		A	B	C	E	Vent Cap H	Vent Cap J	Vent Cap K
CRGBL	**500, 600**	inches	47-1/8	36-5/8	45-1/8	34-1/2	10	3	11-13/16
		mm	1216	930	1146	876	254	76	300
	700, 1050	inches	53-3/8	42-1/8	50-5/8	40	12	12	14-1/8
		mm	1356	1070	1286	1016	305	305	359
	400, 800, 1200	inches	58-7/8	47-5/8	56-1/8	45-1/2	12	12	14-1/8
		mm	1495	1210	1426	1156	305	305	359
RPBL	**500, 600**	inches	47-1/8	36-5/8	45-1/8	34-1/2	None		
		mm	1216	930	1146	876			
	700, 1050	inches	53-3/8	42-1/8	50-5/8	40			
		mm	1356	1070	1286	1016			
	400, 800, 1200	inches	58-7/8	47-5/8	56-1/8	45-1/2			
		mm	1495	1210	1426	1156			

Air Openings:	Dimensions	
Standard Horizontal Air Inlet	inches	19-1/2 x B
	mm	495 x B
Optional Return Air Opening (bottom)	inches	19-1/2 x B
	mm	495 x B
Standard Horizontal Discharge Air Opening	inches	18 x E
	mm	457 x E
Optional Discharge Air Opening (with Downturn Plenum)	inches	19-1/2 x B
	mm	495 x B

Models	Size	with Downturn Opt AQ5 or AQ8*	F	G
RPBL, CRGBL	**400**	No	83-3/4	--
			2127	--
		Yes	107-3/4	60-5/16
			2737	1532
	500, 600, 700, 800	No	109-3/4	--
			2788	--
		Yes	133-3/4	86-5/16
			3397	2192
	1050, 1200	No	135-3/4	--
			3448	--
		Yes	159-3/4	112-5/16
			4058	2853

*Dimensions F and G listed here do not apply to system with field-attached cooling coil cabinet and downturn plenum (Option AU); see **FIGURE 1D**.

Approximate Gas Connection Location			
Size	Drawing Location	Approximate Distance from inside Curb Cap on Blower End of System	
400	1	7 ft + 5 to 6 inches (2.3 meters)	The gas line is manifolded requiring only one supply connection. The gas connection is at curb cap "height" on the control side of the system.
500, 600, 700, 800	2	8 ft + 7 to 8 inches (2.7 meters)	
1050, 1200	3	9 ft + 2 to 3 inches (2.8 meters)	

Refrigerant R22 (DX) Coil Cabinet - Options AU3, AU13, AU14

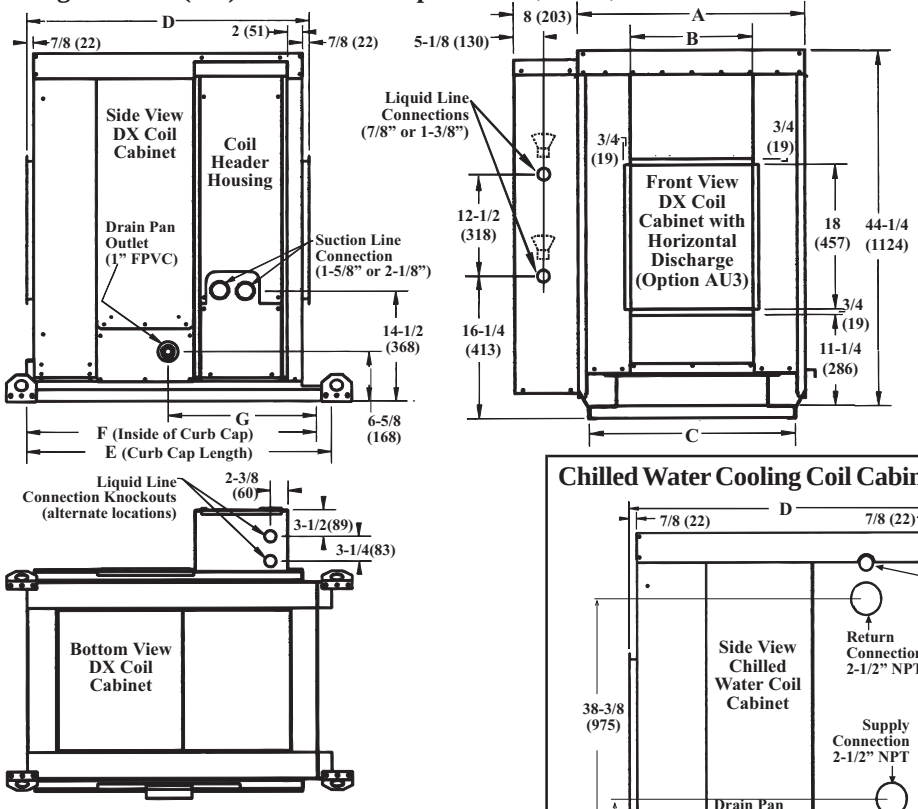
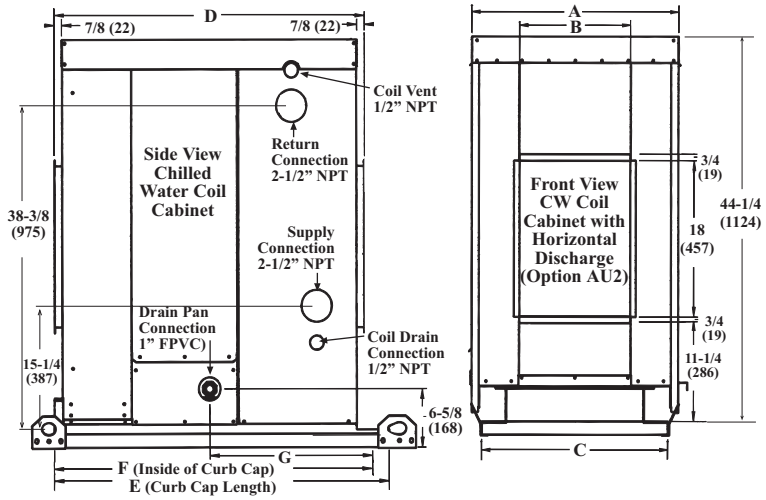


FIGURE 1D - Optional Cooling Coil Cabinets with DX or Chilled Water Coil, with and without Downturn Plenum Cabinet

(NOTE: Cooling coil cabinet does not apply to Model RPDBL)

Chilled Water Cooling Coil Cabinet in Options AU2, AU11, AU12



Dimensions (inches ± 1/8; mm± 3)

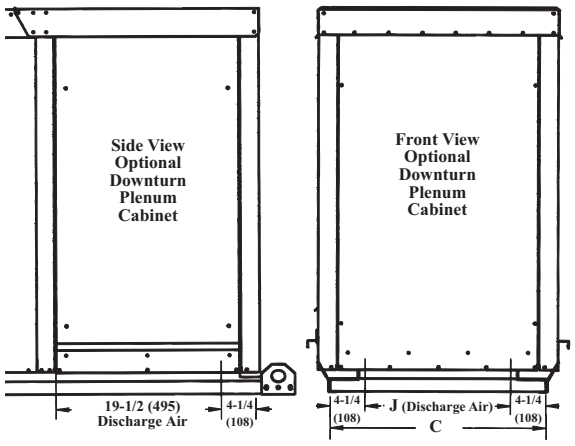
Furnace Size			500, 600	700, 1050	400, 800, 1200
A		inches	47-3/4	53-1/4	58-3/4
		mm	1213	1353	1492
B		inches	34-1/2	40	45-1/2
		mm	876	1016	1156
C		inches	45-1/8	50-5/8	56-1/8
		mm	1146	1286	1426
D		inches	56-3/8	62	67-3/8
		mm	1432	1575	1711
E	Without Downturn	inches	59-3/8	64-7/8	70-3/8
		mm	1508	1648	1788
	With Downturn	inches	83-3/8	88-7/8	94-3/8
		mm	2118	2257	2397
F	Without Downturn	inches	57-3/8	63	68-3/8
		mm	1457	1600	1737
	With Downturn	inches	81-3/8	87	92-3/8
		mm	2067	2210	2346
G		inches	29-1/8	31-7/8	34-5/8
		mm	740	810	879
J		inches	45-1/8	50-5/8	56-1/8
		mm	1146	1286	1426

NOTE: For the length of an outdoor system with a cooling coil cabinet, see the table on the right. Cooling coil cabinet is shipped separately and attached in the field. See page 10 for roof curb dimensions.

Total length of an indoor system with a cooling coil cabinet depends on how the system is installed. If the blower/furnace is suspended, a special curb cap and a field-installed transition duct are required. Contact your Sales Representative to receive specific information. If an indoor system is mounted, add the cabinet length to the blower/furnace length on page 3.

Downturn Plenum Cabinet (factory attached to the Cooling Coil Cabinet)

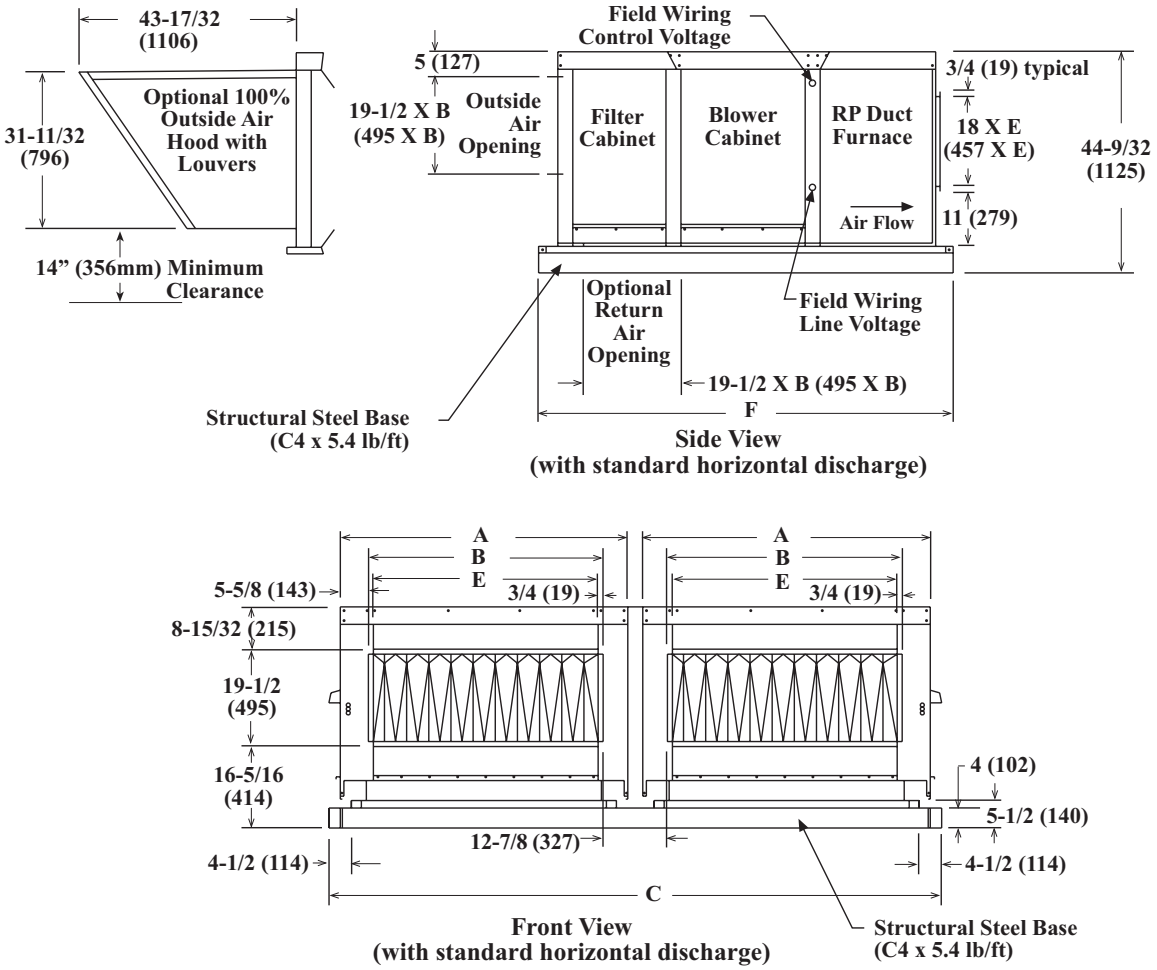
Discharge Damper Note: Optional two-position discharge dampers in Option AU12 or AU14 fit in the discharge air opening. The damper motor fits inside the downturn cabinet. See field wiring instructions in Paragraph 31.



CRGBL, RPBL	Width of Cabinets (*not curb*)				Length of Cabinets (*not curb*)			
	w/Chilled Water Coil Cabinet		w/DX Coil Cabinet		w/Cooling Coil Cabinet only		w/Cooling Coil Cabinet w/Downturn	
	inches	mm	inches	mm	inches	mm	inches	mm
400	58-7/8	1495	66-7/8	1698	150-3/8	3820	173-1/2	4407
500, 600	47-1/8	1197	55-1/8	1400	165-3/8	4201	188-1/2	4788
700	53-3/8	1356	61-3/8	1559	171	4343	194-1/8	4931
800	58-7/8	1495	66-7/8	1698	176-3/8	4480	199-1/2	5067
1050	53-3/8	1356	61-3/8	1559	197	5004	220-1/8	5591
1200	58-7/8	1495	66-7/8	1698	202-3/8	5140	225-1/2	5728

3. Package Arrangements and Dimensions (cont'd)

FIGURE 1E - Dimensions, Outdoor Model RPDBL



Key to Dimensions:

A = Width of Each Cabinet Section

B = Width of Each Standard Horizontal Air Inlet Opening
Width of Each Optional Bottom Discharge Air Opening with Duct Flange
Width of Each Optional Return Air Bottom Opening

C = Overall Width of Outside of Structural Steel Base (illustrated) ***OR***
Overall Width of Inside of Factory-Installed Curb Cap

E = Width of Standard Horizontal Discharge Air Opening

F = Overall Length of Outside of Structural Steel Base (illustrated) ***OR***
Overall Length of Inside of Factory-Installed Curb Cap

Approximate Gas Connection Location	
Height:	Base height on the control side of the system.
Distance:	Size 800 - approximately 7' 6" (2.3M) from the end of the base at the blower end of the system
	All other Sizes - approximately 8' (2.7M) from the end of the base at the blower end of the system

Dimensions (inches ± 1/8"/ mm ±3)

Model	No. of Furnace Sections		A	B	C (Width)		E	F (Length)			
					Structural steel base (without curb cap)	With factory-installed curb cap		With horizontal discharge		With factory-installed downturn cabinets	
								Without curb cap	With curb cap (inside of cap)	Without curb cap	With curb cap (inside of cap)
RPDBL 800	2 (Size 400)	inches	58-7/8	47-5/8	122-11/16	116-3/4	45-1/2	83-3/4	83-1/16	107-3/4	107-1/16
		mm	1495	1210	3116	2965	1156	2127	2110	2737	2719
RPDBL 1000	4 (Size 250)	inches	47-1/8	36-5/8	100-11/16	94-3/4	34-1/2	109-3/4	109-1/16	133-3/4	133-1/16
		mm	1197	905	2557	2407	876	2788	2770	3397	3380
RPDBL 1200	4 (Size 300)	inches	47-1/8	36-5/8	100-11/16	94-3/4	34-1/2	109-3/4	109-1/16	133-3/4	133-1/16
		mm	1197	905	2557	2407	876	2788	2770	3397	3380
RPDBL 1400	4 (Size 350)	inches	53-3/8	42-1/8	111-11/16	105-3/4	40	109-3/4	109-1/16	133-3/4	133-1/16
		mm	1356	1070	2837	2686	1016	2788	2770	3397	3380
RPDBL 1600	4 (Size 400)	inches	58-7/8	47-5/8	122-11/16	116-3/4	45-1/2	109-3/4	109-1/16	133-3/4	133-1/16
		mm	1495	1210	3116	2965	1156	2788	2770	3397	3380

4. Uncrating and Preparation

This furnace was test operated and inspected at the factory prior to crating and was in operating condition. If the equipment has incurred any damage in shipment, document the damage with the carrier and immediately contact your Reznor Distributor.

Check the rating plate for the gas specifications and electrical characteristics of the furnace to be sure that they are compatible with the gas and electric supplies at the installation site. Read this booklet and become familiar with the installation requirements of your particular model. If you do not have knowledge of local requirements, check with the local gas company or any other local agencies who might have requirements concerning this installation.

Before beginning, make preparations for necessary supplies, tools, and manpower. Check to see if there are any field-installed options that need to be assembled to the furnace prior to installation.

Option Parts -- Some gas control options will have parts either shipped loose with the heater or shipped separately. If your unit is equipped with any of the following gas control options, be sure these parts are available at the job site.

Heating -- Gas Control Options	**Opt AG**	**Shipped-Separate Components**
	7	Thermostat, P/N 48033
	10	Thermostat, P/N 91919
	11	Thermostat, P/N 93435
Makeup Air -- Gas Control Options	**3, 6, 8, 13**	Control Switch, P/N 29054
	9	Remote Temperature Selector, P/N 48042 Control Switch, P/N 29054
	15	Remote Temperature Selector, P/N 115848 Stage Adder Module, P/N 115849 (one furnace - 1; two furnaces - 3; three furnaces - 5) Control Switch, P/N 29054
(If an optional remote console is ordered, the control switch is mounted on the console.)	**16**	Remote Temperature Selector, P/N 115848 Stage Adder Module, P/N 115849 (one furnace - 1; two furnaces - 3; three furnaces - 5) Remote Display Module, P/N 115852 Control Switch, P/N 29054
	17, 19, 23	Remote Temperature Selector, P/N 115848 Stage Adder Module, P/N 115849 (two furnaces - 1; three furnaces - 2; four furnaces - 3) Control Switch, P/N 29054
	18, 20, 24	Remote Temperature Selector, P/N 115848 Stage Adder Module, P/N 115849 (two furnaces - 1; three furnaces - 2; four furnaces - 3) Remote Display Module, P/N 115852 Control Switch, P/N 29054
	39, 41	Remote Temperature Selector, P/N 174849

Before beginning installation, be sure that any other shipped-separate options ordered are available at the site. Other shipped-separate options could include a gas shutoff valve, a thermostat, an optional control switch, a remote console, a gas supply regulator, a vertical vent extension, a screened outside air hood, a roof curb, and/or a disconnect switch. If ordered with a optional cooling coil cabinet, it is shipped separately for field installation. If ordered with an evaporative cooling module, the module is shipped separately. A drain and fill or freeze kit and a water hammer arrestor are shipped-separate options for an evaporative cooling module.

5. Combustion Air Requirements

5A. Indoor Model PGBL

The duct furnaces in this packaged system are designed to take combustion air from the space in which the furnace is installed. Combustion air enters through the screened air intakes located in each furnace section access door. The air that enters into the combustion process is then vented to the outdoors. Sufficient air must enter the equipment location to replace the air exhausted through the vent system. Modern construction methods involve the greater use of insulation, improved vapor barriers and weather stripping, with the result that buildings generally are much tighter structurally than they have been in the past. The combustion air supply for gas-fired equipment can be affected by these construction conditions because infiltration that would have existed in the past may not be adequate. Extensive use of exhaust fans aggravates the situation. In the past the filtration of outside air assumed in heat loss calculations (one air change per hour) was assumed to be sufficient. However, current construction methods may now require the introduction of outside air through wall openings or ducts.

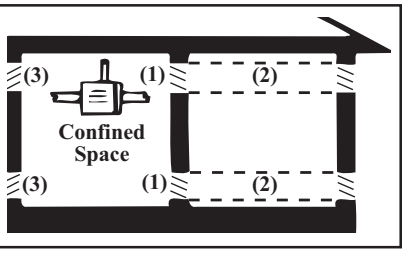
Requirements for combustion air and ventilation air depend upon whether the unit is located in a confined or unconfined space. An "unconfined space" is defined as a space whose volume is not less than 50 cubic feet per 1000 BTUH of the installed appliance. Under all conditions, enough air must be provided to ensure there will not be a negative pressure condition within the equipment room or space. A positive seal must be made in all return-air connections and ducts. Even a slight leak can create a negative pressure condition in a confined space and affect combustion.

WARNING: These indoor furnaces are designed to take combustion air from the space in which the furnace is installed and are not designed for connection to outside combustion air intake ducts. Use of outside air ducts voids the warranty and could cause hazardous operation. See Hazard Levels, page 2.

Indoor Furnace Located in a Confined Space

Do not install a unit in a confined space without providing wall openings leading to and from the space. Provide openings near the floor and ceiling for ventilation and air for combustion as shown in **FIGURE 2**, depending on the combustion air source as noted in Items 1, 2 and 3.

FIGURE 2 - Confined Space: A space whose volume is less than 50 cubic feet per 1000 BTUH of the installed appliance input rating



Add total BTUH of all appliances in the confined space and divide by figures below for square inch free area size of each (top and bottom) opening.

1. Air from inside the building - openings 1 square inch free area per 1000 BTUH. Never less than 100 square inches free area for each opening. See (1) in **FIGURE 2**.

2. Air from outside through duct - openings 1 square inch free area per 2000 BTUH. See (2) in **FIGURE 2**.

3. Air direct from outside - openings 1 square inch free area per 4000 BTUH. See (3) in **FIGURE 2**.

NOTE: For further details on supplying combustion air to confined space, see National Fuel Gas Code ANSI Z223.1a (latest edition) 5.3.3.

5B. Combustion Air for Gravity-Vented, Outdoor Model CRGBL

Combustion air enters through the screened air intakes located in the furnace section access doors.

5C. Combustion Air for Power-Vented, Outdoor Models RPBL and RPDBL

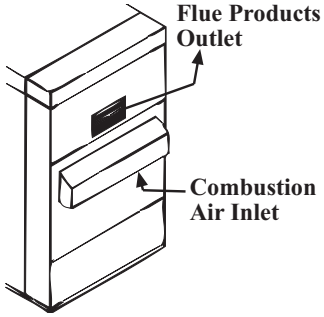
The combustion air and flue gas openings are carefully designed screened openings located on the side of each furnace section just

5. Combustion Air Requirements (cont'd)

5C. Combustion Air for Power-Vented, Outdoor Models RPBL and RPDBL

above the control access panel. Location of the flue opening directly above the air intake is designed to discourage recirculation of combustion products. See **FIGURE 3**.

FIGURE 3 - Combustion Air Intakes, Outdoor Power-Vented Models RPBL and RPDBL



5D. Chlorine -- All Models

The presence of chlorine vapors in the combustion air of gas-fired heating equipment presents a potential corrosion hazard. Chlorine will, when exposed to flame, precipitate from the compound, usually freon or degreaser vapors, and go into solution with any condensation that is present in the heat exchanger or associated parts. The result is hydrochloric acid which readily attacks all metals including 300 grade stainless steel.

Care should be taken to separate these vapors from the combustion process. This may be done by wise location of the furnace with regard to exhausters or prevailing wind direction. Remember, chlorine is heavier than air. This fact should be kept in mind when determining installation locations of heating equipment and building exhaust systems.

6. Clearances

Provide clearance to combustibles as shown in the table. Clearance to combustibles is defined as the minimum distance from the heater to a surface or object that is necessary to ensure that a surface temperature of 90°F above the surrounding ambient temperature is not exceeded. Clearance is also required to sides of the furnace for combustion air space and for convenient installation and burner control system service.

Recommended minimum clearance from the bottom of the outside air hood to the mounting surface is 14" (356mm).

Models	Required Clearances
PGBL	Side Opposite Controls, Top, Flue Connection - 6" (152mm); Control Side - 56" (1422mm); Furnace Bottom - 6" (152mm)
CRGBL, RPBL, RPDBL	Control Side - 56"(1422mm); *Furnace Bottom - 0"
CRGBL	30' (9M) radius from the center of the vent cap to obstructions such as walls, parapets, or cupolas
* When installed on a roof curb on a combustible roof, the roof area enclosed within the curb must be either ventilated, left open, or covered with non-combustible material which has an "R" value of at least 5.0. See **FIGURE 7A**, page 11.	

7. Suspending/Mounting

7A. Suspending/Mounting Indoor Models

Approximate Net Weight (lbs) - Indoor Model PGBL			
Size	**400**	**800**	**1200**
Weight	849	1245	1565

Before installing the furnace/blower package, check the supporting structure to verify that it has sufficient load-carrying capacity to support the weight of the unit. These weights are for blower/furnace section(s) only; if included, add the weight of an optional cooling coil cabinet or evaporative cooling module.

INSTALLATION NOTES: If installing as a makeup air system with an **evaporative cooling module**, the module is shipped separately and **must be mounted** (blower/furnace section may be either mounted or suspended). Follow the installation instructions included with the module; a field-supplied transition duct may be required. An evaporative cooling module ranges in weight from 375-520 lbs.

OR, if the system includes a **cooling coil cabinet**, the cabinet is shipped separately for field attachment. A cooling coil cabinet with a coil can weigh as much as 1020 lbs. If the system is mounted, provide sufficient support and attach according to the instructions in Paragraph 31. If the system is to be suspended, the cooling coil cabinet must be ordered with a special curb cap. Contact your Sales Representative or the factory for information about suspending a cooling coil cabinet. Installation may require a field-supplied transition duct.

WARNING: Unit must be level for proper operation. Do not place or add additional weight to the suspended unit. See Hazard Levels, page 2.

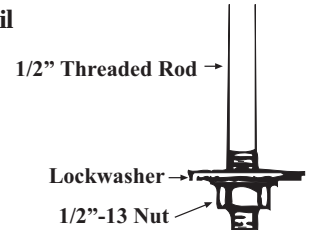
Suspending Furnaces (Refer to FIGURE 4)

This system is equipped with a load-bearing curb cap which forms an integral part of the unit. The curb cap is welded at all joints and has suspension holes at each corner and hanger brackets on the sides. See **FIGURE 1B**, page 3, for the number of suspension points and suspension dimensions.

Each suspension location requires a 1/2" threaded rod as illustrated in **FIGURE 4**.

FIGURE 4 - Support Rod Detail

Required at all Suspension Points



Mounting Indoor Furnaces

Prior to installation, be sure that the method of support is in agreement with all local building codes. **NOTE: The curb cap is not designed to be placed directly on a flat surface.**

Whether the field-supplied rails are being mounted directly on a surface or being placed "up" on additional structure, the horizontal length of the system should be supported by two 4x4 treated wooden rails. Cut the rails to the appropriate length (Dimension "A") in **FIGURE 5A**.

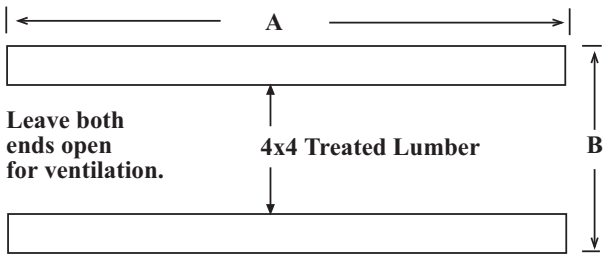
Space the 4x4 wooden rails (See "B" Dimension, **FIGURE 5A**) so that the curb cap "skirt" will fit over the edge of the boards with the rails setting inside the horizontal length of the curb cap.

If the rails are being laid directly on a surface, position them as shown in **FIGURE 5A**. Set the system on the rails, leaving the "ends" underneath open for ventilation.

If the wooden rails are not placed directly on a surface, cross-supports should be placed underneath the rails at the ends of the unit and at all cabinet "joints" (between the blower cabinet and the heater section,

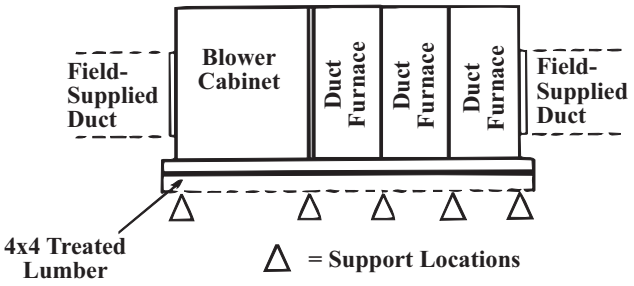
between each heater section, between the heater section and an optional cooling coil cabinet or downturn plenum cabinet). See **FIGURE 5B**. The field-supplied, cross-support structure must be adequate for the weight of the unit, and all cross-supports should run the entire width of the unit, supporting the 4x4 wooden rails at all recommended locations. Do not enclose the area under the furnace; leave space for ventilation.

FIGURE 5A - Mounting Support Dimensions



Model PGBL	Standard Heater(s) and Blower Package	With Option AQ5 or AQ8 Downturn Plenum Cabinet	With Option AU Cooling Coil Cabinet only	With Option AU Cooling Coil Cabinet with Downturn Plenum	All Configurations
	"A"	"A"	"A"	"A"	"B"
400	82-1/4"	106-1/4"	150-1/4"	174-1/4"	54-1/2"
	2089mm	2699mm	3816mm	4426mm	1384mm
800	108-1/4"	132-1/4"	176-1/4"	200-1/4"	54-1/2"
	2750mm	3359mm	4477mm	5086mm	1384mm
1200	134-1/4"	158-1/4"	202-1/4"	226-1/4"	54-1/2"
	3410mm	4020mm	5137mm	5747mm	1384mm

FIGURE 5B - Cross-Support Locations for Indoor Systems when the wooden 4x4 rails supporting the length of the system are supported by additional structure



Do not enclose the area underneath the furnace; leave space for ventilation.

WARNINGS: Do not close or block the openings under each end of a Model PGBL mounted on 4x4 treated wooden rails; the space under the furnace MUST be left open for ventilation.

If cross supports are used under the 4x4 rails, do not enclose the area under the furnace; leave open space for ventilation.

7B. Mounting Outdoor Models Rigging

Lifting holes are provided for rigging. Use spreader bars when lifting to prevent chains or cables from damaging the unit. If the unit is being mounted on a roof curb, apply caulking to the roof curb prior to lifting the unit to the roof and setting it on the curb. See **FIGURE 7A**, page 11.

If the system includes an outside air hood, a cooling coil cabinet, or an evaporative cooling module, attach them *after* the system is in place.

Location

When selecting a location for an outdoor installation, position the unit so that the air inlet will not be facing into the prevailing wind. System must be level for proper operation.

Approximate Net Weight Outdoor Systems (blower and furnace sections only)							
CRGBL, RPBL	**400**	**500**	**600**	**700**	**800**	**1050**	**1200**
Wt (lbs)	849	1104	1104	1184	1245	1476	1565
RPDBL	**800**	**1000**	**1200**	**1400**	**1600**		
Wt (lbs)	1810	2328	2328	2508	2650		

If the system includes a cooling coil cabinet, the cooling coil cabinet must be lifted to the roof separately, set on the roof curb (or field-provided supports), and attached to the furnace.

Approximate Net Weight (lbs) - Optional Cooling Coil Cabinet (includes approximate weight of a coil with 12 fpi)			
CRGBL, RPBL	**500, 600**	**700, 1050**	**400, 800, 1200**
DX	661	753	848
DX with Downturn	813	914	1018
Chilled Water	654	746	841
Chilled Water w/Downturn	806	907	1011

Curb Cap Base - Model Series CRGBL and RPBL

Models CRGBL and RPBL are equipped with a load-bearing curb cap which forms an integral part of the unit. This curb cap is welded at all joints and has a "skirt" which fits over a roof curb to provide a weatherproof installation. Holes are provided at the curb cap corners for lifting the unit. These holes do not interfere with unit weatherproofing. **The curb cap is not designed to be placed directly on the roof surface.** The system may be mounted on an optional roof curb purchased with the unit, a field-supplied roof curb, or field-supplied supports. If the system has a downturn plenum and/or a bottom return air opening, a roof curb is recommended to provide a weatherproof installation as well as more workable clearances for ductwork.

Structural Steel Base - Model Series RPDBL

Model RPDBL systems have a structural steel base that is designed to sit directly on a flat surface (rails are not required). Holes are provided for lifting. Be sure that any supporting structure has sufficient load-carrying capacity to support the weight of the unit.

If ordered with a roof curb, a curb cap that will sit over the roof curb is welded to the structural steel base. When ordered with a curb cap, the base is not designed to be placed directly on the roof surface.

Mounting Outdoor Models on Field-Supplied Supports (without a roof curb) - Applies to Models CRGBL and RPBL

Prior to installation, be sure that the method of support is in agreement with all local building codes and is suited to the climate. If considering this type of installation in snow areas, it is recommended that the 4x4 wooden rails underneath the system be on cross-support structure at least 12" higher than the roof surface (see cross support locations in **FIGURE 6B**).

Whether the supports are being mounted directly on the roof or being placed "up" on additional structure, the horizontal length of the system should be supported by two 4x4 treated wooden rails. Cut the rails to the appropriate length (Dimension "A") in **FIGURE 6A**. (NOTE: Although dimensions are included for units with a downturn plenum cabinet, it is strongly recommended that a full roof curb be used on an installation with a downturn plenum cabinet and/or a bottom return air duct.)

7. Mounting (cont'd)

Mounting Outdoor Models on Field-Supplied Supports - Models CRGBL and RPBL (cont'd)

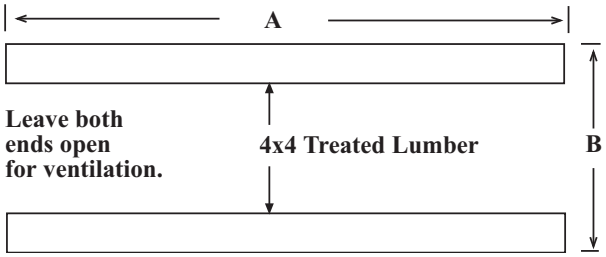
Space the 4x4 wooden rails (See "B" Dimension, **FIGURE 6A**) so that the curb cap "skirt" will fit over the edge of the boards with the rails setting inside the horizontal length of the curb cap.

If the rails are being laid directly on the roof, position them as shown in **FIGURE 6A**. Set the system on the rails, leaving the "ends" underneath open for ventilation.

If the treated wooden rails are not being placed directly on the roof surface, cross-supports should be placed underneath the rails at the ends of the unit and at all cabinet "joints" (between the blower cabinet and the heater section and between the furnace and the optional downturn plenum cabinet). See **FIGURE 6B**.

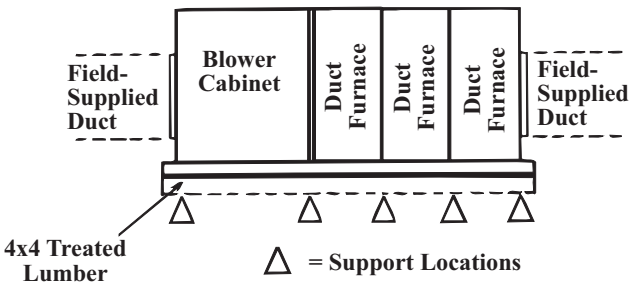
The field-supplied, weather-resistant cross-support structure must be adequate for the weight of the system, and all cross-supports should run the entire width of the system supporting the 4x4 wooden rails at the recommended locations. Do not enclose the area under the furnace; leave space for ventilation.

FIGURE 6A - Mounting Support Dimensions



Size	Standard Heater(s) and Blower Package	With Option AQ Downturn Plenum	With Option AU Cooling Coil Cabinet	With Option AU Cooling Coil Cabinet with Downturn Plenum	All
	"A"	"A"	"A"	"A"	"B"
400	82-1/4"	106-1/4"	150-1/4"	174-1/4"	54-1/2"
	2089mm	2699mm	3816mm	4426mm	1384mm
500/600	108-1/4"	132-1/4"	165-1/4"	189-1/4"	43-9/16"
	2750mm	3359mm	4197mm	4807mm	1106mm
700	108-1/4"	132-1/4"	170-3/4"	194-3/4"	49-1/16"
	2750mm	3359mm	4337mm	4947mm	1246mm
800	108-1/4"	132-1/4"	176-1/4"	200-1/4"	54-1/2"
	2750mm	3359mm	4477mm	5086mm	1384mm
1050	134-1/4"	158-1/4"	196-3/4"	220-3/4"	49-1/16"
	3410mm	4020mm	4997mm	5607mm	1246mm
1200	134-1/4"	158-1/4"	202-1/4"	226-1/4"	54-1/2"
	3410mm	4020mm	5137mm	5747mm	1384mm

FIGURE 6B - Cross-Support Locations for Outdoor Systems when the wooden 4x4 rails supporting the length of the system are supported by additional structure



- A structure height of at least 12" (305mm) is recommended in snow areas.
- Do not enclose the area underneath the furnace; leave space for ventilation.

WARNINGS: Do not close or block the openings under each end of a system mounted on 4x4 treated wooden rails; the space under the furnace MUST be left open for ventilation.
If cross supports are used under the 4x4 rails, do not enclose the area under the furnace; leave open space for ventilation.

Mounting on a Roof Curb - Applies to Models CRGBL and RPBL

Whether using an optional roof curb supplied with the system or a field-supplied curb, the curb must be secure, square and level. The top surface of the roof curb must be caulked with 1/4" x 1-1/4" sealant tape or two 1/4" beads of suitable sealant. The unit must be sealed to the curb to prevent water leakage into the curb area due to wind blown rain and capillary action. Except for the curb assembly details, the information and requirements in this section apply to all curbs. See **FIGURES 7A, 7B, and 7C** and the curb installation instructions.

Roof Curb Dimensions and Weights for Model Series CRGBL and RPBL (Refer to FIGURE 7A)

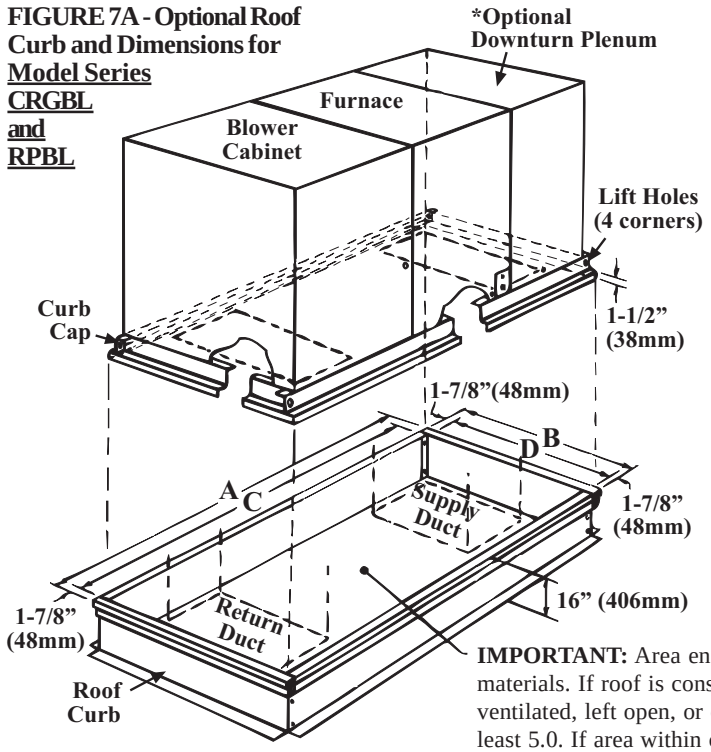
Size		400	500/600	700	800	1050	1200
Option CJ1 - Roof Curb for CRGBL and RPBL							
A	inches	82-1/4	108-1/4	108-1/4	108-1/4	134-1/4	134-1/4
	mm	2089	2750	2750	2750	3410	3410
B	inches	54-1/2	43-9/16	49-1/16	54-1/2	49-1/16	54-1/2
	mm	1384	1106	1246	1384	1246	1384
C*	inches	78-1/2	104-1/2	104-1/2	104-1/2	130-1/2	130-1/2
	mm	1994	2654	2654	2654	3315	3315
D*	inches	50-13/16	39-13/16	45-5/16	50-13/16	45-5/16	50-13/16
	mm	1291	1011	1151	1291	1151	1291
Wt	lbs	150	167	173	179	202	208
	kg	68	76	78	81	92	94
Option CJ2 - Roof Curb for CRGBL and RPBL with *Factory-Installed* Downturn Plenum, Option AQ5 or AQ8							
A	inches	106-1/4	132-1/4	132-1/4	132-1/4	158-1/4	158-1/4
	mm	2699	3359	3359	3359	4020	4020
B	inches	54-1/2	43-9/16	49-1/16	54-1/2	49-1/16	54-1/2
	mm	1384	1106	1246	1384	1246	1384
C*	inches	102-1/2	128-1/2	128-1/2	128-1/2	154-1/2	154-1/2
	mm	2604	3264	3264	3264	3924	3924
D*	inches	50-13/16	39-13/16	45-5/16	50-13/16	45-5/16	50-13/16
	mm	1291	1011	1151	1291	1151	1291
Wt	lbs	177	193	199	205	228	234
	kg	80	88	91	93	103	106
Option CJ4 - Roof Curb for CRGBL and RPBL with *Field-Installed* ** Cooling Coil Cabinet, Option AU2 or AU3							
A	inches	150-1/4	165-1/4	170-3/4	176-1/4	196-3/4	202-1/4
	mm	3816	4197	4337	4477	4997	5137
B	inches	54-1/2	43-9/16	49-1/16	54-1/2	49-1/16	54-1/2
	mm	1384	1106	1246	1384	1246	1384
C*	inches	146-1/2	161-1/2	167	172-1/2	193	198-1/2
	mm	3721	4102	4242	4382	4902	5042
D*	inches	50-13/16	39-13/16	45-5/16	50-13/16	45-5/16	50-13/16
	mm	1291	1011	1151	1291	1151	1291
Wt	lbs	227	231	243	255	271	282
	kg	103	105	110	116	123	128

Size		400	500/600	700	800	1050	1200
Option CJ5 - Roof Curb for CRGBL & RPBL with *Field-Installed* Cooling Coil Cabinet w/Downturn, Option AU11, AU12, AU13 or AU14**							
A	inches	174-1/4	189-1/4	194-3/4	200-1/4	220-3/4	226-1/4
	mm	4426	4807	4947	5086	5607	5747
B	inches	54-1/2	43-9/16	49-1/16	54-1/2	49-1/16	54-1/2
	mm	1384	1106	1246	1384	1246	1384
C*	inches	170-1/2	185-1/2	191	196-1/2	217	222-1/2
	mm	4331	4712	4851	4991	5512	5652
D*	inches	50-13/16	39-13/16	45-5/16	50-13/16	45-5/16	50-13/16
	mm	1291	1011	1151	1291	1151	1291
Wt	lbs	253	257	269	280	296	308
	kg	115	117	122	127	134	140

*__C__ and __D__ are roof opening dimensions.

** Field installed means that the cooling coil cabinet with or without the downturn is factory assembled and shipped separately. The roof curb is sized to accommodate the complete length of the system. The shipped-separate cooling coil cabinet with or without a downturn must be lifted to the roof separately from the packaged system, set on the roof curb, and attached to the furnace section (see instructions in Paragraph 31).

FIGURE 7A - Optional Roof Curb and Dimensions for Model Series CRGBL and RPBL



* Illustration is shown with an Option AQ5 or AQ8 downturn plenum. The system can have a variety of configurations which affect installation.

- If the system does not have a downturn plenum, the discharge is horizontal.
- Downturn plenum Options AQ5 and AQ8 are factory installed to be lifted to the roof and set on the roof curb as part of the packaged system.
- If the system has an Option AU2 or AU3 cooling coil cabinet, the discharge is horizontal. If the system has an AU11, AU12, AU13, AU14 cooling coil cabinet, there is a downturn plenum with vertical discharge. **Options AU2, AU3, AU11, AU12, AU13, and AU14 are not factory installed. Options AU2, AU3, AU11, AU12, AU13, and AU14 must be lifted to the roof separately from the packaged system, set on the roof curb, and attached to the furnace.**

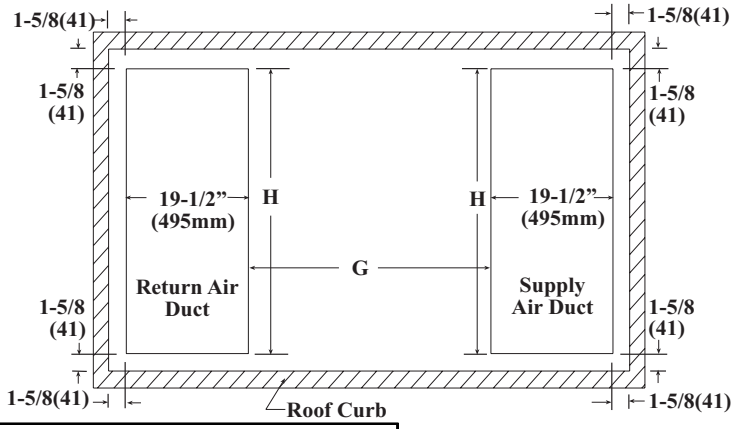
IMPORTANT: Top surface of curb **MUST** be sealed. See instructions below.

IMPORTANT: Area enclosed by the roof curb must comply with clearance to combustible materials. If roof is constructed of combustible materials, area within curb must be either ventilated, left open, or covered with non-combustible material which has an "R" value of at least 5.0. If area within curb is left open, higher radiated sound levels may result.

FIGURE 7B - Duct Opening Dimensions (inches and mm) in relation to Roof Curb Option for Model Series CRGBL and RPBL

Bottom Duct Connections - The blower section and optional downturn plenum have duct flanges for connection to return air and supply air ducts. Duct opening sizes and curb spacing shown are for currently manufactured curbs that are available from the system manufacturer.

- 1-5/8" (41mm) is the measurement from the duct openings to the inside edge of the roof curb.
- Openings for ductwork should be 1" (25mm) larger than the duct size for installation clearance.



CRGBL/ RPBL	H		G			
			With Downturn AQ5 or AQ8 (no cooling coil)		With Cooling Coil Cabinet with Downturn, Options AU11, AU12, AU13, AU14	
	inches	mm	inches	mm	inches	mm
400	47-5/8	1210	60-5/16	1532	127-17/32	3239
500, 600	36-5/8	930	86-5/16	2192	142-17/32	3620
700	42-1/8	1070	86-5/16	2192	148-1/32	3760
800	47-5/8	1210	86-5/16	2192	153-17/32	3900
1050	42-1/8	1070	112-5/16	2853	174-1/32	4420
1200	47-5/8	1210	112-5/16	2853	179-17/32	4560

7. Mounting (cont'd)

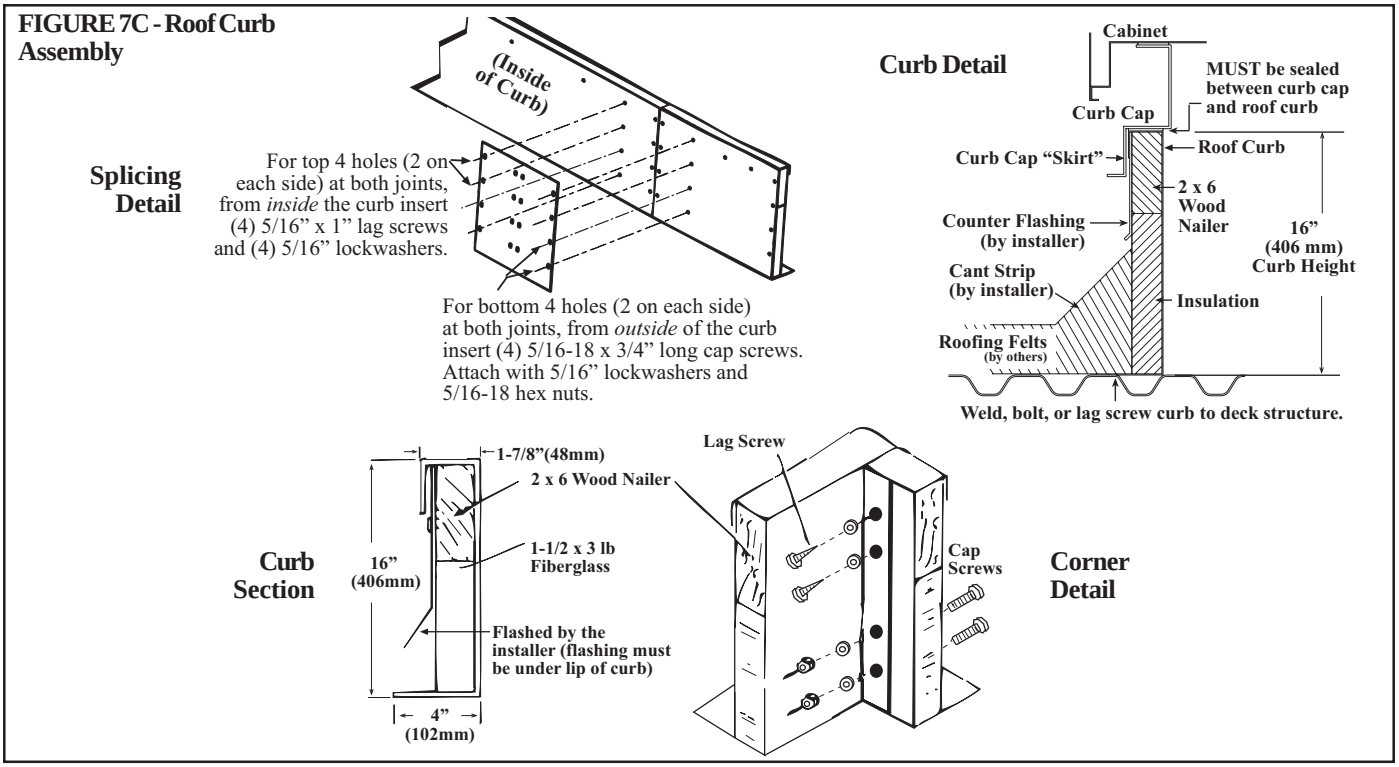
Mounting on a Roof Curb (cont'd)

Roof Curb Assembly and Installation Instructions - Applies to all Outdoor Models

Curbs are shipped unassembled. Field assembly and mounting on the roof are the responsibility of the installer. All required hardware necessary to complete the assembly is supplied. Before installing roof curb, verify that the size is correct for the system being installed.

1. Position curb cross rails and curb side rails as illustrated in **FIGURE 7A**. If there are two side pieces to a side, fasten them with splice plates and hardware as illustrated in the splicing detail drawing (**FIGURE 7C**). Join the corners as illustrated in the corner detail (**FIGURE 7C**).
2. Check the assembly for squareness. Adjust the roof curb so that the diagonal measurements are equal within a tolerance of + or - 1/8".
3. Level the roof curb. To ensure a good weathertight seal between the curb cap and the roof curb, the roof curb must be leveled in both directions with no twist end to end. Shim level as required and secure curb to roof deck before proceeding with flashing.
4. Install field-supplied flashing.
5. Before placing the unit into position, apply furnished 1/4" x 1-1/4" foam sealant tape to top surface of curb, making good butt joint at corners. The unit must be sealed to the curb to prevent water leakage into the curb area due to blown rain and capillary action.

FIGURE 7C - Roof Curb Assembly



Mounting on an Optional Roof Curb - Applies to Model RPDBL

The roof curb must be secure, square and level. The top surface of the roof curb must be caulked with 1/4" x 1-1/4" sealant tape or two 1/4" beads of suitable sealant. The unit must be sealed to the curb to prevent water leakage into the curb area due to wind blown rain and capillary action.

Refer to the curb assembly instructions above and the assembly illustrations in **FIGURE 7C**.

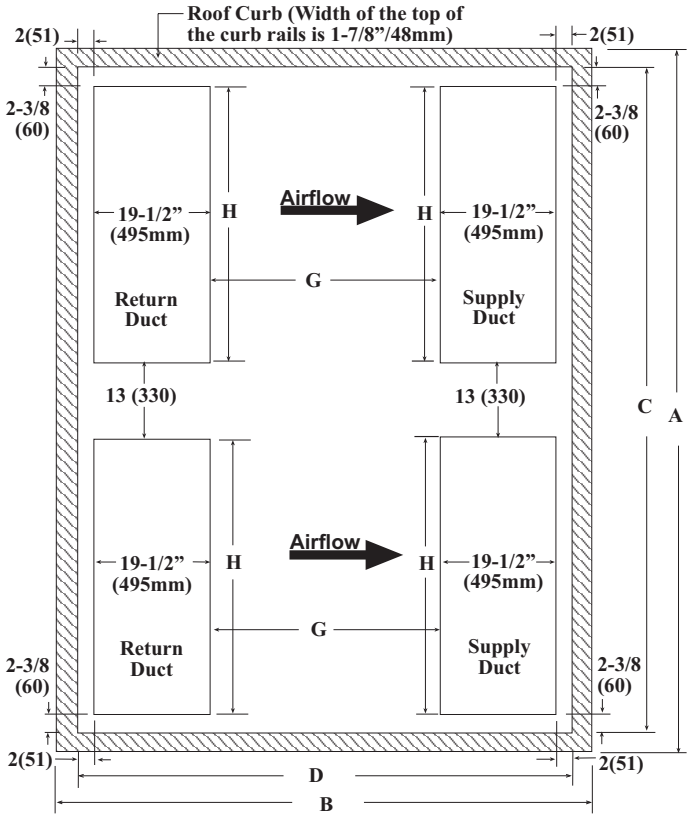
Refer to **FIGURE 8** and tables below for dimensions.

Size	800	1000/1200	1400	1600
Dimensions (inches) of Option CJ1 - Roof Curb for RPDBL				
A	116-1/4	94-1/4	105-1/4	116-1/4
B	82-9/16	108-9/16	108-9/16	108-9/16
C*	113	91	102	113
D*	79-5/16	105-5/16	105-5/16	105-5/16
Dimensions (inches) of Option CJ2 - Roof Curb for RPDBL with *Factory-Installed* Downturn Plenums, Opt AQ5 or AQ8				
A	116-1/4	94-1/4	105-1/4	116-1/4
B	106-9/16	132-9/16	132-9/16	132-9/16
C*	113	91	102	113
D*	103-5/16	129-5/16	129-5/16	129-5/16
G	60-5/16	86-5/16	86-5/16	86-5/16
H	47-5/8	36-5/8	42-1/8	47-5/8

Size	800	1000/1200	1400	1600
Dimensions (mm) of Option CJ1 - Roof Curb for RPDBL				
A	2953	2445	2673	2953
B	2097	2757	2757	2757
C*	2870	2311	2591	2870
D*	2015	2675	2675	2675
Dimensions (mm) of Option CJ2 - Roof Curb for RPDBL with *Factory-Installed* Downturn Plenums, Opt AQ5 or AQ8				
A	2953	2445	2673	2953
B	2707	3361	3361	3361
C*	2870	2311	2591	2870
D*	2624	3285	3285	3285
G	1532	2192	2192	2192
H	1210	930	1070	1210

*C and D are roof opening dimensions.

FIGURE 8 - Dimensions of Optional Roof Curb and Duct Openings for a Model RPDBL



- 2-3/8" (60mm) and 2" (51mm) are the measurements from the duct openings to the inside edge of the roof curb.
- Openings for ductwork should be 1" (25mm) larger than the duct size for installation clearance.

8. Venting

8A. Venting Indoor Model PGBL Power Vented Units

DANGER: Failure to provide proper venting could result in death, serious injury, and/or property damage. This unit must be installed with a vent connection and proper vent to the outside of the building. Follow the installation codes listed in Paragraph 1 and the venting recommendations below.

Model PGBL indoor packaged system is equipped with a motorized vent exhauster and requires a field-installed horizontal or vertical vent system which terminates with a vent cap outside of the building.

Specific Venting Requirements for Model PGBL Units (*read all before installing*)

1. Venter (Flue) Outlet

- If the pipe used in the vent run is larger than the diameter of the venter outlet (See Vent Length Tables), make the transition at the venter outlet.
- A minimum of 12" of straight pipe is required at the venter outlet (or transition fitting) before installing an elbow in the vent system. An elbow should never be attached directly to the venter.

Size	Outlet
400	6" dia
800	8" dia
1200	8" dia

2. Vent Pipe - Use only one of the flue pipe diameters listed in the Vent Length Tables for the furnace size being installed. The type of vent pipe required depends on **the construction of the building *and* the vent configuration.**

- **If a *horizontal* vent system runs through *non-combustible* construction**, use either minimum 26-gauge, single-wall vent pipe or vent pipe approved for a Category III appliance.
- **If a *horizontal* vent system runs through *combustible* construction**, use double-wall vent pipe that is approved for a Category III appliance.
- **If *at least half of the equivalent length of the vent system is vertical* and runs through *non-combustible* construction,** use either single-wall vent pipe, double-wall (Type B) vent pipe, or vent pipe approved for a Category III appliance.
- **If *at least half of the equivalent length of the vent system is vertical* and runs through *combustible* construction,** use either double-wall (Type B) vent pipe or double-wall vent pipe approved for a Category III appliance.

3. Vent Length Tables - Use the "Tables of Permissible Vent Lengths" (pages 13-14) as a guideline in designing an appropriate vent system. The tables list required vent pipe diameter and maximum vent length runs for systems with one, two, or three furnace sections. Since each vent system requires a vent cap, the vent cap is calculated into the tables.

Instructions for Using "Tables of Permissible Vent Lengths for Model PGBL"

Determine the requirements of the application **(See illustrated example in FIGURE 9 on page 15.)**

1) Determine overall venting system arrangement.
- ☐ Size of Unit - One, Two or Three Furnace Sections
- ☐ Total Horizontal Length
- ☐ Total Vertical Length
- ☐ Total Number of 90° Elbows (45° Elbow = 1/2 of 90°)

2) Determine required vent pipe diameter. There are two tables each for a system with one furnace section, a system with two furnace sections, and a system with three furnace sections -- a table with standard diameter vent pipe size for that model and a table with a larger-than-standard diameter vent pipe for that model. If the vent arrangement requires the use of the larger vent pipe size, the vent pipe diameter must be increased using a taper-type "enlarger" at the venter outlet.

3) If the proposed venting arrangement exceeds maximum values shown in the Tables, re-evaluate vent pipe routing for the possibility of a shorter system.

Vent Length TABLES 1A and 1B for PGBL 400 using either 6" or 7" diameter pipe

KEY: X = not applicable for this system

TABLE 1A - System with ONE Furnace Section (Size 400) with 6" Diameter Vent Pipe

Vertical Height		Maximum Horizontal Distance							
		Number of 90° Elbows							
		3		2		1		0	
(ft)	(M)	ft	M	ft	M	ft	M	ft	M
0-39	**0-12**	5	1.5	20	6	35	10.7	X	
40-59	**12.1-18**	10	3	20	6	X		X	
60-79	**18.1-24**	10	3	X		X		X	
80-90	**24.1-27**	X		X		X		0	

8. Venting (cont'd)

8A. Venting Indoor Model PGBL Units (cont'd)

Vent Length TABLES 1A and 1B for PGBL 400 using either 6" or 7" diameter pipe (cont'd)

KEY: X = not applicable for this system

TABLE 1B - System with ONE Furnace Section (Size 400) with 7" Diameter Vent Pipe (Use a taper-type connection at the venter outlet to increase vent pipe diameter.)

Vertical Height		Maximum Horizontal Distance Number of 90° Elbows													
		6		5		4		3		2		1		0	
(ft)	(M)	ft	M	ft	M	ft	M	ft	M	ft	M	ft	M	ft	M
0-9	0-2.9	10	3	30	9.1	50	15.2	70	21.3	90	27.4	110	33.5	X	
10-29	3-8.9	20	6.1	40	12.2	60	18.3	75	22.9	90	27.4	110	33.5	X	
30-39	9-11.9	25	7.6	45	13.7	60	18.3	75	22.9	90	27.4	100	30.5	X	
40-49	12-14.9	25	9.1	45	13.7	60	18.3	65	19.8	80	24.4	90	27.4	X	
50-59	15-17.9	25	7.6	45	13.7	60	18.3	65	19.8	70	21.3	80	24.4	X	
60-79	18-24	15	4.6	40	12.2	45	13.7	50	15.2	50	15.2	60	18.3	X	
80-99	24.1-30	10	3	15	4.6	20	6.1	25	9.1	30	9.1	40	12.2	X	
100-119	30.1-36	X		X		X		10	3	15	4.6	20	6.1	X	
120-140	36.1-43	X		X		X		X		X		X		0	

Vent Length TABLES 2A and 2B for PGBL 800 using either 8" or 10" diameter pipe

KEY: X = not applicable for this system

TABLE 2A - System with TWO Furnace Sections (Size 800) with 8" Diameter Vent Pipe

Vertical Height		Maximum Horizontal Distance Number of 90° Elbows					
		2		1		0	
(ft)	(M)	ft	M	ft	M	ft	M
0-9	0-2.9	10	3.0	35	10.7	X	
10-39	3-11.9	12	3.7	38	11.6	X	
40-79	12-24	15	4.6	40	12.2	X	
80-100	24.1-30	X		X		0	

TABLE 2B - System with TWO Furnace Sections (Size 800) with 10" Diameter Vent Pipe (Use taper-type connection at the venter outlet to increase vent pipe diameter.)

Vertical Height		Maximum Horizontal Distance Number of 90° Elbows									
		4		3		2		1		0	
(ft)	(M)	ft	M	ft	M	ft	M	ft	M	ft	M
0-4	0-1.4	40	12.2	70	21.3	90	27.4	120	36.6	X	
5-9	1.5-2.9	45	13.7	75	22.9	95	29.0	125	38.1	X	
10-19	3-5.9	50	15.2	80	24.4	100	30.5	120	36.6	X	
20-29	6-8.9	55	16.8	85	25.9	105	32.0	120	36.6	X	
30-39	9-11.9	60	18.3	90	27.4	110	33.5	110	33.5	X	
40-49	12-14.9	65	19.8	90	27.4	90	27.4	90	27.4	X	
50-79	15-24	70	21.3	70	21.3	70	21.3	70	21.3	X	
80-99	24.1-30	100	30.5	50	15.2	50	15.2	50	15.2	X	
100-119	30.1-36	30	9.1	30	9.1	30	9.1	30	9.1	X	
120-140	36.1-43	X		X		X		X		0	

Vent Length TABLES 3A and 3B for PGBL 1200 using either 8" or 10" diameter pipe

KEY: X = not applicable for this system

TABLE 3A - System with THREE Furnace Sections (Size 1200) with 8" Diameter Vent Pipe

Vertical Height		Maximum Horizontal Distance Number of 90° Elbows					
		2		1		0	
(ft)	(M)	ft	M	ft	M	ft	M
0-4	0-1.4	5	1.5	25	7.6	X	
5-9	1.5-2.9	5	1.5	20	6.1	X	
10-19	3-5.9	X		15	4.6	X	
20-29	6-8.9	X		10	3.0	X	
30-39	9-11.9	X		5	1.5	X	
40-60	12-18.3	X		X		0	

TABLE 3B - System with THREE Furnace Sections (Size 1200) with 10" Diameter Vent Pipe (Use taper-type connection at the venter outlet to increase vent pipe diameter.)

Vertical Height		Maximum Horizontal Distance Number of 90° Elbows									
		4		3		2		1		0	
(ft)	(M)	ft	M	ft	M	ft	M	ft	M	ft	M
0-4	0-1.4	40	12.2	70	21.3	90	27.4	120	36.6	X	
5-9	1.5-2.9	45	13.7	75	22.9	95	29.0	125	38.1	X	
10-19	3-5.9	50	15.2	80	24.4	100	30.5	120	36.6	X	
20-29	6-8.9	55	16.8	85	25.9	105	32.0	120	36.6	X	
30-39	9-11.9	60	18.3	90	27.4	110	33.5	110	33.5	X	
40-49	12-14.9	65	19.8	90	27.4	90	27.4	90	27.4	X	
50-79	15-24	70	21.3	50	12.2	70	21.3	70	21.3	X	
80-99	24.1-30	100	30.5	50	12.2	50	15.2	50	15.2	X	
100-119	30.1-36	30	9.1	30	9.1	30	9.1	30	9.1	X	
120-140	36.1-43	X		X		X		X		0	

How to Apply the Tables to Determine Vent Pipe Size Needed for Vent System illustrated in FIGURE 9:

1) System Parameters for **Size 800** (two furnace sections) - **use example shown in FIGURE 9**

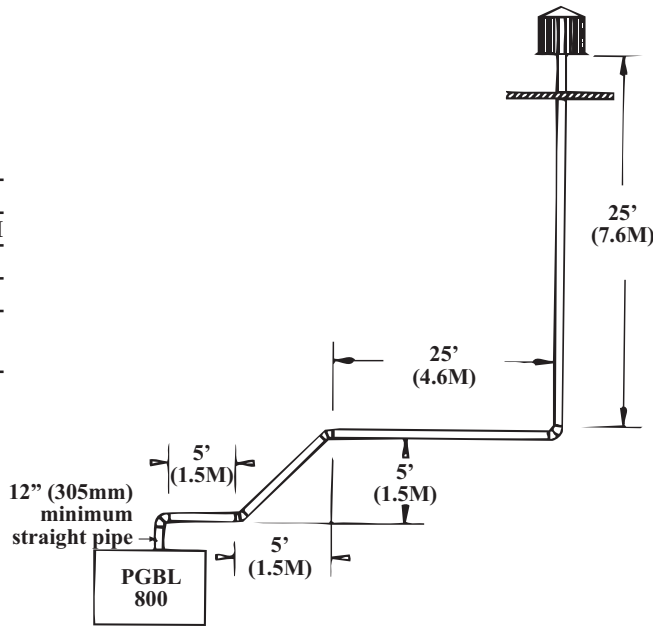
2) Select the Tables for a system with two furnace sections - **TABLES 2A and 2B**.

3) Determine which Table applies to the Application - Since the vent system arrangement in the example requires three elbows, the table for 8" diameter pipe (**TABLE 2A**) cannot be used because the maximum number of elbows allowed with 8" diameter pipe is two. **TABLE 2B** for 10" diameter pipe indicates that with three elbows and 30' of vertical pipe, up to 90' of horizontal pipe can be used. Since the example requires only a total of 25' of horizontal pipe, this system "fits" the parameters of the Table, and the pipe system can be installed as designed, using 10" diameter pipe.

FIGURE 9 - Venting System Example

Vent System Example (use with Tables)

Type of Unit	PGBL 800 (2 furnaces)
Horizontal Vent Run Length	5' + 5' + 15' = 25' 1.5M + 1.5M + 4.6M = 7.6M
Vertical Vent Run Length	5' + 25' = 30' 1.5M + 7.6M = 9.1M
Number of 90° Elbows	1 + 1/2 + 1/2 + 1 = 3



4. **Vent System Joints** - Vent system joints depend on the type of pipe being used (See No. 2 "Vent Pipe" requirements, page 13).

- If using single wall, 26-gauge or heavier galvanized pipe, secure slip-fit connections using sheetmetal screws or rivets. Seal pipe joints either with tape suitable for 550°F (such as Option FA1, P/N 98266) or high-temperature silicone sealant.
- If using Category III vent pipe, follow pipe manufacturer's instructions for joining pipe sections. When attaching Category III pipe to the venter outlet or the vent cap, make secure, sealed joints following a procedure that best suits the style of Category III pipe being used.
- If using double-wall (Type B) vent pipe (at least 1/2 of the equivalent length must be vertical), follow the pipe manufacturer's instructions for joining pipe sections. For joining double-wall pipe to the venter outlet collar, single-wall pipe, and/or the vent cap, follow the instructions in **FIGURES 10A, 10B, and 10C**.

FIGURE 10A - Attaching Double-Wall (Type-B) Vent Pipe to the Venter Outlet

A double-wall pipe run is allowed only if at least 1/2 of the vent length is vertical.

Figure 10A - STEP 1

Slide the double-wall pipe over the collar so that the collar is inside the inner pipe.

Double-Wall Pipe

Venter Collar

Figure 10A - STEP 2

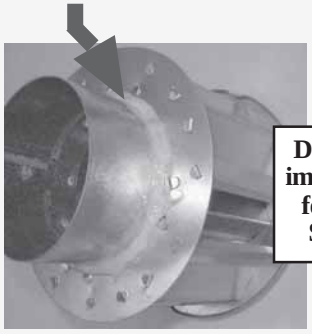
To secure the connection, spaced equal distance around the pipe, drill and insert three 3/4" long sheetmetal screws through the pipe and into the collar. Do not over tighten the screws.

Fill inside the pipe, around the collar, with silicone sealant being sure there are no gaps.

FIGURE 10B - Attaching Double-Wall (Type B) Pipe to a Vent Cap

Figure 10B - STEP 1

Place a continual 3/8" bead of silicone sealant around the circumference of the vent cap collar. This will prevent any water inside the vent cap from running down the double-wall pipe.



Do STEP 2 immediately following STEP 1.

Figure 10B - STEP 2

Insert the collar on the vent cap inside the inner wall of the double-wall pipe. Insert as far as possible. Add additional silicone sealant to fully close any gaps between the vent cap and the double-wall pipe. This is necessary to prevent water from entering the double-wall pipe.

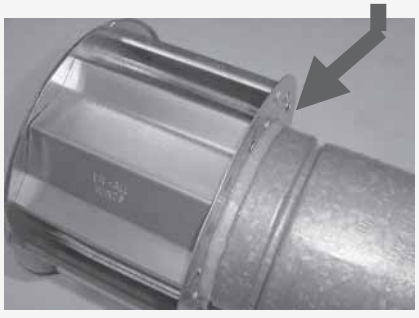


Figure 10B - STEP 3

Secure the vent cap to the double wall pipe by drilling and inserting a 3/4" long sheetmetal screw into the vent cap collar. Do not over tighten screw.

8. Venting (cont'd)

8A. Venting Indoor Model PGBL Units (cont'd)

4. Vent System Joints (cont'd)

FIGURE 10C - Attaching Double-Wall (Type B) Terminal Pipe to a Single Wall Vent Pipe Run

Figure 10C - STEP 1

On the single-wall pipe, place a continual 1/4 inch bead of silicone sealant around the circumference. **Do STEP 2 immediately after STEP 1.**

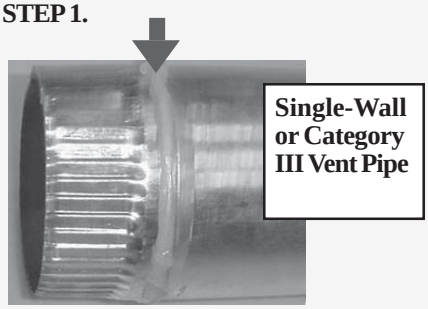


Figure 10C - STEP 2

Insert the pipe with the sealant into the inner pipe of the double-wall pipe until the bead of sealant contacts the inner pipe creating a sealed joint.

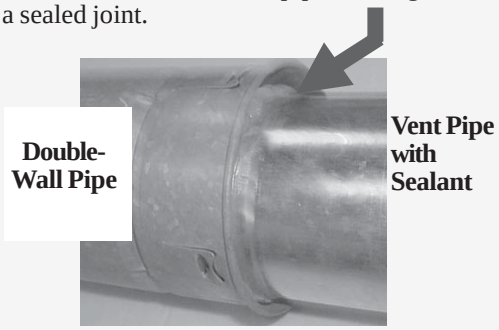
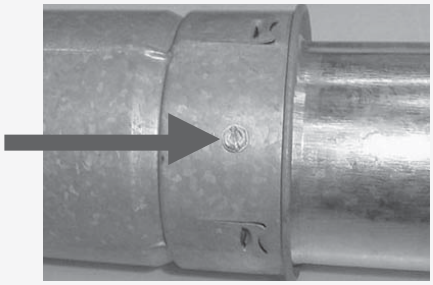


Figure 10C - STEP 3

Spaced equally around the double-wall pipe, drill three small holes below the sealant ring. Insert 3/4 inch long sheetmetal screws to secure the joint. Do not over tighten screws.



5. Vent System Support - Support horizontal runs every six feet (1.8M). Support vertical runs of type "B" double-wall or Category III vent pipe in accordance with the requirements of the pipe manufacturer. Support single-wall vertical pipe in accordance with accepted industry practices. Do not rely on the heater for support of either horizontal or vertical pipes. Use non-combustible supports on vent pipe.

6. Condensation - Single-wall vent pipe exposed to cold air or run through unheated areas must be insulated. Where extreme conditions are anticipated, install a means of condensate disposal.

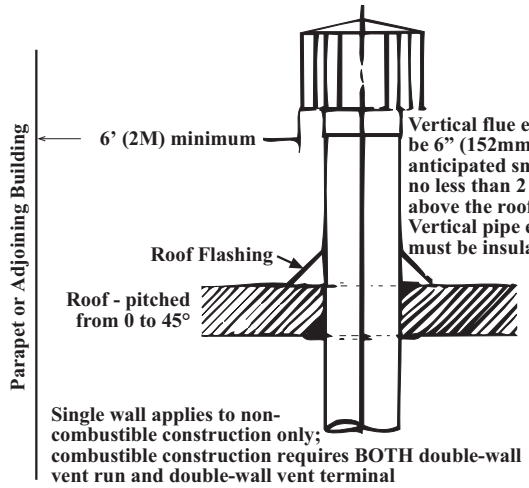
7. Vent Terminal (Pipe and Vent Cap) - The vent system must be terminated with a suitable vent cap that is the same size as the vent run. Heaters approved for installation in the United States that are ordered with an optional vent cap and all heaters approved for installation in Canada have a vent cap shipped with the heater. If the "standard" size (Vent Length **TABLE 1A, 2A, or 3A**) of vent pipe is used, install the vent cap provided. If a vent cap is not included or if a non-standard size (Vent Length **TABLE 1B, 2B, or 3B**) of vent pipe is used, a field-provided cap must be used. If the vent cap is field-supplied, use a Type L Breidert *Air-x-hauster*® or equivalent vent cap. A different style vent cap could cause nuisance problems or unsafe conditions. (Type L Air-x-hauster® is a trademark of The G. C. Breidert Company.)

See the illustrations in **FIGURES 11A or 11B** for requirements of vertical and horizontal vent termination. The vent terminal section may be either single-wall or double-wall vent pipe. If double-wall pipe is used in the vent terminal with a single-wall vent run, follow the instructions in **FIGURE 10B** to attach the vent cap and **FIGURE 10C** to connect the double-wall pipe to the single-wall vent pipe run.

FIGURE 11A - Vertical Vent Terminal Arrangements

Single-Wall Terminal - Vertical

Single-Wall Vent Run and Single-Wall Vent Terminal
Applies to Non-Combustible Construction *Only*



Double-Wall Terminal - Vertical

Single-Wall or Double-Wall Vent Run
and Double-Wall Vent Terminal

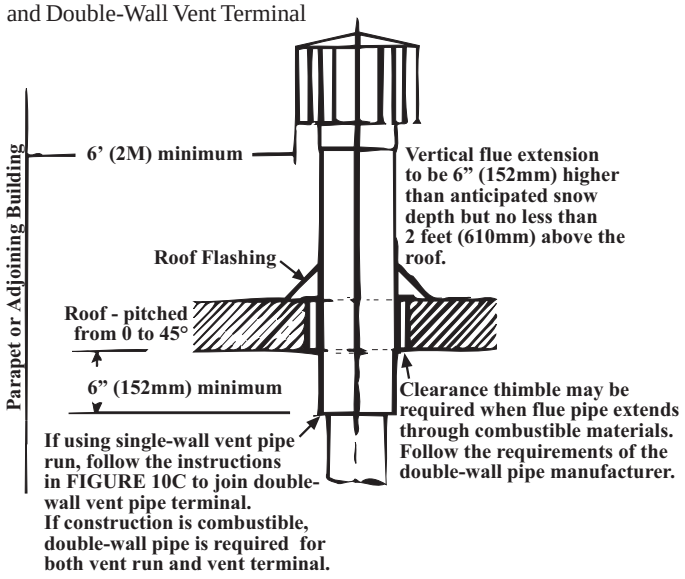
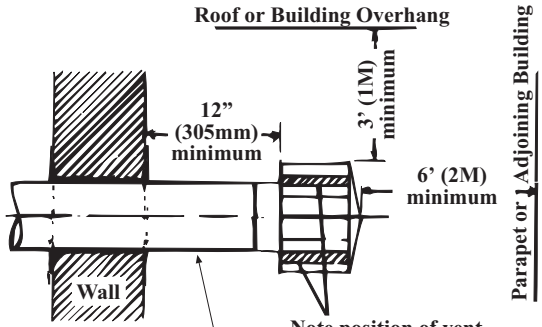


FIGURE 11B - Horizontal Vent Terminal Arrangements

Single-Wall Terminal - Horizontal

Single-Wall Vent Run and Single-Wall Vent Terminal
Applies to Non-Combustible Construction *Only*



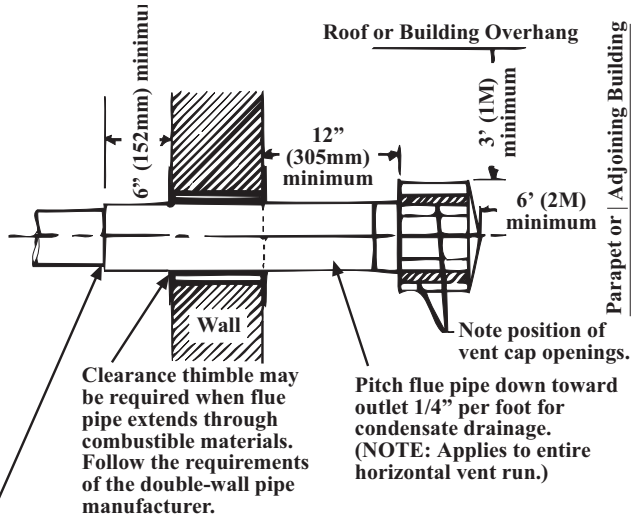
SINGLE WALL applies to non-combustible construction only; combustible construction requires BOTH double-wall vent run and double-wall vent terminal.

Note position of vent cap openings.

Pitch flue pipe down toward outlet 1/4" per foot for condensate drainage. (NOTE: Applies to entire horizontal vent run.)

Double-Wall Terminal - Horizontal

Single-Wall or Double-Wall Vent Run and Double-Wall Vent Terminal



Note position of vent cap openings.

Clearance thimble may be required when flue pipe extends through combustible materials. Follow the requirements of the double-wall pipe manufacturer.

Pitch flue pipe down toward outlet 1/4" per foot for condensate drainage. (NOTE: Applies to entire horizontal vent run.)

Follow the instructions in FIGURE 10C to join and seal single-wall vent pipe and double-wall pipe. If construction is combustible, double-wall pipe is required for BOTH vent run and vent terminal.

Horizontal Vent Terminal Clearances

NOTES: Maintain the required 12" (305mm) clearance from the wall to the vent terminal cap for stability under wind conditions.

Products of combustion can cause discoloration of some building finishes and deterioration of masonry materials. Applying a clear silicone sealant that is normally used to protect concrete driveways can protect masonry materials. If discoloration is an esthetic problem, relocate the vent or install a vertical vent.

Structure	Minimum Clearances for Horizontal Vent Termination Location (all directions unless specified)
Forced air inlet within 10 ft (3.1m)	3 ft (0.9m) above
Combustion air inlet of another appliance	6 ft (1.8m)
Door, window, or gravity air inlet (any building opening)	4 ft (1.2m) horizontally
	4 ft (1.2m) below
	3 ft (0.9m) above
Electric meter, gas meter * and relief equipment	4 ft (1.2m) horizontally
Gas regulator *	3 ft (0.9m)
Adjoining building or parapet	6 ft (1.8m)
Grade (ground level)	7 ft (2.1m) above

*Do not terminate the vent directly above a gas meter or service regulator.

8B. Venting Outdoor Model CRGBL Gravity-Vented Units

WARNING: For best operation, this gravity-vented furnace should be located on a roof or slab with at least 30 feet (9M) radius between the center of the vent cap and obstructions such as walls, parapets or cupolas. See Hazard Levels, page 2.

These gravity-vent systems have a balanced flue system in which combustion air enters through hooded intakes located in each furnace side panel and is discharged at the top of the furnace by means of an approved weather-protected gravity vent cap. Each furnace section requires a vent cap. All furnaces (except CRGBL Sizes 500 and 600) require an extension collar between the heater outlet and the vent cap. The vent cap and extension are supplied with the system and must be field installed.

Model	Furnace Sections	Vent Cap		Extension	
		Size	P/N	Height	P/N
CRGBL 400	1	12"	61875	12"(305mm)	20524
CRGBL 500, 600	2	10"	61866	None	
CRGBL 700, 800	2	12"	61875	12"(305mm)	20524
CRGBL 1050, 1200	3	12"	61875	12"(305mm)	20524

Instructions for Installing Extensions and Vent Caps (See FIGURES 12A and 12B)

1. **Unpacking** -- Gravity vent cap extension is packed inside the vent cap and must be removed before installing. Remove the extension from the inside of the cap.

2) Attach the extension to the furnace flue collar --

a) With 3/8" centerline clearance holes at the bottom, wrap extension ***around*** flue collar on the top of the furnace.

b) Align holes in the extension with holes in the flue collar.

c) Secure with No. 10, 1/2" long sheetmetal screws.

8. Venting (cont'd)

8B. Venting Outdoor Model CRGBL Gravity-Vented Units (cont'd)

3) Attach the vent cap to the extension --

a) Position vent cap ***into*** top of extension. **(See Important Requirement in FIGURE 12B.)**

b) Align holes and push cap into extension.

c) Secure with No. 10, 1/2" long sheetmetal screws.

FIGURE 12A - Vent Cap Extension, P/N 20524

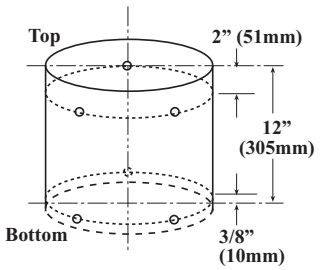
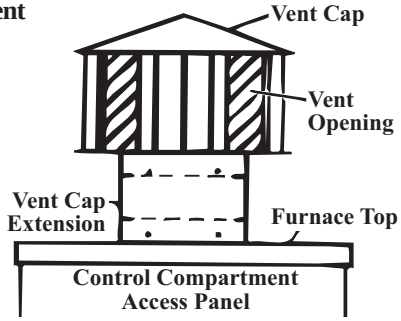


FIGURE 12B - Vent Cap Installation

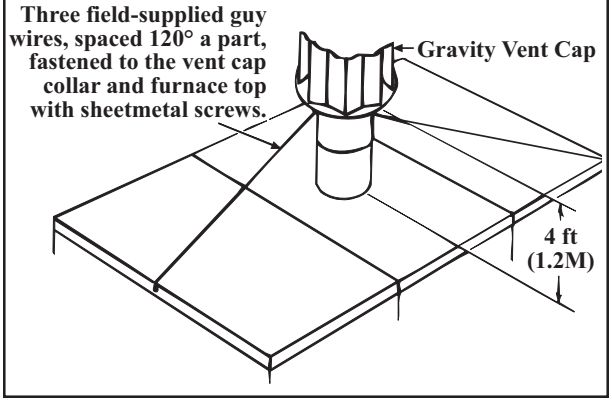


IMPORTANT REQUIREMENT:
For proper operation, holes should be positioned so that the solid side panel of the cap faces the control compartment access panel side of the furnace.

Optional 4-foot Stack Extension (Option ZZ) for Outdoor, Gravity Vent Model CRGBL

Outdoor, gravity-vented furnaces that are factory-built with Option ZZ are designed to release flue gases four feet (1.2M) above the top of each furnace. A field-provided 4-ft vent extension must be installed between the top of each furnace section and the bottom of the vent cap. (See **FIGURE 13**). Furnaces with Option ZZ (factory-installed restrictor plus field-provided 4-ft stack) may be installed adjacent to fresh air inlet(s) when local code requires that release of flue gases be above an adjacent fresh air inlet that is not part of the furnace.

FIGURE 13 - Optional Stack Extension applies only to Furnaces with Suffix "Z" in their Model No.



8C. Venting Outdoor Power Vented Models RPBL and RPDBL

Install a power-vented furnace so that the flue discharge is **not** directed at fresh air inlets.

Flue Gas and Combustion Air Openings

The screened openings are located on the side of each furnace section just above the control access panel (**FIGURE 14**).

The positions of the openings discourage recirculation of combustion products and provide for furnace operation in all normal weather conditions.

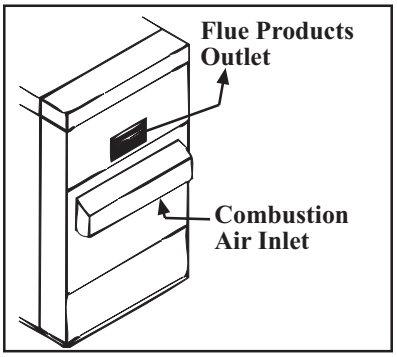


FIGURE 14 - Flue Outlet, Models RPBL and RPDBL

Optional Vertical Flue Discharge (Option CC3) for Model RPBL or RPDBL

These power vented furnaces are certified with four feet (1.2M) of vertical pipe attached as shown in **FIGURES 15A and 15B**. The distance is measured from the top of the unit to the bottom of the vent cap. The option package includes the 5" vent cap, the adapter assembly and the seal plate. (One package is required for each furnace section.) The vent pipe and supports are field supplied. **The straight pipe connecting the furnace to the 90° elbow must be at least 18" (457mm) in length**.

Optional vertical vent piping provides compliance with local codes that require either 10-ft (3M) horizontal or 4-ft (1.2M) vertical clearance between the flue outlet and fresh air intake of the heating system and/or the building.

FIGURE 15A - Installation of Adapter for Optional Vertical Flue Discharge (Option CC3, P/N 45021)

1) Remove and discard the louvered discharge grill.

2) Using venter seal plate as a template, drill holes. Use 3/8"-10 sheetmetal screws to attach both the venter seal plate and the oval adapter assembly.

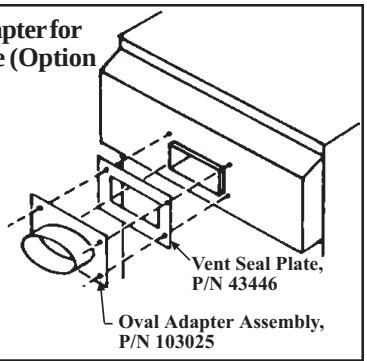
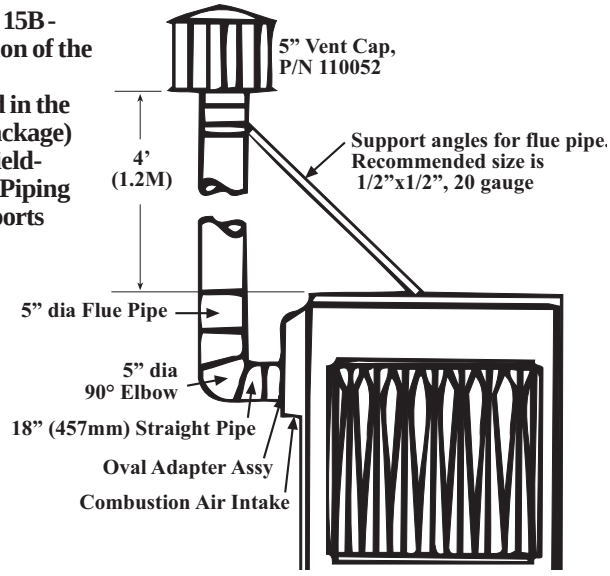


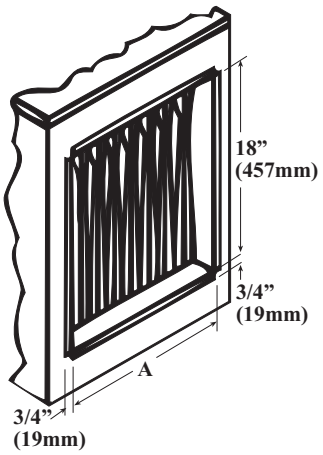
FIGURE 15B - Installation of the Vent Cap (included in the option package) and the field-supplied Piping and Supports



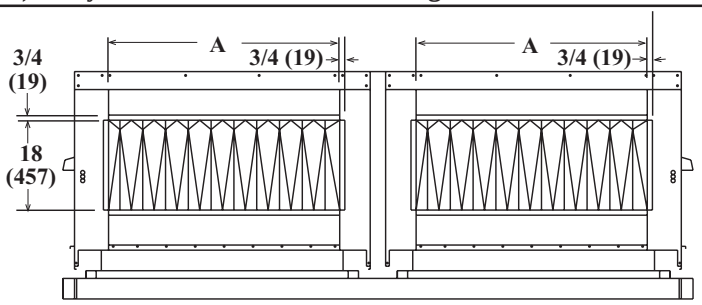
9. Duct Connections

FIGURE 16A - Duct Connection Dimensions (inches and mm) for Systems with Horizontal Discharge

Models PGBL, CRGBL, and RPBL



Model RPDBL



PGBL, CRGBL , RPBL	RPDBL	A
500, 600	1000, 1200	34-1/2" (876mm)
700, 1050	1400	40" (1016mm)
400, 800, 1200	800, 1600	45-1/2" (1156mm)

Requirements and Suggestions for Connecting and Installing Ducts

- **Type of Ductwork** - The type of duct installation to be used depends in part on the type of construction of the roof (whether wood joist, steelbar joist, steel truss, pre-cast concrete) and the ceiling (whether hung, flush, etc.).
- **Ductwork Material** - Rectangular duct should be constructed of not lighter than No. 26 U.S. gauge galvanized iron or No. 24 B & S gauge aluminum.
- **Ductwork Structure** - All duct sections 24" (610mm) or wider, and over 48" (1219mm) in length, should be cross broken on top and bottom and should have standing seams or angle-iron braces. Joints should be S and drive strip, or locked.
- **Through Masonry Walls** - No warm air duct should come in contact with masonry walls. Insulate around all air duct through masonry walls with not less than 1/2" (1" is recommended) of insulation.
- **Through Unheated Space** - Insulate all exposed warm air ducts passing through an unheated space with at least 1/2" (1" is recommended) of insulation.
- **Duct Supports** - Suspend all ducts securely from adjacent buildings members. Do not support ducts from unit duct connections.
- **Duct Sizing** - Proper sizing of the supply air ductwork is necessary to ensure a satisfactory heating installation. The recognized authority for such information is the Air Conditioning Contractors Association, 2800 Shirlington Road, Suite 300, Arlington, VA 22206 (www.acca.org). A manual covering duct sizing in detail may be purchased directly from them.

CAUTION: An external duct system static pressure not within the limits shown on the rating plate, or improper motor pulley or belt adjustment, may overload the motor. See Hazard Levels, page 2.

- **Removable Panels** - The ducts should have removable access panels on both upstream and downstream sides of the furnace. These openings must be accessible when the furnace is in service and should be a minimum of 6" x 10" (152 x 254 mm) in size so smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The covers for the openings must be attached in such a manner as to prevent leakage. See **FIGURE 16B**.
- **Horizontal Supply Air Duct Length** - For all installations with a horizontal discharge, a minimum horizontal duct run of 24" (305mm) is recommended before turns or branches are made in the duct system to reduce losses at the furnace outlet.
- **Horizontal Supply Air Connection** - The seal between the furnace and the duct must be mechanical. Duct connection should be made with "U" type flanges on the top and bottom of the connecting duct. Slide the duct over the flanges of the heater giving an airtight fit. Provide "U" type channels for the other side flanges to ensure tight joints. Use sheetmetal screws to fasten ducts and "U" channels to the furnace flange. See **FIGURES 16B and 16C**.

A Model RPDBL has two separate supply air duct connections. Attach a duct separately to each duct flange. A transition may be fabricated that attaches to each duct flange and combines into a single ductwork. Or, depending on the application, ductwork may remain separate. (NOTE: Model RPDBL 800 with two-stage Options AG4, AG17, or AG18 requires transition into a single ductwork. See Paragraph 21.)

FIGURE 16B - Connecting Ductwork (with removable panels) to the Furnace

(1) Flanges on the heat exchanger (furnace) turn out as shown.

(2) Shape duct connection as shown -- "U" on top and bottom; "L" on sides.

(3) Slide "U" over top and bottom heat exchanger flange.

(4) Form "U" channels to seal sides.

(5) Drill and lock with sheetmetal screws.

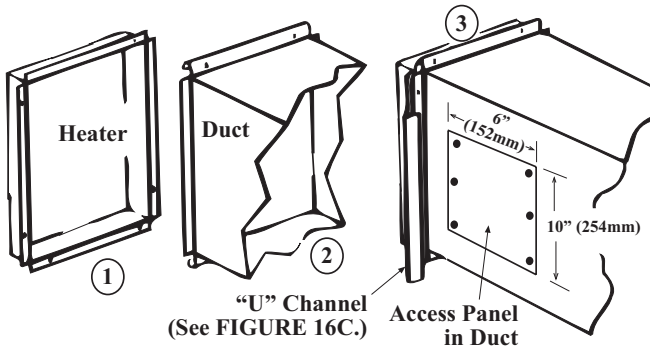
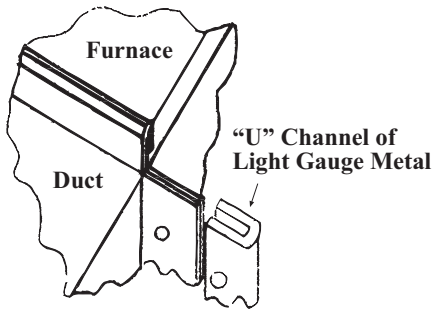


FIGURE 16C - "U" Channel Duct Connection



9. Duct Connections (cont'd)

CAUTION: Joints where supply air ducts attach to the furnace must be sealed securely to prevent air leakage into burner rack area. Leakage can cause poor combustion, pilot problems, shorten heat exchanger life and cause poor performance. See Hazard levels, page 2.

- **Bottom Supply Air Duct Connections** (See dimensions in Paragraph 7) - On outdoor models, insert ducts from below roof deck through roof opening into the heater. Form 1" flanges, fold over, and fasten with sheetmetal screws inside heater. Gain access to the unit by removing side panels from the blower and downturn plenum sections. Ducts must be attached and sealed to provide airtight connections.

  A Model RPDBL has two separate supply air duct connections. Attach a duct separately to each duct flange. A transition may be fabricated that attaches to each duct flange and combines into a single ductwork. Or, depending on the application, ductwork may remain separate. (NOTE: Model RPDBL 800 with two-stage Options AG4, AG17, or AG18 requires transition into a single ductwork. See Paragraph 21.)
- **Return Air Duct/Furnace Connection** - All return air ducts should be attached and sealed to return air flanges to provide airtight connection.
- **Return Air Duct/Grill Size** - Make certain that return air ducting or grills have a free area equal to the return duct size connection.

10. Gas Piping and Pressures

WARNING

This appliance is equipped for a maximum gas supply pressure of 1/2 psi, 3.5 kPa, or 14 inches water column. Supply pressure higher than 1/2 psi requires installation of an additional service regulator external to the unit.

PRESSURE TESTING SUPPLY PIPING

Test Pressures Above 1/2 PSI: Disconnect the heater and manual valve from the gas supply line which is to be tested. Cap or plug the supply line.

Test Pressures Below 1/2 PSI: Before testing, close the manual valve on the heater.

All piping must be in accordance with requirements outlined in the National Fuel Gas Code NFPA54/ANSI Z223.1 (latest edition) or CSA-B149.1 (latest edition) (See Paragraph 1). Gas supply piping installation should conform with good practice and with local codes.

Furnaces for natural gas are orificed for operation with gas having a heating value of 1000 (+ or - 50) BTUH per cubic ft. If the gas at the installation does not meet this specification, consult the factory for proper orificing.

Pipe joint compounds (pipe dope) shall be resistant to the action of liquefied petroleum gas or any other chemical constituents of the gas being supplied.

The National Fuel Gas Code requires the installation of a trap with a minimum 3" drip leg. Local codes may require a minimum drip leg longer than 3" (typically 6").

After all connections are made, disconnect the pilot supply at the control valve and bleed the system of air. Reconnect the pilot line and leak-test all connections by brushing on a leak-detecting solution.

WARNING: All components of a gas supply system must be leak tested prior to placing equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME. Failure to comply could result in personal injury, property damage or death.

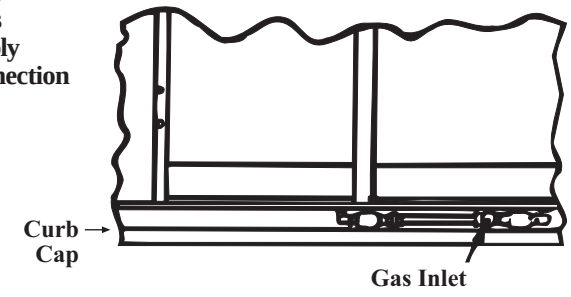
Gas Connection

These systems are composed of one, two, or three duct furnaces assembled in a series. When there are two or three furnace sections, the gas train is manifolded so that only one field connection is required. At the field connection, there is a factory installed adapter with a 1/8" N.P.T. plugged hole for connecting a pressure test gauge. Each furnace section has its own manual shutoff valve. The gas connection is piped along the bottom. See **FIGURE 17** for gas train manifold arrangement and connection location.

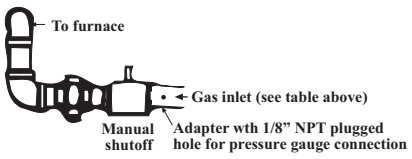
Gas Connection Size (Not Gas Supply Line Size)

PGBL/CRGBL/ RPBL	400	500, 600, 700, 800, 1050, 1200
Natural Gas	1"	1-1/4"
Propane Gas	1"	1-1/4"
RPDBL	**800, 1000, 1200**	**1400, 1600**
Natural Gas	1-1/4"	2"
Propane Gas	1-1/4"	2"

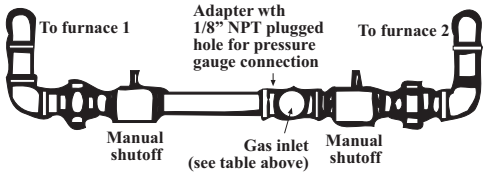
FIGURE 17 - Gas Supply Connection



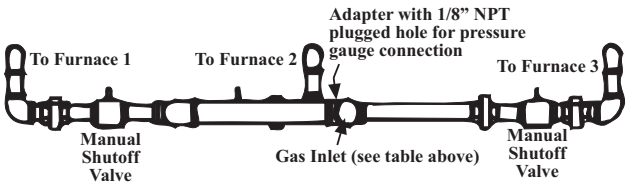
PGBL, CRGBL, RPBL with 1 furnace section or RPDBL with 2 furnace sections (one on each side)



PGBL, CRGBL, RPBL with 2 furnace sections or RPDBL with 4 furnace sections (two on each side)



PGBL, CRGBL, RPBL with 3 furnace sections



Sizing Gas Supply Lines

Capacity of Piping - Cubic Feet per Hour based on 0.3" w.c. Pressure Drop Specific Gravity for Natural Gas -- 0.6 (Natural Gas -- 1000 BTU/Cubic Ft) Specific Gravity for Propane Gas -- 1.6 (Propane Gas -- 2550 BTU/Cubic Ft)										
Length of Pipe	Diameter of Pipe									
	1"		1-1/4"		1-1/2"		2"		2-1/2"	
	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane
20'	350	214	730	445	1100	671	2100	1281	3300	2013
30'	285	174	590	360	890	543	1650	1007	2700	1647
40'	245	149	500	305	760	464	1450	885	2300	1403
50'	215	131	440	268	670	409	1270	775	2000	1220
60'	195	119	400	244	610	372	1105	674	1850	1129
70'	180	110	370	226	560	342	1050	641	1700	1037
80'	170	104	350	214	530	323	990	604	1600	976
90'	160	98	320	195	490	299	930	567	1500	915
100'	150	92	305	186	460	281	870	531	1400	854
125'	130	79	275	168	410	250	780	476	1250	763
150'	120	73	250	153	380	232	710	433	1130	689
175'	110	67	225	137	350	214	650	397	1050	641
200'	100	61	210	128	320	195	610	372	980	598
Note: When sizing supply lines, consider possibilities of future expansion and increased requirements. Refer to National Fuel Gas Code for additional information on line sizing.										

Manifold or Orifice (Valve Outlet) Pressure Settings

Measuring manifold gas pressure cannot be done until the heater is in operation. It is included in the steps of the "Check-Test-Start" procedure in Paragraph 27. The following warnings and instructions apply.

For Natural Gas: When the heater leaves the factory, the combination valve is set so that the outlet gas pressure of a single-stage valve or high fire of a two-stage valve is regulated to 3.5" w.c. Low fire on a two-stage valve is set to 1.8" w.c. Inlet supply pressure to the valve must be a minimum of 5" w.c. or **as noted on the rating plate** and a maximum of 14" w.c. **NOTE: Always check the rating plate for minimum gas supply pressure.** Minimum supply pressure requirements vary based on size of burner and the gas control option. Most units require a minimum of 5" w.c. of natural gas as stated above, but larger sizes with electronic modulation require a minimum of 6" w.c. natural gas supply pressure. Larger sizes with mechanical modulation require 7" w.c.

For Propane Gas: When the heater leaves the factory, the combination valve is set so that the outlet gas pressure of a single-stage valve or high fire of a two-stage valve is 10" w.c. Low fire on a two-stage valve is set to 5" w.c. Inlet pressure to the valve must be a minimum of 11" w.c. and a maximum of 14" w.c.

Before attempting to measure or adjust manifold gas pressure, the inlet (supply) pressure must be within the specified range for the gas being used both when the heater is in operation and on standby. Incorrect inlet pressure could cause excessive manifold gas pressure immediately or at some future time.

Instructions to Check Valve Outlet (Manifold) Pressure:

1) With the manual valve (on the combination valve) positioned to prevent flow to the main burners, connect a manometer to the 1/8" pipe outlet pressure tap in the valve. NOTE: A manometer (fluid-filled gauge) is recommended rather than a spring type gauge due to the difficulty of maintaining calibration of a spring type gauge.

2) Open the valve and operate the heater. Measure the gas pressure to the manifold. To measure the low stage pressure on units equipped with a two-stage valve, disconnect the wire from the "HI" terminal on the valve. (Be sure to reconnect the wire.)

Normally adjustments should not be necessary to the factory preset regulator. If adjustment is necessary, set pressure to correct settings by turning the regulator screw IN (clockwise) to increase pressure. Turn regulator screw OUT (counterclockwise) to decrease pressure. Consult the valve manufacturer's literature provided with the furnace for more detailed information.

11. Electrical Supply and Connections

All electrical wiring and connections, including electrical grounding MUST be made in accordance with the National Electric Code ANSI/NFPA No. 70 (latest edition) or, in Canada, the Canadian Electrical Code, Part I-CSA. Standard C22.1. In addition, the installer should be aware of any local ordinances or utility company requirements that might apply.

Check the rating plate on the heater for the supply voltage and current requirements. A separate line voltage supply with fused disconnect switch should be run directly from the main electrical panel to the furnace, making connection to the motor contactor or starter in the junction box. All external wiring must be within approved conduit and have a minimum temperature rise rating of 60°C. Conduit from the disconnect switch must be run so as not to interfere with the service panels of the furnace.

Field-Supplied Wiring Size from Disconnect to Electrical Box for Connection to Motor Contactor or Starter

Voltage/ Phase	Motor HP	Wire Gauge	BX Cable
120/1	1	12	3/8"
	1.5 - 2	10	1/2"
	3	6	1"
208/1 or 230/1	1 - 2	14	3/8"
	3	10	1/2"
	5	8	1/2"
	7.5	6	1"
	10	4	1"
208/3 or 230/3	1 - 3	14	3/8"
	5	12	3/8"
	7.5	10	1/2"
	10	8	1/2"
	15	6	1"
	20	4	1"
460/3	1 - 7.5	14	3/8"
	10	12	3/8"
	15	10	1/2"
	20	8	1/2"
575/3	1 - 7.5	14	3/8"
	10 - 20	10	1/2"

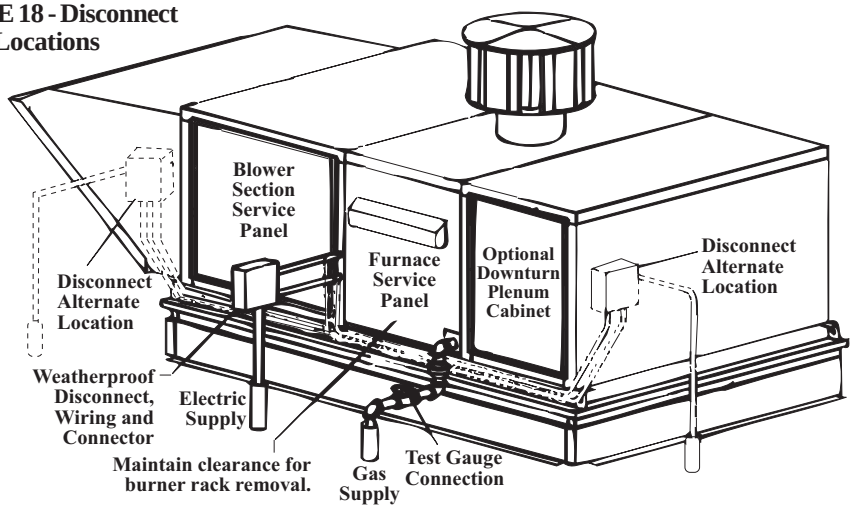
11. Electrical Supply and Connections (cont'd)

Disconnect Switch

A disconnect switch is a required part of this installation. Switches are available, as options or parts, or may be purchased locally. When ordered as an optional component, the disconnect switch is shipped separately.

The disconnect switch may be fusible or non-fusible. When providing or replacing fuses in a fusible disconnect switch, use dual element time delay fuses and size according to 1.25 times the maximum total input amps. When installing, be careful that the conduit and switch housing are clear of furnace panels and inspection plates. Allow at least four feet (1.2M) of service room between the switch and removable panels. See **FIGURE 18** for suggested locations.

FIGURE 18 - Disconnect Switch Locations



Specific wiring diagrams that include standard and factory-installed options are included with the heater. If the system has an optional convenience outlet (Option BC), a separate power supply is required. This circuit MUST BE on a ground fault breaker to meet requirements. All wiring to the convenience outlet must meet National Electrical Code ANSI/NFPA No. 70 (latest edition) and any local or utility codes that apply.

If the heater has field-installed options that require electrical connections, consult the instruction sheet and wiring diagram supplied in the option package.

WARNING: If you turn off the power supply, turn off the gas. See Hazard Levels, page 2.

CAUTION: If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C, except for sensor lead wires which must be 150°C. See Hazard Levels, page 2.

Thermostat, Other Optional Controls, and Control Wiring

A thermostat is not standard equipment but is an installation requirement. Use either an optional thermostat available with the system or a field-supplied thermostat. Install according to the thermostat manufacturer's instructions.

A 24 volt thermostat must be used to actuate low voltage gas controls. If line voltage from the thermostat to the unit is desired, consult the factory representative.

Wiring between the thermostat and the heater must be suitable for a temperature rise rating of 60°C. Labeled thermostat leads are provided in the heater junction box for connection of thermostat wiring.

Thermostats should be located five feet above the floor on an inside wall, not in the path of warm or cold air currents and not in corners where air may be pocketed. Do NOT install on cold air walls. For specific connection details, refer to the instructions with the thermostat.

If more than one unit is cycled from one thermostat, separately activated relays must be substituted at unit thermostat connections.

CAUTION: Make sure the thermostat has an adequate VA rating for the total requirements. Add coil rating of all relays and match thermostat rating. See Hazard Levels, page 2.

There are a variety of optional controls available as part of the gas and air control options. Check the wiring diagram and literature supplied with the unit for operation of factory-installed optional controls. See **FIGURE 21,** page 24, for location of standard and optional controls.

24 Volt Controls - Maximum Amps			
Single-Stage Valve	.6	Fan Control	.12
Two-Stage Valve	.6	Time Delay Relay Heater	.1
Maxitrol System	.5	Relay Coil	.12
Spark Ignition System	.1	Motor Contactor Coil	.33

Optional shipped-separate heating and makeup air controls could include a single or two-stage thermostat, system switches, selectrastat, freezestat, an automatic night setback device, a Maxitrol temperature selector, a potentiometer, a pressure null switch, or a combination of these controls. Install controls according to the manufacturer's instructions packaged with the heater.

Wiring Requirements for Maxitrol Systems

Control wires connected to a Selectrastat, a discharge air sensor, a remote temperature selector or sensor, an amplifier, or the valve must not be run close to or inside conduit with power or ignition wires. Doing so may cause the unit to function erratically or may destroy the amplifier. If shielded wires are used, shield must be insulated and grounded at the amplifier location only.

Remote Console

If the unit being installed includes an optional console, it is shipped separately for field installation. All consoles include indicator lights for the blower and burner. Consoles may include a dirty filter indicator light, a cooling indicator light, an on/off switch, a summer/off/winter switch, a heat/vent/cool switch, a potentiometer, a thermostat, and/or a Maxitrol temperature selector. Consoles are shipped separately for remote installation and may be either mounted on a wall or recessed.

Field Control Wiring - Length and Gauge		
Total Wire Length	Distance from Unit to Control	Minimum Recommended Wire Gauge
150 ft (46M)	75 ft (23M)	#18 gauge
250 ft (76M)	125 ft (38M)	#16 gauge
350 ft (107M)	175 ft (53M)	#14 gauge

12. Blower Motors

Use an amp meter to check motor amps. The chart below lists full load amps for various HP's and voltages. Amps may be adjusted downward by reducing blower RPM or increasing duct system static pressure.

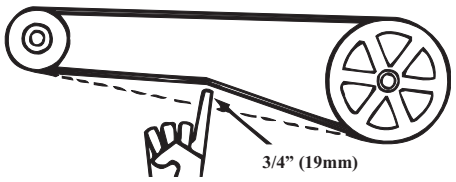
This chart can be used for sizing line wiring but should not be interpreted as the exact motor amps. See the motor rating plate for exact motor specifications.

Full Load Amps - Blower Motors (Open) (Single Speed- Average Values)							
HP	**115V/1PH**	**208V/1PH**	**230V/1PH**	**208V/3PH**	**230V/3PH**	**460V/3PH**	**575V/3PH**
1	13.0	7.5	6.5	3.7	3.2	1.6	1.1
1-1/2	15.0	8.3	7.5	5.6	5.0	2.7	1.6
2	20.4	11.3	10.2	7.0	6.6	3.3	2.1
3		14.0	12.4	9.0	8.6	4.2	3.6
5		28.0	26.0	13.4	13.2	6.6	5.4
7-1/2		35.0	32.0	22.5	19.4	9.7	7.8
10		42.0	38.0	30.0	26.0	13.0	10.4
15				43.1	39.0	19.5	16.0
20				58.7	53.0	26.5	21.2

13. Blowers, Belts and Drives

Check belt tension. Proper belt tension is important to the long life of the belt and motor. A loose belt will cause wear and slippage. Too much tension will cause excessive motor and blower bearing wear. Adjust the belt tension by turning the adjusting screw on the motor base until the belt can be depressed 3/4". (See **FIGURE 19**.) After correct tension is achieved, re-tighten the locknut on the adjustment screw. Be sure that the belt is aligned in the pulleys.

FIGURE 19 - Check Belt Tension



Adjusting Blower Speed

The system is set at the factory for the RPM required to meet the CFM and external static pressure specified on the order. If estimated external static pressure is incorrect, or changes were made to the duct system, the blower RPM may have to be adjusted.

Motors are equipped with adjustable pitch pulleys which permit adjustment of blower speed. **To make adjustments to units with less than a 5HP motor, follow these instructions.**

1. Turn off the gas and the electric power.
2. Loosen belt tension and remove the belt.
3. Loosen the set screw on the side of the pulley away from the motor.
4. **To increase the blower speed, decreasing outlet temperature**, turn the adjustable half of the pulley inward. **To decrease the blower speed, increasing the outlet temperature**, turn the adjustable half of the pulley outward. One turn of the pulley will change the speed 8-10%.
5. Tighten the set screw on the flat portion of the pulley shaft.
6. Replace the belt and adjust the belt tension. Adjust tension by turning the adjusting screw on the motor base until the belt can be depressed 3/4". (See **FIGURE 19**.) Re-tighten the lock nut on the adjusting screw. Be sure that the belts are aligned in the pulley grooves properly and are not angled from pulley to pulley.
7. Turn on the gas and electric. Light the heater following the instructions on the lighting instruction plate.
8. Check the motor amps with an amp meter. The maximum motor amp rating on the motor nameplate must not be exceeded.
9. When service is complete, check for proper operation.

For units with 5 HP and larger motor, follow these instructions for adjusting RPM:

1. Turn off the gas and the electric power.
2. Slack off all belt tension by moving motor towards driven shaft until belts are free of grooves. For easiest adjustment, remove the belts from the grooves.
3. On the outer locking ring, locate the two locking screws that are directly across from each other. Loosen these two screws, but do not remove them. Do not loosen any other screws.
4. Adjust sheave to desired pitch diameter by turning the outer locking ring. One complete turn of the outer locking ring will result in .233" change in pitch diameter. To decrease blower speed, increase diameter; to increase blower speed, decrease diameter.

CAUTION: Sheaves should not be adjusted in either direction to the point where movable and stationary flanges are in contact.

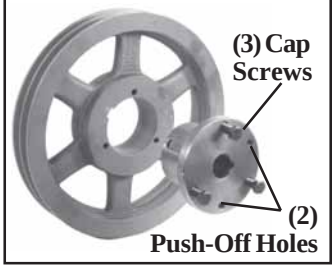
5. After completing adjustment, tighten both locking screws in the outer locking ring (loosened in Step 2.).
6. Replace belts and move motor away from the driven shaft to apply sufficient belt tension to prevent slippage. (See **FIGURE 19**.) Proper belt tension is important to the long life of the belt and motor. A loose belt will cause wear and slippage. Too much tension will cause excessive motor and blower bearing wear. Be sure that the belts are aligned in the pulley grooves and are not angled from pulley to pulley.
7. Check motor amps with an amp meter. The maximum motor amp rating on the nameplate must not be exceeded.
8. When service is complete, check for proper operation.

Blower Pulley

Some blower pulleys require the use of a split taper bushing in the blower pulley. These split taper bushings must be loosened in order to remove the pulley. Follow these instructions to loosen the bushing:

a) Notice that there are three cap screws in the bushing and two holes without screws, called push-off holes. (See **FIGURE 20**.)
b) Remove the three cap screws.
c) Put two of the cap screws into the two push-off holes. Tighten the two screws evenly until the pulley is loosened.
d) Pulley may now be removed from the shaft.

FIGURE 20 - Split Taper Bushing



Blower Bearings

The blower bearings on systems with less than a 10 HP motor (standard blower) are permanently lubricated cartridge ball bearings and do not require greasing.

The blower bearings on systems equipped with a 10-20 HP motor are pillow block ball bearings and are equipped with a grease fitting. (NOTE: Units manufactured prior to 1/91 with a 10 HP motor may have permanently lubricated ball bearings.) These bearings should be lubricated twice a year with a high temperature, moisture-resistant grease. (Type NLGI-1 or -2 standard grease is recommended.) Be sure to clean the grease fitting before adding grease. Add grease with a handgun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by over lubricating. NOTE: If unusual environmental conditions exist (temperatures below 32°F or above 200°F; moisture; or contaminants), more frequent lubrication is required.

CAUTION: If the blower is unused for more than three months, bearings with a grease fitting should be purged with new grease prior to start-up.

Blower Rotation

Each blower housing is marked for proper rotation. Rotation may be changed on single-phase motors by re-wiring in the motor terminal box. Three-phase motors may be reversed by interchanging two wires on the 3-phase supply connections.

Optional Air Flow Proving Switch (Makeup Air only) - Outdoor Models with Option BW1

The optional air flow proving switch ensures that the circulating air blower is functionally providing an adequate amount of air flow prior to the unit being fired. The switch is a single pole/normally open device which closes when an increase in pressure above the setpoint is sensed in the circulating air blower. The switch is located in the blower junction box. (See **FIGURE 21**, Item 40).

Contacts are set to close at .10" w.c. (+.05" or -.02" w.c.).

13. Blowers, Belts and Drives (cont'd)

Optional Variable Frequency Drive

If the system is equipped with an optional variable frequency drive, the motor will operate on speeds as determined by the electrical frequency. 60 hertz is maximum speed. Speeds must be within the temperature rise range shown on the heater rating plate.

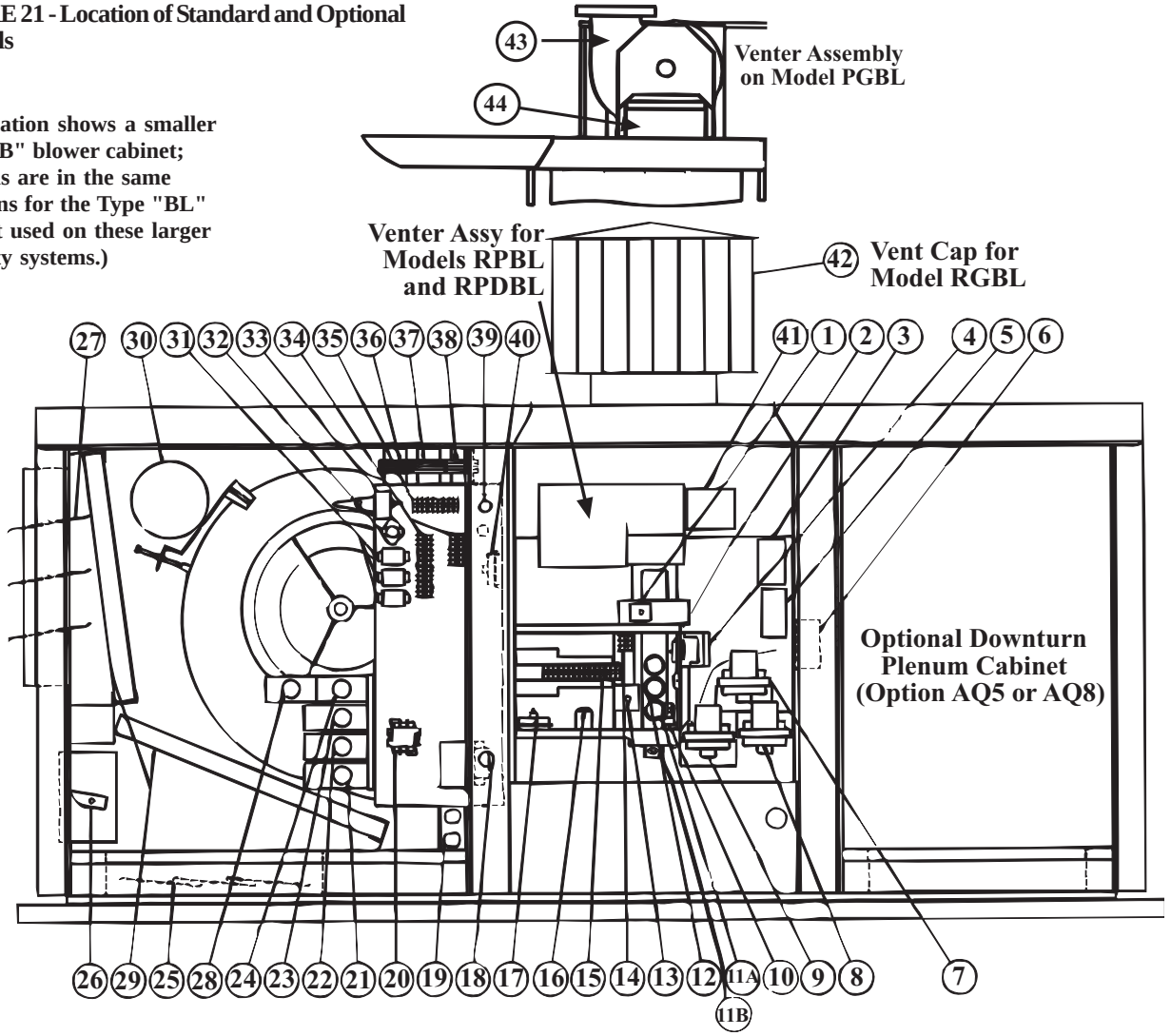
Follow the variable frequency controller manufacturer's instructions that are packaged with the heater (in the owner's envelope) to program the variable frequency drive settings. The formula for motor speed is **N** = 120 x f/p where N is speed; **f** is frequency; and **p** is number of poles (3600 RPM motor has 2 poles; an 1800 RPM motor has 4 poles).

Example: 1800 RPM motor on 60Hz; N = 120 x 60/4 = 1800

1800 is synchronous speed; assume 2% slip. Motor will run between 1750 and 1790 RPM at full load depending on de sign. Run the same motor at 45Hz (120 x 45/4 = 1350). 1350 RPM less 2% slip equals about 1300 RPM.

FIGURE 21 - Location of Standard and Optional Controls

(Illustration shows a smaller Type "B" blower cabinet; controls are in the same locations for the Type "BL" cabinet used on these larger capacity systems.)



Key:

1. **Opt** Auto Reset Freezestat
2. Combustion Air Pressure Switch (outdoor power-vented models; for indoor models, see Item 44)
3. **Opt** Discharge Air Firestat
4. Ignition Controller
5. **Optional** Maxitrol Discharge Air Sensor (Opt AG8 or AG9)
6. **Opt** 2-Stage Controller (Opt AG3) or Maxitrol Amplifier (Opt AG7, 8, or 9)
7. **Opt** Main Low Gas Pressure Switch
8. **Opt** Pilot High Gas Pressure Switch
9. **Opt** Main High Gas Pressure Switch
10. Time Delay Relay (power-vented)
11A. Limit Control (disc type)
11B. Limit Control (capillary type)
12. Fan Control
13. **Opt** Freezestat Time Delay Relay
14. Line Voltage Terminal Block
15. Low Voltage Terminal Block
16. Freezestat Relay
17. **Opt** Dirty Filter Pressure Switch
18. Line Voltage Connection
19. **Opt** Convenience Outlet
20. Blower Motor Contactor or Starter
21. **Opt** High Ambient Limit Control and/or **Opt** AG41 and 42 Heat Stage Controls (2 or 4)
22. **Opt** Outside Air or Return Air Controller
23. **Opt** Mixed Air Controller
24. **Opt** Potentiometer
25. **Opt** Return Air Dampers
26. **Opt** Damper Motor
27. **Opt** Outside Air Damper
28. **Opt** Potentiometer
29. **Opt** Filters
30. Blower Motor
31. **Opt** Control Relays (as required, 8 maximum)
32. Auto Reset Reverse Flow Limit
33. **Opt** Return Air Firestat
34. Low Voltage Terminal Strip
35. Line Voltage Terminal Strip
36. Control Transformer
37. Control Transformer (as required)
38. **Opt** Damper Motor Transformer
39. Low Voltage Connection
40. **Opt** Air Proving Switch
41. Venter Assembly (RPBL)
42. Vent Cap (gravity-vented)
43. Venter Assembly (PGBL)
44. Combustion Air Pressure Switch (indoor power-vented models; for outdoor models, see Item 2)

14. Fan Control

1. A fan control provides for the following control of the blower.
   (a) After the gas valve opens, there is a time delay of blower operation to prevent the discharge of cold air.
   (b) Blower operation continues after the thermostat is satisfied as determined by the fan time delay.
2. To be sure that the blower can continue to operate, the power supply to the furnace **MUST NOT** be interrupted **except** when servicing the unit.
3. If the customer wants the furnace off at night, the gas valve circuit SHOULD BE OPENED by a single pole switch wired in series with the thermostat. Some thermostats are provided with this feature. Multiple units controlled from a single thermostat are shut off in the same manner. For proper operation, be sure the fan control wiring is observed.

For location, see **FIGURE 21**, Item 12. **Service NOTE:** To replace a fan control on units manufactured prior to 11/04, a replacement kit is required. Order P/N 209184.

15. High Temperature Limits

Each furnace is equipped with a non-adjustable high temperature limit switch which shuts off the gas in the event of motor failure, lack of air due to dirty filters, or restrictions at the inlet or outlet of the unit. See Paragraph 27, "Check Installation after Start-up", for checking operation of high temperature limit controls.

Effective with models manufactured beginning 1/97, the furnace farthest downstream in each system is also equipped with a linear-type limit control. The switch is mounted on a bracket on the bottom of the junction box with the capillary sensor extending across the discharge opening of the furnace.

For locations, see **FIGURE 21**, Items 11A and 11B.

16. Reverse Flow, Limit Control

The furnace is factory equipped with an automatic reset reverse flow limit control. This control is located in the blower compartment, mounted in the blower junction box adjacent to the blower inlet opening, and is wired in series with the main limit control mounted on the heat exchanger duct side. For location, See **FIGURE 21**, Item 32.

In case of belt breakage or motor failure, the limit control will be opened by the high temperatures caused by reverse flow from the heat exchanger to the blower compartment, thus breaking the circuit to the electric gas valve and preventing burner operation.

17. Combustion Air Proving Switch - PGBL and RPBL

The combustion air proving switch ensures that proper combustion air flow is available. The switch is a single-pole, double-throw switch, which senses pressure caused by the flow of combustion air from the venter. The switch is designed to close when a decreasing pressure is sensed in the outlet duct of the gas collection box. For locations, see **FIGURE 21**, Items 2 and 44.

On start-up when the furnace is cold, the sensing pressure is at the most negative level, and as the furnace and the flue system warm-up, the sensing pressure becomes less negative. After the system has reached equilibrium (approximately 20 minutes), the sensing pressure levels off. If a restriction or excessive flue length or turns cause the sensing pressure to become less than the switch setpoint, the pressure switch will function to shut off the main burners. The main burners will remain off until the system has cooled and/or the flue system resistance is reduced. The table below gives approximate water column negative pressure readings and switch setpoints for sea level operating conditions.

Start-up Cold	**-1.0" to -1.5" w.c.**
Equilibrium	**-.70" to -.80" w.c.**
Factory Setpoint	**-.58 ± .05" w.c.**

DANGER: Safe operation requires proper venting flow. Never bypass the combustion air proving switch or attempt to operate the unit without the venter running and proper flow in the vent system. Hazardous condition could result. See Hazard Levels, page 2.

18. Optional High Ambient Limit Control - Makeup Air

The optional high ambient limit control functions to shutoff the burner when the entering outside air reaches a set temperature. The temperature setting is field adjustable from 0-100°F. For location, see **FIGURE 21**, Item 21.

19. Operating Valve

All furnaces are equipped with a 24-volt combination valve which includes the automatic electric on/off valve controlled by the room thermostat, the pressure regulator, the safety pilot valve, and the manual shutoff valve. The standard gas valve allows for single-stage control from a single-stage, 24-volt thermostat.

WARNING: The operating valve is the prime safety shutoff. All gas supply lines must be free of dirt or scale before connecting the unit to ensure positive closure. See Hazard Levels, page 2.

20. Optional Two-Stage Operation - Heating Only

The standard combination control valve is replaced with a two-stage combination gas control valve providing for low fire or high fire operation controlled by a two-stage thermostat. First stage (low fire) is factory set (not field adjustable). Both high and low stages are controlled by a servo regulator, maintaining constant gas input under wide variations in gas supply pressure. The two-stage thermostat, thermostat installation instructions, and gas valve manufacturer's control specifications are included with the heater. Follow these instructions and the wiring diagram. Two-stage heating control is identified as Option AG11.

21. Optional Two-Stage Operation - Makeup Air

On systems with more than one furnace section, there are two methods of achieving multiple-stage makeup air operation. In addition, for each of these methods, there are two types of control mechanisms. Consult the wiring diagram on the furnace to identify the optional control system.

The first method, identified by **Options AG3, AG15, or AG16**, is comparable to the two-stage heating units. Instead of control from a two-stage room thermostat, the discharge air temperature is monitored and the two-stage gas valve is controlled by a two-stage ductstat. When the discharge air temperature drops to the setpoint, low fire is energized. If low fire cannot satisfy the ductstat setting, high fire is energized. Since the packaged systems may include two, three, or four furnace sections, and each section is equipped with a two-stage gas valve, the operation stages increase with the number of furnace sections. Set the ductstats as indicated in **TABLE 4A**.

21. Optional Two-Stage Operation - Makeup Air (cont'd)

The second method of multiple-stage makeup air operation is applicable only to systems that include two, three, or four furnace sections. On systems with two furnaces, this optional control system is identified as **Option AG4, AG17, or AG18**. On packaged systems with three furnace sections, this optional control method is identified as **Option AG5, AG19, or AG20**. On packaged systems with four furnace sections, this optional control method is identified as **Option AG5, AG23, or AG24**. Each furnace in the package is equipped with a single-stage gas valve. The single-stage gas valves are staged by two-stage ductstats. The furnaces are staged in sequence. This concept will achieve two-stage control on packaged systems with two furnaces, three-stage control on systems with three furnaces, and four-stage control on systems with four furnaces. Set the ductstats as indicated in **TABLE 4B**.

The two types of ductstat control mechanisms used in these multiple-stage systems are either --

(1) the complete ductstat (including the sensor and temperature selector) is installed in the furnace discharge (Option AG3, AG4, and AG5) or

(2) a sensing probe only is installed in the heater discharge with the sensing probe electrically connected to a remote electronic temperature selector. The remote electronic temperature selection option is available with or without a display module. Options AG15, 17, 19, and 23 do not have a display module; Options AG16, 18, 20 and 24 are identical with the addition of the display module.

Options AG3, AG4, AG5 installed in the heater discharge use a ductstat (See **FIGURE 22**) with an adjustable range from 60° to 110°F with a fixed differential of 2-1/2°. Due to different CFM settings and outside air temperatures, the average downstream outlet temperature may not match the ductstat setting

TABLE 4A - Recommended Settings for Staging Application - Options AG3, AG15, AG16

Option	No. of Furnaces	Ductstat Settings - Set ***each*** ductstat control (See **FIGURE 22**) in furnace "order"				
		1st	2nd	3rd	4th	Sequence of Staging with these settings
AG3	1	70°F	--	--	--	66°F High Stage ➔ 70°F Low Stage ➔ 74°F Shutdown
	2	70°F	64°F	--	--	60°F High Stage Both Furnaces ➔ 64°F Low Stage 2nd Furnace ➔ 68°F Shutdown 2nd furnace ➔ 70°F Low Stage 1st furnace ➔ 74°F Shutdown 1st furnace
	3	70°F	66°F	62°F	--	58°F High Stage All Furnaces ➔ 62°F Low Stage 3rd Furnace ➔ 66°F Shutdown 3rd Furnace; Low Stage 2nd Furnace ➔ 70°F Shutdown 2nd furnace; Low Stage 1st Furnace ➔ 74°F Shutdown 1st Furnace
	4	70°F	66°F	64°F	60°F	58°F High Stage All Furnaces ➔ 60°F Low Stage 4th Furnace➔ 64°F Shutdown 4th Furnace; Low Stage 3rd Furnace ➔ 66°F Shutdown 3rd Furnace; Low Stage 2nd Furnace ➔ 70°F Shutdown 2nd furnace; Low Stage 1st Furnace ➔ 74°F Shutdown 1st Furnace

Options AG15 & AG16 - Adjust the setpoint and the differential of the temperature selector (Johnson #A350). Adjust the offset potentiometer on each of the stage adder modules (Johnson #S350). The settings listed below will provide the same sequence of staging as shown above for Option AG3. Follow the manufacturer's instructions provided. IMPORTANT: Set the temperature selector and each stage adder module to "HEAT". Follow the wiring diagram to obtain proper sequencing. Models RPDBL only - Temperature sensor is shipped separately for field installation.

Option	No. of Furnaces	Temperature Selector (A350)		Stage Adder (S350) Offset Settings (Refer to **FIGURE 23**)						
		Setpoint	Differential							
AG15 & AG16	1	74°F	8°F	4°F	--	--	--	--	--	--
	2	74°F	14°F	10°F	6°F	4°F	--	--	--	--
	3	74°F	16°F	10°F	8°F	8°F	4°F	4°F	--	--
	4	74°F	14°F	10°F	8°F	6°F	4°F	4°F	4°F	4°F

Operation: The differential setting and offset degrees allow the controls to adapt to any adjustment in temperature selection (50-130°F).

TABLE 4B - Recommended Settings for Staging Application - Options AG4, AG5, AG17, AG18, AG19, AG20, AG23, AG24

Option	No. of Furnaces	Ductstat Settings - Set ***each*** Ductstat (See **FIGURE 22**) in furnace "order"			
		1st	2nd	3rd	Sequence of Staging with this setting
AG4	2*	70°F	--	--	66°F Full Rate Both Furnaces ➔ 70°F Shutdown 1st Furnace ➔ 74°F Shutdown 2nd furnace
AG5	3	70°F	64°F	--	60°F Full Rate Both Furnaces ➔ 68°F Shutdown 2nd & 3rd Furnace ➔ 74°F Shutdown 1st furnace

Options AG17, AG18, AG19, AG20, AG23, AG24 - Adjust the setpoint and the differential of the temperature selector (Johnson #A350). Adjust the offset potentiometer on each of the stage adder modules (Johnson #S350). The settings listed below will provide the same sequence of staging as shown above for Option AG4. Follow the manufacturer's instructions provided. IMPORTANT: Set the temperature selector and each stage adder module to "HEAT". Follow the wiring diagram to obtain proper sequencing. Models RPDBL only - Temperature sensor is shipped separately for field installation.

Option	No. of Furnaces	Temperature Selector (A350)		Stage Adder (S350) Offset Settings (Refer to illustrations in **FIGURE 23**)		
		Setpoint	Differential			
AG17 & AG18	2**	74°F	8°F	4°F	--	--
AG19 & AG20	3	74°F	10°F	6°F	6°F	--
AG23 & AG24	4	74°F	14°F	10°F	8°F	6°F

Operation: The differential setting and offset degrees allow the controls to adapt to any adjustment in temperature selection (50-130°F).

*On Model RPDBL 800 a *single* ductstat is shipped separately for field mounting in the discharge duct.

**On Model RPDBL 800 a *single* sensor and mounting bracket is shipped separately for field mounting in the discharge duct.

FIGURE 22 - Ductstat Control in Option AG3, AG4, and AG5. Control is factory set as listed in the tables on page 26.

Adjustable range 0-100°F; markings are on the dial.

exactly. After the installation is complete, re-adjust the setpoint of the ductstat(s) to achieve the desired average discharge air temperature. In general, makeup air applications are usually adjusted to discharge an outlet air temperature between 65°F and 75°F.

Two-stage makeup air options that are controlled from a sensing probe with a remote electronic temperature selector have a temperature operating range to 130°F. The remote modules (**FIGURE 23**) are shipped separately for field installation. Follow the wiring diagram with the unit and the manufacturer's instructions for wiring and installing the remote modules. **CAUTION: Make sure heat/cool selector switch is set on "HEAT".**

Depending on the staging provided, there will be one module for selecting temperature and one to five stage-adder modules. The digital display module is optional.

FIGURE 23 - (A) Remote Temperature Selector (A350), (B) Stage-Adder Module (S350), and (C) Optional Display Module for Ductstat in Two-Stage Makeup Air Control Options (Option AG15, 16, 17, 18, 19, 20, 23 and 24)

See **TABLES 4A and 4B** for recommended settings and staging sequence of all two-stage makeup air options.

22. Optional Mechanical Modulation - Makeup Air Application

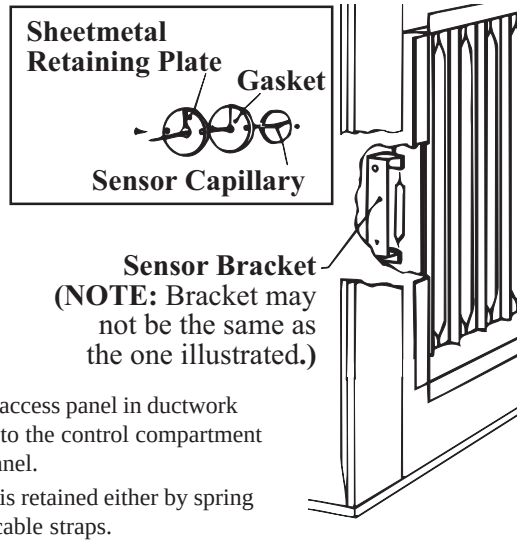
The mechanical modulation valve regulates the flow of gas to the main burner, depending on the demands of the sensing bulb which is located in the airstream adjacent to the heat exchanger. Inputs are varied from 50% through 100% of full rate in direct response to the modulating control sensing element and depending on the temperature of outside air being forced through the furnace. Outlet air or return air temperature can be maintained within a range of 50°F to 100°F (Option AG6) and is adjustable at the mechanical modulating valve.

Refer to the manufacturer's specification and operating sheet in the heater instruction envelope accompanying the furnace.

Mechanical modulating gas control is available with bypass. With the bypass option, the unit is equipped with a single-stage valve and relay. On call from a remote override thermostat, the single-stage bypass gas valve cycles on at 100% fire. Optional mechanical modulation controls with full fire bypass are identified as Option AG13 (50-100°F). (See **FIGURE 24** for a general location of the factory-installed sensor.)

Installation Note: Sizes 400, 600, 700, and 800 with mechanical modulation gas control require a minimum of 7" of gas supply pressure.

FIGURE 24 - Duct Temperature Sensor Location



1. Remove access panel in ductwork adjacent to the control compartment access panel.
2. Element is retained either by spring clips or cable straps.
3. Round gasket and metal retaining plate provide airtight seal for capillary and must be removed to remove the element.

23. Optional Electronic Modulation

The type and capability of the electronic modulation system, depends on the option selected. Electronic modulation options are identified by a suffix to the Serial No. printed on the heater rating plate. AG7 is identified as MV-1; AG8 is identified as MV-3; AG9 is identified as MV-4; AG21 is identified as MV-A; AG39 is identified as MP-1; and AG40 is identified as MP-2. AG39 and AG40 are available only on Model RPBL 400.

Installation Note: "BL" Sizes 400, 700, 800, 1050, and 1200 and "DBL" Sizes 800, 1400 and 1600 with electronic modulation gas control require a minimum of 6" gas supply pressure.

23A. Electronic Modulation between 50% and 100% Firing Rate (Options AG7, AG8, and AG9)

Depending on the heat requirements as established by the thermistor sensor, the burner modulates between 100% and 50% firing. The thermistor is a resistor that is temperature sensitive in that as the surrounding temperature changes, the Ohms resistance changes through the thermistor. This change is monitored by the solid state control center (amplifier) which furnishes varying DC current to the modulating valve to adjust the gas input.

Each modulating valve is basically a regulator with electrical means of raising and lowering the discharge pressure. When no DC current is fed to this device, it functions as a gas pressure regulator, supplying 3.5" w.c. pressure to the main operating valve.

Refer to the wiring diagram supplied with the furnace for proper wiring connections. Electronic modulation for heating controlled by a specially designed room thermostat (60°-85°F) is identified as Option AG7. Electronic modulation control systems for makeup air applications controlled by a duct sensor and temperature selector (55-90°F) are identified as either Option AG8 or Option AG9. The temperature selector setting for Option AG8 is on the amplifier; Option AG9 has a remote temperature selector. Both systems are available with an override thermostat.

23. Optional Electronic Modulation (cont'd)

23B. Computer Controlled Electronic Modulation between 50% and 100% Firing Rate (Option AG21)

With this option the furnace is equipped with a Maxitrol signal conditioner which operates much the same way as the amplifier above to control the regulator valve. The conditioner accepts an input signal of either 4-20 milliamps or 0-10 volts from a customer-supplied control device such as a computer. With the dip switches on the conditioner in the "on" positions, the conditioner accepts a 4-20 milliamp signal. In the "off" positions, the conditioner accepts a 0-10V signal. The conditioner converts the signal to the 0 to 20 volt DC current required to control the modulating valve. Temperature selection is through the computer software.

FIGURE 25 - Maxitrol SC10C-B6S1 signal conditioner in Option AG21, AG40, and AG42

23C. Electronic Modulation between 25% and 100% Firing Rate (U.S. Patent 6,109,255), Options AG39 and AG41 -

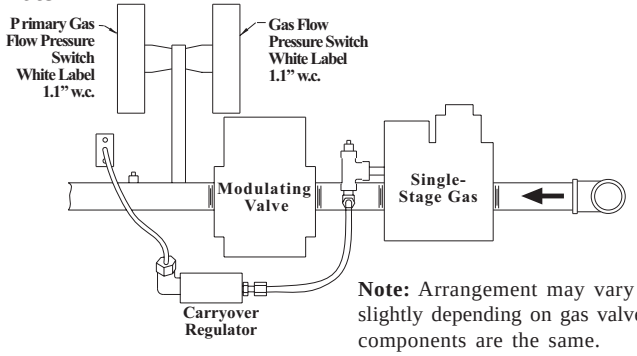
Available only on Model RPBL, natural gas

A Model RPBL 400 equipped with electronic modulation Option AG39 has a 25%-100% firing range (4:1 turndown ratio). Option AG41 applies to Sizes 500, 600, and 800 with two furnaces and Size 1200 with three furnaces. The furnace closest to the blower is equipped with the electronic modulation option. The other furnace has two-stage burner control from outside air temperature sensors identified as heat stage controllers. Option AG41 provides 6:1 turndown with two furnaces and 8:1 turndown with three furnaces.

The furnace with this type of electronic modulation will ignite at any input rate in the available range and will maintain average thermal efficiencies equal to or greater than the thermal efficiency at full fire. The following table applies to the furnace with the manifold illustrated in **FIGURE 26**.

Model RPBL	Maximum Turndown %	MBH Input Range	Inlet Pressure to Modulating Valve (factory set)	Gas Supply Pressure Required
400	25	100-400	4.4" w.c.	6" w.c.
500	28	69-250	4.0" w.c.	5" w.c.
600	23	69-300	4.0" w.c.	5" w.c.
800	25	100-400	4.4" w.c.	6" w.c.
1200	25	100-400	4.4" w.c.	6" w.c.

FIGURE 26 - Manifold Arrangement on Furnace with Optional Electronic Modulation between 25-100% Firing Rate



Note: Arrangement may vary slightly depending on gas valve; components are the same.

The gas train (**FIGURE 26**) in the furnace section with this type of electronic modulation control includes a single-stage gas valve, a modulating valve, and two gas pressure switches. The burner rack is equipped with one flash carryover and a regulated gas lighter tube system. The carryover lighter tube receives its gas supply through the regulator, simultaneously with the gas to the burner. Control of the system is through a Maxitrol amplifier with a corresponding remote temperature dial. All furnaces in systems with gas control Option AG39, 40, 41, or 42 have stainless steel burner racks and heat exchangers.

Description of Operation - furnace with AG39, 40, 41 or 42 with manifold in FIGURE 26

The gas supply (6" w.c. required) connects to the single-stage gas valve. To compensate for additional pressure loss through the modulating valve, the single-stage gas valve has a custom outlet pressure setting higher than when it is used on a standard gas manifold. The pilot tubing connects to the pilot port on the single-stage gas valve. When the valve receives a call for heat from the amplifier and pilot is established, gas flow from the single-stage valve goes to both the modulating valve and the regulated lighter tube system. **When the signal from the amplifier to the modulating valve requires less-than-high fire operation,** the modulating valve functions to lessen the gas flow to the burner to reduce the input rate to that required to maintain the desired temperature. When the input rate is reduced enough to decrease the gas pressure to 1.1" w.c., the primary gas pressure switch in the manifold activates the gear motor that controls the bypass damper in the venter/combustion air system. The bypass damper opens diverting some of the incoming air directly into the flue duct, reducing airflow through the burner. Safety switches monitor the position of the bypass damper. When the gas pressure increases above 1.1" w.c., the bypass damper closes.

Combustion Air Pressure Switch Setting

This uniquely designed modulation system requires combustion air pressure settings different from the standard system. The approximate settings for the combustion air proving switch at sea-level operation are:

w/AG 39, 40, 41, 42	Startup Cold	Equilibrium at Full Rate	Factory Setting
400	-1.2"w.c.±0.2	-0.95"w.c.±0.1	-.75"w.c.±0.5
500	-1.2"w.c.±0.2	-0.95"w.c.±0.1	-.75"w.c.±0.5
600	-1.2"w.c.±0.2	-0.95"w.c.±0.1	-.75"w.c.±0.5
800	-1.2"w.c.±0.2	-0.95"w.c.±0.1	-.75"w.c.±0.5
1200	-1.2"w.c.±0.2	-0.95"w.c.±0.1	-.75"w.c.±0.5

Sensor Location - Options AG39 and AG41

For the convenience of the installer, the duct temperature sensor is factory installed in the cabinet leg (See **FIGURE 24**). Although the sensor has a mixing tube, at this distance from the discharge it does not receive a true mix, so the temperature read by the sensor will be slightly higher than the actual air entering the ductwork. The system will provide comfort level heat if the selector is set slightly lower to compensate for this reading. The offset temperature will vary with the application. If a direct correlation of these two temperatures is required, move the duct sensor to a location in the ductwork about 10-12 feet (3 - 3.7M) from the furnace discharge.

Set Heat Stage Controllers - applies to Options AG41 and AG42 only

Systems with Option AG41 and AG42 have “heat stage controllers” that control operation of the "two-stage" furnace based on outside air temperature setpoints. Proper setpoints are important to ensure the modulating furnace ("Heat Stage 1") is always in control and avoids cycling**.** The proper setpoint for each controller must be determined from basic design information. Sizes 500, 600, and 800 with two furnace sections have two heat stage controllers; Size 1200 with three furnace sections has four heat stage controllers.

Follow the steps and example to determine appropriate setpoints. Follow the instructions to locate and set the controllers.

Calculate the Setpoints with Two Furnace Sections - Use the following formulas to calculate the controller settings for Heat Stage 2 and Heat Stage 3 in a system with two furnace sections.

$\mathbf{T_{SP}}$ = Setpoints of Heat Stage Controllers (T_{SP2} and T_{SP3})

$\mathbf{T_{SA}}$ = Desired Supply Air Temperature

$\mathbf{T_D}$ = Design (minimum) Entering Air Temperature

Formulas for two furnace sections:

Setpoint for Heat **Stage 2**: $\mathbf{T_{SP2} = T_{SA} - 0.46 (T_{SA} - T_D)}$

Setpoint for Heat **Stage 3**: $\mathbf{T_{SP3} = T_{SA} - 0.73 (T_{SA} - T_D)}$

EXAMPLE : 3600 CFM, Power vented, 100% Outside Air, -10°F Outdoor Winter Design, 75°F Desired Supply Air

$\mathbf{T_{SP2}}$ = 75 - [.46 x (75 - (-10))] = 75 - (.46 x 85) = 35.9

$\mathbf{T_{SP3}}$ = 75 - [.73 x (75 - (-10))] = 75 - (.73 x 85) = 12.9

Set Stage Heat #2 Controller to 36°F

Set Stage Heat #3 Controller to 13°F

Calculate the Setpoints with Three Furnace Sections - Use the following formulas to calculate the controller settings for Heat Stage 2, Heat Stage 3, Heat Stage 4, and Heat Stage 5 in a system with three furnace sections.

$\mathbf{T_{SP}}$ = Setpoints of Heat Stage Controllers (T_{SP2} , T_{SP3}, T_{SP4} , T_{SP5})

$\mathbf{T_{SA}}$ = Desired Supply Air Temperature

$\mathbf{T_D}$ = Design (minimum) Entering Air Temperature

Formulas for three furnace sections:

Setpoint for **Heat Stage 2**: $\mathbf{T_{SP2} = T_{SA} - 0.30 (T_{SA} - T_D)}$

Setpoint for **Heat Stage 3**: $\mathbf{T_{SP3} = T_{SA} - 0.49 (T_{SA} - T_D)}$

Setpoint for **Heat Stage 4**: $\mathbf{T_{SP4} = T_{SA} - 0.65 (T_{SA} - T_D)}$

Setpoint for **Heat Stage 5**: $\mathbf{T_{SP5} = T_{SA} - 0.82 (T_{SA} - T_D)}$

EXAMPLE : 8850 CFM, Power vented, 100% Outside Air, -10°F Outdoor Winter Design, 75°F Desired Supply Air

$\mathbf{T_{SP2}}$ = 75 - [.30 x (75 - (-10))] = 75 - (.30 x 85) = 49.5

$\mathbf{T_{SP3}}$ = 75 - [.49 x (75 - (-10))] = 75 - (.49 x 85) = 33.3

$\mathbf{T_{SP4}}$ = 75 - [.65 x (75 - (-10))] = 75 - (.65 x 85) = 19.8

$\mathbf{T_{SP5}}$ = 75 - [.82 x (75 - (-10))] = 75 - (.82 x 85) = 5.3

Set Stage Heat #2 Controller to 49°F

Set Stage Heat #3 Controller to 33°F

Set Stage Heat #4 Controller to 20°F

Set Stage Heat #5 Controller to 5°F

Locate and Set the Heat Stage Controllers

1. In the inlet air section, locate the heat stage controllers. The same type of controller may also used as the optional high ambient limit control (Option BN2) and as the mixed air controller that is part of certain air control options (Options AR12, AR13, AR15, and AR16). Identify the controllers marked Heat #2 and Heat #3 or Heat #2, Heat #3, Heat #4, and Heat #5.

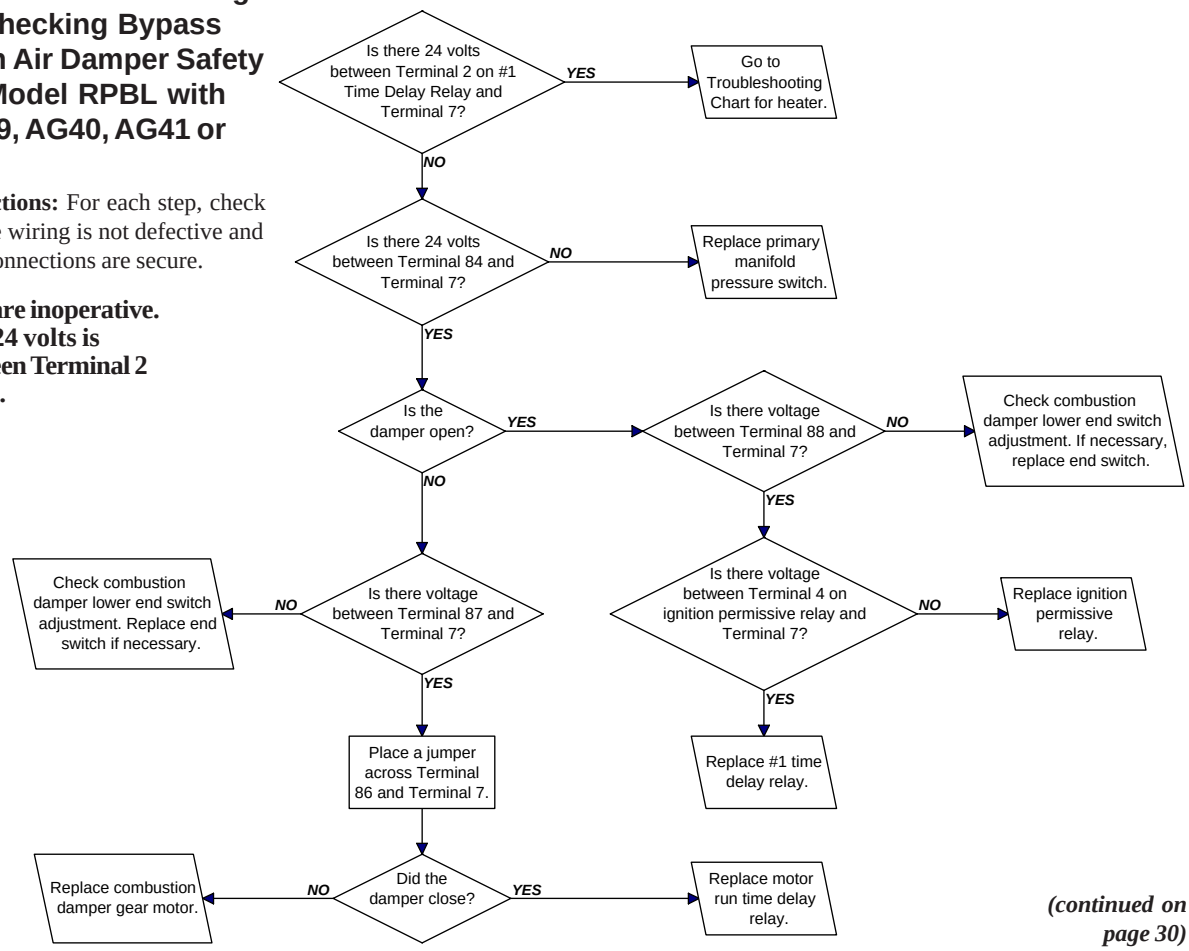
2 Furnaces - Identify controllers marked Heat #2 and Heat #3; set as calculated above.
3 Furnaces - Identify controllers marked Heat #2, Heat #3, Heat #4, and Heat #5; set as calculated above.

2. Adjust each controller to the setpoint as determined in the calculation.

FIGURE 27 - Troubleshooting Guide for Checking Bypass Combustion Air Damper Safety Circuit on Model RPBL with Option AG39, AG40, AG41 or AG42

General Instructions: For each step, check to ensure that the wiring is not defective and that the wiring connections are secure.

Main burners are inoperative. Assumes that 24 volts is available between Terminal 2 and Terminal 7.



(continued on page 30)

23. Optional Electronic Modulation (cont'd)

23C. Electronic Modulation between 25-100% (U.S. Patent 6,109,255) (cont'd)

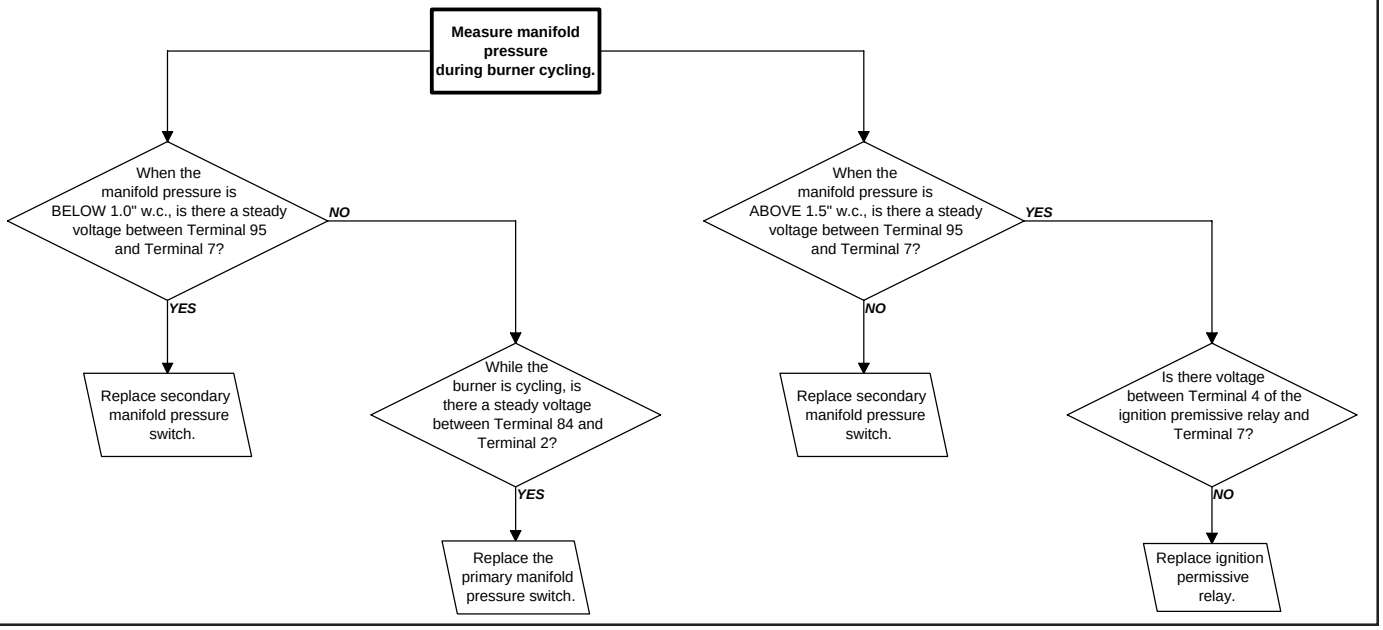
FIGURE 27 - Troubleshooting Guide for Checking Bypass Combustion Air Damper Safety Circuit on Model RPBL with Option AG39, AG40, AG41 or AG42 (cont'd)

General Instructions: For each step, check to ensure that the wiring is not defective and that the wiring connections are secure.

Symptom - Part 2:

Steady call for heat - burner cycles.

Assumes that 24 volts is available between Terminals 11 and 7 and Terminals 2 and 7.



Wiring and Service

For wiring, consult the wiring diagram attached to the furnace. All wires in the electrical box connecting the modulation controls must be 150°C. This is a unique system which includes custom-built components and custom settings. If service is required, follow the general troubleshooting guide and the special troubleshooting guides in **FIGURE 27**.

23D. Computer Controlled Electronic Modulation between 25% and 100% Firing Rate (U.S. Patent 6,109,255), Option AG40 and AG42

The furnace functions and is equipped in the same way as described in Paragraph 23C (Options AG39 and AG41) except that the temperature settings are selected through field-supplied computer software and there is no temperature selector or duct sensor.

The furnace is equipped with a Maxitrol signal conditioner (see **FIGURE 25**) which accepts an input signal of either 4-20 milliamps or 0-10 volts from a customer-supplied control device such as a computer. With the dip switches on the conditioner in the "on" positions, the conditioner accepts a 4-20 milliamp signal. In the "off" positions, the conditioner accepts a 0-10V signal. The conditioner converts the signal to the 0 to 20 volt DC current required to control the modulating valve.

24. Pilot and Ignition Systems

The horizontal pilot is located in the control end of the burner rack and is accessible after the control compartment panel has been removed. All pilots are target type with lint-free features. Pilot gas pressure should be the same as supply line pressure. (See Paragraph 10.) If required, adjust the pilot flame length to approximately 1-1/4" with pilot adjustment screw in control valve body. See the valve manufacturer's instructions.

All models have a standard spark ignition pilot system; lockout is optional. Refer to the wiring diagram supplied with the furnace for pilot system identification -- spark pilot without lockout is Option AH2; and spark pilot with lockout is Option AH3.

Intermittent Spark Ignition Safety Pilot Systems - There are two types of intermittent spark pilots. The standard type (identified as Option AH2) shuts off the pilot gas flow between cycles. The other type (identified as Option AH3) not only shuts off the pilot gas flow between cycles but also has a lockout device that stops the gas flow to the pilot if the pilot fails to light in 120 seconds. This lockout feature requires manual reset by interruption of the thermostat circuit.

Propane units require the spark ignition system with the lockout device.

Refer to the wiring diagram supplied with the heater for pilot system identification and proper wiring.

Ignition Controller - As part of the intermittent safety pilot system, the ignition controller provides the high voltage spark to ignite the pilot gas and also acts as the flame safety device. After ignition of the pilot gas, the ignition controller electronically senses the pilot flame. A low voltage DC electrical signal is imposed on the separate metal probe in the pilot assembly. The metal probe is electrically insulated from ground. The pilot flame acts as a conduction path to ground completing the DC circuit and proving pilot flame. **Proper operation of the electronic spark ignition system requires a minimum flame signal of .2 microamps DC as measured by a microampmeter.** With pilot flame proven, the ignition controller energizes the main gas valve.

CAUTION: Due to high voltage on pilot spark wire and pilot electrode, do not touch when energized. See Hazard Levels, page 2.

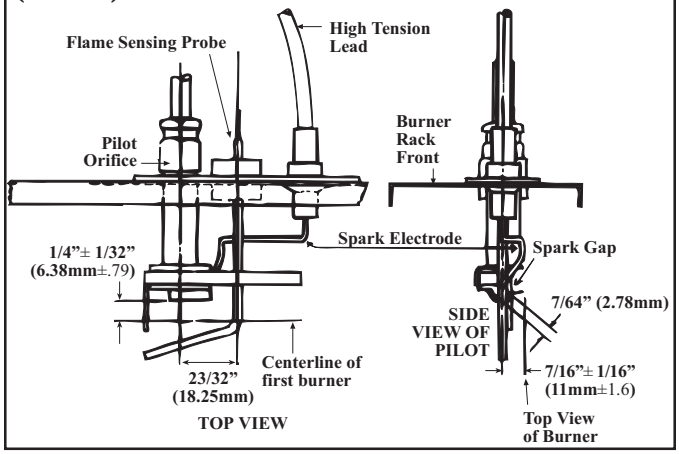
If no spark occurs, check the following:

a) Voltage between blue and white terminals (non-lockout type pilot) and Terminals 2 and 5 (lockout type pilot) on the ignition controller should be at least 20 volts and no higher than 32 volts. Refer to Troubleshooting (Paragraph 38) if no voltage is observed.

b) Short to ground in the high tension lead and/or ceramic insulator.

c) Pilot spark gap should be approximately 7/64" (2.78mm). (See **FIGURE 28**.)

FIGURE 28 - Spark Pilot; maintain spark gap of 7/64" (2.78mm)



NOTE: When checking for spark with the pilot burner assembly removed from the burner rack, the pilot assembly must be grounded to the heater for proper spark.

If the above conditions are normal and no spark occurs, replace the ignition controller.

If the main gas valve fails to open with a normal full size pilot flame established, check for the following:

a) Voltage between black and brown leads on the main gas valve is 20 to 32 VAC and there is no main gas flow with the built-in manual valve in FULL OPEN position -- the main valve is defective.

b) No voltage between black and brown leads on the main gas valve -- check for disconnected or shorted flame sensor lead or flame sensor probe.

When the above conditions are normal and the main gas flow is still off, the ignition controller is probably defective. Do not attempt to service the ignition controller; it does not contain any replaceable components.

25. Burners and Carryover System

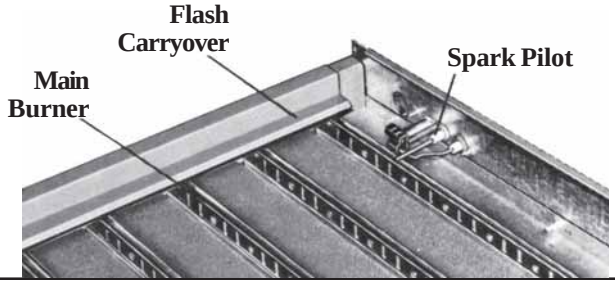
These duct furnaces have individually formed steel burners with accurately die-formed ports to give controlled flame stability without lifting or flashback with either natural or propane gas. The burners are lightweight and factory mounted in an assembly which permits them to be removed as a unit for inspection or service.

Natural gas burners (except when equipped with electronic modulation Option AG39, AG40, AG41 or AG42; see Paragraph 23C) are equipped with a gas lighter tube carryover on the orifice end of the burner rack and a flash carryover on the other end.

Propane gas burners are equipped with one flash carryover and a regulated gas lighter tube system.

During regular service, check the main burner ports, the carryover assemblies, and the orifices for cleanliness.

FIGURE 29 - Burner Rack



26. Burner Air Adjustment

Burner air shutters are required on propane gas units. Air shutters are not normally required on natural gas furnaces, but are available as Option AE2. Burner air shutters may require adjustment; follow the instructions below.

Before making any adjustments to the air shutters, allow the furnace to operate for about fifteen minutes with the air shutters open. The slotted screw on the end of the manifold bracket moves the air shutters and adjusts all burners simultaneously. Turning the screw clockwise opens the shutters; counterclockwise closes the shutters. After the furnace has been in operation for 15 minutes, close the air shutters observing the flame for yellow-tipping. Open the shutters until the yellow disappears. A limited amount of yellow-tipping is permissible for propane gas. Natural gas should not display any yellow-tipping.

When making the adjustment, close the air shutters no more than is necessary to eliminate the problem condition.

DANGER: Failure to install and/or adjust air shutters according to directions could cause property damage, personal injury, and or death.

27. Check Installation and Start-Up

Check the installation prior to start-up:

- ☐ Be certain the electrical supply matches voltage rating of the furnace. (Refer to the rating plate.)
- ☐ Check all field wiring against the wiring diagram. Be sure that wire gauges are as required for the electrical load.
- ☐ Be certain that the electrical entrances are sealed against the weather.
- ☐ Check that fuses or circuit breakers are in place and sized correctly.
- ☐ Check clearances from combustibles. Requirements are shown in Paragraph 6.
- ☐ Check piping for leaks and proper gas line pressure. Bleed gas lines of trapped air. See Paragraph 10.
  - a) Turn manual shutoff valve to OFF position.
  - b) Turn gas supply ON.
  - c) Observe gas meter for movement, or
  - d) Attach pressure gauge readable to .1" w.c. and after turning gas on for 10 seconds, turn gas supply off. No change in pressure should occur over a 3-minute period.
  - e) If either c) or d) above indicate a leak, locate leak by brushing a soapy solution on all fittings. Bubbles will appear at a leak. Repair and repeat tests.
- ☐ Check to make sure that combustion air and flue discharge openings are free from obstructions.
- ☐ Be certain all optional manual reset controls (firestat and high gas pressure switch) are reset
- ☐ PGBL/CRGBL - Be sure that the vent system or vent cap is installed properly. CRGBL - If ordered with Option ZZ, stack extension must be installed; see Paragraph 8B.
- ☐ Check blower pulley and motor pulley to be sure they are secure to the shafts. Check belt tension and alignment. See Paragraph 12.
- ☐ If the furnace is equipped with outside air and return air dampers, adjust the damper linkage. See Paragraph 33, **FIGURE 41B**.

7. Check Installation and Start-Up (cont'd)

Checks prior to start-up (cont'd):

☐ Option AG 41 or 42 - set the heat stage controllers. See Paragraph 23C.

Start-Up

☐ Turn electric and gas supply on to the furnace. Adjust the thermostat or ductstat so that a call for heat exists. Observe for complete sequencing of safety pilot and ignition.

Operating Sequence for Gravity-Vented Models

1. Set the thermostat switch at its lowest setting.
2. Turn on power, main and pilot manual gas valves.
3. Set thermostat at desired setting.
4. On call for heat by the thermostat, the pilot gas valve and spark gap are energized to produce a pilot flame on each operating cycle. The sensing probe proves the presence of the pilot flame and energizes the safety switch portion of the control. The switch action de-energizes the spark gap and energizes the main valve. The main gas ignites and the unit fires at full rate. NOTE: If the flame is extinguished during main burner operation, the safety switch closes the main valve and recycles the spark gap. On unit equipped with a G770NGC-4 controller which includes lockout control, if the pilot is not established within 120 seconds (approximately), the unit locks out and must be reset by interrupting the power to the control circuit (see the lighting instruction plate on the furnace).
5. Blower motor operates from fan time delay.
6. Set the thermostat switch at lowest setting for shutdown. Blower motor remains on as determined by the fan time delay.

Operating Sequence for Power-Vented Models (indoor and outdoor)

1. Set the thermostat switch at its lowest setting.
2. Turn on power, main and manual gas valves.
3. Set thermostat switch at desired setting.
4. Thermostat calls for heat
   (a) The venter motor is energized after 15-second (approximate) time delay.
   (b) Venter flow switches from normally closed to normally open contacts, energizing the pilot gas valve and spark to produce a pilot flame on each operating cycle. The sensing probe proves the presence of the pilot flame and energizes the safety switch portion of the control. The switch action de-energizes the pilot spark and energizes the main valve. The main gas ignites and the unit fires at full rate.
5. Blower motor operates from fan time delay.
6. If the flame is extinguished during main burner operation, the safety switch closes the main valve and recycles the spark. On unit equipped with a G770NGC-4 controller which includes lockout control, if the pilot is not established within 120 seconds (approximately), the unit locks out and must be reset by interrupting the power to the control circuit (see the lighting instruction plate on the furnace).
7. Thermostat is satisfied.
   (a) Solenoid gas valve de-energized
   (b) Pilot gas valve de-energized.
   Ignition controller de-energized
   (d) Time delay relay keeps venter motor on for approximately 1-1/2 minutes (post purge).
8. To shut down, set the thermostat to lowest setting. Blower motor remains on as determined by fan time delay.

Check installation after start-up:

☐ With the unit in operation, measure manifold gas pressure. Manifold pressure for natural gas should be 3.5" w.c. and 10" w.c. for propane gas. See Paragraph 10.

☐ Turn the unit off and on, pausing two minutes between each cycle. Observe for smooth ignition. On two-stage or modulating burner systems, manipulate temperature adjustment slowly up and down to see if control is sequencing or modulating properly. Raising temperature setting drives burner on or to full fire.

☐ Observe burner flame at full fire. Natural gas flame should be about 1-1/2" in height with blue coloring. Propane gas flame should be approximately the same length with blue coloring. Yellow tipping may appear on propane gas. If yellow extends beyond 1/2 to 3/4", adjust air shutters. See Paragraph 26.

☐ Close all panels tightly. With the heater on, check limit control by completely blocking off distribution air. The limit control should open within a few minutes, shutting off the gas supply to the main burners.

☐ If equipped with a dirty filter switch, set the switch so that the indicator light will activate at approximately 50% filter blockage. Follow the instructions in Paragraph 32.

☐ Place "Owner's Envelope" containing Limited Warranty Card, this booklet, and any optional information in an accessible location near the heater. Follow the instructions on the envelope.

DANGER: The gas burners in this gas-fired equipment are designed and equipped to provide safe and economically controlled complete combustion. However, if the installation does not permit the burner to receive the proper supply of combustion air, complete combustion may not occur. The result is incomplete combustion which produces carbon monoxide, a poisonous gas that can cause death. Safe operation of indirect-fired gas burning equipment requires a properly operating vent system which vents all flue products to the outside atmosphere. FAILURE TO PROVIDE PROPER VENTING WILL RESULT IN A HEALTH HAZARD WHICH COULD CAUSE SERIOUS PERSONAL INJURY OR DEATH.

Always comply with the combustion air requirements in the installation codes and instructions. Combustion air at the burner should be regulated only by manufacturer-provided equipment. NEVER RESTRICT OR OTHERWISE ALTER THE SUPPLY OF COMBUSTION AIR TO ANY HEATER. Indoor units installed in a confined space must be supplied with air for combustion as required by Code and in Paragraph 5A of this heater installation manual. MAINTAIN THE VENT SYSTEM IN STRUCTURALLY SOUND AND PROPERLY OPERATING CONDITION.

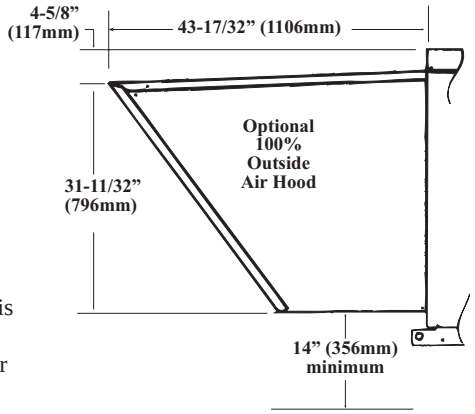
OPTIONAL EQUIPMENT
28. 100% Outside Air Hood (outdoor models)

Outside air hood (Option AS2) is a weatherized, screened hood designed to be field assembled and installed around the horizontal inlet air opening of the blower cabinet. The air hood includes a louver assembly (U.S. Patent 4,999,037) designed to help eliminate moisture from the inlet air. Complete installation instructions are packaged with the air hood option. **NOTE:** Model RPDBL requires two outside air hoods.

CAUTION: It is recommended that the inlet to the outside air hood NOT be facing into the prevailing wind. Allow 14" minimum clearance from the bottom of the air hood to the mounting surface.

NOTE: Either a manufacturer designed optional air inlet hood as shown in **FIGURE 30** or an evaporative cooling module as shown in Paragraph 30 is required to ensure complete weather resistance.

FIGURE 30 - Dimensions of Optional Outside Air Hood



The width of the outside air hood is the same as the width of a blower cabinet.

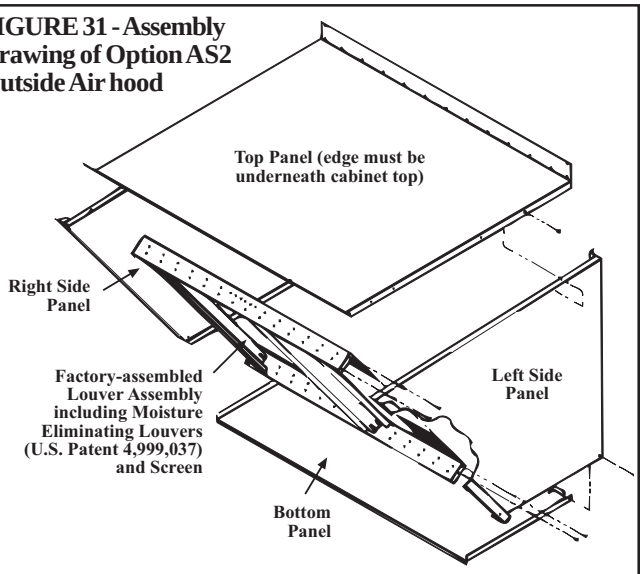
Installation Instructions - 100% Outside Air Hood

Refer to **FIGURE 31**. All screw ends except those across the bottom should be inside the air hood.

To avoid possible damage, it is recommended that the outside air hood be installed after the system has been placed on the roof. The air hood should be installed before the heater is operated. Do not install the hood while the system (furnace or blower) is in operation.

1. **Top Panel** -- On the air inlet side of the blower cabinet, remove the factory-installed screws attaching the blower cabinet top. Slide the air hood top panel underneath the edge of the blower cabinet top. **The edge of the air hood top panel must be between the blower cabinet top and the end panel.** Reinsert all of the sheetmetal screws.
2. **Side Panels** -- Slide the air hood right side panel into the groove in the blower cabinet end panel. Be sure that the side panel is underneath and to the inside of the air hood top panel. Attach to the blower cabinet and the air hood top using the required number of sheetmetal screws. Repeat with the left side panel.
3. **Bottom Panel** -- Position the air hood bottom panel so that it is to the **inside** of the two side panels and **above** the factory-installed support angle. Attach to the side panels.
   If the bottom panel does not rest tightly against the support angle, follow these instructions to adjust the position of the support angle:
   a) Slightly loosen (do not remove the screws).
   b) Slide the support angle up so that it is against the bottom panel.
   c) Tighten the screws.
   Attach the support angle to the air hood bottom panel. The bottom panel of the air hood and the support angle should be tight together; do not draw with the sheetmetal screws.
4. **Louver Assembly** -- With the intake screen toward the inside of the hood, position the pre-assembled vertical louver assembly in the inlet opening of the air hood. Using the remaining sheetmetal screws, attach the louver assembly to the air hood side panels using the holes provided.

FIGURE 31 - Assembly Drawing of Option AS2 Outside Air hood



RPBL / (C)RGBL	RPDBL (requires 2)	Top Panel	Bottom Panel	Louver Assy
400, 800, 1200	800, 1600	100232	100239	103778
500, 600	1000, 1200	100230	100237	103776
700, 1050	1400	100231	100238	103777

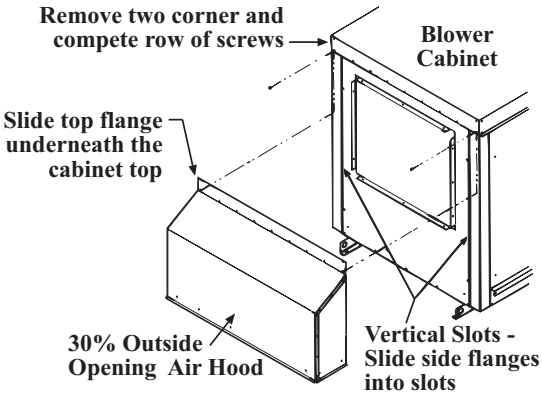
29. Screened Air Hood for 30% Outside Air Opening, Part of Inlet Air Options AR6 & AR7

The outside air hood included in the air inlet options that have a 30% outside air opening (Option AR6 or AR7) is shipped separately for field installation. Instructions are packaged with the air hood.

Installation Instructions - 30% Outside Air Hood

1. On the inlet air side of the blower cabinet, remove the factory installed screws attaching the blower cabinet top.
2. Slide the air hood top flange underneath the lip of the blower cabinet top and the sides into the vertical slots. **The air hood flange must be between the blower cabinet top and the cabinet end panel.**
3. Reinsert all of the sheetmetal screws.

FIGURE 32 - Installation of Air Hood on Cabinets with 30% Outside Air Opening Options



30. Optional Evaporative Cooling Module - Applies to Models PGBL, CRGBL, and RPBL

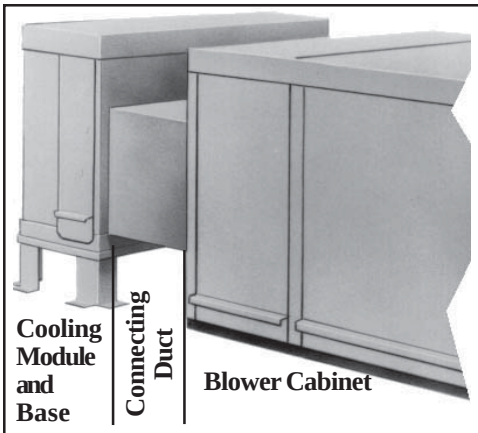


FIGURE 33 - Optional Evaporative Cooling Module is factory-assembled for field attachment to the blower cabinet (duct and base are shipped knocked down for field assembly)

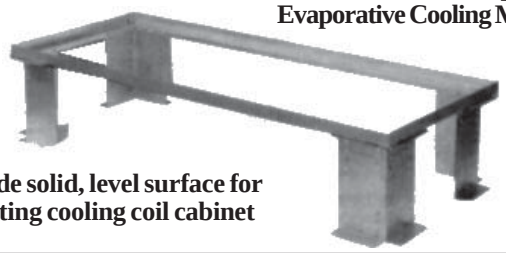
Evaporative cooling provides excellent comfort cooling at low initial equipment and installation costs and low operating and maintenance costs. Direct evaporative cooling works solely on the principle that water in direct contact with a moving airstream will eventually evaporate if the droplets have long enough exposure. This evaporative cooling module uses wetted rigid cellulose or glass fiber media to retain water in order to allow time for evaporation.

The evaporative cooling module for these systems is factory assembled but is not attached to the blower cabinet at the factory. It is shipped separately for field attachment to the system blower cabinet. The base support for the cooling module and the transitional ductwork between the cooling module and the blower cabinet inlet are shipped separately and must be field assembled and installed. **Complete installation/ operation instructions including water and electrical connections, optional controls, and troubleshooting are included with the evaporative cooling module package.**

Included in the cooling module booklet is a preparation checklist. All items in that checklist should be consulted prior to beginning installation of the optional evaporative cooling module. Four of those items are listed below.

- ☐ Make certain the supporting platform is capable of handling the additional load of a full cooling module reservoir.
  Weights of Evaporative Cooling Module - With Wet Media and Full Reservoir (lbs.)
  Module with 6" rigid cellulose media (Opt AS3) ..... 349 lbs
  Module with 12" rigid cellulose media (Opt AS4) ... 431 lbs
  Module with 6" rigid glass fiber media (Opt AS5) .... 420 lbs
  Module with 12" rigid glass fiber media (Opt AS8) .. 514 lbs
- ☐ Make certain the surface is level and free of debris where cooling module will be mounted.
- ☐ Provide a weather-resistant, solid wood or metal base under cooling module support legs.

FIGURE 34 - Field-Assembled Base for Optional Evaporative Cooling Module



Provide solid, level surface for mounting cooling coil cabinet base.

- ☐ Make certain that there will be adequate clearance between the bottom of the reservoir and the mounting surface to allow for drain and overflow pipe connections.

The optional evaporative cooling module is equipped with high efficiency pad media of either 6" or 12" rigid cellulose **(Option AS3 or AS4**) or 6" or 12" rigid glass fiber **(Option AS5 or AS6)**. Six-inch media provides 68% efficiency; 12" media provides 90% efficiency. Efficiency values are stated at maximum allowable CFM without the addition of a moisture elimination pad with an inlet dry bulb temperature of 95°F and inlet wet bulb temperature of 65°F. The evaporative cooling efficiency is a function of inlet temperature and of face velocity through the media. The stated cooling efficiency will rise with the decrease of CFM and the increase of inlet temperature. Moisture elimination pads (Option ASA1) may be used on all units but are required on units with over 11,200 CFM (950 FPM). Instructions for field installation of the optional moisture elimination pad are included with the cooling module.

WARNING: Water reservoir (outdoor system) must be drained and pump motor turned off when outside temperature falls below 32°F. Pump must never be operated without water in the reservoir. See Hazard Levels, page 2.

WARNING: Disconnect all power to the unit before doing any maintenance. Failure to do so can cause electrical shock, personal injury or death.

Evaporative Cooling Module Maintenance

Media -- Over time, excessive amounts of mineral deposits will begin to build up on the media. Annually, scale and dirt should be washed off the entering surface of the media. Remove the pad retainers and screen (See Steps 1-3 and 6-8 of Media Replacement Instructions). Clean the media using a garden hose, mild soap, and a **soft** bristled brush. When the media becomes too clogged with mineral deposits and dirt that it cannot be cleaned, the pads should be replaced. The average pad life expectancy is approximately three cooling seasons.

Select the correct replacement part numbers and order replacement media pads from your distributor. Follow the instructions below and remove and replace pads as shown in **FIGURES 35A and 35B**.

Instructions for Replacing Evaporative Cooling Media (FIGURES 35A and 35B)

1. Remove the three sheetmetal screws that hold the top pad retainer in place. Release the top pad retainer from the cooling module.
2. Remove the three sheetmetal screws that hold the bottom pad retainer in place. Release bottom pad retainer from the cooling module.
3. Disengage the screen retainers from the sides of the media.
4. Disengage inlet screen from media pads and remove.
5. Slide all media pads horizontally away from the cooling module until clear of bottom reservoir pan. Dispose of properly.
6. Replace media by sliding media pads over both support rails until back stop is encountered. Media ***must*** be placed as shown in **FIGURE 35B**.
7. Center screen on the incoming air side of the media.
8. Replace the two side screen retainers by fitting them between the side of the media pad and the side of the cooling module. The retainers should fit snugly, pinching the screen against the media pads.
9. Replace the bottom pad retainer by securing the retainer between the pad and the reservoir pan. Fasten with the three sheetmetal screws removed in Step 2.
10. Replace the top pad retainer by securing the retainer between the pad and top of the cooling module. Fasten with the three sheetmetal screws removed in Step 1.

Water Feed Line and Distribution Piping – Annually, the water supply line and the water distribution line (either PVC pipe or water sock) should be flushed of debris and contaminants.

1. Remove the media pads following the instructions above.
2. Remove the water feed line from the downstream side of the ball valve and unscrew the water bleed line barbed hose fitting.
3. Force a fresh water supply up through the water inlet hose and thoroughly flush the distribution line.
4. Re-assemble, being careful to install media with air flow direction as shown in **FIGURE 35B**.

FIGURE 35A - Removal and Replacement of Evaporative Cooling Module Media

Media Pad Sizes (inches)	Qty	Replacement Part No. (each)			
		Rigid Cellulose		Rigid Glass Fiber	
		6"	12"	6"	12"
48 x 12	4	107190	107194	107199	107201
48 x 8-5/8	1	107191	107195	107200	107202

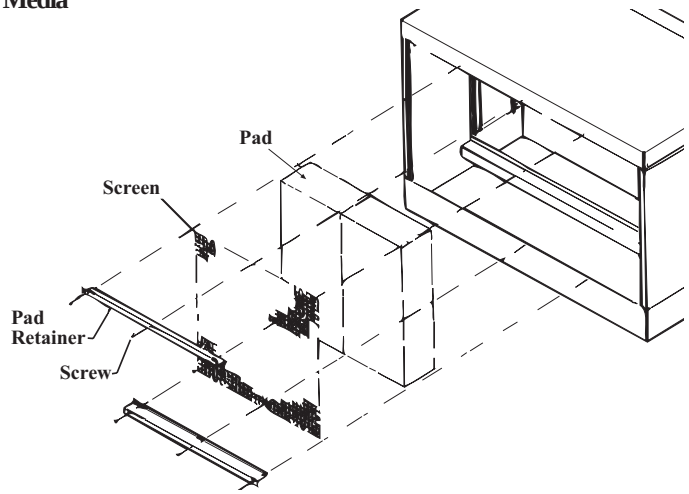
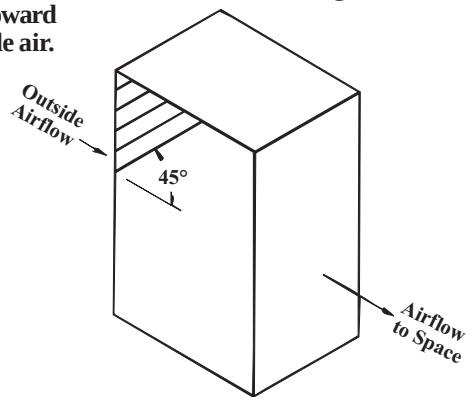


FIGURE 35B - Media must be installed with 45° angle sloping downward toward the incoming outside air.



IMPORTANT: The media is made up of two different sheets of cooling material. Each sheet has its own unique angle. When replacing the cooling media, BE CERTAIN that the 45° angle slopes downward toward the incoming outside air (as illustrated above). If the media is not installed properly, water blowoff from the media pads will occur.

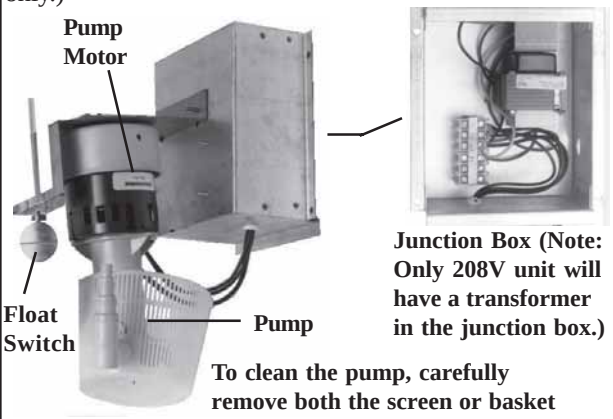
Water Pump and Inlet Basket Screen (Does not apply to module with optional timed metering system.) – Annually, the pump and inlet basket should be removed, disassembled and cleaned.

WARNING: Do not expose pump motor or any part of the electrical box to water. Evaporative cooling pump is NOT submersible.

Cleaning Instructions (See FIGURE 36.)

1. Disconnect the power supply to the unit.
2. Remove the junction box door and disconnect the two power supply wires from the terminal block inside the junction box.
3. Disconnect the water feed line hose from the upstream side of the ball valve.
4. Unscrew the four sheetmetal screws holding the junction box to the cooling module. Remove the junction box-pump-float switch assembly.
5. Dislodge the inlet basket screen from the pump and clean any build-up of debris and dirt. Carefully remove the base cover plate from the bottom of the pump. Using a mild soap solution, wash all deposits from the inside of the pump and remove all debris from the impeller.
6. Reassemble the pump. Replace the parts in exact reverse order, being careful that everything is returned to its proper position.

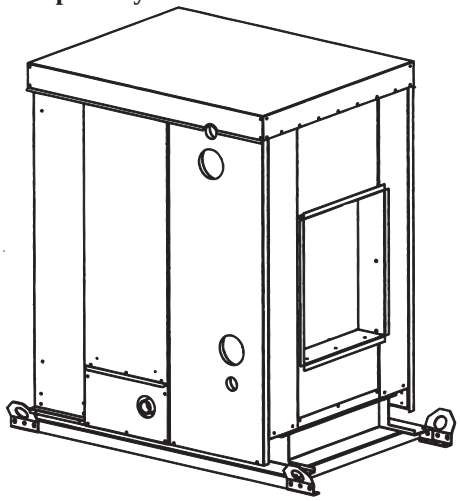
FIGURE 36 - Remove Junction Box, Pump and Float Switch as an Assembly (NOTE: Actual assembly may not appear exactly as in the photo. Applies to evaporative cooling module with float and pump control system only.)



To clean the pump, carefully remove both the screen or basket and the snap-on cover plate.

31. Optional Cooling Coil Cabinet, Option AU

FIGURE 37 - Optional Cooling Coil Cabinet is shipped separately for field attachment.



The optional cooling coil cabinet is shipped separately for attachment in the field. The cabinet includes either a chilled water or a refrigerant (DX) air conditioning coil. Cabinets alone have horizontal discharge but may have an attached downturn plenum for vertical discharge. If the downturn plenum is equipped with discharge dampers, field wiring including drilling holes and running wires is required. Cooling coil cabinet dimensions are on page 5.
(NOTE: If the system is being installed indoors, consult the factory regarding installation.)

31. Optional Cooling Coil Cabinet, Option AU (cont'd)

Factory-Supplied Parts for Attaching Optional Cooling Coil Cabinet

Description	Qty	400	500, 600	700	800	1050	1200
Top/Bottom Duct Connectors	2	106340, 47"	106338, 36"	106339, 41-1/2"	106340, 47"	106339, 41-1/2"	106340, 47"
Side Duct Connectors. 19-1/2"	2	106395	106395	106395	106395	106395	106395
#14 x 3/4" long Sheetmetal Screws	8	105171	105171	105171	105171	105171	105171
Left Side Filler Panel	1	172357	172357	172357	172357	172357	172357
Right Side Filler Panel	1	172358	172358	172358	172358	172358	172358
Top Filler Panel	1	172364	172362	172363	172364	172363	172364
Insulation - 1" x 42" x 9"	2	172546	172546	172546	172546	172546	172546
#10 x 1/2" long Sheetmetal Screws	>	(26) 11813	(24) 11813	(25) 11813	(26) 11813	(25) 11813	(26) 11813
Rubber Gasket Strip	1	106310	103608	103609	103610	103609	103610
3/32" x 1-1/8" x		64-7/8"	53-7/8"	59-3/8"	64-7/8"	59-3/8"	64-7/8"

WARNINGS: Do not attach the cooling coil cabinet before lifting the packaged blower/furnace system into position. Lift cooling coil cabinet separately. Do not attach the cooling coil cabinet while the furnace is in operation.

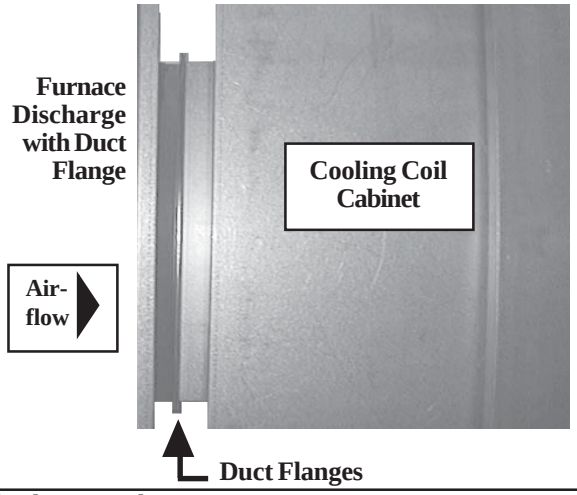
Using the parts shipped inside the cooling coil cabinet (see list top of page), follow the instructions to connect the coil cabinet to the furnace. In addition to normally required tools, a driver extension, a hammer, and bar or short length of 2x4 will be required. Silicone caulking must be field-supplied.

Instructions for Lifting and Attaching Cabinet

(NOTE: If suspending cabinet, consult factory.)

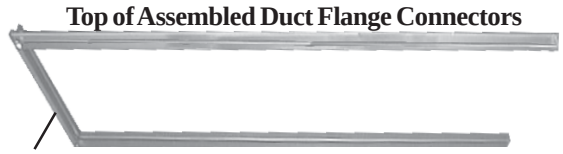
1. ***After*** the blower/furnace packaged system is in place on the roof curb or mounting rails, use a 9/16" wrench or socket to remove the lifting lugs that are on the discharge end of the system.
2. Lift the cooling coil cabinet and position it with the inlet side next to the discharge opening of the furnace. Remove the lifting lugs that are on the cooling coil cabinet.
3. Slide the cooling coil cabinet so that the duct flanges of the furnace and the cooling coil cabinet butt together **(See FIGURE 38A)**.

FIGURE 38A -
1) Place the cooling coil cabinet on the curb;
2) Remove the lifting lugs; and
3) Slide the cabinet so that the duct flange on the cooling coil cabinet butts against the duct flange on the furnace.



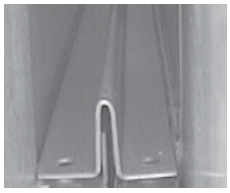
4. **Join the Duct Flanges**
   a) Use the four "U" shaped duct connector pieces and the 3/4" screws to join the duct flanges. Attach one of the 19-1/2" (495mm) long side connectors to both the top and bottom duct connectors, being sure that the "U" in the metal is open to the inside. **(See FIGURE 38B.)**

FIGURE 38B - Assemble top, bottom, and one side of the duct connector pieces using the 3/4" sheetmetal screws



   b) Position the assembled connectors so that the screw holes will be in the *top* piece at the open side **(See FIGURE 38C)**. In this position, insert the assembled top and bottom connectors into the space between the furnace and the cooling coil cabinet.
   Tap with a hammer, first on the side, then on the top, and last on the bottom of the assembled duct connector until it is seated over both duct flanges.

FIGURE 38C - The end of the top connector on the "open side" of the connector assembly.



   c) Position the remaining side connector. Use a driver extension to insert the screws that attach the side connector to the top and bottom connectors. **See FIGURE 38D.**

FIGURE 38D - Position the remaining side connector over the duct flanges. Attach to the top and bottom connectors with 3/4" screws creating a "U" shaped rectangular frame that joins the duct flanges on all four sides.

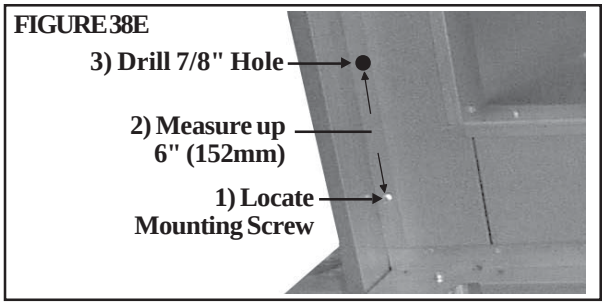
5. **Wiring Instructions - Apply to Downturn Plenum Cabinet with Optional Discharge Dampers *Only*** - If installing an Option AU12 or AU14 cooling coil cabinet with a downturn plenum cabinet equipped with optional discharge dampers, the damper motor wires must be connected to the terminal blocks in the furnace electrical compartment. If the coil cabinet being installed does not include a downturn plenum with a discharge damper, skip Step 5 and proceed to Step 6.

a) Drill three 7/8" holes as instructed below. Be sure all holes are free of burrs.

First Hole:

1) Remove the control side door on the discharge plenum.
2) Locate the discharge damper motor. Connected to the motor are three wires in lengths adequate to reach the furnace section.
3) Refer to **FIGURE 38E**. On the leg of the downturn plenum next to the cooling coil cabinet locate the mounting screw illustrated. Measure up 6" (152mm). At same centerline as the screw, drill the first 7/8" hole.

FIGURE 38E



Second Hole:

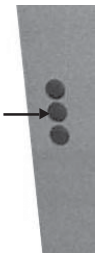
1) Remove the cooling coil access panel(s).
2) Locate the coil blockoff plate. Measure up 4" (102mm) from the bottom of the blockoff plate. At that location, find the center point of the blockoff plate and drill a 7/8" hole. The hole should be approximately even with the hole drilled in the downturn plenum leg.

Third Hole:

On the cabinet leg on the entering air side of the cooling coil cabinet, measure up 10" (254mm) from the bottom pan. At that height, measure in 4" (102mm) from the edge and drill a 7/8" hole.

b) On the outside of the furnace section (where the flanges were joined in Step 4), locate the three hole plugs. Remove the center plug exposing a 7/8" hole in the cabinet leg. See **FIGURE 38F**.

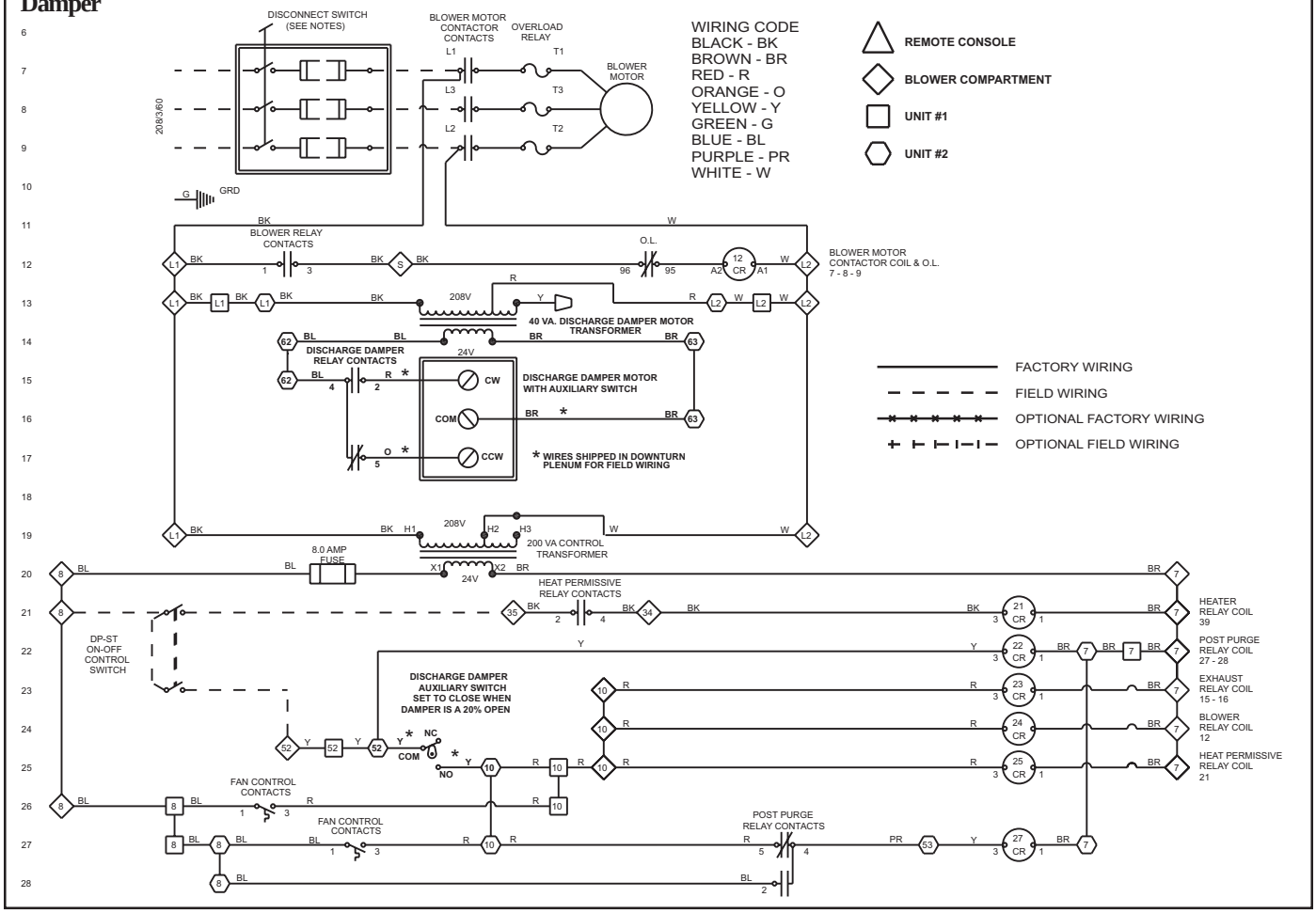
FIGURE 38F



c) Run the wires attached to the damper motor **1)** out through the hole in the discharge plenum leg into the cooling coil cabinet, **2)** through the blockoff plate, across the coil cabinet, **3)** out through the hole in the cooling coil cabinet leg, and **4)** into the furnace section.

d) On the bottom of the electrical box in the furnace section, remove the hole plug that is below the terminal blocks. Route the damper motor wires up through the hole and into the electrical box. Attach according to the connections on the wiring diagram. Refer to sample in **FIGURE 38G**.

FIGURE 38G - Sample of a Partial Wiring Diagram showing Typical Field-Wiring Connections for Optional Discharge Damper



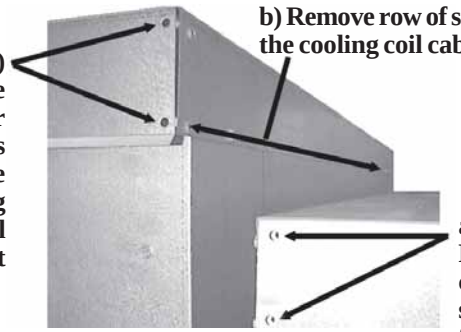
31. Optional Cooling Coil Cabinet, Option AU (cont'd)

6. Prepare Cabinets to Install Filler Panels (See FIGURE 38H.)

a) At the side corners of both the cooling coil cabinet and the furnace, remove the factory-installed screws that attach the cabinet tops.

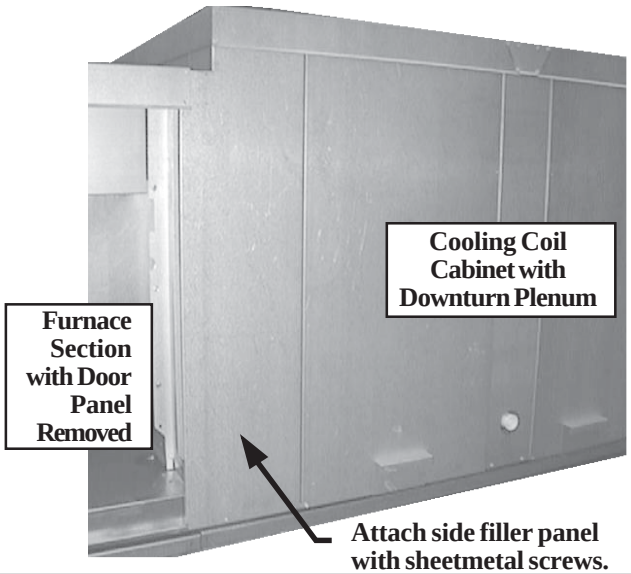
b) Across the edge of the cooling coil cabinet, remove the row of screws that attach the top.

FIGURE 38H - To install side and top filler panels, remove screws from top corners of both cabinets and the entire row across the cooling coil cabinet.



7. Install the Cabinet Side Filler Panels (See FIGURE 38J.)
Place a piece of the supplied insulation against the inner panel of the cooling coil cabinet. Slide the filler panel into place and attach with 1/2" sheetmetal screws. Repeat on the other side. NOTE: It may be easier to slide the filler panels in place with the door panels removed.

FIGURE 38J - Side Filler Panel Installed



8. Install the Cabinet Top Filler Panel (See FIGURE 38K)

a) Remove the backing from the gasket strip, and adhere it along the edge of the bottom of the top filler panel.

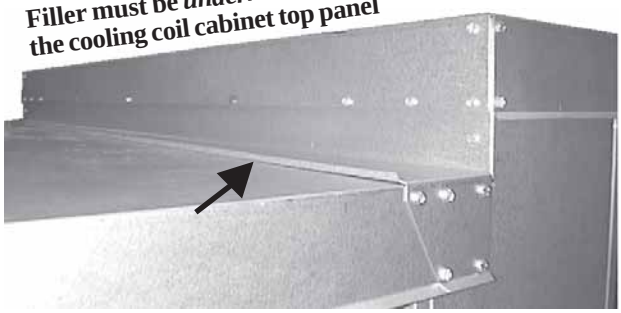
b) Slide the filler panel underneath the edge of the cooling coil cabinet top (NOTE: The edge of the top panel may have to be pulled out slightly to slide the panel underneath.) The **filler panel *must be between* the cooling coil cabinet top and end panel** to prevent water from leaking into the cabinet. Attach with 1/2" screws.

9. Reinsert Screws and Apply Caulking

a) Reinsert any remaining screws removed in Step 6. Check for gaps between the top and side filler panels; apply caulking as needed.

b) Apply silicone caulking where the cooling cabinet curb cap meets the furnace curb cap.

FIGURE 38K - Top Filler Panel Installed



Before the top filler panel is attached, remove the backing and adhere the gasket strip along the bottom of the outside edge so that any gaps between the top filler panel and the top panel of the furnace section are sealed.

10. The cooling coil cabinet is installed. Follow the instructions provided by the cooling coil manufacturer to make cooling coil connections.

Cooling Coil Maintenance

The cooling coil cabinet is designed with easily removable panels on both sides of the cabinet to provide access for inspection and cleaning. Inspect the coil during routine maintenance and whenever the filters are changed. Check the cooling coil for build up of debris; clean as required.

32. Optional Filter Rack and Filters

The system is equipped with a combination blower/filter cabinet. Filter rack and filters are optional equipment. Filters are available in 1" or 2", disposable, permanent, or pleated disposable styles.

Quantities and Sizes of Optional Filters

1" or 2"	**CRGBL, RPBL, PGBL 400, 800, 1200**	**CRGBL and RPBL 500, 600**	**CRGBL and RPBL 700, 1050**
Disposable	(2) 16 x 16, (1) 16 x 25, (4) 12 x 25, (4) 12 x 30	(1) 16 x 25, (1) 16 x 20, (4) 12 x 20, (4) 12 x 25	(2) 16 x 25, (4) 12 x 30, (4) 12 x 20
Permanent	(2) 16 x 16, (8) 12 x 16, (1) 16 x 25, (4) 12 x 26	(1) 16 x 20, (4) 12 x 20 , (1) 16 x 25, (4) 12 x 26	(2) 16 x 25, (8) 12 x 26
Pleated	(2) 16 x 16, (4) 12 x 25, (1) 16 x 25, (4) 12 x 32	(1) 16 x 20, (1) 16 x 25, (4) 12 x 20, (4) 12 x 25	(2) 16 x 25, (4) 12 x 32, (4) 12 x 20
1" or 2"	**RPDBL 800, 1600**	**RPDBL 1000, 1200**	**RPDBL 1400**
Disposable	(4) 16 x 16, (8) 12 x 25, (2) 16 x 25, (8) 12 x 30	(2) 16 x 25, (8) 12 x 20, (2) 16 x 20, (8) 12 x 25	(4) 16 x 25, (8) 12 x 20, (8) 12 x 30
Permanent	(4) 16 x 16, (2) 16 x 25, (16) 12 x 16, (8)12 x 26	(2) 16 x 20, (2) 16 x 25, (8) 12 x 20, (8) 12 x 25	(4) 16 x 25, (16) 12 x 26
Pleated	(4) 16 x 16, (2) 16 x 25, (8) 12 x 25, (8)12 x 32	(2) 16 x 20, (2) 16 x 25, (8) 12 x 20, (8) 12 x 25	(4) 16 x 25, (8) 12 x 20, (8) 12 x 32

PGBL, CRGBL, & RPBL	CFM	Filter Pressure Drops (" w.c.)					
		Disposable		Permanent		Pleated	
		1"	2"	1"	2"	1"	2"
400	3300	0.01	0.02	0.02	0.03	0.04	0.03
	4000	0.02	0.03	0.04	0.05	0.09	0.06
	5000	0.03	0.04	0.06	0.08	0.15	0.10
1 Size 400	6000	0.05	0.06	0.08	0.12	0.21	0.14
Furnace	7000	0.06	0.08	0.11	0.16	0.28	0.19
and 1 BL	8000	0.08	0.10	0.15	0.21	0.37	0.25
Blower	9000	0.11	0.13	0.19	0.26	0.46	0.31
	10000	N/A	N/A	0.23	0.33	0.57	0.39
	11000	N/A	N/A	0.28	0.40	0.69	0.47
	12000	N/A	N/A	0.34	0.48	0.82	0.56
	13000	N/A	N/A	0.40	0.56	N/A	N/A
	14000	N/A	N/A	0.46	0.65	N/A	N/A
	3700	0.02	0.04	0.03	0.04	0.09	0.06
500	4000	0.04	0.05	0.04	0.06	0.12	0.08
600	5000	0.06	0.08	0.07	0.10	0.18	0.12
	6000	0.08	0.12	0.10	0.14	0.25	0.17
2 Size 250	7000	0.10	0.16	0.14	0.20	0.35	0.23
or 300	8000	N/A	N/A	0.18	0.25	0.46	0.31
Furnaces	9000	N/A	N/A	0.22	0.31	0.59	0.40
and 1 BL	10000	N/A	N/A	0.28	0.39	N/A	N/A
Blower	11000	N/A	N/A	0.33	0.46	N/A	N/A
	12500	N/A	N/A	0.43	0.60	N/A	N/A
700	5200	0.04	0.06	0.06	0.08	0.14	0.10
2 Size 350	6000	0.04	0.06	0.08	0.10	0.22	0.15
Furnaces	7000	0.06	0.08	0.10	0.14	0.30	0.20
and 1 BL	8000	0.08	0.10	0.14	0.18	0.39	0.27
Blower	9000	N/A	N/A	0.18	0.24	0.49	0.33
	10000	N/A	N/A	0.22	0.30	0.61	0.41
	11000	N/A	N/A	0.26	0.36	N/A	N/A
	12000	N/A	N/A	0.32	0.42	N/A	N/A
	13000	N/A	N/A	0.38	0.50	N/A	N/A

NOTE: If the unit was manufactured prior to 9/91; filter sizes and arrangements are different; refer to Parts Replacement Form P-RG/RP/RBL or contact your distributor.

PGBL, CRGBL, & RPBL	CFM	Filter Pressure Drops (" w.c.)					
		Disposable		Permanent		Pleated	
		1"	2"	1"	2"	1"	2"
800	5900	0.04	0.05	0.07	0.10	0.18	0.12
	6000	0.05	0.06	0.08	0.12	0.21	0.14
	7000	0.06	0.08	0.11	0.16	0.28	0.19
2 Size 400	8000	0.08	0.10	0.15	0.21	0.37	0.25
Furnaces	9000	0.11	0.13	0.19	0.26	0.46	0.31
and 1 BL	10000	N/A	N/A	0.23	0.33	0.57	0.39
Blower	11000	N/A	N/A	0.28	0.40	0.69	0.47
	12000	N/A	N/A	0.34	0.48	0.82	0.56
	13000	N/A	N/A	0.40	0.56	N/A	N/A
	6500	0.04	0.06	0.08	0.10	0.14	0.08
1050	7000	0.06	0.08	0.10	0.14	0.18	0.12
	8000	0.08	0.10	0.14	0.18	0.24	0.16
3 Size 350	9000	N/A	N/A	0.18	0.24	0.30	0.2
Furnaces	10000	N/A	N/A	0.22	0.30	0.36	0.24
and 1 BL	11000	N/A	N/A	0.26	0.36	N/A	N/A
Blower	12000	N/A	N/A	0.32	0.42	N/A	N/A
	13000	N/A	N/A	0.38	0.50	N/A	N/A
	7400	0.06	0.08	0.11	0.16	0.28	0.19
1200	8000	0.08	0.10	0.15	0.21	0.37	0.25
3 Size 400	9000	0.11	0.13	0.19	0.26	0.46	0.31
Furnaces	10000	N/A	N/A	0.23	0.33	0.57	0.39
and 1 BL	11000	N/A	N/A	0.28	0.40	0.69	0.47
Blower	12000	N/A	N/A	0.34	0.48	0.82	0.56
	13000	N/A	N/A	0.40	0.56	N/A	N/A

Filter Range

Disposable ..... 0 to 400 FPM
Pleated Disposable ... 0 to 500 FPM
Permanent ..... 0 to 600 FPM

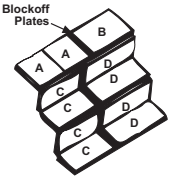
Type of Filter		*Average Efficiency	*Average Arrestance
Disposable	1"	Less than 20%	75%
	2"	Less than 20%	80%
Permanent	1"	Less than 20%	53% to 60%
	2"	Less than 20%	64% to 67%
Pleated Disposable	1"	30% to 35%	90% to 93%
	2"	30% to 35%	90% to 93%

*Tested in accordance with ASHRAE 52-76 Test Standard.

RPDBL Size	CFM	Filter Pressure Drops ("w.c.)					
		Disposable		Permanent		Pleated	
		1"	2"	1"	2"	1"	2"
800	6600	0.01	0.02	0.02	0.03	0.04	0.03
	8000	0.02	0.03	0.04	0.05	0.09	0.06
2 Size 400	10000	0.03	0.04	0.06	0.08	0.15	0.10
Furnaces	12000	0.05	0.06	0.08	0.12	0.21	0.14
and 2 BL	14000	0.06	0.08	0.11	0.16	0.28	0.19
Blowers	16000	0.08	0.10	0.15	0.21	0.37	0.25
	18000	0.11	0.13	0.19	0.26	0.46	0.31
	20000	N/A	N/A	0.23	0.33	0.57	0.39
	22000	N/A	N/A	0.28	0.40	0.69	0.47
1000	7400	0.02	0.04	0.03	0.04	0.09	0.06
	8000	0.04	0.05	0.04	0.06	0.12	0.08
4 Size 250	10000	0.06	0.08	0.07	0.10	0.18	0.12
Furnaces	12000	0.08	0.12	0.10	0.14	0.25	0.17
and 2 BL	14000	0.10	0.16	0.14	0.20	0.35	0.23
Blowers	16000	N/A	N/A	0.18	0.25	0.47	0.31
	18000	N/A	N/A	0.22	0.31	0.59	0.40
	20000	N/A	N/A	0.28	0.39	N/A	N/A
1200	8900	0.05	0.07	0.06	0.08	0.15	0.10
	10000	0.06	0.08	0.07	0.10	0.18	0.12
4 Size 300	12000	0.08	0.12	0.10	0.14	0.25	0.17
Furnaces	14000	0.10	0.16	0.14	0.20	0.35	0.23
and 2 BL	16000	N/A	N/A	0.18	0.25	0.46	0.31
Blowers	18000	N/A	N/A	0.22	0.31	0.59	0.40
	20000	N/A	N/A	0.28	0.39	N/A	N/A
1400	10400	0.04	0.06	0.06	0.08	0.14	0.10
	12000	0.04	0.06	0.08	0.10	0.22	0.15
4 Size 350	14000	0.06	0.08	0.10	0.14	0.30	0.20
Furnaces	16000	0.08	0.10	0.14	0.18	0.39	0.27
and 2 BL	18000	N/A	N/A	0.18	0.24	0.49	0.33
Blowers	20000	N/A	N/A	0.22	0.30	0.61	0.41
	22000	N/A	N/A	0.26	0.36	N/A	N/A
1600	11800	0.04	0.05	0.07	0.10	0.18	0.12
	14000	0.06	0.08	0.11	0.15	0.28	0.19
4 Size 400	16000	0.08	0.10	0.15	0.21	0.37	0.25
Furnaces	18000	0.11	0.13	0.19	0.26	0.47	0.31
and 2 BL	20000	N/A	N/A	0.23	0.33	0.57	0.39
Blowers	22000	N/A	N/A	0.28	0.40	0.69	0.47

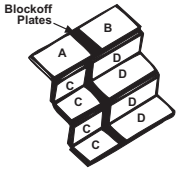
FIGURE 39 - Filter Arrangements

Filter Arrangements for 1" or 2" Disposable Filters (Options AW2 and AW7)



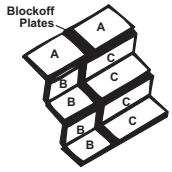
A	16 x 16
B	16 x 25
C	12 x 25
D	12 x 30

PGBL, CRGBL , RPBL 400, 800, 1200; RPDBL 800, 1600 (2 sets)



A	16 x 20
B	16 x 25
C	12 x 20
D	12 x 25

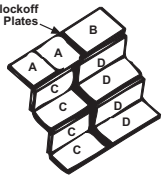
PGBL, CRGBL , RPBL 500, 600; RPDBL 1000, 1200 (2 sets)



A	16 x 25
B	12 x 20
C	12 x 30

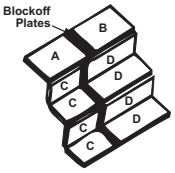
PGBL, CRGBL , RPBL 700, 1050; RPDBL 1400 (2 sets)

Filter Arrangements for 1" or 2" Disposable Pleated Filters (Options AW10 and AW11)



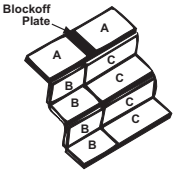
A	16 x 16
B	16 x 25
C	12 x 25
D	12 x 32

PGBL, CRGBL , RPBL 400, 800, 1200; RPDBL 800, 1600 (2 sets)



A	16 x 20
B	16 x 25
C	12 x 20
D	12 x 25

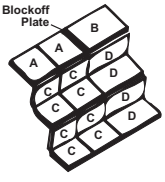
PGBL, CRGBL , RPBL 500, 600; RPDBL 1000, 1200 (2 sets)



A	16 x 25
B	12 x 20
C	12 x 32

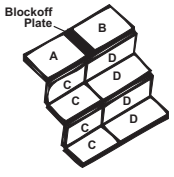
PGBL, CRGBL , RPBL 700, 1050; RPDBL 1400 (2 sets)

Filter Arrangements for 1" or 2" Permanent Filters (Options AW8 and AW9)



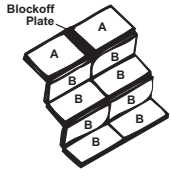
A	16 x 16
B	16 x 25
C	12 x 16
D	12 x 26

PGBL, CRGBL , RPBL 400, 800, 1200; RPDBL 800, 1600 (2 sets)



A	16 x 20
B	16 x 25
C	12 x 20
D	12 x 26

PGBL, CRGBL , RPBL 500, 600; RPDBL 1000, 1200 (2 sets)



A	16 x 25
B	12 x 26

PGBL, CRGBL , RPBL 700, 1050; RPDBL 1400 (2 sets)

32. Optional Filters and Filter Rack (cont'd)

Optional Dirty Filter Switch - All Models

The optional dirty filter pressure switch is used to provide warning to the user by energizing an indicator light on an optional remote console. The light indicates that the filters are in need of cleaning or changing. The adjustable, single-pole/normally open differential switch closes when an increase in pressure differential above the setpoint, is sensed across the filter bank.

This switch is located in the furnace section. See **FIGURE 19**, Item 17. After the unit is started, before continuous operation, the dirty filter switch must be set.

Instructions for Setting Dirty Filter Switch

With clean filters in place, blower doors closed, and blower in operation, decrease the pressure setting by adjusting the set screw on the switch clockwise until the filter light is energized or the screw is bottomed out. At that point, adjust the set screw three full turns counterclockwise or until the screw is top-ended. At that setpoint the filter light will be activated at approximately 50% filter blockage.

FIGURE 40 - Dirty Filter Switch

Set screw (on front of switch) must be manually adjusted after the system is in operation.

Positive pressure connection is toward the "front or top" of the switch (senses air inlet side of filters).

Negative pressure connection is toward the "back or bottom" of the switch (senses blower side of filters).

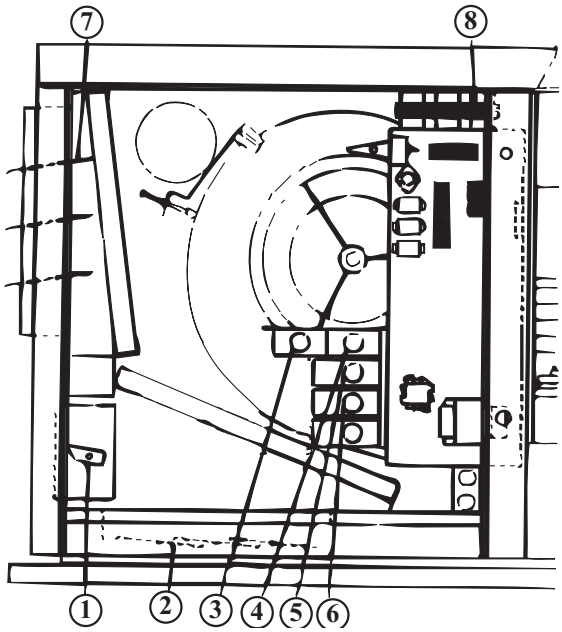
33. Optional Inlet Air Dampers and Controls

Damper controls are identified on the wiring diagram as AR Options.

NOTES: Model RPDBL has two blower cabinets with dampers and controls in each cabinet.

NOTE: The illustration in **FIGURE 41A** is intended to show location only of various air control accessories and does not represent suggested combinations of accessories.

FIGURE 41A - Control Locations for 100% Outside Air and 100% Return Air Damper Options



1. Damper Motor
2. Return Air Damper
3. Potentiometer
4. Potentiometer
5. Mixed Air Controller
6. Warm-up Control
7. Outside Air Damper
8. Damper Motor Transformer

FIGURE 41B - Location of Controls for 30% Outside Air Hood and Damper Options (AR6 or AR7)

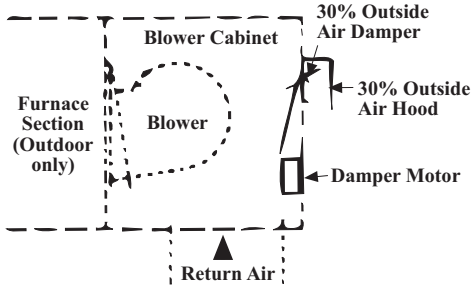
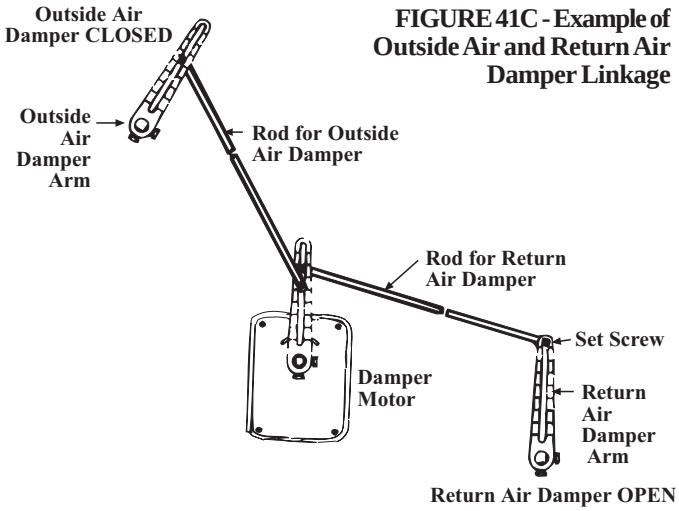


FIGURE 41C - Example of Outside Air and Return Air Damper Linkage



Inlet Air Damper Linkage -- When units are equipped with dampers, the dampers are closed during shipment. When there are **both** return air and outside air dampers, **the return damper linkage must be adjusted prior to use.**

1. Loosen the set screw on the return air damper rod at the damper arm.
2. Manually open the return air dampers. While the dampers are opening, the damper rod and arm will automatically move to their correct positions.
3. Tighten the set screw.

Pressure Null Switch (Used to control outside air dampers in Inlet Air Option AR23)

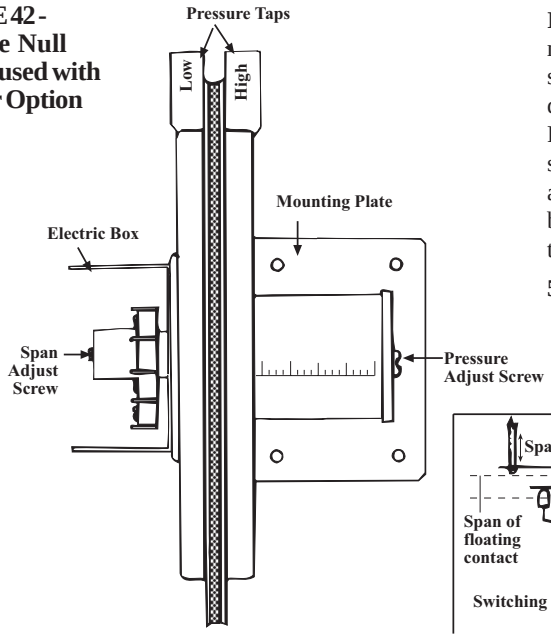
The pressure null switch used in Option AR23 is a Dwyer #1640-0 with a range of .01-.20" w.c. It is shipped separately for field installation. Refer to the following paragraphs and the manufacturer's installation instructions included with the switch.

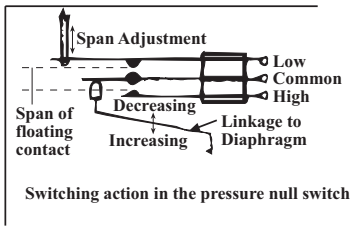
Description and Application - The pressure null switch is a diaphragm operated differential pressure switch used in makeup air applications to control building pressure. It maintains a selected positive or negative pressure setpoint by changing the amount of outside air being introduced to the building through the modulating outside air dampers. As more pressure is required in the building, the pressure null switch activates the damper motor driving the outside air damper towards the full open position and the recirculated air damper towards the closed position. Conversely, as less pressure is required, the switch drives the dampers in the opposite direction.

Installation Instructions for Pressure Null Switch

1. Select an indoor location free from excessive vibration where oil or water will not drip onto the switch and where ambient temperature will be within a range of -30°F (dry air) to 110°F.
2. **Mount the switch with the diaphragm in a vertical plane.** The switch is position sensitive and is calibrated to operate properly when the diaphragm is vertical. Mount switch securely.
3. Connect the pressure taps on the top of the switch to sources of air pressure differential. Metal tubing with 1/4" O.D. is recommended, but any tubing system which will not unduly restrict the air flow may be used. To maintain a positive building pressure, vent the low pressure tap to the outdoors and allow the high pressure tap to monitor building pressure. To maintain a negative building pressure, reverse the functions of the high and low pressure taps. In either case, be sure that the outdoor vent is protected from the wind and screened from insects.
4. **Adjustment of the Switch** - The "HIGH" actuation point of the null switch is indicated on a calibrated scale secured to the transparent range screw enclosure. Building pressure is set by turning the adjustment screw. The "Low" actuation point is set by adjusting the span of the null by turning the span adjustment screw. The span range is .01 to .03" w.c.

FIGURE 42 - Pressure Null Switch (used with Inlet Air Option AR23)





Switching action in the pressure null switch

IMPORTANT: To eliminate shipping damage to the switch contacts, the manufacturer reduced the span adjustment to zero before shipping. The span should be adjusted prior to using the switch. (If the switch has been installed, disconnect the vent tube so that the null switch is in a neutral position.) Remove the electrical box cover and while observing the contacts, turn the span adjustment screw slowly in a clockwise direction. Continue turning the adjustment screw until you are able to see gaps between the common and both the low and high contacts. A minimum gap provides the greatest sensitivity. The wider the gap the lower the sensitivity.

5. See the wiring diagram included with the furnace to make electrical connections.

MAINTENANCE AND SERVICE

WARNING: If you turn off the power supply, turn off the gas. See Hazard Levels, page 2.

This unit will operate with a minimum of maintenance. To ensure long life and satisfactory performance, a furnace that is operating under normal conditions should be inspected every four months. If the furnace is operating in an area where an unusual amount of dust or soot or other impurities are present in the air, more frequent inspection is recommended. When servicing, follow standard safety procedures as well as those specific instructions and warnings mentioned in this manual.

The following procedures should be carried out at least annually (See Paragraphs 34-38 for specific instructions.):

- ☐ Clean all dirt and grease from the primary and secondary combustion air openings.
- ☐ Check the gas valve to ensure that gas flow is being shutoff completely..
- ☐ Clean the heat exchanger(s) both internally and externally.
- ☐ Check the pilot burner and main burners for scale, dust, or lint accumulation. Clean as needed.
- ☐ Check the vent system for soundness. Replace any parts that do not appear sound.
- ☐ Check the wiring for any damaged wire. Replace damaged wiring. (See Paragraph 11 for replacement wiring requirements.)
- ☐ Change or clean the filters; see Paragraph 32.

NOTE: Use only factory-authorized replacement parts.

34. Operating Gas Valve

WARNING: The operating valve is the prime safety shutoff. All gas supply lines must be free of dirt or scale before connecting to the unit to ensure positive closure. See Hazard Levels, page 2.

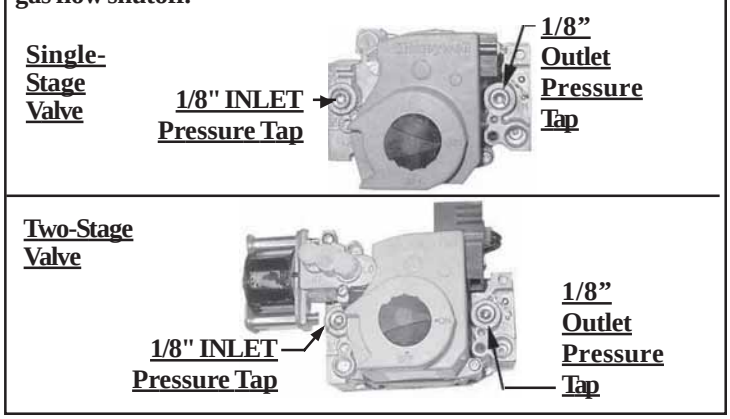
Remove external dirt accumulation and check wiring connections.

The combination gas valve must be checked annually to ensure that the valve is shutting off gas flow completely.

Instructions:

1) Locate the 1/8" FPT **INLET** pressure tap on the combination valve (See **FIGURE 43**).

FIGURE 43 - Connect manometer to inlet pressure tap to check gas flow shutoff.



34. Operating Gas Valve (cont'd)

2) With the manual valve turned off to prevent flow to the gas valve, connect a manometer to the 1/8" inlet pressure tap in the valve. **NOTE:** A manometer (fluid-filled gauge) with an inches water column scale is recommended.

3) With the field-installed manual valve remaining closed, observe the manometer for two to three minutes for an indication of gas pressure. No pressure should be indicated on the manometer. **If the manometer indicates a gas pressure**, the field-installed manual gas valve must be replaced or repaired before the combination gas valve can be checked.

4) **If the manometer does not indicate gas pressure**, slowly open the field-installed manual gas valve. After the manometer's indicated gas pressure has reached equilibrium, close the manual shutoff valve. Observe the gas pressure. There should be no loss of gas pressure on the manometer. If the manometer indicates a loss of pressure, replace the combination gas valve before placing the heater in operation.

NOTE: Operational pressure settings and instructions for checking pressure settings are in Paragraph 10.

35. Burner Rack Removal Instructions

Instructions apply to all furnace sections.

1. Turn off the gas supply.
2. Turn off the electric supply.
3. Remove control access side panel.
4. Disconnect the pilot tubing and flame sensor lead.
5. Mark and disconnect electric valve leads.
6. Uncouple the union in the gas supply.
7. Remove sheetmetal screws in the top corners of the burner rack assembly.
8. Pull "drawer-type" burner rack out of the furnace.

To disassemble the burner rack:

1. Remove Carryover System (the type of carryover system depends on the model and type of gas)

   Natural Gas - If the burner rack has a flash carryover on the "manifold end" of the burner rack, remove that flash carryover. If the burner rack has a carryover lighter tube, break the lighter tube connection at the orifice and remove the supply tubing, the drip shield, and the lighter tube.

   Propane Gas - All propane burner racks have a regulated lighter tube carryover. Break the lighter tube connection at the regulator and remove the lighter tube orifice supply tubing; remove the retaining screws in the drip shield and the shield; remove the screws and slide out the lighter tube.
2. Pull main burners horizontally away from injection opening and lift out.
3. Remove manifold bracket screws and remove manifold.
4. Change main burner orifices, if necessary.
5. Remove screws and lift out pilot burner.

Follow the instructions in Paragraph 35 to clean. To re-assemble and replace, reverse the above procedures being careful not to create any unsafe conditions.

CAUTION: When cleaning, wearing eye protection is recommended.

36. Cleaning Pilot and Main Burners

In the event the pilot flame is short and/or yellow, check the pilot orifice for blockage caused by lint or dust accumulation. Remove the pilot orifice and clean with air pressure. DO NOT REAM THE ORIFICE. Check and clean the aeration slot in the pilot burner.

Clean the metal sensing probe and the pilot hood with an emery cloth and wipe off the ceramic insulator. Check the spark gap; spark gap should be maintained to 7/64" (2.78mm). After the pilot is cleaned, blow any dirt away with compressed air.

Main burners may be cleaned using air pressure. Use an air nozzle to blow out scale and dust accumulation from the burner ports. Alternately blow through the burner ports and the venturi. Use a fine wire to dislodge any stubborn particles. Do not use anything that might change the port size.

Clean the burner rack carryover systems with air pressure.

37. Cleaning the Heat Exchanger

To clean the outer surfaces (circulating air side) of the heat exchanger, gain access by removing the inspection panels in the ductwork or remove the ductwork. Use a brush and/or an air hose to remove accumulated dust and grease deposits from the heat exchanger tubes and the baffles.

Gain access to the inner surfaces (combustion air side) of the heat exchanger by removing the burner rack and also following the appropriate instructions below. An air hose; an 18-24" long, 1/2" diameter furnace brush (or heavy wire with steel wool securely attached); a flashlight; and a mirror are needed. The required procedure depends on the date of manufacturer and whether or not the furnace is rated for high (80%) efficiency. Furnaces designed to provide high efficiency heating have "V" shaped baffles in the top of each heat exchanger tube. Follow these instructions to remove these baffles when cleaning the inner surfaces of the heat exchanger.

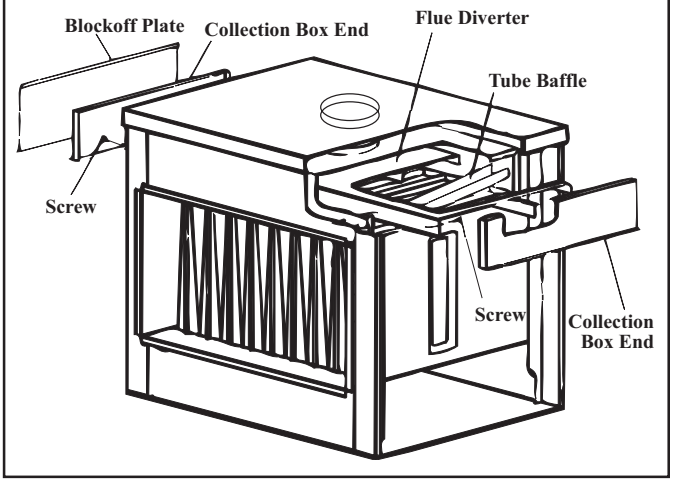
NOTE: High efficiency furnaces manufactured prior to 3/95 have a "C" prefix in their model designation. All furnaces manufactured beginning 3/95 are designed for high efficiency and include these heat exchanger "V" baffles.

Instructions to Remove Heat Exchanger "V" Baffles:

Outdoor, Gravity Vent <u>Model CRGBL</u> (See FIGURE 43)

1) Remove the ends of the flue gas collection box. On the control side of the furnace, remove the block-off plate to gain access to the collection box end.
2) Remove the flue diverter. Remove the screw at each end and slide the flue diverter out of the furnace.
3) Pull the "V" baffles out of the heat exchanger.

FIGURE 43 - Remove "V" Baffles to Clean Inner Surface of Heat Exchanger Tubes



Outdoor, Power Vent Models

1) Remove the ends of the flue gas collection box. On the control side of the furnace, remove the venter assembly and the flue outlet duct to gain access to the collection box end.
2) **<u>RPBL Sizes 500 and 600; RPDBL 1000 and 1200</u>** - Remove one of the tube baffle retaining angles on each inside wall of the collection box. Each tube baffle angle has one screw.

RPBL Sizes 400, 700, 800, 1050 and 1200; RPDBL 800, 1400, and 1600 - Remove the inner baffle from the flue collection box. On the control side, align the inner baffle with the slot in the collection box edge. Pull the inner baffle until it clears the heat exchanger. Remove the screw at each end and slide the flue diverter out of the furnace.

3) Pull the "V" baffles out of the heat exchanger.

Indoor, Power Vent Model PGBL

1) Remove the ends of the "internal" flue gas collection box. On the control side of the furnace, remove the block-off plate to gain access to the collection box end.
2) Remove the flue diverter. Remove the screw at each end and slide the flue diverter out of the furnace.
3) Pull the "V" baffles out of the heat exchanger.

All Models - Clean the inner surfaces of the heat exchanger from beneath using the brush to "scrub" the tube walls to remove any accumulated dust, rust and/or soot. Clean the "V" tubes and re-assemble the heat exchanger and the furnace.

Check the furnace for proper operation.

38. Blower Bearings

The blower bearings on models with less than a 10 HP motor (standard blower) are permanently lubricated cartridge ball bearings and do not require greasing.

The blower bearings on models equipped with 10-20 HP motor are pillow block ball bearings and are equipped with a grease fitting. (NOTE: Models with 10 HP motor manufactured prior to 1/91 have permanently lubricated ball bearings.) The pillow block bearings with a grease fitting should be lubricated twice a year with a high temperature, moisture-resistant grease (Type NLGI-1 or -2 standard grease is recommended). Be sure to clean the grease fitting before adding grease. Add grease with a handgun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by over lubricating. NOTE: If unusual environmental conditions exist (temperatures below 32°F or above 200°F; moisture; or contaminants), more frequent lubrication is required.

CAUTION: If the blower is unused for more than three months, bearings with a grease fitting should be purged with new grease prior to start-up.

39. Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Venter motor will not start	**1.** No power to the furnace.	**1.** Turn on power, check supply fuses or circuit breaker.
	2. No 24-volt power to venter relay.	**2.** Turn up thermostat, check control transformer output. Check for loose or improper wire connections.
	3. Venter relay defective.	**3.** Replace.
	4. Defective motor or capacitor.	**4.** Replace defective part.
Pilot will not light (Venter operating on power-vented models)	**1.** Manual valve not open.	**1.** Open manual valve.
	2. Air in gas line.	**2.** Bleed gas line.
	3. Dirt in pilot orifice.	**3.** Remove and clean with compressed air or solvent (do not ream).
	4. Gas pressure too high or too low.	**4.** Adjust supply pressure. (See Paragraph 10).
	5. Kinked pilot tubing.	**5.** Replace tubing.
	6. Pilot valve does not open.	**6.** If 24 volt available at valve, replace valve.
	7. No spark:	**7.**
	a) Loose wire connections	**a)** Be certain all wires connections are solid.
	b) Transformer failure.	**b)** Be certain 24 volts is available.
	c) Incorrect spark gap.	**c)** Maintain spark gap at 7/64".
	d) Spark cable shorted to ground.	**d)** Replace worn or grounded spark cable.
	e) Spark electrode shorted to ground.	**e)** Replace pilot if ceramic spark electrode is cracked or grounded.
	f) Drafts affecting pilot.	**f)** Make sure all panels are in place and tightly secured to prevent drafts at pilot.
	g) Ignition control not grounded.	**g)** Make certain ignition control is grounded to furnace chassis.
	h) Faulty ignition controller.	**h)** Replace ignition controller.
	8. Optional lockout device interrupting control circuit by above causes.	**8.** Reset lockout by interrupting control at thermostat.
	9. Faulty combustion air proving switch.	**9.** Replace combustion air proving switch.
	10. Activated blocked vent switch (indoor system)	**10.** Correct venting problem. Reset switch.
Pilot lights, main valve will not open	**1.** Manual valve not open.	**1.** Open manual valve.
	2. Main valve not operating.	**2.**
	a) Defective valve.	**a)** If 24 volt is measured at valve connections and valve remains closed, replace valve.
	b) Loose wire connections.	**b)** Check and tighten all wiring connections.
	3. Ignition control does not power main valve.	**3.**
	a) Loose wire connections.	**a)** Check and tighten all wiring connections.
	b) Flame sensor grounded. (Pilot lights - spark continues)	**b)**Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required.
	c) Gas pressure incorrect.	**c)** Adjust gas pressure. (See Paragraph 10.)
	d) Cracked ceramic at sensor.	**d)** Replace sensor.
	e) Faulty ignition controller.	**e)** See Paragraph 25. If all checks indicate no other cause, replace ignition controller. **Do not** attempt to repair the ignition controller. This device has no field replaceable parts.
	f) Poor microamp signal	**f)** Adjust pilot regulator

(continued)

39. Troubleshooting (cont'd)

TROUBLE	PROBABLE CAUSE	REMEDY
No heat (Heater Operating)	**1.** Dirty filters in blower system..	**1.** Clean or replace filters.
	2. Incorrect manifold pressure or orifices.	**2.** Check manifold pressure (See Paragraph 10).
	3. Cycling on limit control.	**3.**Check air throughput (See Paragraph 12).
	4. Improper thermostat location or	**4.** See thermostat manufacturer's instructions.
	5. Belt slipping on blower	**5.** Adjust belt tension
	6. Fan control improperly wired	**6.** Connect as per wiring diagram.
	7. Defective fan control.	**7.** Replace fan control.
	8. Blower set for too low temperature rise.	**8.** Slow down blower or increase static pressure.
Motor will not run	**1.** Circuit open	**1.** Check wiring and connections.
	2. Fan control inoperative	**2.** Replace fan control.
	3. Fan control improperly wired	**3.** Connect as per wiring diagram.
	4. Contactor inoperative	**4.** Replace contactor.
	5. Defective motor.	**5.** Replace motor.
Motor turns on and off while burner is operating	**1.** Motor overload device cycling	**1.** Check motor load against motor rating place. Replace motor or overload device.
	2. 3-phase motor rotating in opposite direction	**2.** Interchange two legs of supply connections.
Motor cuts out on overload	**1.** Improper motor pulley adjustment	**1.** See instructions on air throughput (See Paragraph 12).
	2. Improper static pressure on duct system	**2.** Adjust dampers in duct system.
	3. Low voltage	**3.** Check power supply.

Installation REFERENCES/NOTES:
(in addition to component manufacturer's information in the Owner's Envelope)

Optional Roof Curbs - **Installation Form I-OPT-C**
Optional Outside Air Hood - **Installation Form I-OPT-WH or I-OPT-H**
Optional Evaporative Cooling Module - **Installation Form I-OPT-EC**
Optional Cooling Coil Cabinet (Option AU2, AU3, AU11, AU12, AU13, or AU14)
1) If mounting a cooling coil cabinet indoors or outdoors, follow instructions in this booklet.
2) If *suspending* a cooling coil cabinet indoors (requires special curb cap), consult the factory.

MAINTENANCE AND TROUBLESHOOTING REFERENCES:

- For additional maintenance and service information, refer to specific paragraphs in the Installation and Operating Section or the Optional Equipment Section of this booklet. (See Index on page 1.)
- For Troubleshooting and additional information about the optional evaporative cooling module, refer to Form I-OPT-EC, installation manual shipped with the evaporative cooling module.
- For Wiring Troubleshooting Guide of Electronic Modulation Gas Control Options with 20% Turndown (Option AG39, AG40, AG41 or AG42), see Paragraph 23C.
- For replacement parts, refer to Form P-RG/RP/RBL.

FOR SERVICE OR REPAIR, FOLLOW THESE STEPS IN ORDER:

FIRST: Contact the installer.

Name _____

Address _____

_____

_____

Phone _____

SECOND: **Contact the nearest distributor** (See Yellow Pages). If no listing, contact Authorized Factory Representative, 1-800-695-1901 (Press 1).

THIRD: Contact: REZNOR®/ Thomas & Betts Corporation
150 McKinley Avenue
Mercer, PA 16137
Phone: (724) 662-4400

Model No. _____ **Unit Serial No.** _____ **Date of Installation** _____

1-800-695-1901; www.RezSpec.com

MANUFACTURER OF HEATING, VENTILATING, AND COOLING SYSTEMS
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9/06 Form I-PGBL/CRGBL /RPBL (Version B)