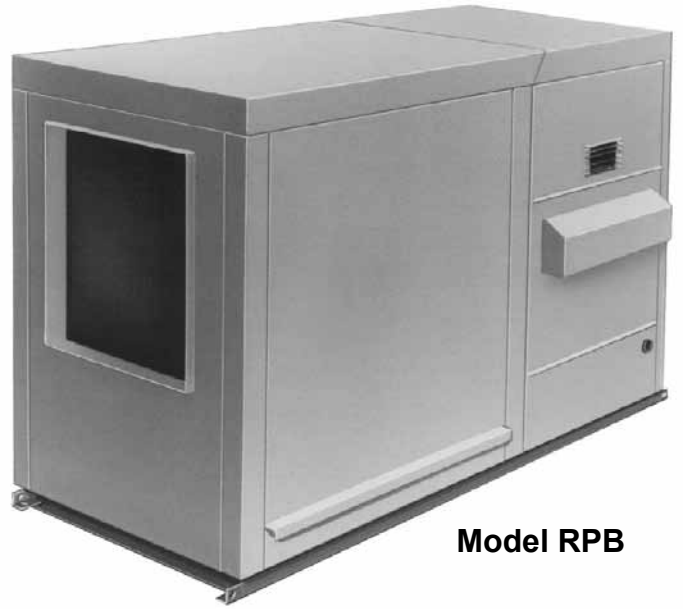
REZNOR®

Form I-RPB (Version F.3)
Obsoletes Form I-RPB (Version F.2)

Installation / Operation / Maintenance

Applies to: **Model Series RPB**
Outdoor Packaged
Duct Furnace and Blower



Model RPB

⚠ WARNING:

FIRE OR EXPLOSION HAZARD

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

Be sure to read and understand the installation, operation, and service instructions in this manual.

Improper installation, adjustment, alteration, service, or maintenance can cause serious injury, death, or property damage.

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

— **WHAT TO DO IF YOU SMELL GAS**
- **Do not try to light any appliance.**
- **Do not touch any electrical switch; do not use any phone in your building.**
- **Leave the building immediately.**
- **Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

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

TABLE OF CONTENTS

1.0 General

1.1 Hazard Labels and Notices

There are warning labels on the unit and throughout this manual. For your safety, read the definitions below and comply with all boxes labeled CAUTION, WARNING, and DANGER during installation, operation, maintenance, and service of this heater.

Definitions of HAZARD INTENSITY LEVELS used 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.**

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, above.

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

To ensure safety, follow lighting instructions located on the outlet box cover. See Hazard Levels, above.

1.2 General Installation Information

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 packaged duct furnace and blower Model Series RPB.

1.3 Warranty

Refer to the limited warranty form in the "Literature Bag".

WARRANTY: Warranty is void if.....

a. **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. (Paragraphs 2.2 & 4.2.)**
d. **Furnace air throughput is not adjusted within the range specified on the rating plate.**

1.4 Installation Codes

The outdoor packaged systems in this manual are design-certified to ANSI and CSA standards by the Canadian Standards Association. These models are approved for installation in the United States and in Canada. The 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 unit. Electrical characteristics are shown on the unit rating plate.

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 NFPA/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 is made to verify local codes and installation procedure requirements.

2.0 Furnace Location

2.1 General Recommendations

Location must comply with the clearances listed in Paragraph 4.2. There are a variety of factors, such as system application, building structure, dimensions, and weight, that contribute to selecting the location. If equipped with an outside air hood, it is recommended that the inlet to the hood not be facing into the prevailing wind.

Read the installation information in this manual and select a location that complies with the requirements.

2.2 Combustion Air Requirements

The combustion air and flue gas openings are carefully designed screened openings located on the side of each unit just above the control access panel. Location of the flue opening directly above the air intakes discourages recirculation of combustion products.

Hazards of Chlorine - 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.

3.0 Uncrating and Preparation

3.1 Uncrating and Inspecting

This furnace was test operated and inspected at the factory prior to crating and was in operating condition. If the furnace has incurred any damage in shipment, document the damage with the transporting agency and immediately contact an authorized Reznor®

3.0 Uncrating and Preparation (cont'd)

3.1 Uncrating and Inspecting (cont'd)

distributor. If you are an authorized Distributor, follow the FOB freight policy procedures as published by Reznor for Reznor® products.

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.

3.2 Preparing the Furnace for Installation

3.2.1 Shipped-Separate Components

Read this booklet and become familiar with the installation requirements of your particular furnace. 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 gas control options in the table below, be sure these parts are available at the job site.

Other shipped-separate options could include a roof curb, a screened outside air hood, a gas shutoff valve, a thermostat, a different control switch, a remote console, a manual fan switch, a vertical vent terminal, a gas supply regulator, and/or a disconnect switch. Or, if equipped with an optional evaporative cooling module, a water hammer arrestor or fill and drain or freeze kit could be shipped separately.

Application	Option	Shipped Separate Components
Heating -- Gas Control	**AG7**	Thermostat, **P/N 48033**
Makeup Air -- Gas Control Options (**NOTE:** If an optional remote console is ordered, the control switch and temperature selector may be mounted on the console.)	**AG3**	Control Switch, **P/N 29054**
	AG8	Control Switch, **P/N 29054;** Sensor & Mixing Tube, **P/N 48041**
	AG9	Control Switch, **P/N 29054;** Remote Temperature Selector, **P/N 48042;** Sensor & Mixing Tube, **P/N 48041**
	AG15	Control Switch, **P/N 29054**; Remote Temperature Selector, **P/N 115848**; Stage Adder Module, **P/N 115849;** Discharge Air Sensor Holder, **P/N 115850;** Discharge Air Sensor Holder Bracket, **P/N 213612**
	AG39	Remote Temperature Selector, **P/N 174849**; Temperature Sensor, **P/N 133228**; Mixing Tube, **P/N 90323**

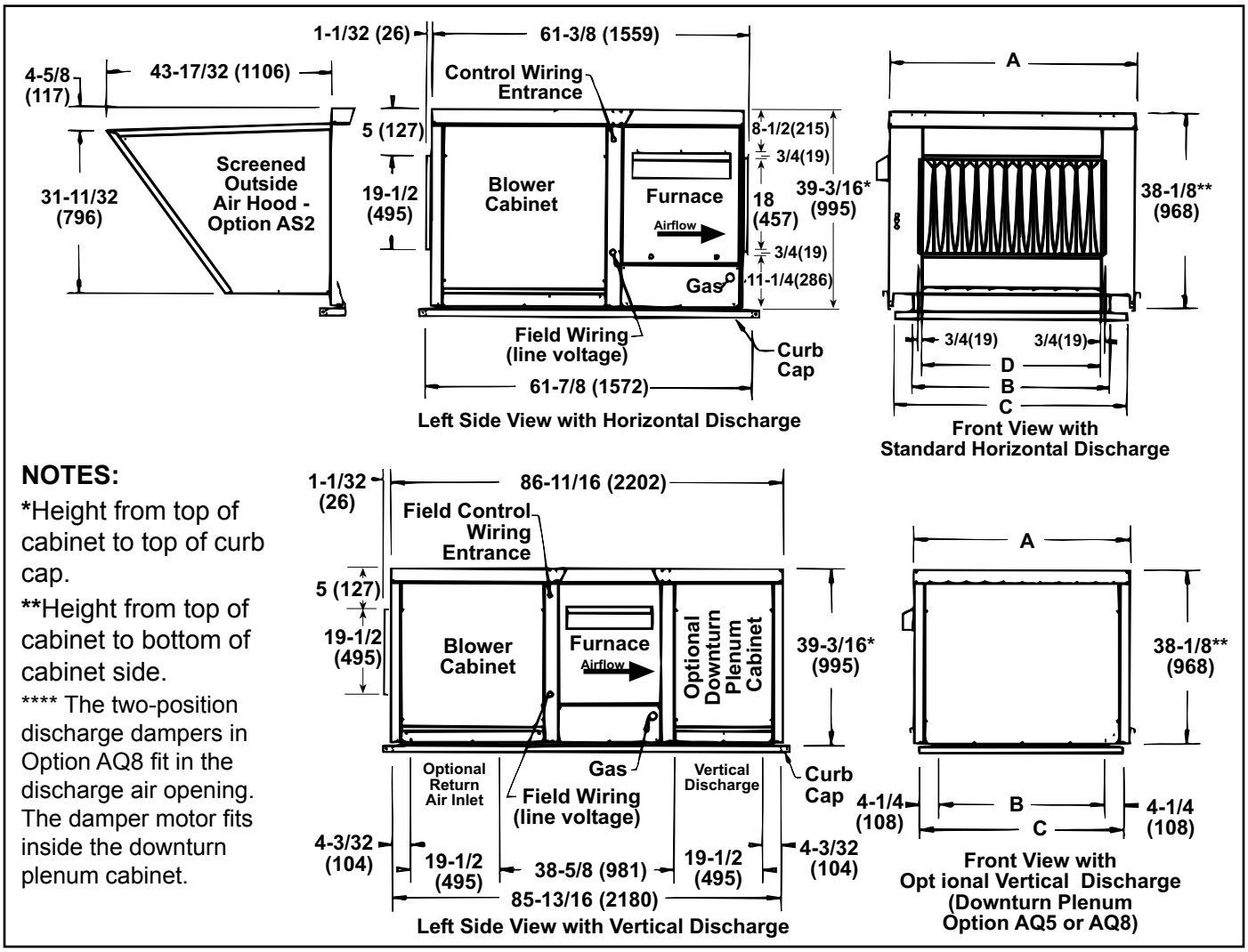
4.0 Dimensions and Clearances

4.1 Dimensions

FIGURE 1 - Dimensions, Outdoor/ Power-Vented Model Series RPB

Size		A	B	C	D	Gas Connection	
						Natural	Propane
125	inches	28-5/8	17-3/8	25-7/8	15-1/4	1/2	1/2
	mm	727	441	657	387	13	13
150, 175	inches	34-1/8	22-7/8	31-3/8	20-3/4	1/2	1/2
	mm	867	581	797	527	13	13
200, 225	inches	39-5/8	28-3/8	36-7/8	26-1/4	1/2	1/2
	mm	1006	721	937	667	13	13
250	inches	47-7/8	36-5/8	45-1/8	34-1/2	1/2	1/2
	mm	1216	930	1146	876	13	13
300	inches	47-7/8	36-5/8	45-1/8	34-1/2	3/4	1/2
	mm	1216	930	1146	876	19	13
350	inches	53-3/8	42-1/8	50-5/8	40	3/4	1/2
	mm	1362	1070	1286	1016	19	13
400	inches	58-7/8	47-5/8	56-1/8	45-1/2	3/4	1/2
	mm	1470	1210	1426	1156	19	13

Air Openings:	**Dimensions**
Standard Horizontal Air Inlet	19-1/2 (495) x B
Optional Return Air Opening (bottom)	19-1/2 (495) x B
Standard Horizontal Discharge Air Opening	18 (457) x D
Optional Vertical Discharge Air Opening (w/Option AQ5 or AQ8 Plenum)	19-1/2 (495) x B



4.2 Clearances

* 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 3A,** page 7.

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 furnace for combustion air space and for convenient installation and burner control system service.

REQUIRED CLEARANCES					
Model Series	Top	Sides		Bottom	
		Control	Opposite	To Combustibles	To Non-Combustibles
RPB	36" (915mm)	Width of furnace plus 6" (152mm)	6" (152mm)	0 *	0

5.0 Mounting

5.1 Weights

Approximate Net Weight (lbs/kg) - Model RPB Series Systems (blower and furnace sections only)							
Size		125	150, 175	200, 225	250, 300	350	400
Weight	lbs	482	520	534	588	630	662
	kg	219	236	242	267	286	300

5.2 Rigging and Lifting

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 and setting it on the curb. See **FIGURE 3A**, page 7.

If the system includes an outside air hood, attach it after the unit is in place.

5.0 Mounting (cont'd)

5.3 Mounting Base and Methods

5.3.1 Curb Cap Base

Outdoor systems are equipped with a load bearing curb cap which forms an integral part of the unit. This curb cap has welded joints and has a "skirt" which fits over a roof curb to provide a weatherproof installation. Four 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.

5.3.2 Mounting on Field-Supplied Supports (without a roof curb)

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 support locations in **FIGURE 2B**).

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 2A**. (**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.)

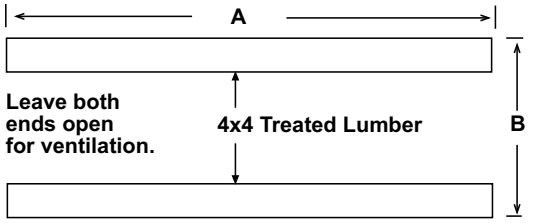
Space the 4x4 wooden rails (See "B" Dimension, **FIGURE 2A**) so that the curb cap "skirt" will fit over the edge of the boards with the rails setting inside the horizontal length of the curb cap.

If the rails are being laid directly on the roof, position them as shown in **FIGURE 2A**. 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 furnace section and between the furnace and the optional downturn plenum). See **FIGURE 2B**.

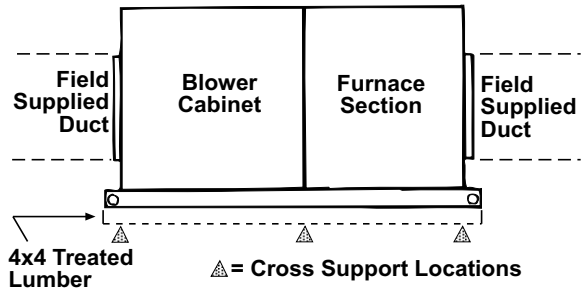
The field-supplied, weather-resistant cross-support structure must be adequate for the weight of the system. Cross-supports should run the entire width of the system supporting the 4x4 wooden rails at the recommended locations (**FIGURE 2B**).

FIGURE 2A - Mounting Support Dimensions (inches/mm)



Model Series RPB Size	Standard Heater and Blower Package	With Factory-Installed Downturn Plenum Cabinet (Option AQ)	All
	"A"	"A"	"B"
125	60-5/8"	84-9/16"	24-5/16"
150, 175	60-5/8"	84-9/16"	29-13/16"
200, 225	60-5/8"	84-9/16"	35-5/16"
250, 300	60-5/8"	84-9/16"	43-9/16"
350	60-5/8"	84-9/16"	49-1/16"
400	60-5/8"	84-9/16"	54-1/2"
125	1540mm	2148mm	618mm
150, 175	1540mm	2148mm	757mm
200, 225	1540mm	2148mm	897mm
250, 300	1540mm	2148mm	1106mm
350	1540mm	2148mm	1246mm
400	1540mm	2148mm	1384mm

FIGURE 2B - Cross-Support Locations

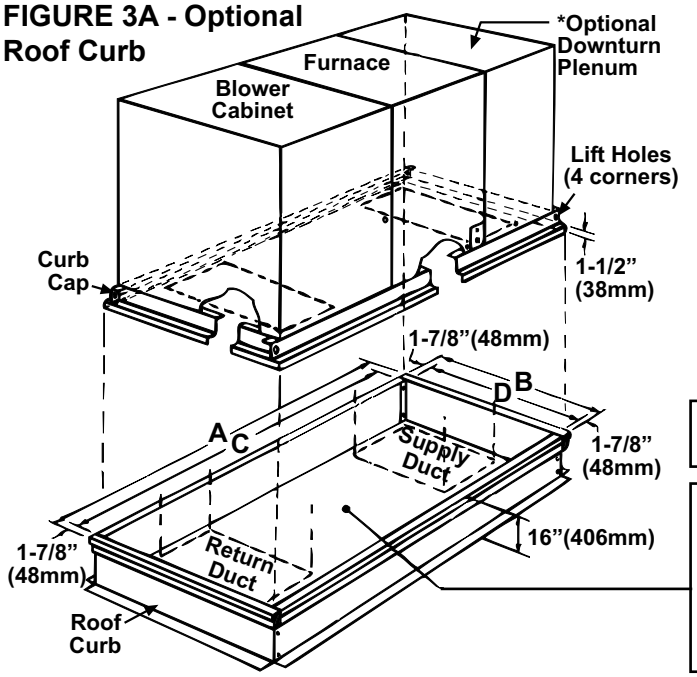


5.3.3 Mounting on a Roof Curb

Whether using an optional roof curb available 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 which are specific to the optional roof curb available with the system, the information and requirements

in this section apply to all curbs. See **FIGURES 3A and 3B** and the curb installation instructions below.

FIGURE 3A - Optional Roof Curb



* 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.**

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

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.

Roof Curb Dimensions (inches)

Size	125	150, 175	200, 225	250, 300	350	400
Option CJ1 - Roof Curb for (H)RPB						
A	60-5/8	60-5/8	60-5/8	60-5/8	60-5/8	60-5/8
B	24-5/16	29-13/16	35-5/16	43-9/16	49-1/16	54-1/2
C**	56-15/16	56-15/16	56-15/16	56-15/16	56-15/16	56-15/16
D**	20-9/16	26-1/16	31-9/16	39-13/16	45-5/16	50-13/16
Option CJ2 - Roof Curb with *Factory-Installed* Downturn Plenum Option AQ5 or AQ8						
A	84-9/16	84-9/16	84-9/16	84-9/16	84-9/16	84-9/16
B	24-5/16	29-13/16	35-5/16	43-9/16	49-1/16	54-1/2
Size	**125**	**150, 175**	**200, 225**	**250, 300**	**350**	**400**
C**	80-13/16	80-13/16	80-13/16	80-13/16	80-13/16	80-13/16
D**	20-9/16	26-1/16	31-9/16	39-13/16	45-5/16	50-13/16
E	25-7/8	31-3/8	36-7/8	45-1/8	50-5/8	56-1/8
F	99-5/32	104-21/32	110-5/32	118-7/16	123-15/16	129-7/16

Roof Curb Dimensions (mm)

Size	125	150, 175	200, 225	250, 300	350	400
Option CJ1 - Roof Curb for (H)RPB						
A	1540	1540	1540	1540	1540	1540
B	618	757	897	1106	1246	1384
C**	1446	1446	1446	1446	1446	1446
D**	522	662	802	1011	1151	1291
Option CJ2 - Roof Curb with *Factory-Installed* Downturn Plenum Option AQ5 or AQ8						
A	2148	2148	2148	2148	2148	2148
B	618	757	897	1106	1246	1384
Size	**125**	**150, 175**	**200, 225**	**250, 300**	**350**	**400**
C**	2053	2053	2053	2053	2053	2053
D**	522	662	802	1011	1151	1291

**** C** and **D** are roof opening dimensions.

Roof Curb Assembly and Installation Instructions (FIGURES 3A and 3B)

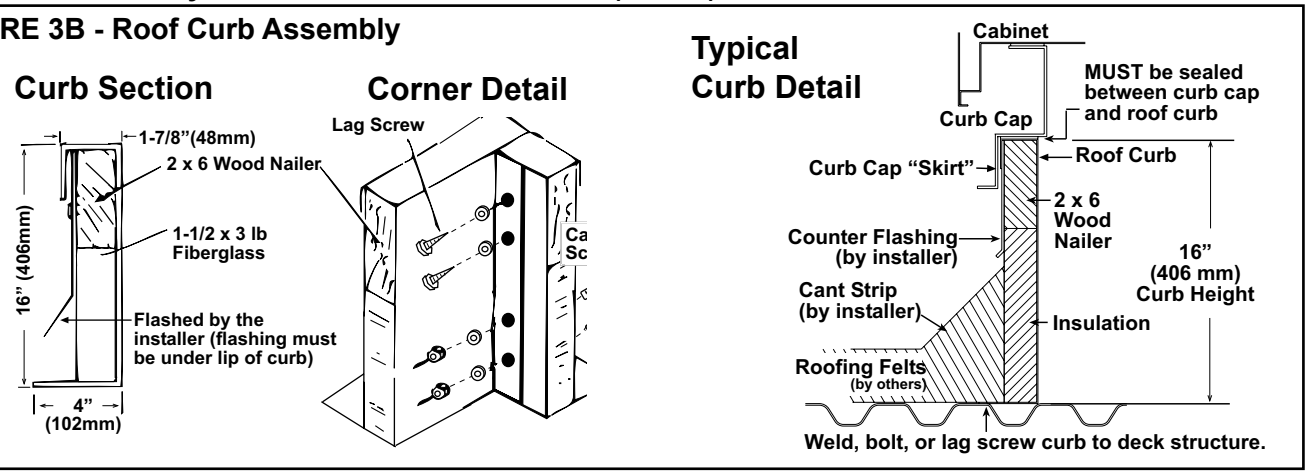
Curbs are shipped unassembled. Field assembly and mounting on the roof are the responsibility of the installer. All required hardware necessary to complete the assembly is supplied.

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 3A**. Join the corners as illustrated in the corner detail (**FIGURE 3B**).
2. Check the assembly for squareness. Adjust the roof curb so that the diagonal measurements are equal within a tolerance of ± 1/8" (3mm).
3. Level the roof curb. To ensure a good weather tight 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.

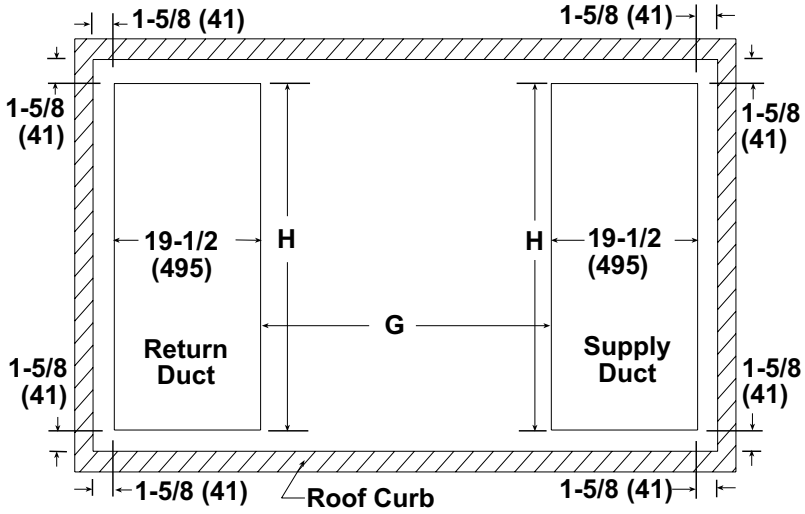
Roof Curb Assembly and Installation Instructions (cont'd)

FIGURE 3B - Roof Curb Assembly



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 in **FIGURE 4** is for currently manufactured curbs that are available from the system manufacturer.

FIGURE 4 - Duct Opening Dimensions in Relation to Roof Curb Option - inches (mm)



Sizes	H	G
		With Downturn Plenum, Option AQ5 or AQ8
125	17-3/8"	38-5/8"
	441mm	981mm
150, 175	22-7/8	38-5/8
	581mm	981mm
200, 225	28-3/8	38-5/8
	721mm	981mm
250, 300	36-5/8	38-5/8
	930mm	981mm
350	42-1/8	38-5/8
	1070mm	981mm
400	47-5/8	38-5/8
	1210mm	981mm

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

6.0 Mechanical

6.1 Gas Piping and Pressures

WARNING

This appliance is equipped for a maximum gas supply pressure of 1/2 psi, 3.4 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) Natural Gas and Propane Installation Code. Gas supply piping installation should conform with good practice and with local codes.

Gas Supply Sizing

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											
	1/2"		3/4"		1"		1-1/4"		1-1/2"		2"	
	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane
20'	92	56	190	116	350	214	730	445	1100	671	2100	1281
30'	73	45	152	93	285	174	590	360	890	543	1650	1007
40'	63	38	130	79	245	149	500	305	760	464	1450	885
50'	56	34	115	70	215	131	440	268	670	409	1270	775
60'	50	31	105	64	195	119	400	244	610	372	1105	674
70'	46	28	96	59	180	110	370	226	560	342	1050	641
80'	43	26	90	55	170	104	350	214	530	323	990	604
90'	40	24	84	51	160	98	320	195	490	299	930	567
100'	38	23	79	48	150	92	305	186	460	281	870	531
125'	34	21	72	44	130	79	275	168	410	250	780	476
150'	31	19	64	39	120	73	250	153	380	232	710	433
175'	28	17	59	36	110	67	225	137	350	214	650	397
200'	26	16	55	34	100	61	210	128	320	195	610	372
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.												

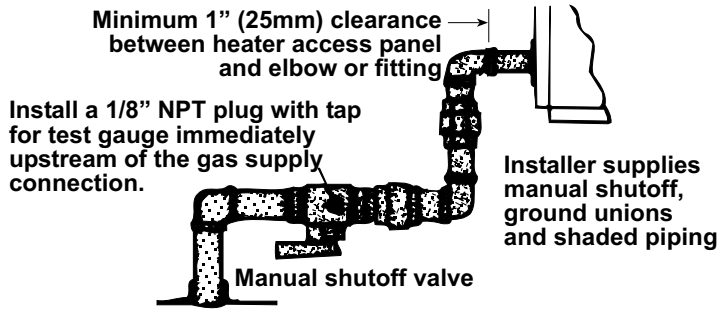
Duct furnaces for natural gas are orificed for operation with gas having a heating value of 1000 (+ or - 50) BTU per cubic ft. If the gas at the installation does not meet this specification, consult the factory for proper orificing.

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.

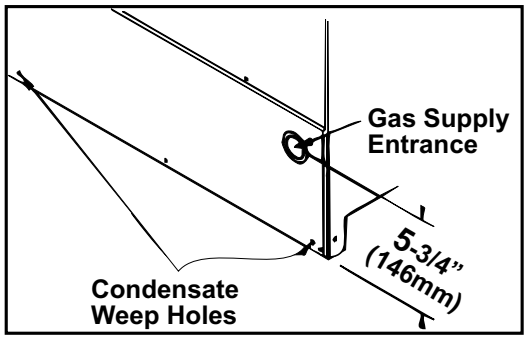
Install a ground joint union and manual shutoff valve upstream of the unit control system, as shown in **FIGURE 5**. The 1/8" plugged tapping in the shutoff valve provides connection for supply line pressure test gauge. The National Fuel Gas Code requires the installation of a trap with a minimum 3" 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 soap solution.

FIGURE 5 - Gas Connection Location and Requirements



Gas Connection to Single-Stage Valve (Not Gas Supply Line Size)		
RPB	**125-250**	**300-400**
Natural Gas	1/2"	3/4"
Propane	1/2"	1/2"



Install the gas supply piping so that when the union is disconnected, the supply pipe will not interfere with the removal of the burner rack. (The burner rack slides out of the control side of the furnace.)

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.

6.0 Mechanical (cont'd)

6.1 Gas Piping and Pressures (cont'd)

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 9.0. The following warnings and instructions apply.

WARNING

Manifold gas pressure must never exceed 3.5" w.c. for natural gas and 10" w.c. for propane gas.

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 Sizes 350 and 400 with electronic modulation require a minimum of 6" w.c. natural gas supply pressure. Sizes 300 and 350 with mechanical modulation require 7" w.c.

For Propane: 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.

CAUTION: DO NOT bottom out the gas valve regulator adjusting screw. This can result in unregulated manifold pressure causing overfire and heat exchanger failure.

6.2 Venting

Locate power-vented furnaces so that flue discharge is not directed at fresh air inlets. The flue discharge openings are located on the side of the furnace just above the control access panel. The position of this opening discourages recirculation of combustion products and provides for furnace operation in all normal weather conditions.

Optional Vertical Flue Discharge (Option CC3)

These power vented furnaces are certified with four feet of vertical pipe attached as shown in **FIGURES 6A** and **6B**. 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. The vent pipe and supports are field supplied.

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

FIGURE 6A - Installation of Adapter for Optional Vertical Flue Discharge (Option CC3, P/N 45021)

Attach the venter seal plate and oval adapter assembly with sheetmetal screws. Use venter seal plate as drill template.

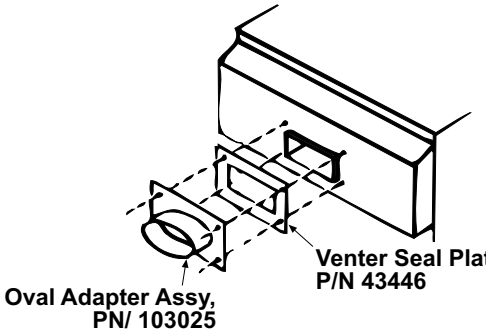
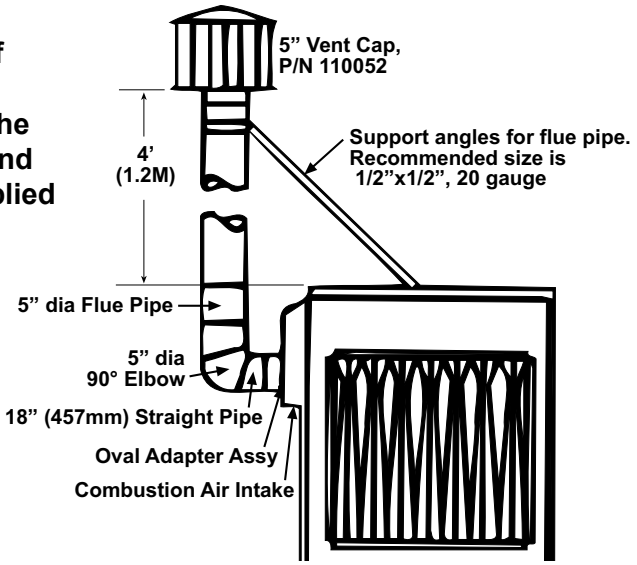


FIGURE 6B - Installation of the Vent Cap (included in the option pkg) and the field-supplied piping and supports



6.3 Unit Inlet Air

Depending on how the unit was ordered, the blower cabinet can have a variety of outside air and return air inlets. The cabinet end can be open requiring a field-installed hood , Option AS2, (See Paragraph 6.3.1), or the cabinet end can have a duct flange (see dimensions in Paragraph 4.1, **FIGURE 1**). With either a hood or duct flange, the inlet can have a damper. Dampers are available in a variety of configurations with a variety of controls (AR Options). Options AR 6 and 7 have a 30% outside air hood and a one-louver damper.

When ordered, a filter rack with a variety of filter options, is factory-installed in the blower cabinet.

If the unit is ordered with an evaporative cooling module (Option AS 3, 4, 5, or 8), it is factory-attached to the blower cabinet and is the point of entry for outside air.

Check the unit to be aware of the inlet air requirements of your installation.

6.3.1 Field-Installed Outside Air Hood

Option AS2, 100% Outside Air Hood

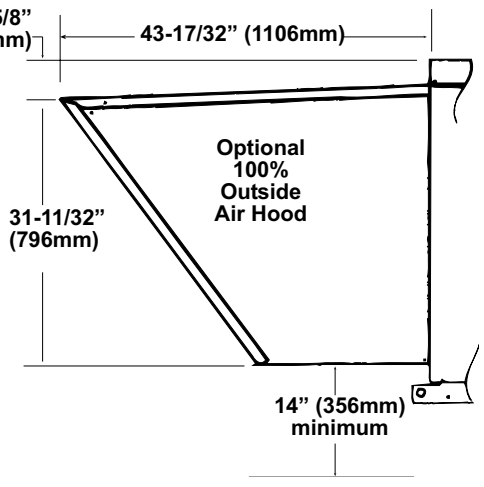
Outside air hood (Option AS2) is a weatherized, screened hood designed to be field assembled and installed around the horizontal inlet air opening of the blower cabinet. The air hood includes factory-assembled louvers designed to help eliminate moisture from the inlet air. Complete installation instructions are packaged with the air hood option.

CAUTION: It is recommended that the inlet to the outside air hood NOT be facing into the prevailing wind. Allow 14" (356mm) minimum clearance from the bottom of the air hood to the mounting surface.

FIGURE 7 - Dimensions of Option AS2, Outside Air Hood

RPB Size	Width of Outside Air Hood	
	inches	mm
125	53-3/8	1356
150,175	34-1/8	867
200,225	39-5/8	1006
250,300	47-7/8	1216
350	53-3/8	1356
400	58-7/8	1495

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



6.0 Mechanical (cont'd)

6.3 Unit Inlet Air (cont'd)

6.3.1 Field-Installed Outside Air Hood (cont'd)

Installation Instructions - Option AS2, 100% Outside Air Hood

Refer to **FIGURE 8**. All screw ends except those across the bottom should be inside the air hood.

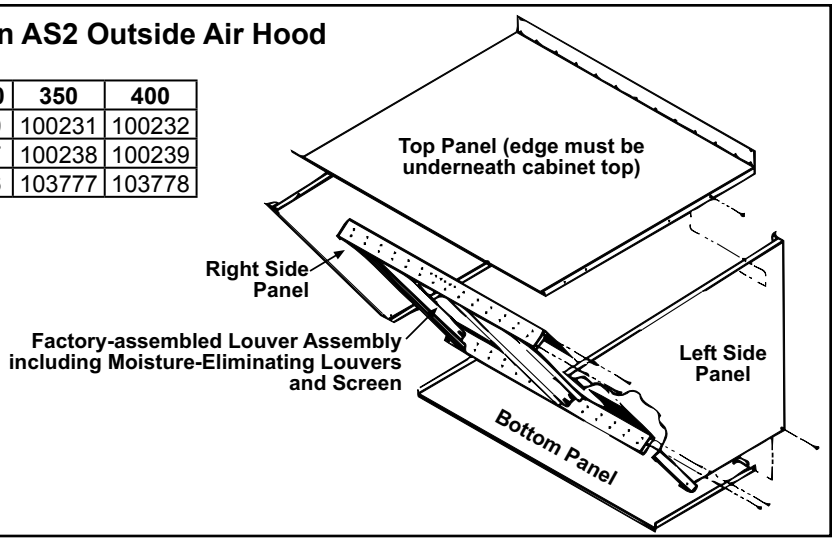
To avoid possible damage, it is recommended that the outside air hood be installed after the system has been placed on the roof. The air hood should be installed before the heater is operated. Do not install the hood while the system (furnace or blower) is in operation.

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 sheet-metal screws.

FIGURE 8 - Assembly Drawing of Option AS2 Outside Air Hood

RPB Size	125	150,175	200,225	250,300	350	400
Top Panel	100227	100228	100229	100230	100231	100232
Bottom Panel	100234	100235	100236	100237	100238	100239
Louver Assy	103773	103774	103775	103776	103777	103778

NOTE: Either a manufacturer designed optional air inlet hood as shown here or an evaporative cooling module as shown in Paragraph 6.3.4 is required to ensure complete weather resistance.



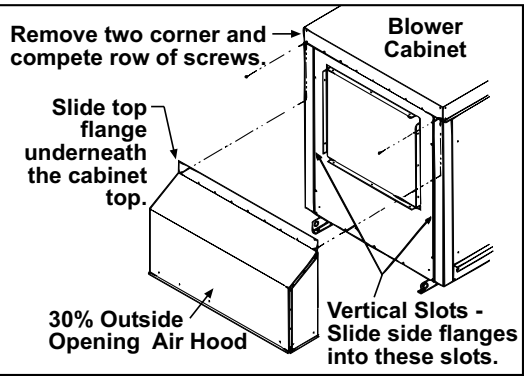
2. **Side Panels** - Slide the air hood right side panel into the groove in the blower cabinet end panel. Be sure that the side panel is underneath and to the inside of the air hood top panel. Attach to the blower cabinet and the air hood top using the required number of sheetmetal screws. Repeat with 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 at the holes.

Screened Air Hood for 30% Outside Air Opening, Part of Inlet Air Options AR6 and 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 for attaching are packaged with the air hood.

FIGURE 9 - Installation of Air Hood on Cabinets with 30% Outside Air Opening Options

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.



6.3.2 Filter Rack and Filters, Option AW

Filter rack and filters are factory installed optional equipment. Refer to **FIGURE 10**, for filter arrangements.

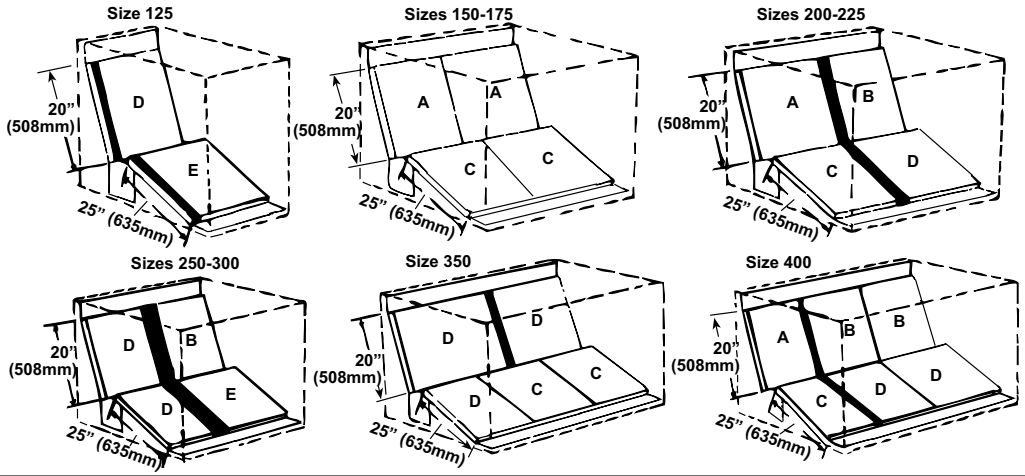
Tested in accordance with ASHRAE 52-76 Test Standard, the filters provided have the specifications shown in the table below.

Size, quantity, and pressure drops of filters for outdoor models shown below.

FIGURE 10 - Filter Arrangements

Shaded areas are filter blockoff plates.

Filter Code	Filter Size
A	16 x 20
B	20 x 20
C	16 x 25
D	20 x 25
E	25 x 25



Filter Pressure Drops (" w.c.)

RPB Size	Qty & Size of Filters	CFM	Disposable	Permanent	Pleated
125	(1) 20x25; (1) 25x25	575	0.00	0.01	0.01
		1000	0.01	0.03	0.04
		1500	0.02	0.06	0.08
		2000	0.02	0.11	0.15
		2500	0.03	0.17	0.23
		3000	N/A	0.24	0.33
		3500	N/A	0.34	0.45
		4000	N/A	0.43	N/A
150, 175	(2) 16x20; (2) 16x25	1175	0.01	0.03	0.03
		1500	0.01	0.06	0.05
		2000	0.02	0.08	0.09
		2500	0.03	0.14	0.14
		3000	0.04	0.20	0.23
		3500	0.05	0.28	0.27
		4000	0.07	0.36	0.36
		4500	N/A	0.45	0.45
		5000	N/A	0.54	0.56
200, 225	(1) 16x20; (1) 16x25; (1) 20x20; (1) 20x25	1550	0.01	0.04	0.04
		2000	0.01	0.07	0.07
		2500	0.02	0.11	0.11
		3000	0.03	0.16	0.16
		3500	0.04	0.22	0.21
		4000	0.05	0.28	0.27
		4500	0.06	0.36	0.35
		5000	N/A	0.44	0.43
		5400	N/A	0.52	0.50
250, 300	(1) 20x20; (3) 20x25	1950	0.02	0.05	0.05
		2500	0.03	0.08	0.08
		3000	0.04	0.12	0.11
		3500	0.05	0.16	0.15
		4000	0.07	0.21	0.20
		4500	0.09	0.26	0.25
		5000	0.11	0.32	0.31
		5500	N/A	0.39	0.37
		6000	N/A	0.46	0.44
		6500	N/A	0.54	0.52
350	(2) 16x25; (3) 20x25	2750	0.03	0.08	0.08
		3500	0.04	0.13	0.13
		4000	0.06	0.17	0.17
		4500	0.07	0.21	0.22
		5000	0.09	0.26	0.27
		5500	0.10	0.32	0.33
		6000	0.12	0.38	0.39
		6500	N/A	0.44	0.46
		7000	N/A	0.51	0.53
		3100	0.04	0.08	0.08
400	(1) 16x20; (1) 16x25; (2) 20x20; (2) 20x25	3500	0.06	0.11	0.11
		4000	0.07	0.14	0.14
		4500	0.09	0.18	0.18
		5000	0.12	0.22	0.22
		5500	0.14	0.27	0.27
		6000	0.17	0.32	0.32
		6500	0.20	0.38	0.37
		7000	0.23	0.44	0.43
		7400	N/A	0.49	0.48

Average Efficiency and Arrestance by Filter Type

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

Optional Dirty Filter Switch

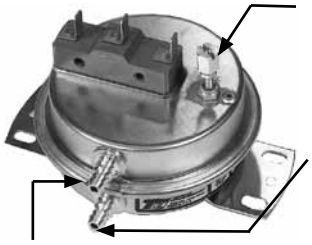
The optional dirty filter pressure switch is used to provide warning to the user by energizing an indicator light on an optional remote console. The light indicates that the filters are in need of cleaning or changing. The adjustable, single-pole/normally open differential switch closes when an increase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

This switch is located in the furnace section. See page 28, **FIGURE 29** Item 17. After the unit is started, before continuous operation, the dirty filter switch must be set.

Instructions for Setting Switch

With clean filters in place, blower doors closed, and blower in operation, decrease the pressure setting by adjusting the setscrew 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 11 - Dirty Filter Switch



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

Positive pressure connection is toward the "back or bottom" of the switch (senses air inlet side of filters)

Negative pressure connection is toward the "front or top" of the switch (senses blower side of filters)

6.3 Unit Inlet Air (cont'd)

6.3.3 Optional Dampers and Controls (See Wiring Diagram on unit.)

FIGURE 12A - Location of Controls for 30% Outside Air Hood and Damper Options (AR6 or AR7)

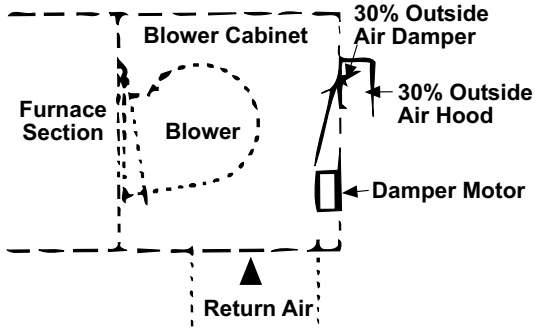
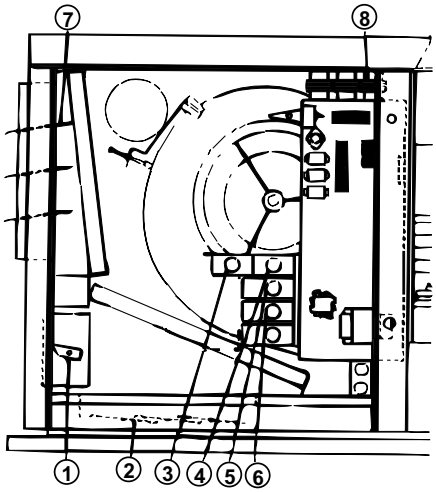


FIGURE 12B - Control Locations for 100% Outside Air and 100% Return Air Damper Options

1 Damper Motor
2 Return Air Damper
3 Potentiometer
4 Potentiometer
5 Mixed Air Controller
6 Warmup Control
7 Outside Air Damper
8 Damper Motor Transformer

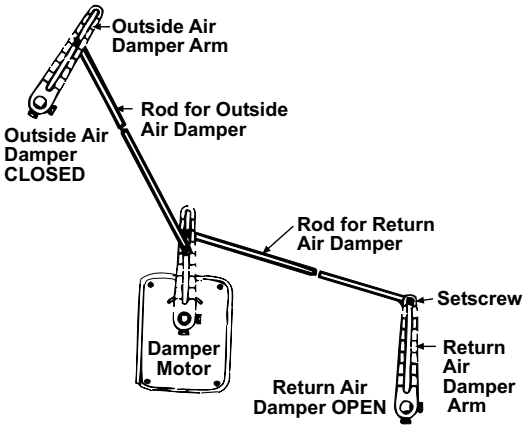


NOTE: Damper controls are illustrated in **FIGURE 12A and 12B. These illustrations** are intended to show location only of various air control accessories and do not represent suggested combinations of accessories.

FIGURE 12C - Example of Outside Air and Return Air Damper Linkage

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 (FIGURE 13)

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.

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

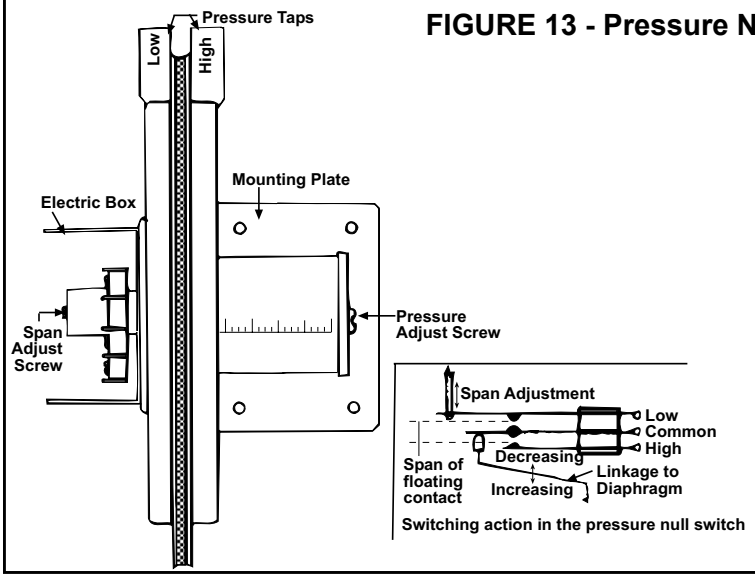


FIGURE 13 - Pressure Null Switch (used with Inlet Air Option AR23)

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.

6.3.4 Evaporative Cooling Module, Option AS 3, 4, 5, 8

FIGURE 14 - Optional Evaporative Cooling Module is factory-installed on the blower cabinet

General - 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 rigid glass fiber media to retain water in order to allow time for evaporation.

The optional evaporative cooling module is equipped with high efficiency pad media of 12" rigid cellulose (Option AS4) or 12" rigid glass fiber (Option AS8). 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 high CFM units as listed in the table.

RPB Size	Moisture Elimination Pad Required on Evaporative Cooling Module
125	2601 - 3800 CFM
150	3201 - 4700 CFM
175	3201 - 5000 CFM
200	3701 - 5100 CFM
225	3701 - 5150 CFM
250	4501 - 5800 CFM
300	4501 - 6300 CFM
350	5101 - 6800 CFM
400	5601 - 7100 CFM

The standard water controls for the evaporative cooling module include the float valve, the float switch, and pump assembly illustrated in the following paragraphs. If the cooling module has an optional AquaSaver metering water system, it will not have these controls but will have a solenoid valve with a timer assembly for controlling water flow.

Installation Instructions - Evaporative Cooling Module

The evaporative cooling module is factory assembled, installed and wired. No additional roof mounting is necessary. Read the following to field connect the water supply and make necessary checks and adjustments before operating the cooling module.

Supply and Drain Water Connections

<u>Float Valve</u> (FIGURE 15)

In a module with pump and float controls, a float valve maintains the appropriate water level in the reservoir.

Use a field-supplied 1/4" diameter tubing with a compression nut and tubing ferrule to connect the fresh water supply to the inlet of the float valve. See **FIGURE 15**. Place nut and ferrule over tubing and insert tubing into the float valve stem. Tighten nut securely.

An optional automatic fill and drain kit (Option CT) is available that will automatically release supply water to the cooling module when a call for cooling is made and drain all water from the reservoir when the cooling switch is deactivated or a cooling ther-

6.0 Mechanical (cont'd)

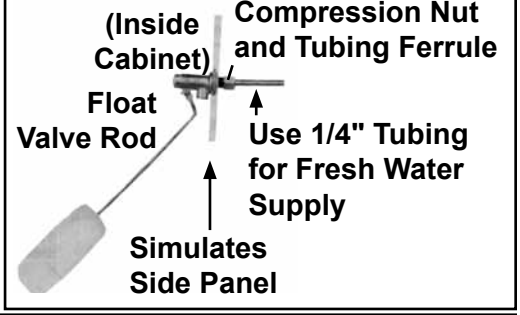
6.3 Unit Inlet Air (cont'd)

6.3.4 Evaporative Cooling Module, (cont'd)

Supply and Drain Water Connections (cont'd)

mostat is satisfied. See **FIGURE 16**. If installing an optional fill and drain kit, follow the instructions with **FIGURE 16**. Consult wiring diagram for electrical connections.

FIGURE 15 - Connect Fresh Water Supply to Inlet of Float Valve



CAUTION: Water reservoir must be drained and pump motor turned off when outside temperature falls below 32°F (0°C). Pump must never be operated without water in the reservoir. See Hazard Levels, page 2.

Instructions for Installing Optional Fill & Drain Kit

NOTE: Follow instructions included in the valve packages for attaching valves to the water line only. The remainder of the installation instructions with the valves does not apply to this type of application.

Water Line Connections (See illustration):

Supply (3-Way Valve) Connections - Connect the water supply line to "B" (normally closed). Connect the water drain line to "A" (normally open). Connect the middle outlet to supply the water to the reservoir.

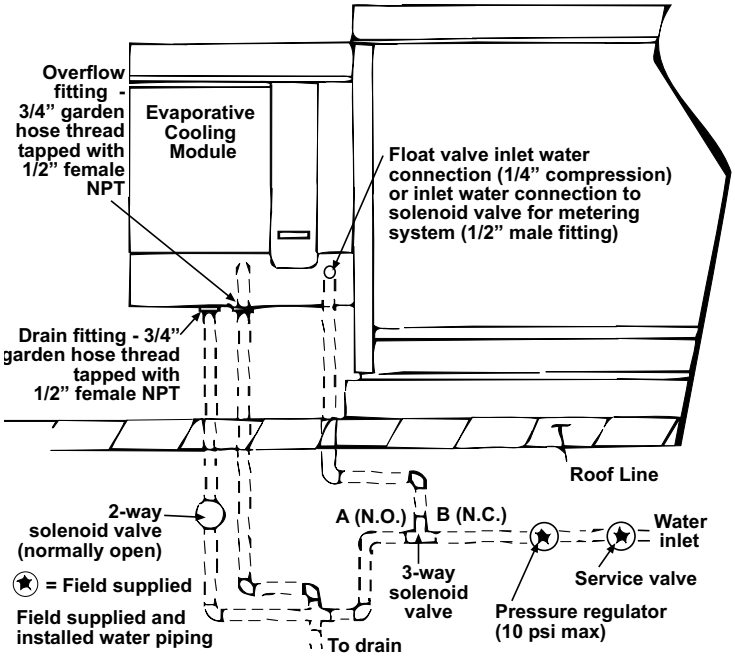
Drain (2-Way Valve) Connections - Connect the drain pipe from the reservoir to the valve inlet. Connect the outlet side into the drain lines from the cooling reservoir and the supply valve.

Electrical Connections (requires black and white 14-gauge wire) Refer to Wiring Diagram provided with the furnace:

WARNING: Risk of electrical shock. Disconnect the power.

1. Refer to the wiring diagram for terminal connections. (**NOTE**: If kit is not ordered with the system, connections will not be shown on the diagram. Terminal connections are specific to each system. Contact the factory for terminal connections. Be prepared to provide all model information.)
2. Run field-supplied black wire from the electrical compartment (terminal on the wiring diagram) of the evaporative cooling module and connect to the black wire on both the 3-way and the 2-way valve.
3. Run field-supplied white wire from the electrical compartment (terminal on the wiring diagram) of the evaporative cooling module and connect to the white wire on both the 3-way and the 2-way valve.

FIGURE 16 - Water Connections including Optional Drain and Fill Kit (pump & float controls)



AquaSaver Timed Metering Control System

If the cooling module is equipped with an optional timed metering system, connect a 1/2" water line to the fitting on the side of the cooling module. Due to various water pressures and installation conditions, the water supply line may bang abruptly when the solenoid valve in the AquaSaver system closes. This banging can be minimized by installing an optional water hammer arrestor in the supply line. When installing an optional water hammer arrestor, select an indoor (above 32°F) location, either horizontal or vertical, in line with and as close to the solenoid valve as possible. Follow the manufacturer's instructions to install and maintain the water hammer arrestor.

A freeze protection kit (Option CT5) is also available.

All Evaporative Cooling Modules - A manual water shutoff valve should be installed upstream of the cooling module inlet, at a convenient non-freezing location, to allow the water supply to be turned on and off. If necessary, install a bleed line between the manual valve and the cooling module to allow drainage of the line between the shutoff valve and the cooling module.

All cooling modules are equipped with an overflow and drain fitting. The fittings are in the cabinet bottom and come complete with a lock nut and a sealing gasket. Check these fittings for tightness before installing the overflow and drain piping. The drain and overflow fitting will accommodate a 3/4" garden hose thread and is tapped with a 1/2" female pipe thread for iron pipe.

FIGURE 17 - Bleed Line Connection

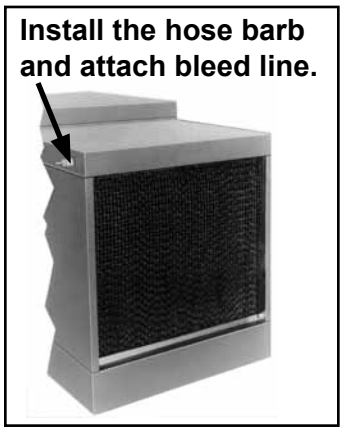
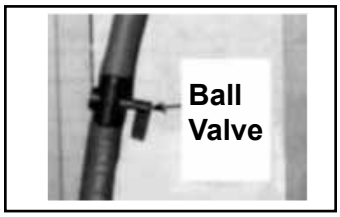


FIGURE 18 - Disconnect the power and use ball valve to adjust water flow.



Bleed Line Connection (Does not apply to module with optional timed metering system.) - Shipped in the evaporative cooling module bottom pan, find a 1/4" I.D. x 1/2" N.P.T. nylon bleed line fitting (hose barb). Thread the fitting into the female adapter located opposite the pump/inlet side of the water distribution line. The hose barb will protrude from the side of the cabinet (See **FIGURE 17**). Attach a 1/4" I.D. hose to the barb and run the hose to the nearest drain.

Discharging a quantity of water by "bleed off" will limit the concentration of undesirable minerals in the water being circulated through the cooling module. Minerals buildup because evaporation only releases "pure water vapor" causing the concentration of contaminants in the water to increase as the evaporation process continues. The minerals accumulate on the media, in the water lines, on the pump, and in the reservoir. Adequate bleed off is important to maintaining an efficiently operating evaporative cooling system.

Filling and Adjusting the Water Level in the Reservoir

Float and Pump Control System - Turn on the water supply. Check for good flow. When the float valve (**FIGURE 15**) shuts off the water supply, measure the water depth. The depth of the water should be approximately 3". It may be necessary to adjust the float valve to obtain the proper water level or to free the float valve from obstructions. To adjust the float valve, simply bend the rod upward to raise the water level or downward to decrease the water level.

Adjusting Water Flow Over Pads

Proper water flow over the evaporative cooling media is critical to extend the life and maintain the efficiency of the pads. Follow the instructions to adjust water flow.

CAUTION: Do not flood the media pads with extreme quantities of water for long periods as this will cause premature breakdown of the media. An even flow from top to bottom of the media with the least amount of water is all that is required to assure maximum efficiency and media life span. More water does not provide more evaporation or more cooling.

WARNING

Adjust ball valve only when the power is disconnected from the system. Failure to do so can cause electrical shock, personal injury or death.

Float and Pump Control System - Using the ball valve, located in the middle of the length of hose running from the pump to the distribution line inlet (**FIGURE 18**), adjust the valve handle to allow the flow to completely dampen the media pads from top to bottom.

Operate the unit watching the water flow. After 15 minutes with the blower in operation, the water should have completely dampened the pads but should not be flowing off the entering side of the media. If water is flowing off the entering side of the media, turn the system off, disconnect the power, and reduce the entering water flow.

AquaSaver Timed Metering Control System - NOTE: Water flow and pad wetting time should be adjusted at maximum airflow and wet bulb depression to assure complete wetting of the media at the extreme operating conditions.

In addition to adjusting water flow, the timing of the water on/off cycle can be adjusted. Adjustments are correct when **1)** the water rises from the holes in the sprinkler pipe (See **FIGURE 19A**) consistently along the entire pipe length, **2)** the media pads wet evenly after a few "ON" cycles (no dry spots or dry streaks), and **3)** a slight amount of excess water collects at the drain at the completion of the "ON" cycle.

6.0 Mechanical (cont'd)

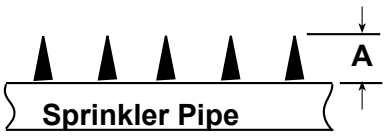
6.3 Unit Inlet Air (cont'd)

6.3.4 Evaporative Cooling Module, Option AS 3, 4, 5, 8 (cont'd)

Adjusting Water Flow Over Pads (cont'd)

1) AquaSaver Water Flow Adjustment - Using the ball valve illustrated in **FIGURE 18**, adjust the water flow depending on the pad height. See **FIGURE 19A**.

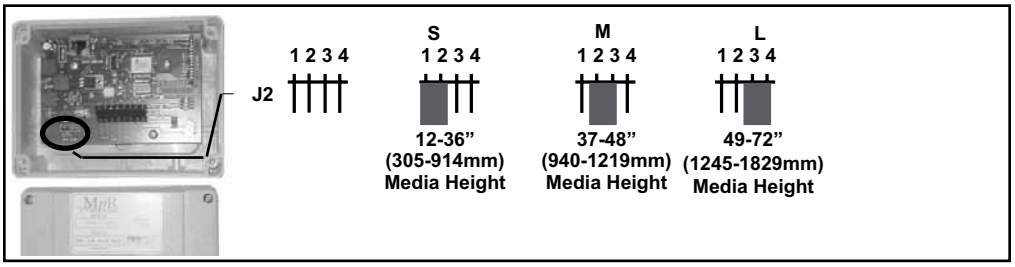
FIGURE 19A - Adjust Water Flow with the Ball Valve in FIGURE 18



Pad Height	A=Water Rise from PVC Sprinkler Pipe
24" (610mm)	1/8" to 1/2" (3 to 13mm)
48" (1219mm)	1/4" to 1/2" (6 to 13mm)

2) AquaSaver Timer Adjustment - At any given temperature, the media pads should completely wet from top to bottom during the ON cycle. The microprocessor has three preset timing settings based on media size. The appropriate setting is selected by changing the position of the suitcase jumper at J2 on the microprocessor. Remove the cover and check the setting (See **FIGURE 19B**).

FIGURE 19B - AquaSaver Microprocessor Control in the Junction Box



If the jumper is at the appropriate location for the media, replace the cover. If the jumper needs to be moved, move it to the appropriate setting. The setting will go into effect when the power is restored.

Check the "ON" timing; the media pads should be wet from top to bottom during the ON cycle.

If the preset timing is not suitable for the application, follow the instructions supplied with the microprocessor to change the calibration of the "On" and/or "Off" cycle.

NOTE: Prior to 2003 the AquaSaver timed cycle was controlled by a mechanical timer. Turn the adjustment screw clockwise to increase the ON time or counterclockwise to decrease the ON time. One complete turn will adjust the cycle by 12 to 14 seconds.

All Modules - Check the reservoir for any water leaks. The reservoir was water tested, but if any small leaks are present, drain the reservoir and apply a waterproof silicone sealer around corners and welds.

Evaporative Cooling Module Maintenance

Reference:
Troubleshooting Guide on page 20.

WARNING

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

Media - Over time, excessive amounts of mineral deposits may 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 cleaner, 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.

RPB Size	125	150, 175	200, 225	250, 300	350	400
12" Media Pads - dimensions and (Qty)	(2) 24x12		(3) 24x12		(4) 24x12	
	(1) 24x2-3/8	(1) 24x7-7/8	(1) 24x1-3/8	(1) 24x9-5/8	(1) 24x2-7/8	(1) 24x8-5/8
Cellulose Fiber Media Replacement P/N's & (Qty)	(2) 106021; (1) 106022	(2) 106021; (1) 106023	(3) 106021; (1) 106024	(3) 106021; (1) 106025	(4) 106021; (1) 106026	(4) 106021; (1) 106027
Glass Fiber Media Replacement P/N's & (Qty)	(2) 106029; (1) 106030	(2) 106029; (1) 106031	(3) 106029; (1) 106032	(3) 106029; (1) 106033	(4) 106029; (1) 106034	(4) 106029; (1) 106035

Select the correct replacement part numbers and order replacement media pads from your distributor. Follow the instructions that follow and remove and replace pads as shown in **FIGURES 20 and 21**.

FIGURE 20 - Removal and Replacement of Evaporative Cooling Module Media

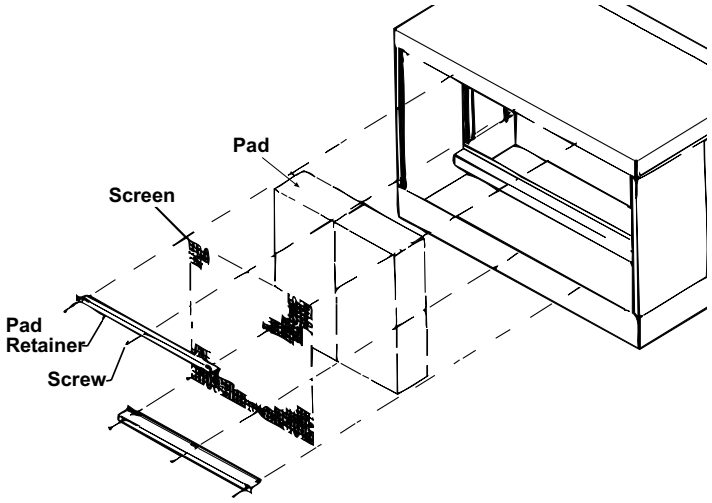
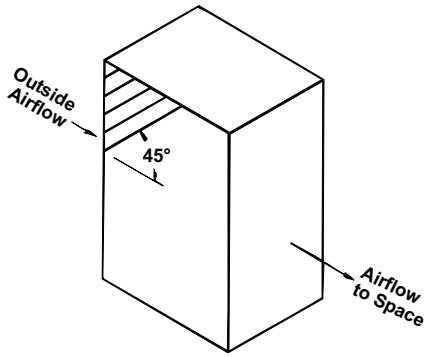


FIGURE 21 - Media must be installed with 45° angle sloping downward toward the incoming outside air.



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. If the media is not installed properly, water blowoff from the media pads will occur.

Instructions for Replacing Media Pads

1. Remove the three sheetmetal screws that hold the top pad retainer. Release the top pad retainer from the cooling module.
2. Remove the three sheetmetal screws that hold the bottom pad retainer. Release the bottom pad retainer from the cooling module.
3. Disengage the inlet screen from media pads and remove.
4. Slide all media pads horizontally away from the cooling module until clear of bottom reservoir pan. Dispose of properly.
5. Slide media pads over both support rails until back stop is encountered. Media **must** be placed as shown in **FIGURE 21.**
6. Center screen on the incoming air side of the media.
7. 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.
8. 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 and Distribution Line

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.
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 through the water inlet hose and thoroughly flush the distribution line.
4. Reassemble being careful to install media with air flow direction as shown in **FIGURE 21**.

Water Pump and Inlet Basket Screen (Does not apply to module with optional timed metering system.) **-** Annually, the pump and inlet basket screen 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.

1. Disconnect the power supply to the unit.
2. Remove the service panel and the junction box door. Disconnect the two-line voltage 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 (See **FIGURE 22**).
5. Dislodge the inlet basket screen from the pump and clean any buildup 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.

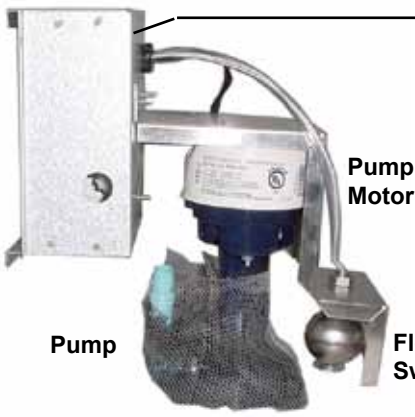
6.0 Mechanical (cont'd)

6.3 Unit Inlet Air (cont'd)

6.3.4 Evaporative Cooling Module, Option AS 3, 4, 5, 8 (cont'd)

FIGURE 22 - Remove Junction Box, Pump and Float Switch as an Assembly

(**NOTE:** Applies to evaporative cooling module with float and pump control system only. Depending on date of manufacture, actual assembly may not appear exactly as in the photo.)



Inside View of the Junction Box (Note: Only 208V unit will have a transformer in the junction box.)

To clean the pump, carefully remove the mesh screening (or basket) and the snap-on cover plate.

WARNING

Disconnect the power before servicing the cooling module. Failure to do so can cause electrical shock, personal injury or death.

Troubleshooting Evap Cooler

Problem	Probable Cause	Remedy
Pump does not run. Unit is calling for cooling (control switch is in cooling position) and reservoir is full.	1. Electrical connections	1. Verify all electrical connections. See Wiring Diagram.
	2. Electric float switch on pump	2. Check position of the actuators on the electric float switch.
	3. Dirty pump	3. Clean pump. See **FIGURE 22**.
	4. Defective pump	4. Replace pump.
Required water level (3") not maintained (pump and float control system)	1. Float valve	1. Adjust float valve. See Filling and Adjusting Water Level.
	2. Optional drain and fill valves	2. Check valve for proper operation. See **FIGURE 16**.
	3. Incorrect overflow pipe nipple - should be 3-1/2"	3. Replace pipe nipple.
	4. Drain leaking	4. Tighten drain plug.
Water running off of media pads	1. Excessive water flow	1. See adjust water flow instructions.
	2. Media needs cleaned or replaced.	2. Clean or replace media pads.
Water not distributing evenly	1. Distribution line clogged	1. Flush distribution line. See Evap Cooling Module Maintenance.
	2. Holes in distribution line turned	2. Check position of distribution line. Holes should be spraying upward. If not positioned with holes up, adjust position of line.
	3. Incorrect voltage to pump	3. Check voltage at pump terminal in cooling module junction box.
Media pads becoming clogged & discolored (scale/salt deposits) and/ or rapid deterioration of the float switch	1. Bleed off line clogged or inadequate bleed off (pump and float control system)	1. Clean bleed line (See **FIGURE 17**). A uniform build-up of minerals on the entering air face of the media indicates insufficient bleed off. Increase the rate until the mineral deposits dissipate.
	2. Excessive water flow	2. See Adjusting Water Flow.
Water blowoff from media pads	1. Media pads installed incorrectly	1. Install media pads correctly. See Cooling Module Maintenance.
	2. Requires moisture elimination pad (over 600 FPM)	2. Install moisture elimination pad. Consult factory.
	3. Water level not 3 inches (pump and float control)	3. See second problem listed above (Required water level)

6.4 Supply Air Discharge

System has either a horizontal or vertical discharge air opening with a duct flange.

If the discharge outlet is vertical, the system was ordered with either a factory-installed downturn plenum (AQ Option).

6.4.1. Duct Connections

Requirements & 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 inches or wider, and over 48 inches 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" 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 23A**.
- **Supply Air Duct/Furnace Horizontal 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 23A and 23B**.

FIGURE 23A - Connecting Supply Air Duct to the Furnace

(1) Flanges on the furnace (heat exchanger) turn out as shown. **(2)** Shape duct connection as shown - "U" on top and bottom; "L" on sides. **(3)** Slide "U" channels over furnace top and bottom flanges making connection. Form "U" channels to seal sides. **Drill and lock with sheetmetal screws.**

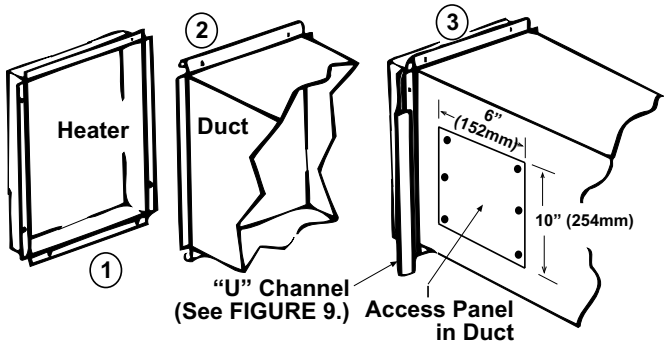
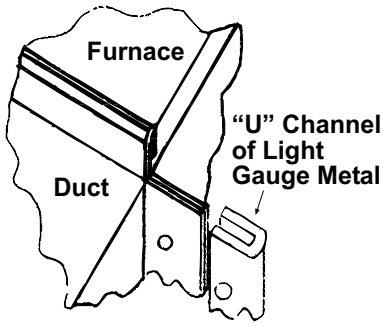


FIGURE 23B - Install "U" Channel on Sides of Duct Connection



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

- **Bottom Duct/Furnace Connections** - On outdoor models, insert ducts from below roof deck through roof opening into the heater. Form 1" (25mm) 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.
- **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.

6.4.2 Discharge Air Sensor for Makeup Air Application

Makeup air Option AG3 has a unit mounted ductstat with a capillary sensor that is factory-installed in the unit discharge (See Paragraph 8.1.3).

Makeup air Options AG15, AG8, AG9, AG39, and AG40 require field installation of the sensor in the discharge ductwork. Option AG15 uses the box and sensor holder in **FIGURE 23A**. Options AG8, AG9, and AG39 include a sensor and mixing tube like the one illustrated in **FIGURE 23B**. Option AG40 requires a field-supplied sensor.

Follow the instructions below to install the sensor in the ductwork.

For control information, see Paragraph 8.1.

6.0 Mechanical (cont'd)

6.4 Supply Air Discharge (cont'd)

6.4.2 Discharge Air Sensor (cont'd)

FIGURE 24A - Discharge Air Sensor Holder, P/N 115850, used in Makeup Air Option AG15

Secure sensor in clip. Position holder so that it shields sensor from direct airflow.

FIGURE 24B - A Discharge Air Sensor and Mixing Tube are used in Electronic Modulation Options AG8, AG9, and AG39

Instructions for Installing Discharge Air Sensor <u>in</u> the <u>Ductwork</u>

1. Depending on the option, the sensor will be as shown in **FIGURE 24A,** in **FIGURE 24B,** or field-supplied for Option AG40. See Paragraph 3.2 for a list of shipped-separate components by option code.
2. Determine a location in the ductwork to install the sensor.
   Select a location a sufficient distance from the outlet to provide a good mixture of discharge air temperature. According to the latest edition of AMCA Standard 201, in straight ducts, the air is typically well mixed a minimum of five equivalent duct diameters from the discharge of the unit with equivalent duct diameter defined as equal to the square root of 4AB/3.14. "A" and "B" are the duct cross-sectional dimensions.

   <u>Example</u>: **Supply ductwork cross-sectional dimension is 24" x 12" (610mm x 305mm).**

   $5 \times \sqrt{\frac{4 \times 12 \times 24}{3.14}} = 96"$ $\quad 5 \times \sqrt{\frac{4 \times 305 \times 610}{3.14}} = 2435mm$

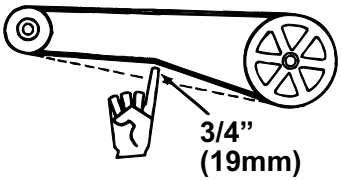
   Solution: Locate the sensor a minimum of 96" (2435mm) from the outlet of the unit.

   NOTE: If the length of the discharge duct is less than 8 ft (2.4M), a mixing vane is recommended for mixing the discharge air.

   Do not mount the sensor in the ductwork after a split in the supply as that will cause loss of control in the duct that does not house the sensor.
3. The position of the sensor holder or mixing tube is important. The holder in **FIGURE 24A** will extend 9-3/16" (233mm) into the ductwork. The mixing tube in **FIGURE 24B** is 12" (305mm) long.
   In horizontal ductwork, locate the sensor assembly in the top, middle of the duct with the sensor probe extending vertically down into the center of the airstream.
   In vertical ductwork, locate the sensor assembly in the middle of the side of the duct that corresponds with the top middle of the discharge outlet.
   Turn the holder so that the element will be shielded from direct airflow and will sense the air temperature as it flows through the holes in the holder.
   At the selected location in the ductwork, mark the diamond-shaped hole [approximately 1" x 1" (25mm x 25mm)] required for the sensor holder or the round hole needed for the mixing tube. Cut the hole no larger than required.
4. **<u>Option AG15</u> -** Push the element into the clip in the holder. Determine where the sensor wire should enter the box and remove the knockout. Slide the holder into the ductwork. Using four field-supplied No. 6 sheetmetal screws, attach the box portion of the holder to the ductwork. Attach a field-supplied cable connector to the box, connect the sensor wire, and attach the box cover.
   <u>Options AG8, AG9, and AG39</u> - Slide the mixing tube into the ductwork and attach the sensor. Connect the wires as shown on the wiring diagram.
   <u>Option AG40</u> - Follow the instructions provided with the field-supplied sensor. Refer to the wiring diagram with the unit and the field-supplied sensor to connect the wires.

6.5 Blowers, Belts, and Drives

FIGURE 25 - Check Belt Tension



6.5.1 Belts and Belt Tension

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" (19mm). (See **FIGURE 25**.) After correct tension is achieved, re-tighten the locknut on the adjustment screw. Be sure that the belt is aligned in the pulleys.

6.5.2 Adjusting Blower Speed

The blower speed may be adjusted to achieve the desired outlet temperature, as long as the adjustment is within the temperature rise and the static pressure limits shown on the furnace rating plate. Motors are factory set between maximum and minimum blower speeds.

If the duct resistance is low, the blower may deliver too high an air volume. If the resistance is very low, the blower may deliver excess air to overload the motor, causing the

overload protector to cycle the motor. Reducing the blower speed will correct these conditions. If ductwork is added to an installation, it may be necessary to increase the blower speed. Decreasing blower speed will increase outlet temperature; increasing blower speed will decrease outlet temperature.

At final adjustment, amperes should not exceed motor nameplate amp rating. The installation must be adjusted to obtain a temperature rise within the range specified on the furnace rating plate.

The belt drive on these units is equipped with an adjustable pulley which permits adjustment of the blower speed. Follow these instructions to adjust the blower speed.

1. Turn off the gas and the electric power.
2. Loosen belt tension and remove the belt.
3. Loosen the setscrew 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 setscrew 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" (19mm). See **FIGURE 25**. 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.

When service is complete, check for proper operation.

6.5.3 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.

6.5.4 Airflow Proving Switch (Makeup Air only) - Outdoor Models with Option BW1

The optional airflow proving switch ensures that the circulating air blower is functionally providing an adequate amount of airflow 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 29**, Item 40).
Contacts are set to close at .10" w.c. (+.05" or -.02" w.c.).

6.5.5 Optional Variable Frequency Drive

When an optional variable frequency drive is ordered, the motor operates on two speeds as determined by the electrical frequency. High speed is used for cooling and low speed for heating. 60 hertz is the maximum high speed. Maximum speed for low speed heating is the frequency that will provide the maximum temperature rise of the heater.
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=120xf/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 design. Run the same motor at 45Hz (120 x 45/4 = 1350). 1350 RPM less 2% slip equals about 1300 RPM.

7.0 Electrical Supply and Connections

7.1 General

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

7.2 Supply Voltage and Supply Wiring

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 leads in the junction box. All external wiring must be within approved conduit and have a minimum temperature rise of 60°C. Conduit from the disconnect switch must be run so as not to interfere with the service panels of the furnace.

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.

If the heater has field-installed options that require electrical connections, consult the instruction sheet and wiring diagram supplied in the option package. Specific wiring diagrams that include standard and factory-installed options are included with the heater. **Typical wiring diagrams are on pages 25-26.**

WARNING

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

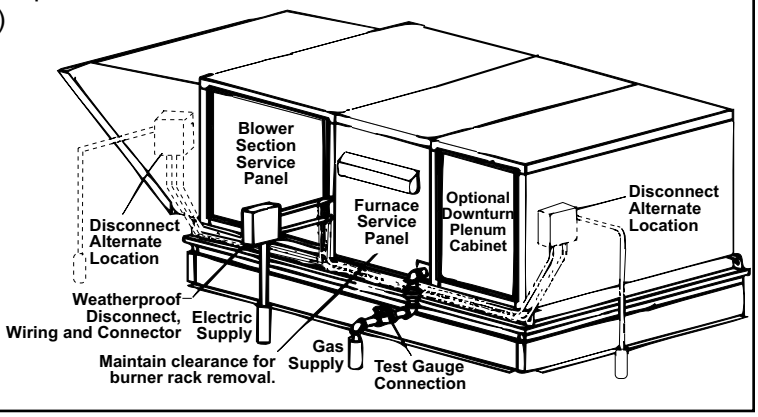
Disconnect Switch - A disconnect switch is a required part of this installation. Switches are available, as options or parts, or may be supplied locally. When ordered as an optional component, the disconnect switch is shipped separately.

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 26** for suggested locations.

FIGURE 26 - Disconnect Switch Locations (Keep electric and gas supply components clear of service panels.)

Field-Supplied Wiring Size from Disconnect to Electrical Box for Connection to Motor Contactor or Starter			
Voltage/ Phase	Motor HP	Wire Gauge	BX Cable
208-230/1	1 - 1.5	14	3/8"
208-230/3	1/4 - 3	14	3/8"
	5	12	3/8"
460/3	1/4 - 5	14	3/8"
575/3	1/2 - 5	14	3/8"

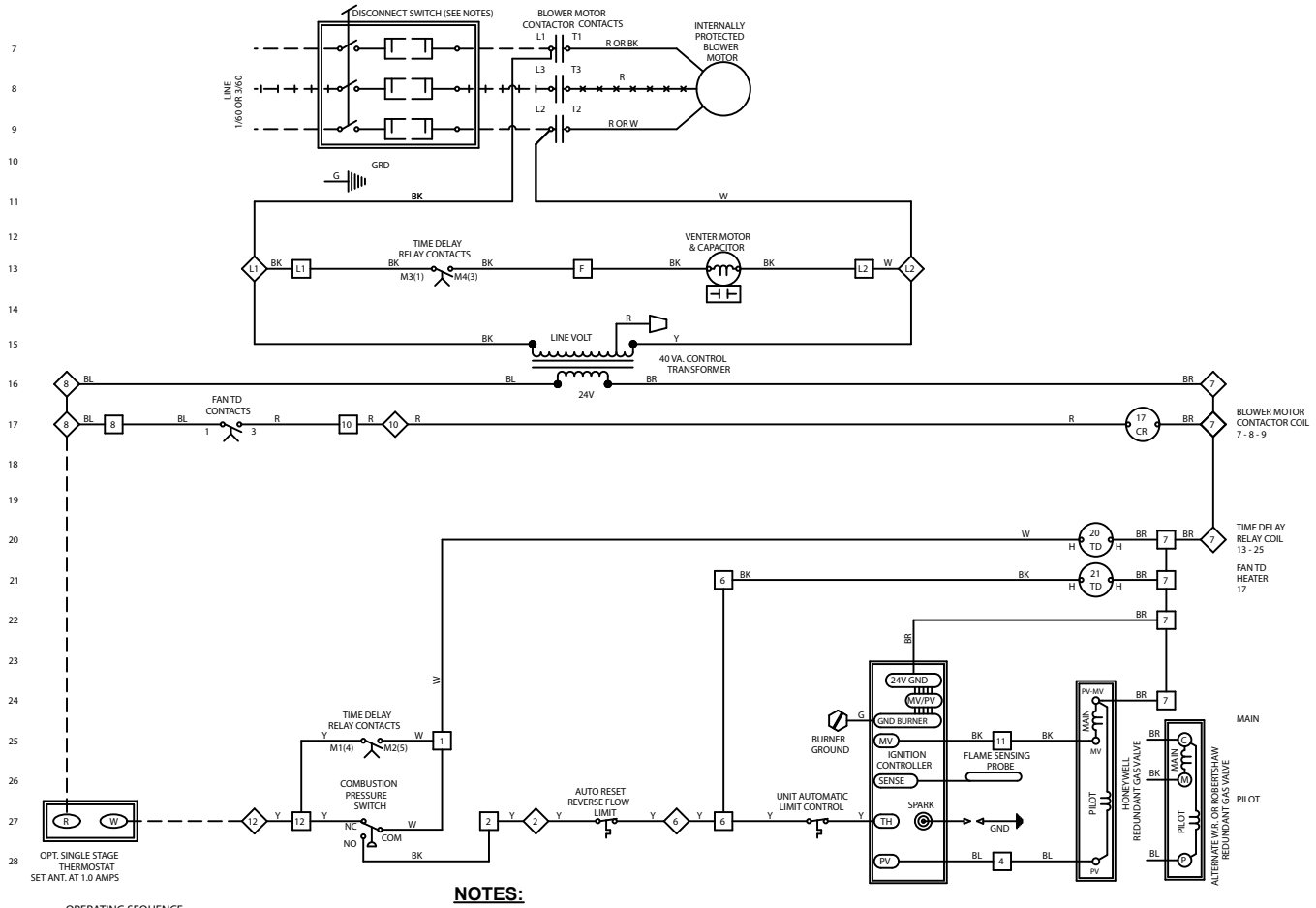


Convenience Outlet Option

When a convenience outlet (Option BC) is included, a separate power supply must be provided to the receptacle. This circuit MUST BE on a ground fault breaker to meet requirements. All wiring to the convenience outlet must meet local, state and national codes and regulations with the National Electrical Code ANSI/NFPA No. 70 (latest edition) or in Canada, the Canadian Electric Code Part 1 CSA C.22.1.

7.3 Typical Wiring Diagrams (Refer to the diagram supplied with the furnace for alternate controls or optional equipment details.)

FIGURE 27 - Typical Wiring Diagram Model RPB, Outdoor, Power-Vented Furnace with Standard Single-Stage Gas Valve



OPERATING SEQUENCE

- SET THERMOSTAT AT LOWEST SETTING.
- TURN ON POWER AND MANUAL GAS VALVE TO UNIT.
- SET THERMOSTAT AT DESIRED SETTING.
  - FIRING RATE IS CONTROLLED BY THE THERMOSTAT.
  - BLOWER MOTOR OPERATES FROM FAN TIME DELAY.
- SET THERMOSTAT AT LOWEST TEMPERATURE FOR SHUTDOWN.
  - BLOWER MOTOR REMAINS ON AS DETERMINED BY FAN TIME DELAY.

FIRING SEQUENCE:

- ON A CALL FOR HEAT BY THE THERMOSTAT.
  - THE VENTER MOTOR IS ENERGIZED AFTER A 15 SECOND (APPROX.) TIME DELAY.
- VENTER FLOW SWITCH SWITCHES FROM N.C. TO N.O. CONTACTS ENERGIZING THE PILOT GAS VALVE AND SPARK GAP 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 UNIT FIRES AT FULL RATE.
- IF THE FLAME IS EXTINGUISHED DURING MAIN BURNER OPERATION, THE SAFETY SWITCH CLOSES THE MAIN VALVE AND RECYCLES THE SPARK GAP.

ON UNITS EQUIPPED WITH LOCKOUT CONTROL, IF PILOT IS NOT ESTABLISHED WITHIN 120 SEC. THE UNIT LOCKS OUT FOR ONE HOUR, UNLESS IT IS RESET BY INTERRUPTING POWER TO THE CONTROL CIRCUIT. (SEE LIGHTING INSTRUCTIONS)

NOTES:

- THE FOLLOWING CONTROLS ARE SUPPLIED BY REZNOR FOR FIELD INSTALLATION: NONE
- THE FOLLOWING CONTROLS ARE SUPPLIED AS OPTIONAL EQUIPMENT: THERMOSTAT
- DOTTED WIRING AND THE FOLLOWING CONTROLS ARE SUPPLIED AND INSTALLED BY OTHERS: NONE
- 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 DEGREES C., EXCEPT FOR SENSOR LEAD WIRE WHICH MUST BE 150 DEGREES C.
- LINE AND BLOWER MOTOR BRANCH CIRCUIT WIRE SIZE SHOULD BE OF A SIZE TO PREVENT VOLTAGE DROP BEYOND FIVE PERCENT OF SUPPLY LINE VOLTAGE.
- USE #14 GA. WIRE FOR LINE AND MOTOR WIRING ON THREE PHASE UNIT.
- USE #12 GA. WIRE FOR LINE AND MOTOR WIRING ON SINGLE PHASE UNIT.
- USE #18 GA. WIRE FOR 24 VOLT CONTROL WIRING ON UNIT.
- ON 208/230V. UNITS THE CONTROL TRANSFORMER HAS A DUAL VOLTAGE PRIMARY. FOR 230V. UNITS USE BLACK AND YELLOW LEADS (CAP RED). FOR 208V. UNITS USE BLACK AND RED LEADS (CAP YELLOW). ON 115/460V. UNITS THE CONTROL TRANSFORMER IS A SINGLE VOLTAGE PRIMARY. FOR 115/460V. UNITS USE BLACK AND YELLOW LEADS.
- WHEN PROVIDING OR REPLACING FUSES IN THE FUSIBLE DISCONNECT SWITCH USE DUAL ELEMENTS TIME DELAY FUSES AND SIZE ACCORDING TO 1.25 TIMES THE MAXIMUM TOTAL INPUT AMPS.
- DISCONNECT SWITCH IS FIELD FURNISHED OR AVAILABLE FROM FACTORY AS AN OPTION.

WIRING CODE
BLACK - BK
BROWN - BR
RED - R
ORANGE - O
YELLOW - Y
GREEN - G
BLUE - BL
PURPLE - PR
WHITE - W

FIELD WIRING

TOTAL WIRE LENGTH	MINIMUM RECOMMENDED WIRE SIZE
150 FEET	#18 GA.
250 FEET	#16 GA.
350 FEET	#14 GA.

2, 6, 7, 8, 10, 12, L1 & L2 — TERMINAL BLOCK -- BLOWER COMPARTMENT

1, 2, 4, 6, 7, 8, 10, 11, 12, L1, L2 & F — TERMINAL BLOCK -- HEATER COMPARTMENT

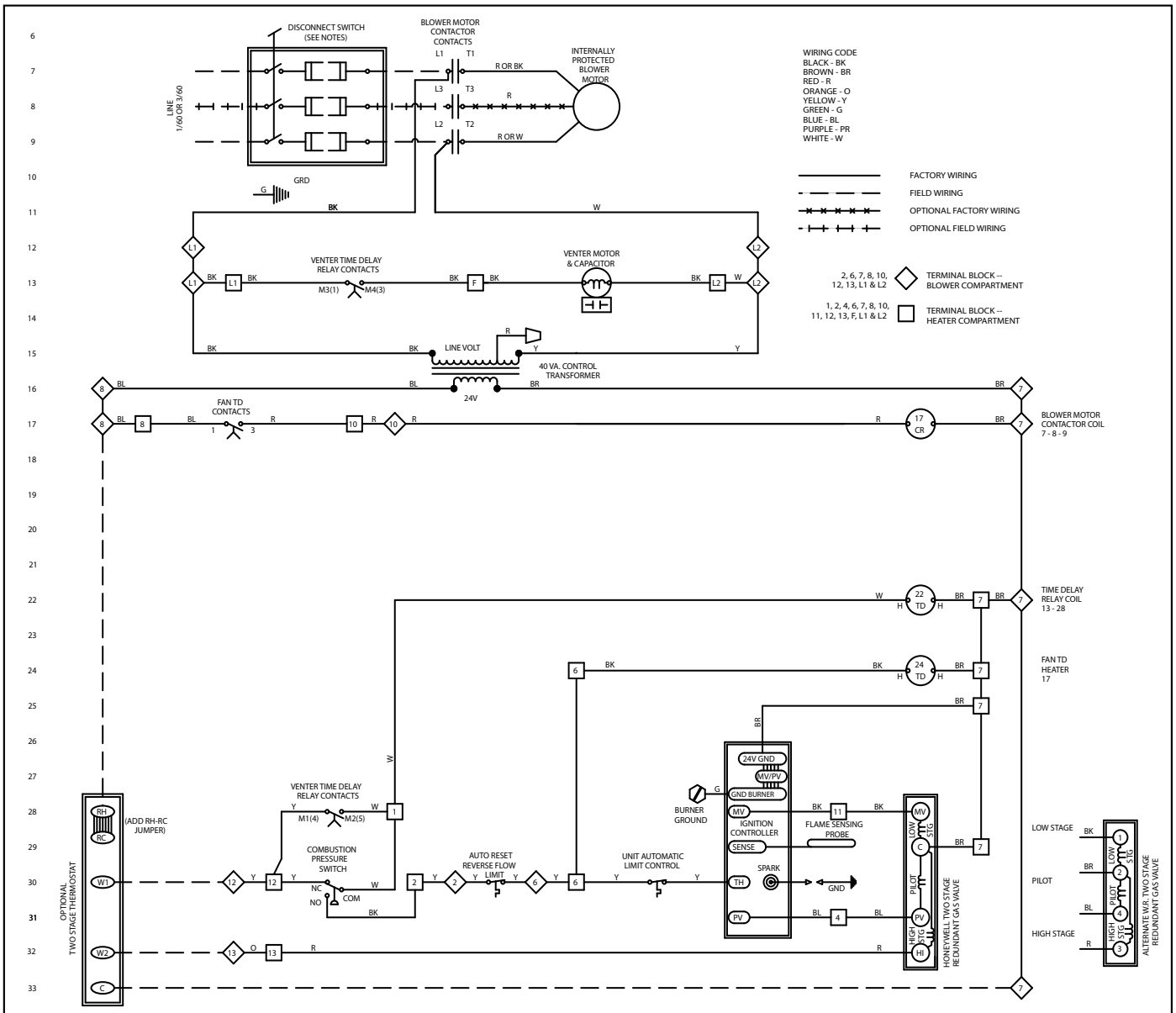
FACTORY WIRING
FIELD WIRING
OPTIONAL FACTORY WIRING
OPTIONAL FIELD WIRING

RPB SERIES AH2 OR AH3-AG1-CL1 DWG. #B-274964 REV. #2 IJB

7.0 Electrical Supply and Connections (cont'd)

7.3 Typical Wiring Diagrams (cont'd) (Refer to the diagram supplied with the furnace for alternate controls or optional equipment details.)

FIGURE 28 - Typical Wiring Diagram for Model RPB, Outdoor, Power-Vented Furnace with Two-Stage Gas Valve



OPERATING SEQUENCE

- SET THERMOSTAT SYSTEM SWITCH AT "OFF" POSITION, FAN SWITCH AT "AUTO" POSITION.
- TURN ON POWER AND MANUAL GAS VALVE TO UNIT.
- SET THERMOSTAT SYSTEM SWITCH AT "AUTO" POSITION, FAN SWITCH AT "AUTO" POSITION.
  - FIRING RATE IS CONTROLLED BY THE THERMOSTAT.
  - BLOWER MOTOR OPERATES FROM FAN TIME DELAY.
- SET THERMOSTAT SYSTEM SWITCH AT "OFF" POSITION, FAN SWITCH AT "AUTO" POSITION FOR SHUTDOWN.
  - BLOWER MOTOR REMAINS ON AS DETERMINED BY FAN TIME DELAY.

FIRING SEQUENCE:

- ON A CALL FOR HEAT BY THE LOW STAGE OF THERMOSTAT.
  - THE VENTER MOTOR IS ENERGIZED AFTER A 15 SECOND (APPROX.) TIME DELAY.
- VENTER FLOW SWITCH SWITCHES FROM N.C. TO N.O. CONTACTS ENERGIZING THE PILOT GAS VALVE AND SPARK GAP 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 UNIT FIRES AT LOW RATE.
- ON A CALL FOR HEAT BY THE HIGH STAGE OF THE THERMOSTAT, THE UNIT FIRES AT FULL RATE.
- IF THE FLAME IS EXTINGUISHED DURING MAIN BURNER OPERATION, THE SAFETY SWITCH CLOSES THE MAIN VALVE AND RECYCLES THE SPARK GAP.

ON UNITS EQUIPPED WITH LOCKOUT CONTROL, IF PILOT IS NOT ESTABLISHED WITHIN 120 SEC. THE UNIT LOCKS OUT FOR ONE HOUR, UNLESS IT IS RESET BY INTERRUPTING POWER TO THE CONTROL CIRCUIT. (SEE LIGHTING INSTRUCTIONS)

NOTE

- THE FOLLOWING CONTROLS ARE SUPPLIED BY REZNOR FOR FIELD INSTALLATION: NONE
- THE FOLLOWING CONTROLS ARE SUPPLIED AS OPTIONAL EQUIPMENT: THERMOSTAT
- DOTTED WIRING AND THE FOLLOWING CONTROLS ARE SUPPLIED AND INSTALLED BY OTHERS: NONE
- 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 DEGREES C., EXCEPT FOR ENERGY CUTOFF OR SENSOR LEAD WIRE WHICH MUST BE 150 DEGREES C.
- LINE AND BLOWER MOTOR BRANCH CIRCUIT WIRE SIZE SHOULD BE OF A SIZE TO PREVENT VOLTAGE DROP BEYOND FIVE PERCENT OF SUPPLY LINE VOLTAGE.
- USE #14 GA. WIRE FOR LINE AND MOTOR WIRING ON THREE PHASE UNIT.
- USE #12 GA. WIRE FOR LINE AND MOTOR WIRING ON SINGLE PHASE UNIT.
- USE #18 GA. WIRE FOR 24 VOLT CONTROL WIRING ON UNIT.
- ON 208/230V. UNITS THE CONTROL TRANSFORMER HAS A DUAL VOLTAGE PRIMARY. FOR 230V. UNITS USE BLACK AND YELLOW LEADS (CAP RED). FOR 208V. UNITS USE BLACK AND RED LEADS (CAP YELLOW). ON 115/460V. UNITS THE CONTROL TRANSFORMER IS A SINGLE VOLTAGE PRIMARY. FOR 115/460V. UNITS USE BLACK AND YELLOW LEADS.
- WHEN PROVIDING OR REPLACING FUSES IN THE FUSIBLE DISCONNECT SWITCH USE DUAL ELEMENTS TIME DELAY FUSES AND SIZE ACCORDING TO 1.25 TIMES THE MAXIMUM TOTAL INPUT AMPS.
- DISCONNECT SWITCH IS FIELD FURNISHED OR AVAILABLE FROM FACTORY AS AN OPTION.

FIELD WIRING

TOTAL WIRE LENGTH	MINIMUM RECOMMENDED WIRE SIZE
150 FEET	#18 GA.
250 FEET	#16 GA.
350 FEET	#14 GA.

RPB SERIES AH2 OR AH3-AG2-CL22 DWG. #B-275073 REV. #1 IJB

7.4 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.

Thermostats should be located five feet (1.5M) 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 instruction packet with the thermostat.

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.

24 Volt Controls - Maximum Amps

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

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

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 29,** page 28**,** for location of standard and optional controls.

Optional shipped-separate heating and makeup air controls could include a single or two-stage thermostat, system switches, selectrastat, discharge temperature low limit, 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.

A selection of remote consoles is available with certain appropriate combinations of controls factory mounted. All consoles include indicator lights for the blower and burner, an off/on system switch, and terminal block wiring.

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

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.

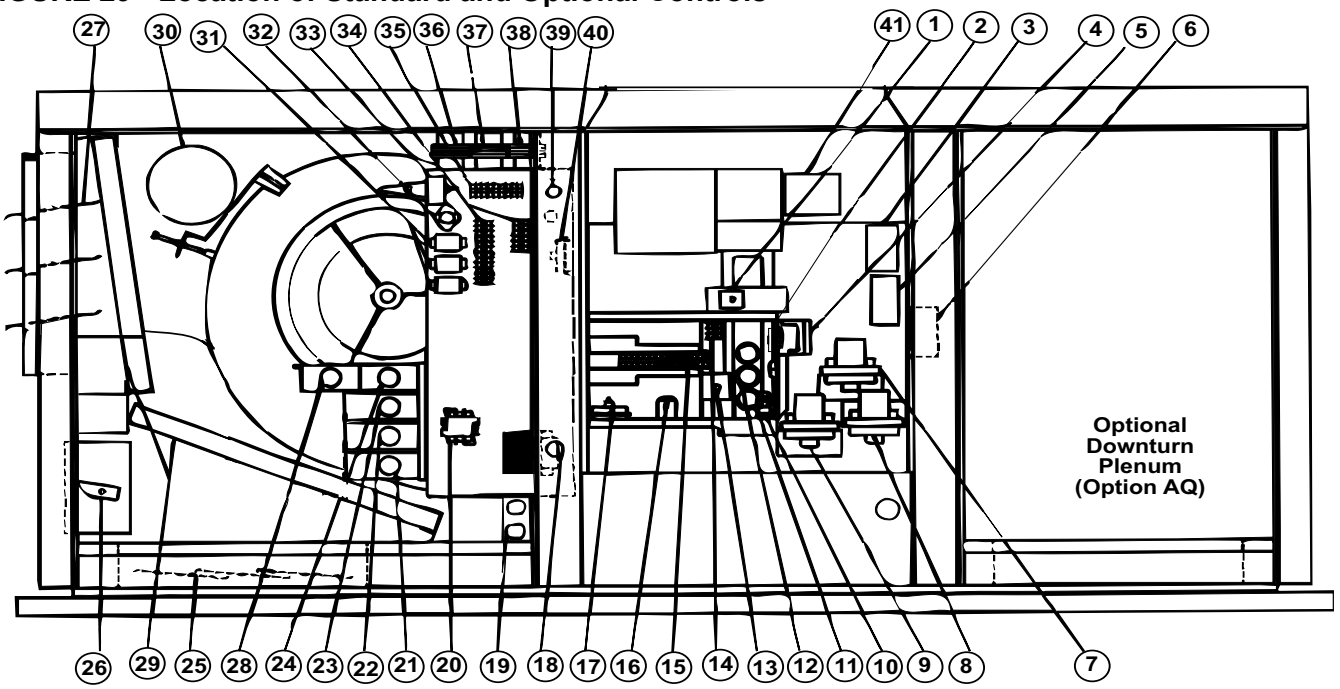
Remote Console

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.

7.0 Electrical Supply and Connections (cont'd)

7.5 Electrical Operating Components

FIGURE 29 - Location of Standard and Optional Controls



1. **Opt** Auto Reset Discharge Temperature Low Limit
2. Combustion Air Pressure Switch
3. **Opt** Discharge Air Firestat
4. Ignition Controller
5. **Optional** Maxitrol Discharge Air Sensor (Opt AG8 or 9)
6. **Optional Two**-Stage Controller (Opt AG3) or Maxitrol Amplifier (Opt AG7, 8, or 9)
7. **Optional** Main Low Gas Pressure Switch
8. **Optional** Pilot High Gas Pressure Switch
9. **Optional** Main High Gas Pressure Switch
10. Time Delay Relay
11. Limit Control
12. Fan Control
13. **Optional** Discharge Temperature Low Limit Time Delay Relay
14. Line Voltage Terminal Block
15. Low Voltage Terminal Block
16. Discharge Temperature Low Limit Relay
17. **Optional** Dirty Filter Pressure Switch
18. Line Voltage Connection (field)
19. **Optional** Convenience Outlet
20. Blower Motor Contactor or Starter
21. **Optional** High Ambient Limit Control
22. **Optional** Outside Air or Return Air Controller
23. **Optional** Mixed Air Controller
24. **Optional** Potentiometer
25. **Optional** Return Air Dampers
26. **Optional** Two Position or Modulating Damper Motor
27. **Optional** Outside Air Damper
28. **Optional** Potentiometer
29. **Optional** Filters
30. Blower Motor
31. **Optional** Control Relays (as required, 8 maximum)
32. Auto Reset Reverse Flow Limit
33. **Optional** Return Air Firestat
34. Low Voltage Terminal Strip
35. Line Voltage Terminal Strip
36. Control Transformer
37. Control Transformer (as required)
38. **Optional** Damper Motor Transformer
39. Low Voltage Connection (field)
40. **Optional** Air Proving switch
41. Venter Assembly

7.5.1 Fan Control

Service NOTE: To replace the fan control on units manufactured prior to 11/04, a replacement kit is required. Order **P/N 209184**.

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 29**, Item 12.

7.5.2 Reverse Flow Limit Control

These outdoor furnaces are 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 29**, 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 automatic electric gas valve and preventing burner operation.

7.5.3 Limit Control

Heaters are equipped with a non-adjustable high 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. For location, see **FIGURE 29**, Item 11.

7.5.4 Combustion Air Proving Switch

The combustion air proving switch ensures that proper combustion airflow 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 location, see **FIGURE 29**, Item 2.)

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.

Startup Cold	Equilibrium	Factory Setpoint
-1.05" w.c.	**-.73" w.c.**	**-.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.

7.5.5 Optional High Ambient Limit

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 29**, Item 21.

7.5.6 Blower Motors

Use an amp meter to check motor amps. The following chart lists full load amps for various HP's and voltages. Amps may be adjusted downward by reducing blower RPM or increasing duct 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	1/4	1/3	1/2	3/4	1	1-1/2	2	3	5
208V 1PH	2.1	3.2	5.1	6.3	7.5	8.3	11.3	14.0	28.0
230V 1PH	2.3	2.8	4.4	5.5	6.5	7.5	10.2	12.4	26.0
208V 3PH	1.1	1.4	2.3	2.9	3.7	5.6	7.0	9.0	13.4
230V 3PH	1.4	1.6	2.0	2.6	3.2	5.0	6.6	8.6	13.2
460V 3PH	.75	.80	1.0	1.3	1.6	2.7	3.5	4.3	6.6
575V 3PH	N/A	N/A	N/A	N/A	1.1	1.6	2.1	3.6	5.4

8.0 Controls

8.1 Gas Controls

8.1.1 Gas Valve

All furnaces are equipped with a 24-volt combination gas 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.

8.1.2 Optional 2-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. See instructions packed with the unit for specific gas valve specifications, wiring, and operating instructions.

8.0 Controls (cont'd)

8.1 Gas Controls (cont'd)

8.1.3. Optional 2-Stage Operation - Makeup Air Application

Optional Ductstat with Capillary Tubing (Option AG3) - The ductstat illustrated in **FIGURE 30A** is used with Option AG3. The control is set to 70°F and has an adjustable range with a fixed differential of 3°F. Due to different CFM settings and outside air temperatures, the average downstream outlet temperature may not match the ductstat setting exactly. After the installation is complete, adjust the setpoint of the ductstat to achieve the desired average outlet air temperature.

Optional Ductstat with Electronic Remote Setpoint Module (Option AG15) - The sensing probe is field-wired to a remote temperature selector with a temperature operating range to 130°F. The sensing probe and remote modules (**FIGURE 31**) are shipped separately for field installation. Follow the instructions in Paragraph 6.4.2 for installing the sensor. Refer to the wiring diagram with the unit and the manufacturer's instructions for wiring and installing the remote modules. Follow the wiring diagram with the unit and the manufacturer's instructions for wiring and installation.

See **FIGURE 31**. There will be one module for selecting temperature and one-stage adder module.

FIGURE 30A - Ductstat Control in Option AG3

Adjustable range 0-100°F with a fixed differential of 3°F.

Factory set at 70°F

FIGURE 30B - Ductstat Bulb in Option AG3 (factory installed)

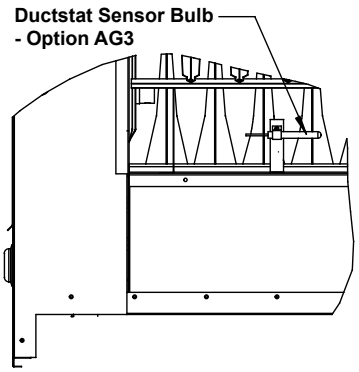


FIGURE 31 - Remote Temperature Selector (A) and Stage-Adder Module (B) In Gas Control Options AG15

CAUTION: Be sure heat/cool selector switch is set at "Heat" position.

8.1.4 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.

Installation NOTE: Sizes 350 and 400 with electronic modulation require a minimum of 6" w.c. natural gas supply pressure.

Electronic Modulation between 50% and 100% Firing Rate (Options AG7, AG8, 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.

FIGURE 32A - Amplifier in Options AG7, AG8, and AG9

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 field-installed duct sensor (See Paragraph 6.4.2.) 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.

Computer Controlled Electronic Modulation between 50% and 100% Firing Rate

FIGURE 32B - Signal Conditioner used in Options AG21 & AG40

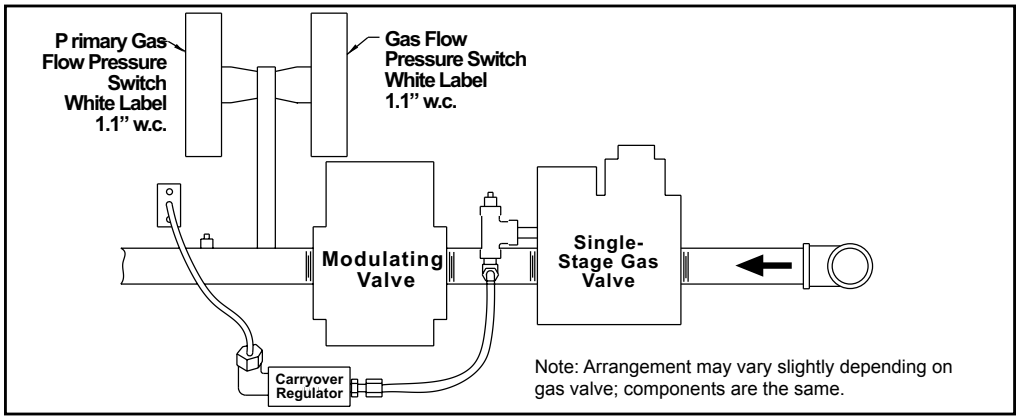
With this option the furnace is equipped with a Maxitrol signal conditioner which operates much the same way as the amplifier above to control the regulator valve. The conditioner accepts an input signal of either 4-20 milliamps or 0-10 volts from a customer-supplied control device such as a computer. 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 field-supplied computer software.

Electronic Modulation between 20-28% and 100% Firing Rate, Option AG39

Depending on the size, furnaces equipped with electronic modulation Option AG39 have a 20-28% turndown ratio. The furnace 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. (**natural gas only; not available on Size 350)**

Model Size	125	150	175	200	225	250	300	400
Maximum Turndown (%)	20	27	23	26	23	28	23	25
Inlet Range (MBH)	25-125	40.3-150	40.3-175	51.8-200	51.8-225	69-250	36-300	100-400
Inlet Pressure to Modulating Valve ("w.c.)	3.9	3.7	3.7	3.9	3.9	4.0	4.0	4.4
Gas Supply Pressure Required ("w.c.)	5	5	5	5	5	5	5	6

FIGURE 33 - Option AG39 Manifold Arrangement



The gas train 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.

Description of Operation of Option AG39

The gas supply (see pressure requirements in the table above) 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,

8.1.5 Optional Electronic Modulation (cont'd)

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 with AG39 and AG40

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:

Sizes with AG39&40	Startup Cold	Equilibrium at Full Rate	Factory Setting
125-225	-1.3" w.c.±0.2	-1.05" w.c.±0.1	-0.58" w.c.±0.05
250-400	-1.2" w.c.±0.2	-0.95" w.c.±0.1	-0.58" w.c.±0.05

Sensor Location

The duct temperature sensor and mixing tube are shipped loose for field installation in the dicharge duct. See Paragraph 6.4.2 for instructions on locating the sensor in the ductwork.

The sensor for Opiton AG40 is field suppleid. Follow the guidelines in Paragraph 6.4.2 and the manufacturer's instrucitons.

Computer Controlled Electronic Modulation between 20-28%, Option AG40

natural gas Model RPB only; not available on Size 350

With this option the furnace is equipped with a Maxitrol signal conditioner (See **FIGURE 32A**) 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. The heater functions and is equipped in the same way as for Option AG39 except that with computer control the temperatures are selected through the field-supplied software and there is no temperature selector or duct sensor.

Wiring and Service - AG39 and AG40

For wiring, consult the wiring diagram attached to the furnace. All wires in the electrical box connecting the modulation controls must have a temperature rating of 150°C.

This is a unique system which includes custom-built components and custom settings. If service is required, follow the general troubleshooting guide on page 38 and the special troubleshooting guide below.

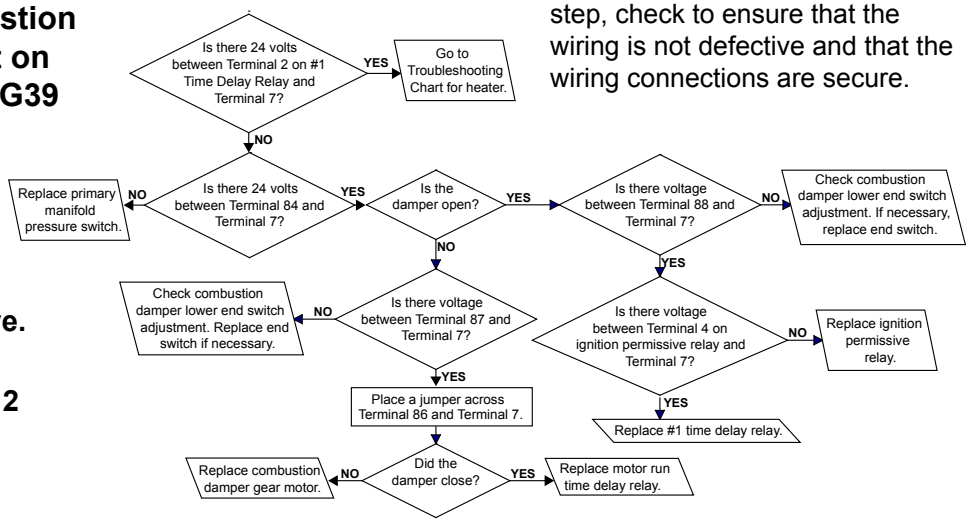
Troubleshooting Guides for Checking Bypass Combustion Air Damper Safety Circuit on Model RPB with Option AG39 or Option AG40

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

<u>Symptom - Part 1</u>:

Main burners are inoperative.

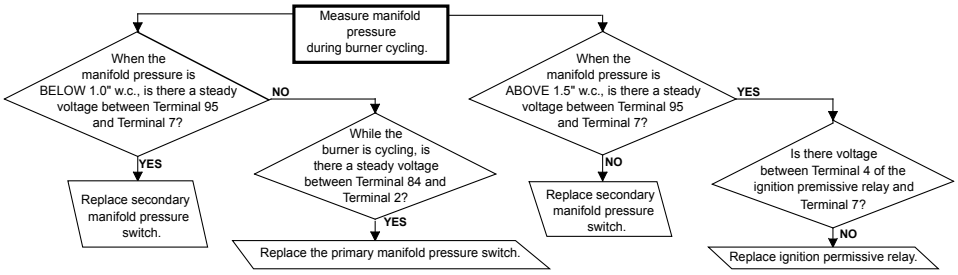
Assumes that 24 volts is available between Terminal 2 and Terminal 7.



<u>Symptom - Part 2</u>:

Steady call for heat - burner cycles.

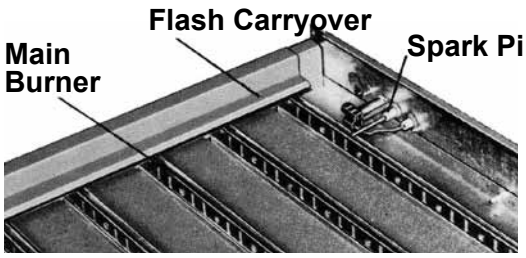
Assumes constant voltage between Terminals 11 and 7 and Terminals 2 and 7.



8.2 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 feature. Pilot gas pressure should be the same as supply line pressure. (See Paragraph 6.1.) If required, adjust the pilot flame length to approximately 1-1/4" with pilot adjustment screw in control valve body.

FIGURE 34 - Burner Rack with Spark Pilot



Intermittent Spark Ignition Safety Pilot Systems - There are two types of intermittent spark pilots -- one type shuts off the pilot gas flow between the cycles and the other 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 has a 1-hour retry or requires manual reset by interruption of the thermostat circuit. Propane units installed in Canada require the spark ignition system with the lockout device. Refer to the wiring diagram supplied with the heater for pilot system identification and wiring. Spark pilot without lockout is designated as Option AH2; with lockout is Option AH3.

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

FIGURE 35 - Ignition Controller

Service NOTE: If replacing an earlier model of ignition controller, order replacement kit **P/N 257472** for a unit with recycling gas control Option AH2 or **P/N 257473** for Option AH3 gas control with lockout. (Option codes are listed on the unit wiring diagram.)

Ignition Controller with Lockout, UTEC 1003-514, P/N 257010, for Option AH3 Gas Control

Recycling Ignition Controller, UTEC 1003-638A, P/N 257009, for Option AH2 Gas Control

Ignition Controller - As part of the intermittent safety pilot systems, 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 as measured by a microampmeter.** With pilot flame proven, the ignition controller energizes the main gas valve.

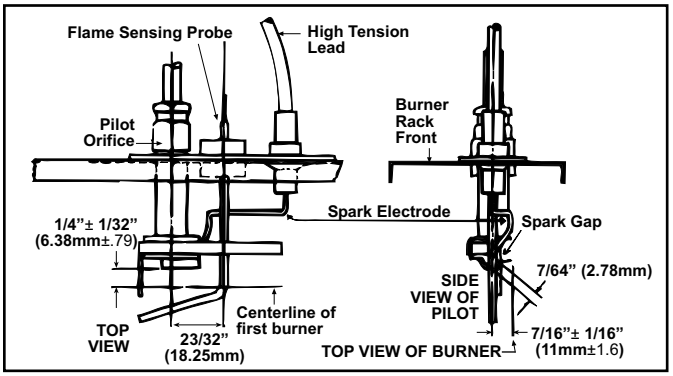
If no spark occurs, check the following:

a) Voltage between Terminals TH and 7 on the ignition controller should be at least 20 volts and no higher than 32 volts. Refer to Troubleshooting (Paragraph 10.3) 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".

FIGURE 36 - Maintain spark gap of 7/64"



8.0 Controls (cont'd)

8.2 Pilot and Ignition Systems (cont'd)

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.

8.3 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 burner racks (except when equipped with electronic modulation Option AG39 or AG40; see Paragraph 8.1.4) are equipped with two flash carryovers. 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.

8.4 Burner Air Adjustment

Burner air shutters are not normally required on natural gas furnaces. Air shutters are required on propane gas units and may require adjustment.

Before making any adjustments to the air shutters, allow the heater to operate for about fifteen minutes with the air shutters open. The slotted screw on the end 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 liquefied petroleum gases. 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.

9.0 Check Installation and Startup

9.1 Check the installation prior to startup:

- ☐ 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.
- ☐ Verify that the condensate drain holes in the corners of the cabinet are open.
- ☐ Check clearances from combustibles. Requirements are shown in Paragraph 4.2.
- ☐ Check piping for leaks and proper gas line pressure. Bleed gas lines of trapped air. See Paragraph 6.1.
  - 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 ten seconds, turn gas supply off. No change in pressure should occur over a three-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 flue discharge openings are free from obstructions.

9.2 Startup

☐ 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

1) Set the thermostat switch at its lowest setting.
2) Turn on power, main and manual gas valves.
   (a) Firing rate is controlled by the thermostat.
   (b) Blower motor operates from fan time delay.
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 N.C. to N. O. contacts, energizing the pilot gas valve and spark gap 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.
5) If the flame is extinguished during main burner operation, the safety switch closes the main valve and recycles the spark gap. On a unit equipped with a controller with lockout, if the pilot is not established within 120 seconds (approximately), the unit locks out for one hour, unless reset by interrupting the power to the control circuit (See Lighting Instructions).

9.3 Check Installation After Startup

☐ 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 6.1.

☐ 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 8.4.

☐ 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.

☐ Return all instruction forms and warranty information to the "Owner's Envelope". Keep for future reference.

DANGER

The gas burner in this gas-fired equipment is designed and equipped to provide safe, 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.

10.0 Maintenance and Service

NOTE: Use only factory-authorized replacement parts.

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.

10.1 Maintenance Schedule

The following procedures should be carried out at least annually (See Paragraphs 10.2.1-10.2.4 for instructions).

- ☐ Inspect the filters. Clean or replace as needed.
- ☐ Inspect the blower and belt. Check belt for tension, wear and alignment. Adjust or replace as needed. Clean dirt from blower and motor.
- ☐ Clean all dirt and grease from the primary and secondary combustion air openings.
- ☐ Check the gas valve to ensure that gas flow is being shut off completely.
- ☐ Clean the heat exchanger both internally and externally.
- ☐ Check the pilot burner and main burners for scale, dust, or lint accumulation. Clean as needed.
- ☐ Check the flue products outlet; clean if needed. Check the vent cap in an optional extended vent system; replace any parts that do not appear sound.
- ☐ Check the wiring for any damaged wire. Replace damaged wiring. (See Paragraph 7.0 for wiring requirements.)

CAUTION: When cleaning, wearing eye protection is recommended.

10.2 Maintenance Procedures

10.2.1 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.

NOTE: Operational pressure settings and instructions for checking pressure settings are in Paragraph 6.1.

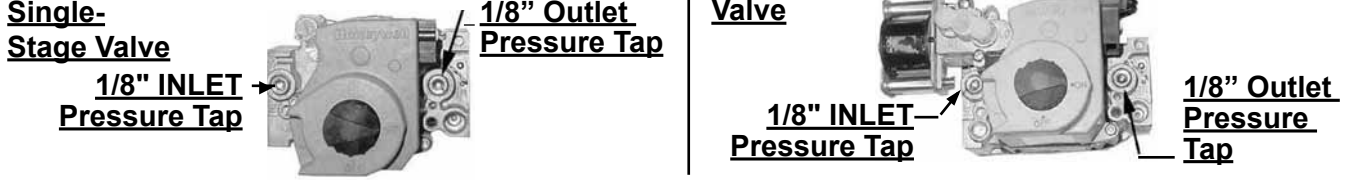
Remove external dirt accumulation and check wiring connections.

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 (**FIGURE 37**).

FIGURE 37 - Top View of Gas Valves



CAUTION: DO NOT bottom out the gas valve regulator adjusting screw. This can result in unregulated manifold pressure causing excess overfire and heat exchanger failure.

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, turn the thermostat up to fire the unit and allow the unit to go through one trial ignition. Reset the thermostat to shut the unit off. 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.

10.2.2 Burner Rack Removal Instructions

CAUTION: When cleaning, wearing eye protection is recommended.

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 --
   Natural Gas - remove the flash carryover system from the "manifold end" of the burner rack
   NOTE: Natural gas burner racks manufactured prior to 3/95 have a lighter tube carryover system. Break the lighter tube connection at the orifice and remove the supply tubing, the drip shield and the lighter tube.
   Propane - 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 retaining 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. Remove the main burner orifices.
5. Remove screws and lift out pilot burner.

Follow the instructions in Paragraph 10.2.3 to clean. To re-assemble and replace, reverse the above procedures being careful not to create any unsafe conditions.

10.2.3 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". After the pilot is cleaned, blow any dirt away with compressed air.

Clean main burners and burner orifices 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 in the burner ports. Do not use anything that might change the port size.

Clean the burner rack carryover systems with air pressure.

10.2.4 Clean 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. Depending on whether or not the furnace is designed for high CFM (Model prefix "H"), there may be directional baffles between the heat exchanger tubes. The standard furnace has baffles between the heat exchanger tubes as shown in **FIGURE 38**. (High CFM furnaces have only the top baffle support which does not need to be removed for cleaning.) To remove the baffles, remove the screws marked "A" in **FIGURE 38**, and slide each baffle forward. Use a brush and/or an air hose to remove accumulated dust and grease deposits from the heat exchanger tubes and the baffles. Re-install the baffles by sliding them into the rear slot and replacing the screw.

The inner surfaces (combustion air side) of the heat exchanger can be reached for cleaning with the burner rack removed. (See Paragraph 10.2.2.) 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. Furnaces designed to provide high efficiency heating have "V" shaped baffles in the top of each heat exchanger tube. Follow the instructions below to remove the "V" baffles when cleaning the inner surfaces of the heat exchanger.

10.0 Maintenance and Service (cont'd)

10.2 Maintenance Procedures (cont'd)

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 the heat exchanger "V" baffles.**

10.2.4 Clean the Heat Exchanger (cont'd)

Instructions to Remove Heat Exchanger "V" Baffles (FIGURES 38 & 39.)

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) **Sizes 125-300** -- Remove one of the tube baffle retaining angles on each inside wall of the collection box. Each tube baffle angle has one screw.
   Size 400 -- 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.

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.**

FIGURE 38 - When cleaning outer heat exchanger surface remove directional air baffles. Remove Screws "A" and slide baffles out. Clean and replace all baffles.

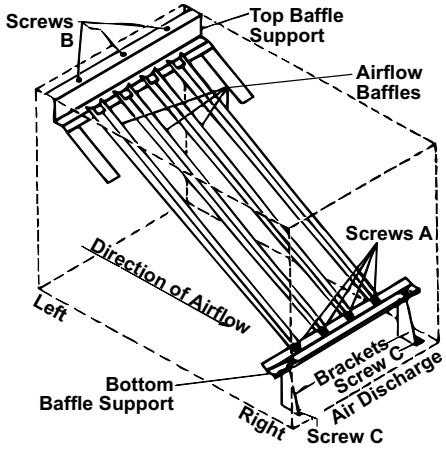
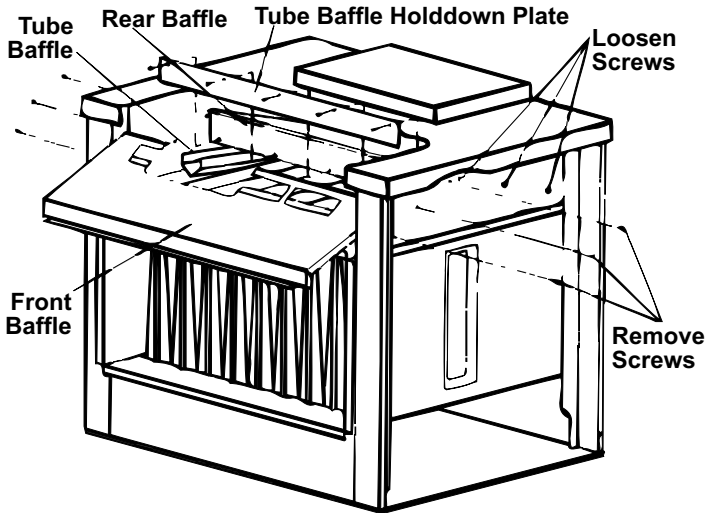


FIGURE 39 - Remove "V" Baffles to Clean Inner Surface of Heat Exchanger Tubes



10.3 Troubleshooting

Troubleshooting the System

TROUBLE	PROBABLE CAUSE	REMEDY
Venter motor will not start. Pilot will not light. (Venter operating on power-vented models.)	**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.
	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 6.1).
	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)** If 24 volt is available to ignition controller and all other causes have been eliminated, replace 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.

TROUBLE	PROBABLE CAUSE	REMEDY
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 6.1.)
	d) Cracked ceramic at sensor.	**d)** Replace sensor.
	e) Faulty ignition controller.	**e)** See Paragraph 8.2. 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
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 6.1).
	3. Cycling on limit control.	**3.** Check air throughput (See Paragraph 6.5).
	4. Improper thermostat location or adjustment.	**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 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 6.5).
	2. Improper static pressure on duct system	**2.** Adjust dampers in duct system.
	3. Low voltage	**3.** Check power supply.

Index

INSTALLATION RECORD - to be completed by the installer:

Installer:

Name _____

Company _____

Address _____

_____

_____

Phone _____

Distributor (company from which the unit was purchased):

Company _____

Contact _____

Address _____

_____

_____

Phone _____

Model _____ Serial No._____Date of Installation _____

SPECIFIC INSTALLATION NOTES: (i.e. Location, Amps, Gas Pressure, Temperature, Voltage, Adjustments, Warranty, etc.)

_____

_____

_____

_____

_____

BUILDING OWNER OR MAINTENANCE PERSONNEL:

For service or repair

- Contact the installer listed above.
- If you need additional assistance, contact the Reznor® Distributor listed above.
- For more information, contact your Reznor® Representative by calling 800-695-1901.

Reznor®
150 McKinley Avenue
Mercer, PA 16137

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

4/15 Form I-/RPB (Version F.3)