

OUTDOOR GAS-FIRED DUCT FURNACE INSTALLATION, OPERATION, AND MAINTENANCE

MODELS RP AND HRPD



⚠ DANGER ⚠

FIRE OR EXPLOSION HAZARD

- Failure to follow safety warnings exactly could result in serious injury, death, or property damage.
- Improper installation, adjustment, alteration, service, or maintenance can cause serious injury, death, or property damage.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.
- Be sure to read and understand the installation, operation, and service instructions in this manual.
- 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.

DO NOT DESTROY. PLEASE READ CAREFULLY. KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.

TABLE OF CONTENTS

GENERAL INFORMATION	3
Important Safety Information	4
Certification	5
Installation Codes	5
Warranty	5
Clearances	5
Dimensions	6
Weights	8
Unit Location	8
Combustion Air Requirements	8
Halogenated Hydrocarbons	8
INSTALLATION	9
Uncrating/Unpacking	9
Pre-Installation Checklist	9
Pre-Installation Modifications	9
High CFM Conversion	9
Reverse Airflow Conversion	11
Mounting	12
Duct Connections	12
Ductwork Requirements	13
Discharge Air Temperature Sensor Installation	14
Vent Connections	16
Duct Furnace Airflow	17
Duct Furnace Blower Connections	18
Bypass Duct Construction	19
Piping Connections	20
Gas Supply Pressure	20
Gas Supply Piping	20
Supply Piping Connections	21
Electrical Connections	22
Control Wiring	22
CONTROLS	23
Standard Controls	23
Thermostat	23
Fan Control	23
Combination Gas Valve	24
Combustion Air Proving Switch	24
Pilot and Ignition Systems	24
Burners and Carryover System	25
Optional Controls	25
Two-Stage Heating Control (Option AG2)	25
Two-Stage Makeup Air Control (Options AG3 and AG15)	26
Electronic Modulation (Options AG7, AG8, AG9, AG21, AG39, AG40, and AG42)	27
Photoelectric Air Duct Smoke Detector (Option SA1)	29

TABLE OF CONTENTS—CONTINUED

OPERATION	30
Pre-Startup Checklist	30
Startup	30
Post-Startup Checklist	31
ADJUSTMENTS	31
Measure and Adjust Manifold (Outlet) Gas Pressure	31
High Elevation Conversion	33
Gas Conversion	35
Burner Air Shutter Adjustment	35
Adjust Heat Stage Controllers (Option AG41 or AG42, Model HRPD)	35
MAINTENANCE	36
Service Checklist	36
Maintenance Procedures	37
Combination Gas Valve Maintenance	37
Burner Rack Maintenance	37
Cleaning Pilot and Burners	38
Spark Ignition System Maintenance	39
Heat Exchanger Cleaning	40
TROUBLESHOOTING	41
General Troubleshooting	41
Troubleshooting Bypass Combustion Air Damper Safety Circuit on Units with Option AG39, AG40, or AG42	43
INSTALLATION RECORD (TO BE COMPLETED BY INSTALLER)	44

GENERAL INFORMATION

- This unit has been tested for capacity and efficiency so as to provide many years of safe and dependable comfort providing it is properly installed and maintained. With regular maintenance, this unit will operate satisfactorily year after year. Abuse, improper use, and/or improper maintenance can shorten the life of the appliance and create unsafe hazards.
- To achieve optimum performance and minimize equipment failure, it is recommended that periodic maintenance be performed on this unit. The ability to properly perform maintenance on this equipment requires certain tools and mechanical skills.
- Model HRPD is dual model RP furnaces configured for higher CFM capacity.

GENERAL INFORMATION—CONTINUED

Important Safety Information

Please read all information in this manual thoroughly and become familiar with the capabilities and use of your appliance before attempting to operate or maintain this unit. Pay attention to all dangers, warnings, cautions, and notes highlighted in this manual. Safety markings should not be ignored and are used frequently throughout to designate a degree or level of seriousness.

DANGER: A danger statement describes a potentially hazardous situation that if not avoided, will result in severe personal injury or death and/or property damage.

WARNING: A warning statement describes a potentially hazardous situation that if not avoided, can result in severe personal injury and/or property damage.

CAUTION: A caution statement describes a potentially hazardous situation that if not avoided, can result in minor or moderate personal injury and/or property damage.

NOTE: A note provides important information that should not be ignored.

DANGER

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

WARNING

For your safety, read the warning labels on the unit.

CAUTION

These duct furnaces are not certified or approved for use in drying or process applications. If a duct furnace is to be used in a drying or process application, contact the factory for application guidelines and for manufacturer's authorization. Without factory authorization, the warranty is void and the manufacturer disclaims any responsibility for the duct furnace and/or the application.

NOTES:

- **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.**
- **Read this manual 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.**
- **The instructions in this manual apply only to duct furnace models RP and HRPD.**

Certification

This unit is design-certified to ANSI and CSA standards by the Canadian Standards Association and is approved for installation in the United States and in Canada. The furnace is approved for use with either natural gas or propane. The type of gas for which the furnace is equipped, the correct firing rate, and electrical requirements are shown on the unit's rating plate.

Installation Codes

- 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 (ANSI Z223.1, latest edition). A Canadian installation must be in accordance with the Natural Gas and Propane Installation Code (CSA B149, latest edition). This code is 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.
- If the heater is being installed in the Commonwealth of Massachusetts, installation must be performed by a licensed plumber or licensed gas fitter.

Warranty

Refer to the limited warranty information on the warranty card in the owner's envelope. Warranty is void if:

- a. Furnaces are used in atmospheres containing flammable vapors or atmospheres containing chlorinated or halogenated hydrocarbons or any contaminant (silicone, aluminum 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 clearance to combustible materials or without proper ventilation and air for combustion.
- d. Furnace air throughput is not adjusted within the range specified on the rating plate.
- e. Duct furnace is installed in a process or drying application without factory authorization (any use in a process or drying application voids agency certification).

Clearances

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 (50°C) above the surrounding ambient temperature is not exceeded. For safety, adequate combustion air, and convenient installation and service, ensure that the clearances listed in **Table 1** are provided.

Table 1. Clearances	
Unit Surface	Minimum Clearance (Inches (mm))
Top	36 (915)
Control side	6 (152) + width of furnace
Side opposite controls	6 (152)
Bottom, to combustibles	0 (0)*
Bottom, to noncombustibles	0 (0)

*The unit is certified for installation on a combustible surface when it is equipped with standard heater-mounting rails.

GENERAL INFORMATION—CONTINUED

Dimensions

NOTES:

Inches (mm)

Standard airflow may be reversed by changing direction of heat exchanger air baffles.

Burner and control access shown left-hand side. Specify right-hand side for opposite access and connections.

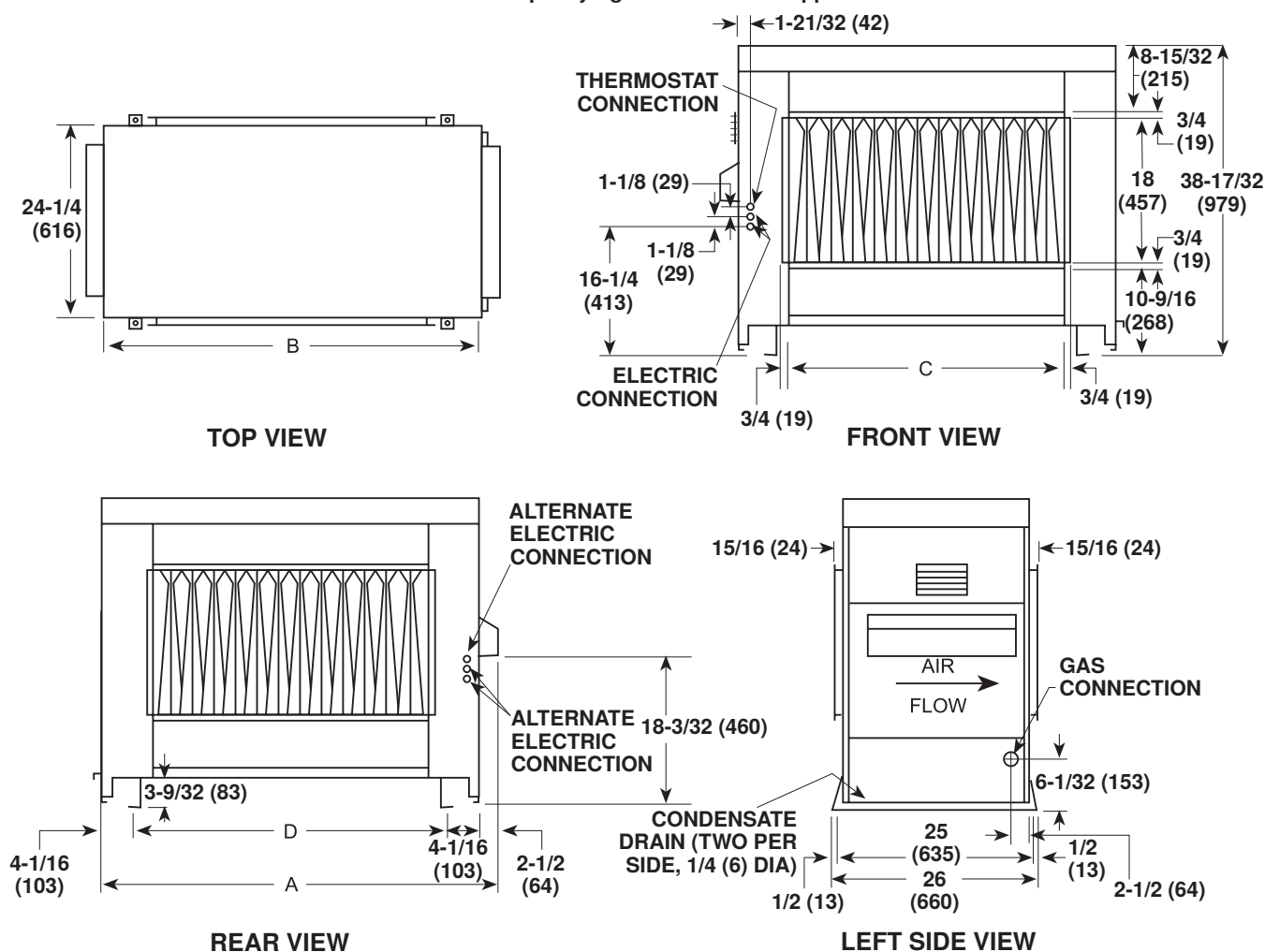


Figure 1. RP Dimensions (Refer to [Table 2](#))

Table 2. RP Dimensions						
Dimension (See Figure 1)	Unit Size (MBTUh)					
	125	150, 175	200, 225	250, 300	350	400
	Inches (mm)					
A	30-15/16 (786)	36-7/16 (914)	41-15/16 (1065)	50-3/16 (1275)	55-11/16 (1414)	61-3/16 (1554)
B	28-1/2 (648)	34 (864)	39-1/2 (1003)	47-3/4 (1213)	53-1/4 (1353)	58-3/4 (1492)
C	15-1/4 (387)	20-3/4 (527)	26-1/4 (667)	34-1/2 (876)	40 (1016)	45-1/2 (1156)
D	20-5/16 (516)	25-13/16 (656)	31-5/16 (795)	39-9/16 (1005)	45-1/16 (1145)	50-9/16 (1284)

Dimensions—Continued

NOTES:

Inches (mm)

Standard airflow may be reversed by changing direction of heat exchanger air baffles.

Burner and control access shown left-hand side. Specify right-hand side for opposite access and connections.

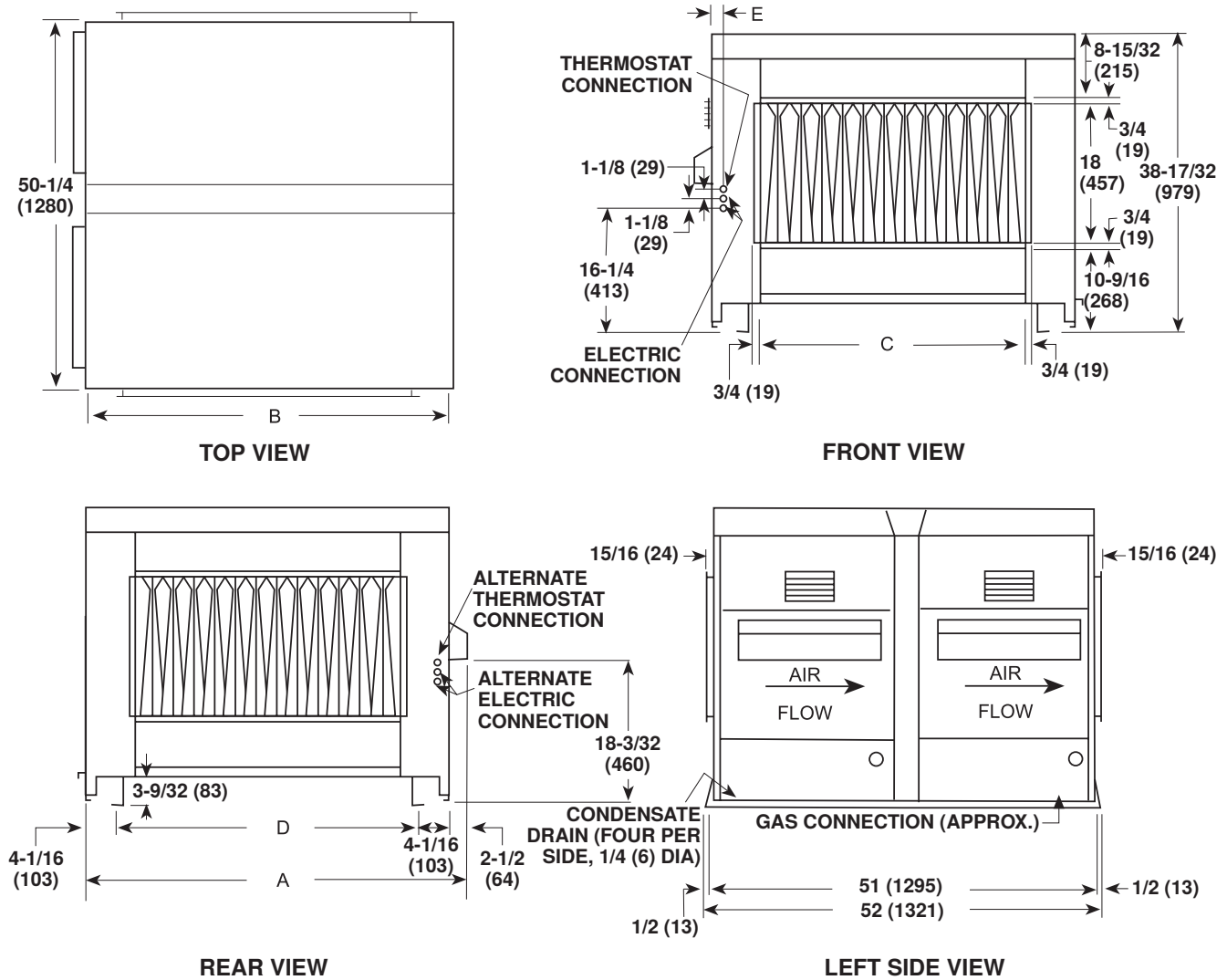


Figure 2. HRPD Dimensions (Refer to [Table 3](#))

Table 3. HRPD Dimensions						
Dimension (See Figure 2)	Unit Size (MBTUh)					
	250	300, 350	400	500, 600	700	800
	Inches (mm)					
A	30-15/16 (786)	36-7/16 (926)	41-15/16 (1065)	50-3/16 (1275)	55-11/16 (1414)	61-3/16 (1554)
B	28-1/2 (724)	34 (864)	39-1/2 (1003)	47-3/4 (1213)	53-1/4 (1353)	58-3/4 (1492)
C	15-1/4 (387)	20-3/4 (527)	26-1/4 (667)	34-1/2 (876)	40 (1016)	45-1/2 (1156)
D	20-5/16 (516)	25-13/16 (656)	31-5/16 (795)	39-9/16 (1005)	45-1/16 (1145)	50-9/16 (1284)
E	3-3/32 (79)	1-21/32 (42)				

GENERAL INFORMATION—CONTINUED

Weights

Table 4. Weights						
Model	RP Unit Size (MBTUh)					
	125	150, 175	200, 225	250, 300	350	400
	HRPD Unit Size (MBTUh)					
	250	300, 350	400	500, 600	700	800
Pounds (kg)						
RP	201 (91)	217 (98)	247 (112)	295 (134)	333 (151)	361 (164)
HRPD	402 (182)	434 (196)	494 (224)	590 (268)	666 (302)	722 (328)

Unit Location

- Select a location that complies with the requirements in this manual.
- There are a variety of factors, such as system application, building structure, dimensions, and weight, that contribute to selecting the location.
- The location must comply with the clearances listed in [Table 1](#).
- A duct furnace is designed for connection to an inlet and an outlet duct and depends on an external air handler.

Combustion Air Requirements

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

Halogenated Hydrocarbons

Halogenated hydrocarbons are a family of chemical compounds characterized by the presence of halogen elements (fluorine, chlorine, bromine, etc.). These compounds are used in refrigerants, cleaning agents, and solvents and are heavier than air, a fact that should be kept in mind when determining the installation location of heaters and building exhaust systems.

⚠ CAUTION ⚠

CORROSION HAZARD: Halogenated hydrocarbons, when exposed to flame, precipitate with any condensation present in the heater to form hydrochloric acid, which readily attacks all metals, including 300 grade stainless steel. Care should be taken to separate these vapors from the combustion process. An outside air supply **MUST BE** provided to the burner whenever the presence of these compounds is suspected.

INSTALLATION

NOTE: Before installation, make preparations for necessary supplies, tools, and manpower.

Uncrating/Unpacking

- 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® distributor. If you are an authorized Distributor, follow the FOB freight policy procedures.
- Check the rating plate for the gas specifications and electrical characteristics of the furnace to ensure that they are compatible with the gas and electric supplies at the installation site.

Pre-Installation Checklist

- ☐ Check the rating plate for the gas specifications and electrical characteristics of the furnace to ensure that they are compatible with the gas and electric supplies at the installation site.
- ☐ Read this manual 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 (refer to [Table 5](#)) that need to be assembled/installed prior to unit installation. Ensure that all options ordered are at the installation site.

Table 5. Field-Installed Options

Option	Description
AG7	Electronic modulation with room thermostat
AG9	Electronic modulation with 2:1 turndown ratio and with ductstat and remote temperature selector
CE1	Manual shutoff valve, natural gas
CE2	Manual shutoff valve, propane
CL1	Single-stage thermostat
CL9	Electronic modulating room override
CL22	Two-stage thermostat
CL33	Two-stage digital thermostat
CL36	Modulating wall heating/cooling thermostat
CL52	Single-stage digital thermostat
CM1	Locking thermostat cover
CM1B	Large locking thermostat cover
CN1A–CN3Z	Various remote switch options
CP5, CP6, CP7, CP8, CP42, CP59	Disconnect switches
SA1	Photoelectric air duct sensor (model HRPD)

Pre-Installation Modifications

High CFM Conversion

This unit was factory assembled with the air throughput range listed on the rating plate. If the application requires a higher CFM than listed on the rating plate, the unit may be converted for lower temperature rise and higher CFM. The conversion will change the air throughput range as specified in [Table 6](#). Verify the unit size on the heater rating plate and, after confirming that this conversion is correct for the unit, perform the following procedure:

Table 6. High Air Throughput

Minimum or Maximum	RP Unit Size (MBTUh)								
	125	150	175	200	225	250	300	350	400
	CFM								
Minimum	1225	1475	1720	1965	2210	2455	2945	3440	3930
Maximum	4605	5530	6450	7370	8295	9215	11,060	12,900	14,745

INSTALLATION—CONTINUED

Pre-Installation Modifications—Continued

High CFM Conversion—Continued

⚠ DANGER ⚠

- This conversion shall be done by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. If the information in these instructions is not followed exactly, a fire, an explosion, or the production of carbon monoxide may cause property damage, personal injury, or loss of life. The qualified service agency performing this work assumes responsibility for the conversion of this appliance to provide for higher CFM.
- These instructions are designed to prepare the duct furnace for increased air throughput conversion prior to installation. If your duct furnace is already installed, for your safety, turn OFF the gas and electric supply before servicing.

NOTE: Before performing this conversion, determine if airflow is being reversed or if other field-installed options apply. Perform desired procedure in accordance with [Pre-Installation Modifications section](#).

1. Remove heat exchanger baffles (see [Figure 3](#)):
 - a. At discharge air side of heat exchanger, remove support bracket screws and slide entire baffle assembly out of heat exchanger.
 - b. Reinstall screws to plug holes.

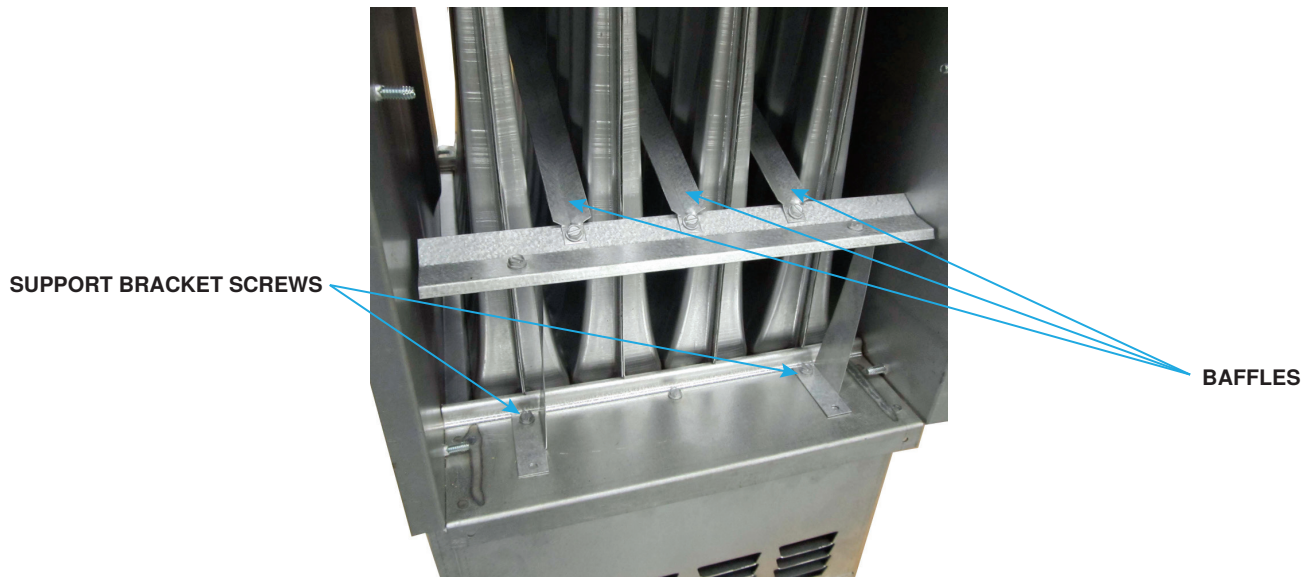


Figure 3. Heat Exchanger Baffle Removal

2. Remove side finger baffles (see [Figure 4](#)):
 - a. At entering air side of heat exchanger, locate side finger baffles and remove two side finger baffle screws from each baffle.
 - b. Remove both side finger baffles.

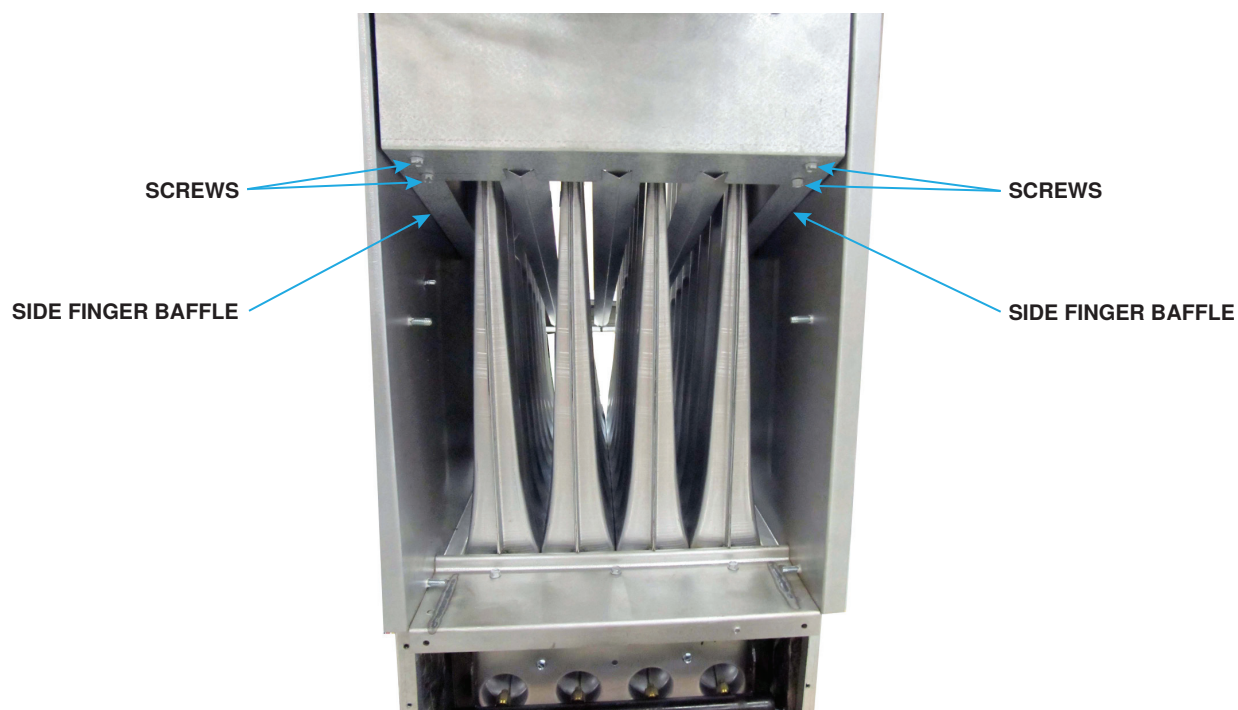


Figure 4. Side Finger Baffle Removal

3. Install field conversion label (see [Figure 5](#)):
 - a. Fill in field conversion label (PN 263310) from literature bag.
 - b. Adhere label to unit on clean dry surface adjacent to rating plate.
4. Test unit for proper operation ensuring that air throughput is in accordance with [Table 6](#).

IMPORTANT	
This appliance has been converted on Cet appareil a été converti _____ (date) _____ to _____ cfm maximum throughput au _____ pi ³ /min consommation maximum to _____ cfm minimum throughput au _____ pi ³ /min consommation minimum by / par (name & address of company making this conversion) _____, with kit no. / avec la kit no. 263308 _____ which accepts the responsibility that this conversion has been properly made. qui accepte la responsabilité que cette conversion a été correctement faite.	263310

Figure 5. Field Conversion Label

Reverse Airflow Conversion

Duct furnaces are equipped with directional air baffles between the heat exchanger tubes. Facing the control compartment of the furnace, the standard direction of airflow is from left to right. If the installation site requires airflow from right to left, the unit may be field-adapted by reversing the position of the directional air baffles (see [Figure 6](#)) as follows:

INSTALLATION—CONTINUED

Pre-Installation Modifications—Continued

Reverse Airflow Conversion—Continued

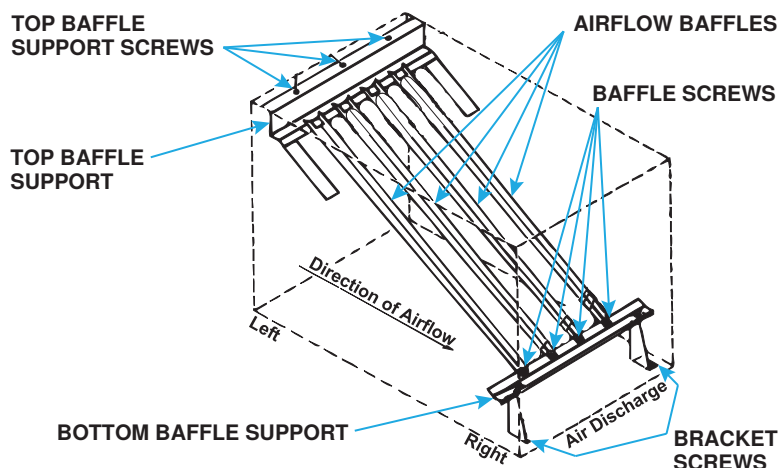


Figure 6. Airflow Baffles

1. Remove and save baffle screws and lift each airflow baffle slightly and slide forward. Remove all baffles from heat exchanger.
2. Remove and save top baffle support screws and remove top baffle support. Reposition and secure support on opposite end of heat exchanger using existing screws.
3. Remove bracket screws and remove bottom baffle support and bracket assembly. Reinstall bracket screws to plug holes in heat exchanger bottom. Reposition bottom baffle support and bracket assembly on opposite end of heat exchanger and secure using field-supplied sheet metal screws.
4. Reinstall airflow baffles removed in step 1 and secure using existing screws.

Mounting

⚠ DANGER ⚠

- Before installing the furnace, check the supporting structure to be used to verify that it has sufficient load-carrying capacity to support the weight (refer to [Weights](#) section) of the unit.
- Use a suitable hoist to lift the unit (refer to [Weights](#) section). Lifting holes are provided at each of the four corners of the mounting support rails. Use spreader bars when lifting to prevent chains or cables from damaging the unit.
- The furnace must be level for proper operation. DO NOT place or add additional weight to a suspended furnace.

Lift the unit using a suitable hoist and spreader bars and set it on a slab or roof where support is adequate.

Duct Connections

⚠ CAUTION ⚠

Joints where ducts attach to furnace must be sealed securely to prevent air leakage into burner rack area. Leakage can cause poor combustion, poor performance, and pilot problems and can shorten heat exchanger life.

NOTE: Make adjustments to ductwork as necessary to obtain a temperature rise and a static pressure within the ranges specified on the heater rating plate.

Ductwork Requirements

- **Type:** the type of duct installation to be used depends in part on the construction type of the roof (wood joist, steel bar joist, steel truss, or pre-cast concrete) and ceiling (hung, flush, etc.).
- **Material:** rectangular duct should be constructed of not lighter than #26 US gauge galvanized iron or #24 B&S gauge aluminum.
- **Size:** proper sizing of 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.
- **Structure:** all duct sections 24 inches (610 mm) or wider and over 48 inches (1,219 mm) 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.
- **Ductwork through masonry walls:** no warm air duct should come in contact with masonry walls. Insulate around all air ducts through masonry walls with not less than 1/2 inch (1 inch is recommended) of insulation.
- **Ductwork through unheated space:** insulate all exposed warm air ducts passing through an unheated space with at least 1/2 inch (1 inch is recommended) of insulation.
- **Supports:** suspend all ducts securely from buildings members. Do not support ducts from unit duct connections.
- **Horizontal discharge duct length:** A minimum horizontal duct run of 24 inches (610 mm) is recommended before turns or branches are made in the duct system to reduce losses at the furnace outlet.

⚠ CAUTION ⚠

The joint where the supply air duct attaches to the furnace must be sealed securely to prevent air leakage into draft hood or burner rack area. Leakage can cause poor combustion and pilot problems, can shorten heat exchanger life, and can cause poor performance.

- **Supply air duct/furnace horizontal connection:** Connect the duct to the furnace in accordance with the following steps shown in [Figure 7](#):
 - a. Ensure that flanges on furnace (heat exchanger) turn out as shown.
 - b. Shape duct connection as shown—U-type on top and bottom and L-type on sides.
 - c. Slide U-channels over furnace top and bottom flanges.
 - d. Drill fastener holes and secure U-channels using sheet metal screws.
- **Access panels:** Install removable access panels (see [Figure 7](#)) on both the upstream and downstream sides of the furnace. The access panels must be accessible when the furnace is in service and should be a minimum of 6 × 10 inches (152 × 254 mm) in size so smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. Ensure that the access panels are installed in such a manner so as to prevent leakage.

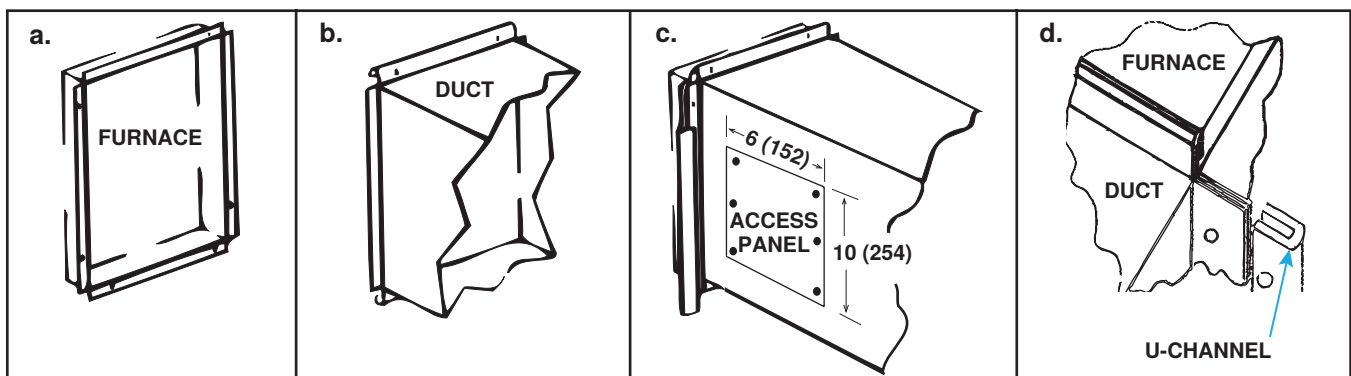


Figure 7. Connecting Ductwork to Furnace

INSTALLATION—CONTINUED

Duct Connections—Continued

Ductwork Requirements—Continued

- **Connection dimensions:** connection dimensions (inches (mm)) are shown in [Figure 8](#) and listed in [Table 7](#).

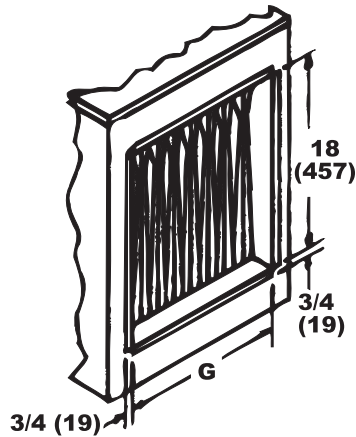


Figure 8. Ductwork Connection Dimensions (Refer to [Table 7](#))

Table 7. Ductwork Connection Dimensions			
Unit Size (MBTUh)		Dimension G*	
RP Models	HRPD Models	Inches	Millimeters
125	250	15-1/4	387
150, 175	300, 350	20-3/4	527
200, 225	400	26-1/4	667
250, 300	500, 600	34-1/2	876
350	700	40	1016
400	800	45-1/2	1156

*See [Figure 8](#).

Discharge Air Temperature Sensor Installation

Depending on the gas control option, the discharge air temperature sensor is either factory- or field-installed. Field-installed sensors have one of two configurations: a sensor and mixing tube assembly or a sensor holder and junction box assembly. For units with the sensor holder and junction box assembly option, the sensor is normally installed on a bracket in the furnace discharge for shipping but it may be mounted in the cabinet leg (see [Figure 9](#)).

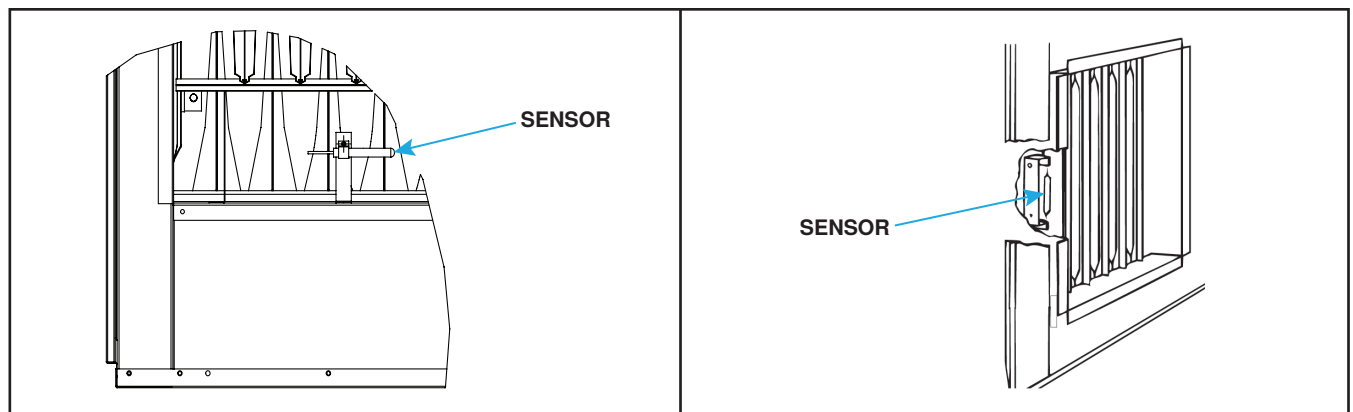


Figure 9. Shipping Locations of Capillary Sensor

NOTE: 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 duct cross-sectional dimensions). If the length of the discharge duct is less than 8 feet (2.4 meters), 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 this will cause loss of control in the duct that does not house the sensor.

1. Determine distance of sensor from unit:
 - a. Locate the sensor a minimum of 96 inches (2,435 mm) from the outlet of the unit. Ensure that there is sufficient distance from outlet to have good mixture of discharge air temperature.
 - b. Refer to following formula for calculating sensor placement—this assumes cross-sectional dimensions for supply ductwork of 24 × 12 inches (610 × 305 mm):

$$5 \text{ equivalent duct diameters} \times \sqrt{\frac{4 \times 12 \times 24}{3.14}} = 96 \text{ inches}$$

$$5 \text{ equivalent duct diameters} \times \sqrt{\frac{4 \times 305 \times 610}{3.14}} = 2435 \text{ millimeters}$$

2. Determine orientation of sensor:
 - a. In horizontal ductwork, position sensor in top-middle of duct with sensor probe extending vertically down into center of air stream.
 - b. In vertical ductwork, position sensor in middle of duct that corresponds with top-middle of discharge outlet.

NOTE: Position of sensor in duct is important—mixing tube is 12 inches (305 mm) long and sensor holder extends 9-3/16 inches (233 mm) into ductwork.

3. Secure sensor in ductwork:
 - a. For units with sensor and mixing tube assembly (see [Figure 10](#)), remove ductwork access panel, slide mixing tube into ductwork, and secure sensor.

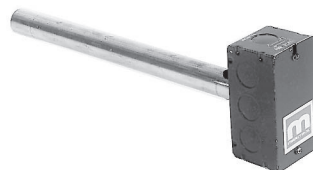


Figure 10. Sensor and Mixing Tube Assembly

NOTE: For the capillary sensor, select a ductwork location so that the minimum length of capillary tubing will be inside the ductwork. Because the sensor is larger than the tubing, a gasket and gasket retainer plate are provided to plug the hole and to protect the capillary tubing where it passes through the ductwork. Two field-supplied sheet metal screws are needed to secure the plate.

- b. For units with sensor holder and junction box assembly option (see [Figure 11](#)):

INSTALLATION—CONTINUED

Duct Connections—Continued

Discharge Air Temperature Sensor Installation—Continued



Figure 11. Sensor Holder and Junction Box Assembly

- (1) Before connecting ductwork to furnace, remove capillary sensor from its shipping position on furnace (see [Figure 9](#)).
- (2) At selected ductwork location, mark and cut 1/2-inch hole that will be sealed with gasket and retainer plate (see [Figure 12](#)). Push sensor and capillary tubing through hole.

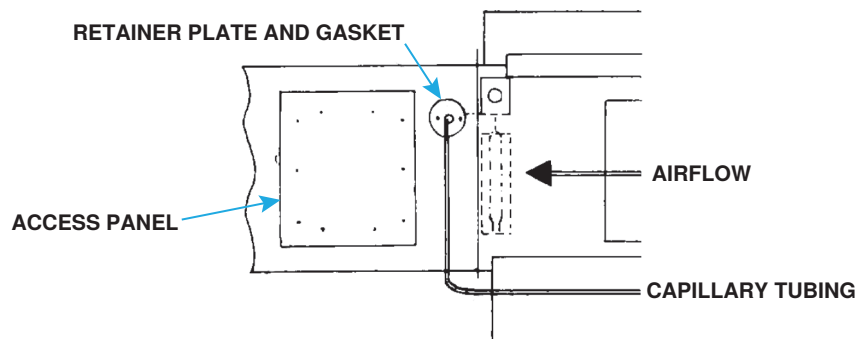


Figure 12. Capillary Sensor Installation

- (3) Remove ductwork access panel (see [Figure 12](#)) and install sensor in sensor holder so that it senses air temperature as it flows through holes in holder.
- (4) Position sensor holder and junction box assembly inside ductwork so that sensor will be shielded from direct airflow and secure junction box to ductwork using four field-supplied #6 sheet metal screws.
- (5) Slide gasket (cut slit) and retainer plate over capillary tubing. With gasket next to ductwork, install hole retaining plate and secure using field-supplied sheet metal screws.
- (6) Close ductwork access panel.

NOTE: Ensure that all sensor wires are connected in accordance with the wiring diagram provided with the unit.

4. Connect sensor wire(s)—for units with sensor holder and junction box assembly, remove junction box knockout and connect sensor wire using field-supplied cable connector secured to box.

Vent Connections

Locate power-vented furnaces so that flue discharge is not directed at fresh air inlets. The screened flue gas outlet and combustion air inlet (see [Figure 13](#)) 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.

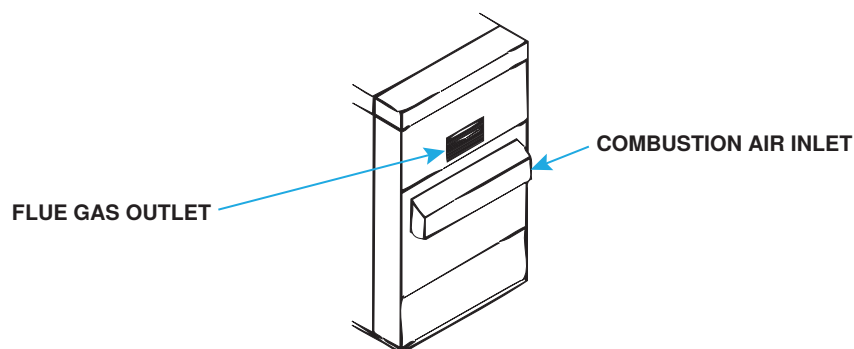


Figure 13. Flue Gas Outlet and Combustion Air Inlet

Duct Furnace Airflow

- The duct furnace must be installed on the positive pressure side of the field-supplied blower.
- The air distribution must be even over the entire heat exchanger. Turning vanes should be employed in elbows or turns in the air inlet to ensure proper air distribution (refer to [Duct Furnace Blower Connections](#) section).
- The air throughput must be within the CFM range stated on the heater rating plate.
- If it is determined that the blower CFM is greater than allowed or desirable, refer to the [Bypass Duct Construction](#) section for instructions on determining the correct size of bypass duct required or refer to the [High CFM Conversion](#) section for instructions on converting the furnace for a higher CFM application.
- To determine temperature rise, the inlet and outlet air temperatures should be measured at points not affected by heat radiating from the heat exchanger. [Table 8](#) and [Table 9](#) list the approved temperature rise range with the required CFM and the internal pressure drop for each size of unit.

Table 8. Model RP Temperature Rise, CFM, and Internal Pressure Drop

Temperature Rise	Unit Size (MBTUh)								
	125	150	175	200	225	250	300	350	400
	CFM/Pressure Drop (IN WC)								
80% Thermal Efficient									
50°F	1840/0.50	2210/0.38	2580/0.52	2945/0.42	3315/0.53	3685/0.40	4420/0.58	5160/0.65	5895/0.67
60°F	1535/0.33	1840/0.26	2150/0.35	2455/0.28	2765/0.36	3070/0.28	3685/0.39	4300/0.44	4915/0.45
70°F	1315/0.25	1580/0.19	1840/0.26	2105/0.22	2370/0.27	2630/0.23	3160/0.29	3685/0.31	4210/0.32
80°F	1150/0.21	1380/0.15	1610/0.19	1840/0.17	2070/0.22	2300/0.22	2765/0.25	3225/0.25	3685/0.25
90°F	1020/0.18	1225/0.12	1430/0.16	1635/0.14	1840/0.17	2045/0.21	2455/0.22	2865/0.23	3275/0.19
With Finger Baffles Removed									
20°F	4605/1.16	5530/0.85	6450/1.19	7370/1.00	8295/1.28	9215/0.90	11,060/1.26	12,900/1.23	14,745/1.23
30°F	3070/0.53	3685/0.39	4300/0.54	4915/0.45	5530/0.58	6140/0.41	7370/0.57	8600/0.56	9830/0.56
40°F	2300/0.28	2765/0.21	3225/0.29	3685/0.25	4145/0.31	4605/0.22	5530/0.32	6450/0.31	7370/0.31
50°F	1840/0.21	2210/0.15	2580/0.18	2945/0.16	3315/0.21	3685/0.15	4420/0.21	5160/0.19	5895/0.19
60°F	1535/0.15	1840/0.12	2150/0.15	2455/0.12	2765/0.15	3070/0.11	3685/0.15	4300/0.14	4915/0.15
75°F	1225/0.12	1475/0.11	1720/0.12	1965/0.11	2210/0.12	2455/0.08	2945/0.11	3440/0.11	3930/0.11

Table 9. Model HRPD Temperature Rise, CFM, and Internal Pressure Drop

Temperature Rise	Unit Size (MBTUh)							
	250	300	350	400	500	600	700	800
	CFM/Pressure Drop (IN WC)							
80% Thermal Efficient								
40°F	4630/1.97	5556/1.45	6481/2.02	7407/1.70	9259/1.53	11,111/2.14	12,963/2.09	14,815/2.09
50°F	3704/1.26	4444/0.92	5185/1.29	5926/1.09	7407/0.98	8889/1.37	10,370/1.34	11,852/1.34
60°F	3086/0.88	3704/0.64	4321/0.90	4938/0.76	6173/0.68	7407/0.95	8642/0.93	9877/0.93
70°F	2646/0.64	3175/0.47	3704/0.66	4233/0.56	5291/0.50	6349/0.70	7407/0.68	8466/0.68
80°F	2315/0.49	2778/0.36	3241/0.51	3704/0.43	4630/0.38	5556/0.54	6481/0.52	7407/0.52
90°F	2058/0.39	2469/0.29	2881/0.40	3292/0.34	4115/0.30	4938/0.42	5761/0.41	6584/0.41
100°F	1852/0.32	2222/0.23	2593/0.32	2963/0.27	3704/0.24	4444/0.34	5185/0.33	5926/0.33

INSTALLATION—CONTINUED

Duct Connections—Continued

Duct Furnace Blower Connections

⚠ WARNING ⚠

The furnace must be installed on the positive pressure side of the air-circulating blower.

- Blowers should be bottom horizontal discharge when coupled to the duct furnace.
- When a top horizontal discharge blower is connected to the duct furnace, ensure that sufficient length of duct is provided to permit even flow of air at the end of the duct. Or, baffles may be inserted between the blower and the heater to ensure an even flow of air across the heat exchanger.
- Proper arrangements of blower and duct furnace with respect to angle of approach of the duct connection and the arrangement of the discharge opening of the blower are shown in [Figure 14](#).

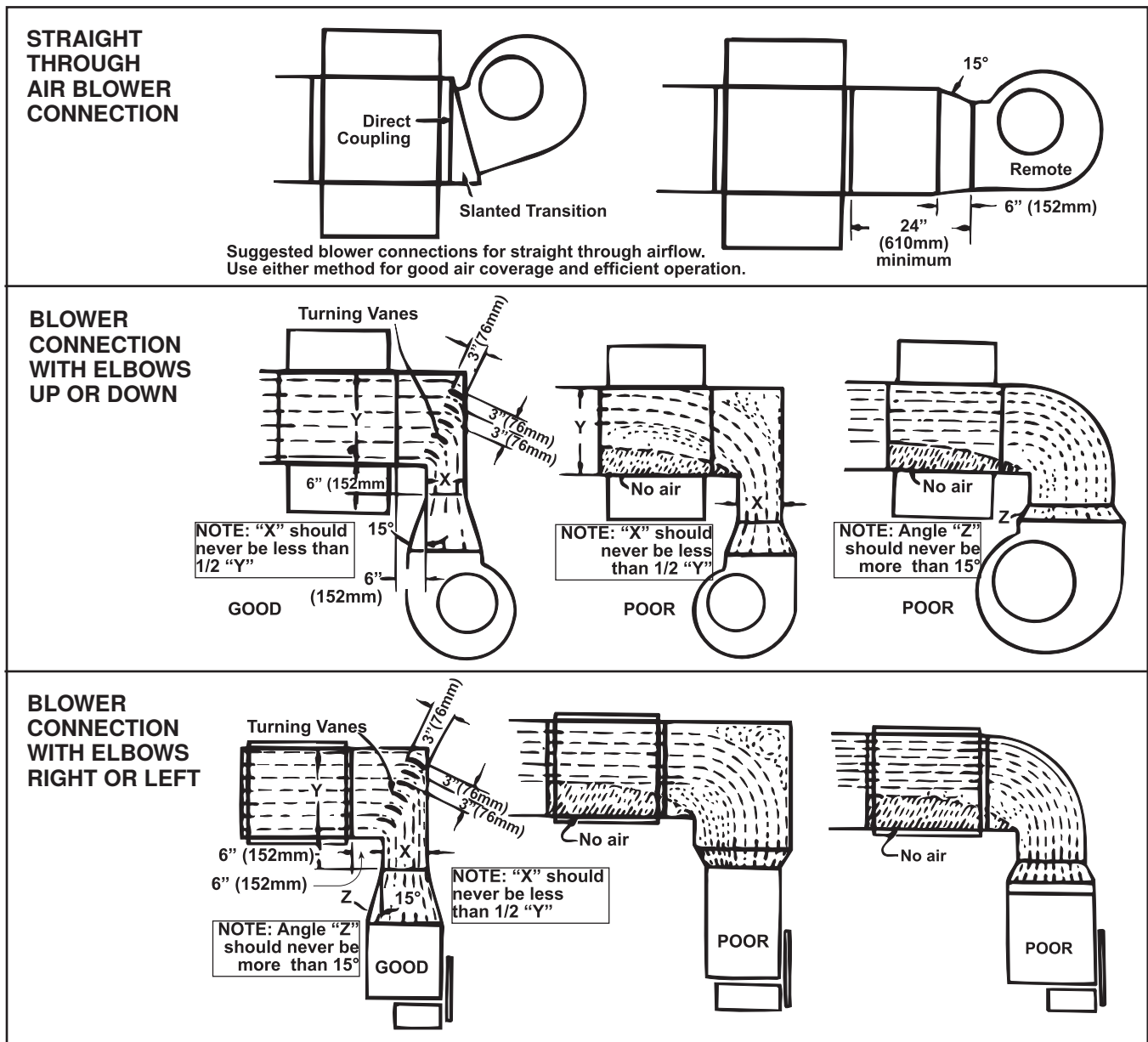


Figure 14. Duct Furnace Blower Connections

Bypass Duct Construction

When the air throughput CFM is greater than desirable or permissible for the unit, a bypass duct (see [Figure 15](#)) may be constructed. Locate the bypass duct on the side of the furnace opposite the controls and 2 inches from the heat exchanger side panel. Extend the bypass duct 18 inches (457 mm) beyond the furnace on both the inlet and outlet ends. Determine the correct size of the bypass duct as follows:

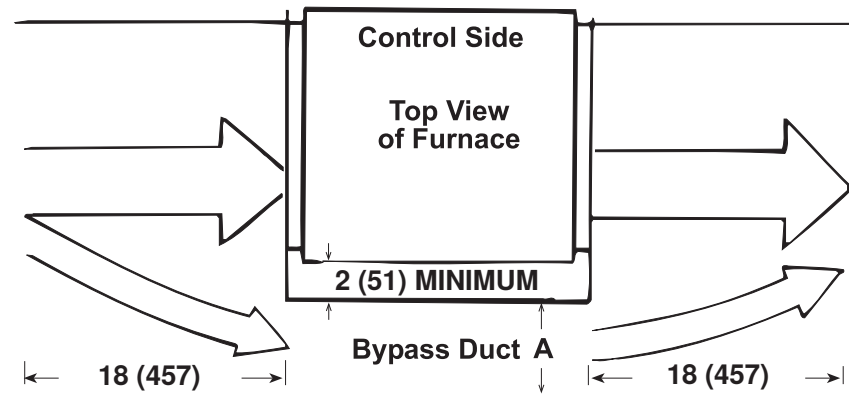


Figure 15. Bypass Duct Dimensions

1. Refer to [Table 8](#) or [Table 9](#) to determine pressure drop and allowable CFM for furnace being installed. For example: model RP unit size **150** @ 50°F temperature rise = pressure drop of **0.38** and CFM of **2,210**.
2. Subtract allowable CFM from blower CFM to determine how much air must be diverted through bypass duct. For example: blower CFM of **3,000** – allowable CFM of **2,210** = bypass CFM of **790**.
3. Refer to [Table 10](#) to determine bypass duct size as follows:
 - a. Go to column closest to pressure drop through heater.
 - b. Move down to CFM closest (round up) to CFM determined in step 2.
 - c. Move to left column to determine required bypass duct size. For example: in pressure drop column **0.40**, move down to bypass CFM row **900** and move left to dimension A column **3 inches**.

Table 10. Bypass Duct Size									
Dimension A (Inches (mm))*	Pressure Drop Through Furnace								
	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
	Bypass CFM								
3 (76)	490	530	610	700	780	830	900	960	1010
4 (102)	630	750	870	980	1090	1160	1250	1310	1400
5 (127)	850	1010	1190	1300	1410	1520	1640	1730	1810
6 (152)	1050	1290	1480	1650	1800	1940	2090	2200	2320
7 (178)	1250	1510	1760	1960	2180	2320	2500	2650	2800
8 (203)	1490	1810	2100	2350	2560	2760	2940	3110	3290
9 (229)	1700	2100	2400	2700	2970	3200	3400	3600	3800
10 (254)	1920	2350	2760	3090	3650	4020	4300	4550	4800
*See Figure 15 .									
NOTE: Not all capacities are covered above. If your installation is not covered, consult your distributor or the factory representative to determine the appropriate size of the bypass duct.									

INSTALLATION—CONTINUED

Piping Connections

Gas Supply Pressure

- The unit is equipped for a maximum gas supply pressure of 1/2 psi, 3.5 kPa, or 14 IN WC for natural gas or propane. The minimum supply pressure, as measured while the unit is operating at full fire, is 5 IN WC for unit sizes 125–300 and 6 IN WC for unit sizes 350 and 400 with electronic modulation or 7 IN WC for unit sizes 350 and 400 with mechanical modulation for natural gas or 11 IN WC for propane.
- Supply pressure higher than 1/2 psi requires the installation of an additional service regulator external to the unit.
- **Pressure testing supply piping:** For test pressures **above** 1/2 psi, disconnect the heater and manual valve from the gas supply line to be tested and cap or plug the supply line. For test pressures **below** 1/2 psi, before testing, close the manual valve on the heater.

Gas Supply Piping

⚠ DANGER ⚠

- **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.
- **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.**

⚠ CAUTION ⚠

- **All piping must be in accordance with requirements outlined in the *National Fuel Gas Code* (ANSI/Z223.1, latest edition) or the *Natural Gas and Propane Installation Code* (CSA B149.1, latest edition).**
- **Gas supply piping installation shall conform with good practice and with local codes.**
- **Support gas piping with pipe hangers, metal strapping, or other suitable material. DO NOT rely on the heater to support the gas pipe.**
- The heater is orificed for operation with natural gas having a heating value of 1,000 (±50) BTU per cubic foot or with propane gas having a heating value of 2,550 (±100) BTU per cubic foot. Sizing of gas supply lines depends on piping capacity and is based on cubic feet per hour based on a 0.3 IN WC pressure drop, a 0.6 specific gravity for natural gas at 1,000 BTU per cubic feet, and a 1.6 specific gravity for propane at 2,550 BTU per cubic feet. If the gas at the installation does not meet this specification, consult the factory for proper orificing.
- Variables for sizing gas supply lines are listed in [Table 11](#). When sizing supply lines, consider the possibility of future expansion and increased requirements. Refer to the *National Fuel Gas Code* for additional information on line sizing.

Table 11. Gas Supply Line Sizes												
Pipe Length (Feet)	Natural Gas						Propane					
	Pipe Diameter (Inches)											
	1/2	3/4	1	1-1/4	1-1/2	2	1/2	3/4	1	1-1/4	1-1/2	2
	Cubic Feet per Hour											
20	92	190	350	730	1100	2100	56	116	214	445	671	1281
30	73	152	285	590	890	1650	45	93	174	360	543	1007
40	63	130	245	500	760	1450	38	79	149	305	464	885
50	56	115	215	440	670	1270	34	70	131	268	409	775
60	50	105	195	400	610	1105	31	64	119	244	372	674
70	46	96	180	370	560	1050	28	59	110	226	342	641
80	43	90	170	350	530	990	26	55	104	214	323	604
90	40	84	160	320	490	930	24	51	98	195	299	567
100	38	79	150	305	460	870	23	48	92	186	281	531
125	34	72	130	275	410	780	21	44	79	168	250	476
150	31	64	120	250	380	710	19	39	73	153	232	433
175	28	59	110	225	350	650	17	36	67	137	214	397
200	26	55	100	210	320	610	16	34	61	128	195	372

Supply Piping Connections

NOTE: The *National Fuel Gas Code* requires the installation of a minimum 3-inch sediment trap with a drip leg. Local codes may require a sediment trap longer than 3 inches (typically 6 inches). To permit burner removal, this sediment trap must extend beyond the edge of the heater.

Connect the gas supply piping as follows (see [Figure 16](#)):

1. Make gas connection (refer to [Table 12](#) for gas connection sizes) at pipe nipple that extends outside cabinet using ground joint union.
2. Seal opening for gas supply pipe with grommet provided.
3. Install manual shutoff valve upstream of unit control system. Manual shutoff valve's 1/8-inch plugged tapping provides connection for supply line pressure test gauge.
4. Install minimum 3-inch sediment trap (typically 6 inches).
5. Bleed trapped air from gas lines as needed.
6. Leak test all connections using leak detecting solution.

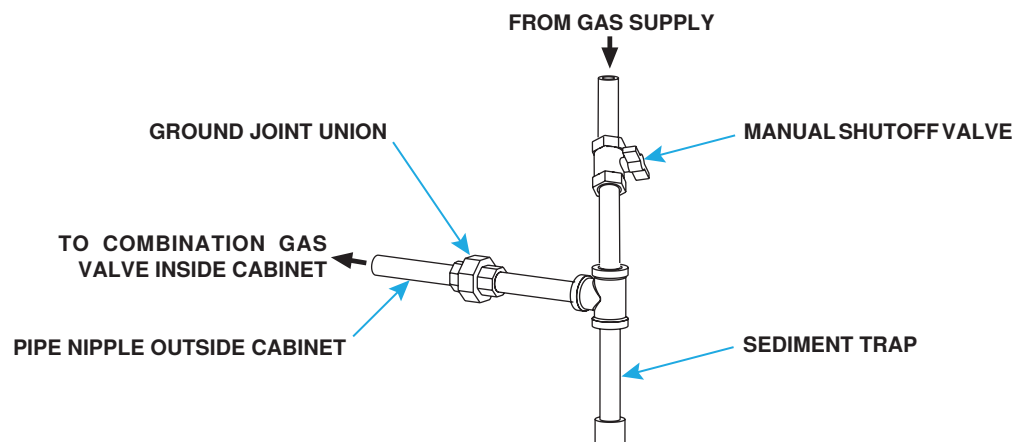


Figure 16. Gas Connections

INSTALLATION—CONTINUED

Piping Connections—Continued

Supply Piping Connections—Continued

Table 12. Gas Connection Sizes			
Model	Gas Type	Unit Size (MBTUh)	Connection Size (Inches (mm))
RP	Natural gas	125–250	1/2 (13)
		300–400	3/4 (19)
	Propane	125–400	1/2 (13)
HRPD	Natural gas	250–500	1/2 (13)
		600–800	3/4 (19)
	Propane	250–800	1/2 (13)

NOTE: The above are not supply line sizes. They are gas connection sizes for a standard unit.

Electrical Connections

⚠ CAUTION ⚠

- Ensure that all wiring is in accordance with the wiring diagram provided with the unit.
- All electrical wiring and connections, including electrical grounding, **MUST** be made in accordance with local, state, and national codes and regulations and with the *National Electric Code* (ANSI/NFPA 70, latest edition) or, in Canada, the *Canadian Electric Code* (Part 1, CSA C.22.1, latest edition). In addition, the installer should be aware of any local ordinances or gas company requirements that apply.
- All external wiring must be within approved conduit and have a minimum temperature rise of 140°F (60°C).
- Keep electric and gas supply components clear of service panels.
- 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 220°F (105°C), except for the limit control, optional bypass damper combustion air safety circuit (option AG39, AG40, AG41, or AG42), and sensor lead wires, which must be rated at 302°F (150°C).

NOTE: Electrical options are identified on the wiring diagram. Refer to separate instruction sheets for any optional equipment provided.

- Check the rating plate on the heater for the supply voltage and for current requirements. A separate line voltage supply with fused disconnect switch should be run directly from the main electrical panel to the unit, making connections in the junction box.
- **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 × maximum total input amps. When installing, ensure that the conduit and switch housing are clear of furnace panels and inspection plates. Allow at least 4 feet (1.2 meters) of service room between the switch and removable panels.

Control Wiring

⚠ CAUTION ⚠

- Ensure that the thermostat has an adequate VA rating for the total requirements. Add the coil rating of all relays and match the thermostat rating.
- Wiring between the thermostat and the heater must be suitable for a temperature rise of 140°F (60°C).

NOTE: Low voltage (24V) thermostats may be equipped with heat anticipators that level out unit cycling for optimum temperature control. Set the anticipator at full load control amps.

A 24V 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 5 feet (1.5 meters) 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. If more than one unit is cycled from one thermostat, separately activated relays must be substituted at unit thermostat connections. Labeled thermostat leads are provided in the heater junction box for connection of thermostat wiring.

Table 13. Control Wiring Sizes

Distance from Unit to Control (Feet (Meters))	Minimum Recommended Wire Gauge (AWG)	Total Wire Length (Feet (Meters))
75 (23)	#18	150 (46)
125 (38)	#16	250 (76)
175 (53)	#14	350 (107)

Table 14. Amp Ratings of 24V Optional Controls

Control	Ampere Rating (Maximum Amps)
Fan control	0.12
Time delay relay heater	0.10
Relay coil	0.12
Spark ignition system	0.10
Maxitrol gas control system	0.50
Single-stage gas valve	0.60
Two-stage gas valve	0.60

NOTE: 24V transformer has 20VA capacity.

CONTROLS

Standard Controls

Thermostat

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.

Fan Control

NOTE: To replace the fan control on units manufactured *before* APR 2004, a replacement kit (PN 209184) is required. Before OCT 2003, the fan control was optional. Check the wiring diagram on the furnace.

The fan for field-supplied blower is controlled as follows:

- After the gas valve opens, there is a time delay of blower operation to prevent the discharge of cold air.
- Blower operation continues after the thermostat is satisfied, as determined by the fan time delay.
- To ensure that the blower can continue to operate, the power supply to the furnace MUST NOT be interrupted except for when servicing the unit.

NOTE: 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, ensure that the fan control is wired correctly.

CONTROLS—CONTINUED

Standard Controls—Continued

Limit Control

Heaters are equipped with a non-adjustable high limit switch that 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.

Combination Gas Valve

⚠ WARNING ⚠

The combination gas valve is the prime safety shutoff. To ensure positive closure, all gas supply lines must be free of dirt or scale before connecting the unit.

All furnaces are equipped with a 24V combination gas valve that 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 combination gas valve allows for single-stage control from a single-stage, 24V thermostat.

Combustion Air Proving Switch

⚠ 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 conditions could result.

- The combustion air proving switch ensures that proper combustion airflow is available. The switch is a single-pole, double-throw switch that senses pressure caused by the flow of combustion air from the venter.
- To prevent the switch from responding to sudden temporary pressure fluctuations and to provide a prepurge, a small diameter orifice is installed in the outlet fitting of the switch.
- The electrical circuit of this heater is designed to check for proper switch position before each complete heat cycle. Only after checking the state of the pressure switch and proving that combustion air is present, will the gas ignition sequence begin. Refer to [Table 15](#) for approximate water column negative pressure readings and combustion air proving switch setpoints for sea level operating conditions.

Table 15. Combustion Air Proving Switch Settings at Sea Level Operating Conditions				
Unit Size (MBTUh)		Factory Setpoint	Startup Cold	Equilibrium
RP Models	HRPD Models			
Units <i>Without</i> Option AG39, AG40, or AG42				
All		-0.58 (±0.05) IN WC	-1.05 IN WC	-0.73 IN WC
Units <i>with</i> Option AG39, AG40, or AG42				
125–225	250–400	-0.58 (±0.05) IN WC	-1.30 (±0.20) IN WC	-1.05 (±0.10) IN WC
250–400	500–800	-0.58 (±0.05) IN WC	-1.20 (±0.20) IN WC	-0.95 (±0.10) IN WC

Pilot and Ignition Systems

⚠ WARNING ⚠

Due to high voltage on the pilot spark wire and pilot electrode, do not touch when energized.

- **Pilot:** The horizontal pilot is located in the control end of the burner rack (see [Figure 17](#)) 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 (refer to [Gas Supply Pressure](#) section). If required, adjust the pilot flame length to approximately 1-1/4 inch using pilot adjustment screw in control valve body.

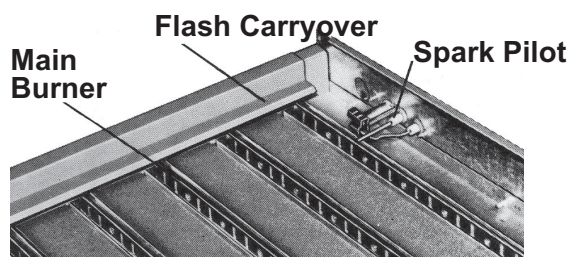


Figure 17. Typical Burner Rack with Spark Pilot

- **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 or with lockout is option AH3.
- **Ignition controller:** As part of the intermittent safety pilot system, the ignition controller provides high voltage spark to ignite 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 to complete the DC circuit and prove pilot flame. Proper operation of the electronic spark ignition system requires a minimum flame signal of 0.2 microamps, as measured by a microammeter. With pilot flame proven, the ignition controller energizes the main gas valve.

Burners and Carryover System

These duct furnaces have individually-formed steel burners with accurately die-formed ports to provide controlled flame stability without lifting or flashback with either natural or propane gas. All burners are lightweight and are factory-mounted in an assembly that permits all of the burners to be removed as a unit for inspection or service. During regular service, check the main burner ports, the carryover assemblies, and the orifices for cleanliness.

NOTE: Natural gas burner racks (except when equipped with electronic modulation option AG39, AG40, AG41, or AG42) are equipped with two flash carryovers. Propane gas burners are equipped with one flash carryover and a regulated gas lighter tube system.

Optional Controls

NOTE: Refer to the wiring diagram provided with the unit for proper wiring connections.

Two-Stage Heating Control (Option AG2)

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. The first stage (low fire) is factory-set (not field-adjustable). Both low fire and high fire stages are controlled by a Servo regulator that maintains constant gas input under wide variations in gas supply pressure. Refer to the instructions provided with the unit for gas valve specifications, wiring, and operating instructions.

CONTROLS—CONTINUED

Optional Controls—Continued

Two-Stage Makeup Air Control (Options AG3 and AG15)

Two-stage makeup air units are equipped with a two-stage gas valve, but instead of control from a two-stage room thermostat, the outlet air temperature is monitored and controlled by a two-stage ductstat. When discharge air temperature drops to the setpoint, low fire is energized. If low fire cannot satisfy the ductstat setting, high fire is energized. Makeup air applications are usually adjusted to maintain discharge air temperature between 65°F (18.3°C) and 75°F (23.9°C). In all applications, the allowable temperature rise of the furnace in the installation dictates the limits of the ductstat temperature setting. Depending on the option selection, the sensor is either connected by capillary tubing to the unit-mounted ductstat or electrically-connected to a remote temperature selector. Refer to the [Discharge Air Temperature Sensor Installation](#) section for instructions on locating the sensor in the ductwork. Set the ductstat as indicated in [Table 16](#).

Table 16. Recommended Settings for Two-Stage Makeup Air Control								
Option	Model	No. of Furnaces	Ductstat Setting			Temperature Selector Setting		
			First	Second	Staging Sequence	Setpoint	Differential	Stage Adder Offset
AG3	RP	1	70°F	—	66°F high stage→70°F low stage→74°F shutdown	—	—	—
	HRPD	2	70°F	64°F	60°F high stage (both furnaces)→64°F low stage (furnace 2)→68°F shutdown (furnace 2)→70°F low stage (furnace 1)→74°F shutdown (furnace 1)			
AG15*	RP	1	—			74°F	8°F	4°F
	HRPD**	2	—			74°F	14°F	10°F, 6°F, 4°F

*Adjust the setpoint and the differential of the temperature selector (Johnson #A350). Adjust the offset potentiometer on each of the stage adder modules (Johnson #S350). The settings listed provide the same sequence of staging as shown for option AG3 (for option AG15) or AG4 (for option AG17). Follow the manufacturer's instructions provided. **IMPORTANT:** Set the temperature selector and each stage adder module to HEAT. Follow the wiring diagram to obtain proper sequencing. **Operation:** The differential setting and offset degrees allow the controls to adapt to any adjustment in temperature selection (50–130°F (10°C–55°C)).

**Model HRPD with option AG15 uses three stage adder modules.

- **Ductstat with capillary tubing (option AG3):** The unit-mounted ductstat (see [Figure 18](#)) has an adjustable range of 0°F to 100°F (–17.8°C to 37.8°C) with a fixed differential of 3°F (1.7°C). The sensor is factory-set at 70°F (21.1°C). 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.

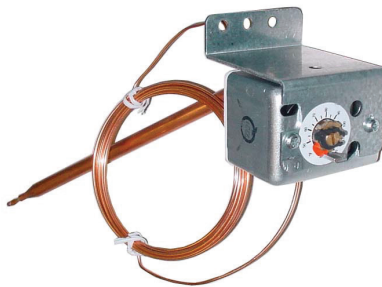


Figure 18. Unit-Mounted Ductstat

- **Ductstat with electronic remote temperature selector (option AG15):** Follow the wiring diagram provided with the unit and the manufacturer's instructions for wiring and installing the WiFi-capable remote temperature selector (see [Figure 19](#)). An expansion module is available as needed. After the installation is complete, adjust the selector to achieve the desired average outlet air temperature.



Figure 19. Remote Temperature Selector

Electronic Modulation (Options AG7, AG8, AG9, AG21, AG39, AG40, and AG42)

NOTE: Unit sizes 350 and 400 for RP models and 350–800 for HRPD models with electronic modulation require a minimum natural gas supply pressure of 6 IN WC. Options AG39 and AG40 are available only on model RP natural gas units. Option AG39 is not available on unit size 350. Option AG42 is available only on model HRPD natural gas units.

The type and capability of the electronic modulation system depends on the option selected. Depending on the heat requirements 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) that furnishes varying DC current to the modulating valve to adjust the gas input. Each modulating valve is basically a regulator with the 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 to supply 3.5 IN WC pressure to the combination gas valve. Refer to the [Discharge Air Temperature Sensor Installation](#) section for instructions on locating the sensor in the ductwork.

- **Electronic modulation between 50% and 100% firing rate (option AG7):** Electronic modulation for heating that is controlled by a specially-designed room thermostat (60–85°F (15.6–29.4°C)).
- **Electronic modulation between 50% and 100% firing rate (option AG8):** Electronic modulation for makeup air application that is controlled by a duct sensor and temperature selector (55–90°F (12.8–32.2°C)). The temperature selector setting for option AG8 is on the amplifier (see [Figure 20](#)). Available with an override thermostat.

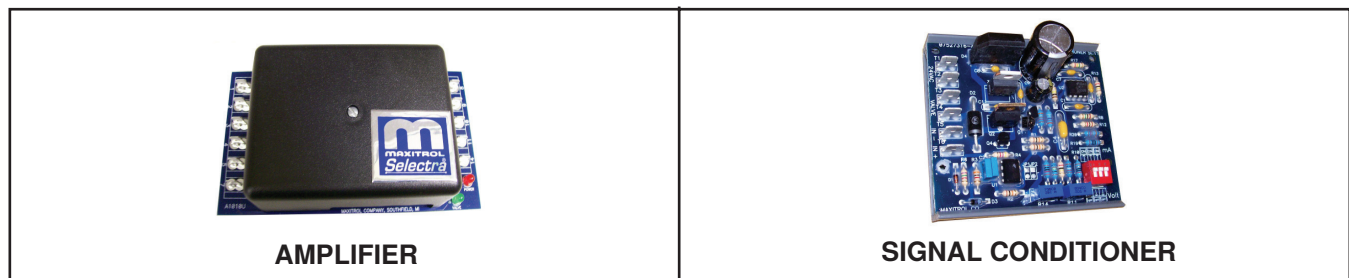


Figure 20. Maxitrol Amplifier and Signal Conditioner

NOTE: 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.

- **Electronic modulation between 50% and 100% firing rate (option AG9):** Electronic modulation for makeup air application that is controlled by a duct sensor and temperature selector (55–90°F (12.8–32.2°C)) has a remote temperature selector and is available with an override thermostat.

CONTROLS—CONTINUED

Optional Controls—Continued

Electronic Modulation (Options AG7, AG8, AG9, AG21, AG39, AG40, and AG42)—Continued

- **Electronic modulation between 50% and 100% firing rate (option AG21):** With option AG21, the furnace is equipped with a Maxitrol signal conditioner (see [Figure 20](#)) that operates much the same way as the amplifier above to control the regulator valve. The signal conditioner accepts an input signal of either 4–20 milliamps or 0–10V from a customer-supplied control device such as a computer. With the dip switches on the conditioner positioned to ON, the conditioner accepts a 4–20 milliamp signal. With the dip switches on the conditioner positioned to OFF, the conditioner accepts a 0–10V signal. The conditioner converts the signal to the 0–20V DC current required to control the modulating valve.
- **Electronic modulation between 20–28% and 100% firing rate (option AG39):** Depending on its size, a furnace equipped with option AG39 has 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. 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 which is necessary to maintain the desired temperature. When the input rate is reduced enough to decrease the gas pressure to 1.1 IN WC, 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 to divert some of the incoming air directly into the flue duct to reduce air flow through the burner. Safety switches monitor the position of the bypass damper. When the gas pressure rises to >1.1 IN WC, the bypass damper closes. The gas train (see [Figure 21](#)) 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 (see [Figure 20](#)) with a corresponding remote temperature dial. The gas supply (refer to pressure requirements in [Table 17](#)) 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. The duct temperature sensor and mixing tube are shipped loose for field installation in the discharge duct. This uniquely-designed modulation system requires combustion air pressure settings different from the standard system. Refer to [Table 15](#) for the approximate combustion air proving switch settings at sea-level operation. Refer to the [Troubleshooting Bypass Combustion Air Damper Safety Circuit on Units with Option AG39, AG40, or AG42](#) section for troubleshooting.

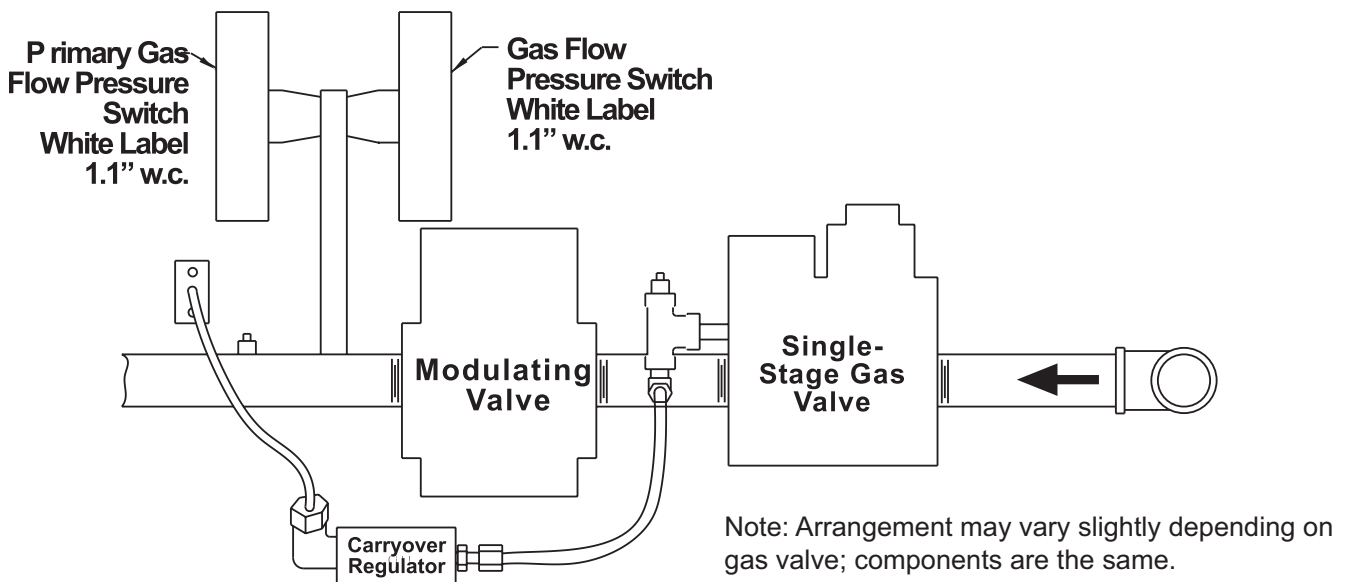


Figure 21. Options AG39, AG40, and AG42 Manifold Arrangement

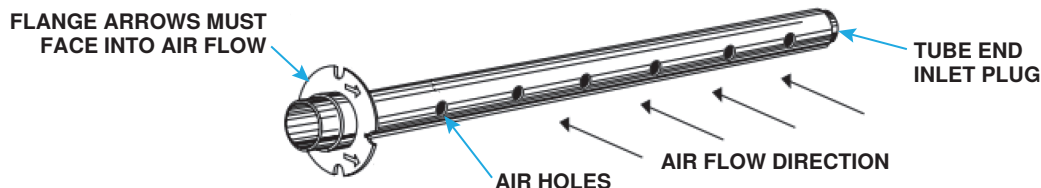
Table 17. Options AG39, AG40, and AG42 Pressure Requirements

Unit Size (MBTUh)		Maximum Turndown (%)	Input Range (MBH)	Factory-Set Inlet Pressure to Modulating Valve (IN WC)	Required Gas Supply Pressure (IN WC)
RP Models	HRPD Models				
125	250	20	25–125	3.9	5.0
150	300	27	40.3–150	3.7	5.0
175	350	23	40.3–175	3.7	5.0
200	400	26	51.8–200	3.9	5.0
225	—	23	51.8–225	3.9	5.0
250	500	28	69–250	4.0	5.0
300	600	23	69–300	4.0	5.0
400	800	25	100–400	4.4	6.0

Electronic modulation between 20–28% and 100% firing rate (options AG40 and AG42): The furnace is equipped with a Maxitrol signal conditioner (see [Figure 20](#)) that receives an input signal of either 4–20 milliamps or 0–10V from a customer-supplied control device such as a computer. With the dip switches on the conditioner positioned to ON, the conditioner accepts a 4–20 milliamp signal. With the dip switches on the conditioner positioned to OFF, the conditioner accepts a 0–10V signal. The conditioner converts the signal to the 0–20V DC current required to control the modulating valve. The heater functions and is equipped in the same way as option AG39 except that with computer control, the temperatures are selected through the software and there is no temperature selector or duct sensor. This uniquely-designed modulation system requires combustion air pressure settings different from the standard system. Refer to [Table 15](#) for the approximate combustion air proving switch settings at sea-level operation. Refer to [Table 17](#) for pressure requirements. Refer to the [Troubleshooting Bypass Combustion Air Damper Safety Circuit on Units with Option AG39, AG40, or AG42](#) section for troubleshooting.

Photoelectric Air Duct Smoke Detector (Option SA1)

The smoke detector (see [Figure 22](#)) is designed to sense the presence of smoke in the air duct system so that appropriate action can be taken to shut off fans and blowers to facilitate the management of toxic smoke and fire gases throughout the areas served by the duct system. The smoke detector is field-installed in accordance with the manufacturer's instructions provided with the detector.

**Figure 22. Air Duct Smoke Detector Sampling Tube**

OPERATION

⚠ WARNING ⚠

To ensure safety, follow the lighting instructions located on the outlet box cover.

Pre-Startup Checklist

- ☐ Ensure that electrical supply is in accordance with voltage rating on unit's rating plate.
- ☐ Ensure that all field wiring is in accordance with wiring diagram and that wire gauges are as required for electrical load.
- ☐ Ensure that electrical entrances are sealed against the weather.
- ☐ Ensure that fuses or circuit breakers are in place and are sized correctly.
- ☐ Ensure that condensate drain holes in the corners of the cabinet are open.
- ☐ Ensure that clearances from combustibles are in accordance with [Clearances](#) sections).
- ☐ Check piping for leaks and proper gas line pressure and bleed trapped air from gas lines (refer to [Supply Piping Connections](#) section):
 - a. Turn OFF manual shutoff valve.
 - b. Turn ON gas supply.
 - c. Observe gas meter for movement or attach pressure gauge readable to 0.1 IN WC and, after turning gas ON for 10 seconds, turn OFF gas supply—no change in pressure should occur over 3-minute period.
 - d. If step c indicates leak, locate leak by brushing soapy solution on all fittings—bubbles will appear at any leaks.
 - e. Repair any leaks and repeat test.
- ☐ Check to ensure that flue discharge openings are free from obstructions.

Startup

1. Close all panels tightly.
2. Turn ON electric and gas supply to furnace.
3. Adjust thermostat or ductstat so that call for heat exists.
4. Observe for complete sequencing of safety pilot and ignition (refer to [Table 18](#)).

Table 18. Sequence of Operation

Step	Action	Observe
1	Set thermostat at its lowest setting	
2	Turn ON electric and main and manual gas valves	Firing rate is controlled by thermostat Blower motor operates from fan time delay
3	Set thermostat at desired setting—thermostat calls for heat	Venter motor is energized after 15-second (approximate) time delay Venter flow switches from NC to NO contacts to energize pilot gas valve and spark gap to produce pilot flame on each operating cycle Sensing probe proves presence of pilot flame and energizes safety switch portion of control to deenergize spark gap and energize main valve Main gas ignites and unit fires at full rate
4	If flame is extinguished during main burner operation, safety switch closes main valve and recycles spark gap	On unit equipped with controller with lockout, if pilot is not established within 120 seconds (approximately), unit locks out for 1 hour unless reset by interrupting power to control circuit

Post-Startup Checklist

- ❑ Observe burner flame at full fire. Natural gas flame should be about 1-1/2 inches in height with blue coloring. Propane gas flame should be approximately same height with blue coloring. Yellow tipping may appear on propane gas. If yellow extends beyond 1/2- to 3/4-inch, adjust air shutters (refer to [Burner Air Shutter Adjustment](#) section). If shutter adjustment does not reduce yellowing, check for gas leaks at control manifold or orifice fitting.
- ❑ Turn unit OFF and ON, pausing 2 minutes between each cycle. Observe to verify 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.
- ❑ Using manometer or slant gauge readable up to 14 IN WC, check orifice manifold for operating pressure on full fire. Natural gas should be 3.5 IN WC at this point. Propane gas should be 10 IN WC at this point. Variations from these pressures are not recommended as ignition and efficiency performance can be adversely affected by improper pressure adjustment (refer to [Measure and Adjust Manifold \(Outlet\) Gas Pressure](#) section).
- ❑ Place owner's envelope containing Limited Warranty Card, this manual, and any optional information in accessible location near heater. Follow instructions on envelope.

⚠ DANGER ⚠

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

ADJUSTMENTS

Measure and Adjust Manifold (Outlet) Gas Pressure

NOTE: Always check the rating plate for minimum gas supply pressure.

Measuring manifold gas pressure cannot be done until the heater is in operation. Minimum supply pressure requirements vary based on the size of the burner and the gas control option. Most units require a minimum of 5 IN WC natural gas as stated above, but sizes 350 and 400 with electronic modulation require a minimum of 6 IN WC natural gas supply pressure. Sizes 300 and 350 with mechanical modulation require 7 IN WC.

- **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 IN WC. Low fire on a two-stage valve is set to 1.8 IN WC. Inlet supply pressure to the valve must be a minimum of 5 IN WC or as noted on the rating plate and a maximum of 14 IN WC.

ADJUSTMENTS—CONTINUED

Measure and Adjust Manifold (Outlet) Gas Pressure—Continued

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

⚠ WARNING ⚠

- **Manifold gas pressure must never exceed 3.5 IN WC for natural gas or 10 IN WC for propane gas.**
- **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 when it is on standby. Incorrect inlet pressure could cause excessive manifold gas pressure immediately or at some future time.**

NOTE: A manometer (fluid-filled gauge) with an inches water column scale is recommended.

1. With manual valve (on combination valve) positioned to prevent flow to main burners, connect manometer to outlet pressure tap (see [Figure 23](#)) on valve.

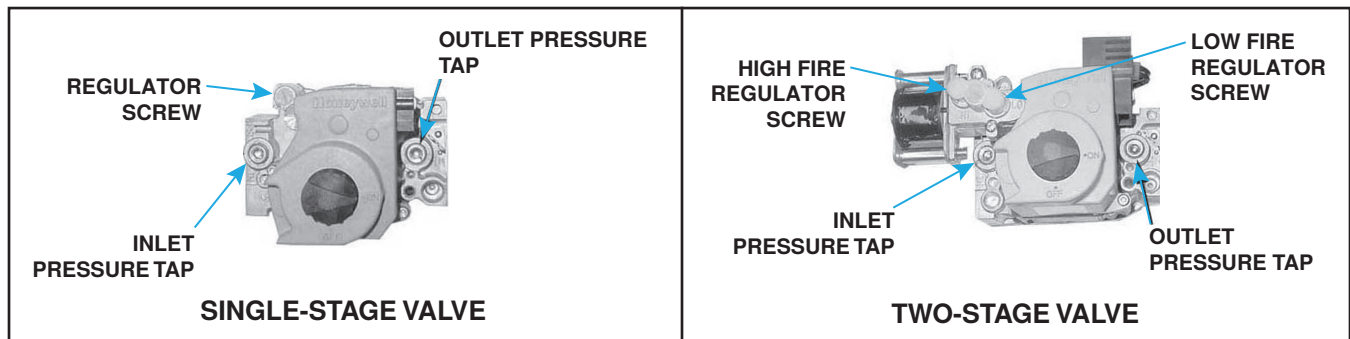


Figure 23. Combination Gas Valves

2. To measure low stage pressure on units equipped with two-stage valve, disconnect wire from HI terminal on valve. Open valve and operate heater and observe manometer reading. Be sure to reconnect wire.

⚠ CAUTION ⚠

DO NOT bottom out the gas valve regulator screw. This can result in excessive overfire and heat exchanger failure due to unregulated manifold pressure.

3. Normally, adjustments to factory-preset regulator should not be necessary. If adjustment is necessary, set pressure to correct settings by turning regulator screw (see [Figure 23](#)) IN (clockwise) to increase pressure or OUT (counterclockwise) to decrease pressure. Consult valve manufacturer's literature provided with furnace for more detailed information.
4. When manometer reading indicates that outlet pressure is correct, disconnect manometer and install cap(s) on regulator screw(s).

NOTES:

- High elevation (>2,000 feet (>609 meters)) application with this unit depends on the installation elevation and the heating value of the gas. At high elevations, the heating value of natural gas is always lower than the heating value at sea level.
- Deration is necessary to compensate for low atmospheric pressure at high elevations. Generally this will require obtaining the gas heating value from the local gas utility and replacing the burner orifices.

For high-elevation (>2,000 feet (>609 meters)) installations that require orifice replacement, replace the burner orifices as follows:

1. Determine model number and rated input (BTUh) from unit's rating plate.
2. Determine appropriate orifice replacement (refer to [Table 19](#)) for installation elevation.

Table 19. Burner Orifices

Table 19. Burner Orifices											
Installation Location	Installation Elevation (Feet (Meters))	Gas Type	Model RP Unit Size (MBTUh)								
			125	150	175	200	225	250	300	350	400
			Model HRPD Unit Size (MBTUh)								
			250	300	350	400		500	600	700	800
PN, Drill Size (Quantity)*											
US, Canada	0–2001 (0–610)	NG	84437, #42 (5)	11833, #44 (7)	84437, #42 (7)	11828, #43 (9)	84437, #42 (9)	11833, #44 (12)	84437, #42 (12)	84437, #42 (14)	84437, #42 (16)
		LP	61652, 1.45 mm (5)	11830, #55 (7)	61652, 1.45 mm (7)	11830, #55 (9)	61652, 1.45 mm (9)	11830, #55 (12)	61652, 1.45 mm (12)	61652, 1.45 mm (14)	61652, 1.45 mm (16)
US	2001–3000 (611–915)	NG	84437, #42 (5)	38678, #45 (7)	84437, #42 (7)	11833, #44 (9)	84437, #42 (9)	38678, #45 (12)	84437, #42 (12)	84437, #42 (14)	84437, #42 (16)
		LP	11834, #54 (5)	11830, #55 (7)	11834, #54 (7)	11830, #55 (9)	11834, #54 (9)	11830, #55 (12)	11834, #54 (12)	11834, #54 (14)	11834, #54 (16)
Canada	2001–4500 (611–1373)	NG	11828, #43 (5)	38678, #45 (7)	11828, #43 (7)	11833, #44 (9)	11828, #43 (9)	38678, #45 (12)	11828, #43 (12)	11828, #43 (14)	11828, #43 (16)
		LP	11834, #54 (5)	11830, #55 (7)	11834, #54 (7)	11830, #55 (9)	11834, #54 (9)	11830, #55 (12)	11834, #54 (12)	11834, #54 (14)	11834, #54 (16)
US	3001–4000 (916–1220)	NG	11828, #43 (5)	38678, #45 (7)	11828, #43 (7)	11833, #44 (9)	11828, #43 (9)	38678, #45 (12)	11828, #43 (12)	11828, #43 (14)	11828, #43 (16)
		LP	11834, #54 (5)	11830, #55 (7)	11834, #54 (7)	11830, #55 (9)	11834, #54 (9)	11830, #55 (12)	11834, #54 (12)	11834, #54 (14)	11834, #54 (16)
	4001–5000 (1221–1525)	NG	11828, #43 (5)	38678, #45 (7)	11828, #43 (7)	11833, #44 (9)	11828, #43 (9)	38678, #45 (12)	11828, #43 (12)	11828, #43 (14)	11828, #43 (16)
		LP	11834, #54 (5)	11830, #55 (7)	11834, #54 (7)	11830, #55 (9)	11834, #54 (9)	11830, #55 (12)	11834, #54 (12)	11834, #54 (14)	11834, #54 (16)
	5001–6000 (1526–1830)	NG	11828, #43 (5)	16590, #46 (7)	11828, #43 (7)	38678, #45 (9)	11828, #43 (9)	16590, #46 (12)	11828, #43 (12)	11828, #43 (14)	11828, #43 (16)
		LP	97360, 1.35 mm (5)	39658, #56 (7)	97360, 1.35 mm (7)	39658, #56 (9)	97360, 1.35 mm (9)	39658, #56 (12)	97360, 1.35 mm (12)	97360, 1.35 mm (14)	97360, 1.35 mm (16)
	6001–7000 (1831–2135)	NG	11833, #44 (5)	84853, #47 (7)	11833, #44 (7)	38678, #45 (9)	11833, #44 (9)	84853, #47 (12)	11833, #44 (12)	11833, #44 (14)	11833, #44 (16)
		LP	97360, 1.35 mm (5)	39658, #56 (7)	97360, 1.35 mm (7)	39658, #56 (9)	97360, 1.35 mm (9)	39658, #56 (12)	97360, 1.35 mm (12)	97360, 1.35 mm (14)	97360, 1.35 mm (16)
*Quantity listed is per duct furnace											

*Quantity listed is per duct furnace.

ADJUSTMENTS—CONTINUED

Measure and Adjust Manifold (Outlet) Gas Pressure—Continued

High Elevation Conversion—Continued

Table 19. Burner Orifices—Continued											
Installation Location	Installation Elevation (Feet (Meters))	Gas Type	Model RP Unit Size (MBTUh)								
			125	150	175	200	225	250	300	350	400
			Model HRPD Unit Size (MBTUh)								
			250	300	350	400		500	600	700	800
PN, Drill Size (Quantity)*											
US	7001–8000 (2136–2440)	NG	11833, #44 (5)	84853, #47 (7)	11833, #44 (7)	16590, #46 (9)	11833, #44 (9)	84853, #47 (12)	11833, #44 (12)	11833, #44 (14)	11833, #44 (16)
		LP	11830, #55 (5)	39658, #56 (7)	11830, #55 (7)	39658, #56 (9)	11830, #55 (9)	39658, #56 (12)	11830, #55 (12)	11830, #55 (14)	11830, #55 (16)
	8001–9000 (2441–2745)	NG	38678, #45 (5)	40414, #48 (7)	38678, #45 (7)	84853, #47 (9)	38678, #45 (9)	40414, #48 (12)	38678, #45 (12)	38678, #45 (14)	38678, #45 (16)
		LP	11830, #55 (5)	39658, #56 (7)	11830, #55 (7)	39658, #56 (9)	11830, #55 (9)	39658, #56 (12)	11830, #55 (12)	11830, #55 (14)	11830, #55 (16)
	9001–10,000 (2746–3048)	NG	16590, #46 (5)	40414, #48 (7)	16590, #46 (7)	84853, #47 (9)	16590, #46 (9)	40414, #48 (12)	38678, #45 (12)	38678, #45 (14)	38678, #45 (16)
		LP	11830, #55 (5)	39658, #56 (7)	11830, #55 (7)	39658, #56 (9)	11830, #55 (9)	39658, #56 (12)	11830, #55 (12)	11830, #55 (14)	11830, #55 (16)

*Quantity listed is per duct furnace.

*Quantity listed is per duct furnace.

- Unthread existing burner orifices from gas manifold.

⚠ DANGER ⚠

- DO NOT use pipe tape or sealant (pipe dope or joint compound) on orifice threads because the hole in the orifice may become blocked and may cause fire, explosion, property damage, carbon monoxide poisoning, personal injury, or death.**
- DO NOT attempt to drill out orifices in the field. Use only factory-supplied orifices. Improperly drilled orifices may cause fire, explosion, carbon monoxide poisoning, personal injury, or death.**

- Thread replacement burner orifices into gas manifold—to prevent cross-threading, hand-tighten orifices into gas manifold until snug and then tighten one-and-one-half to two turns using wrench.

⚠ DANGER ⚠

DO NOT use an open flame to check for gas leaks.

- Check all connections for gas leaks using commercial leak-detecting fluid or rich soap and water solution. Leaks are indicated by presence of bubbles. If leak is detected, tighten connection. If leak cannot be stopped by tightening connection, replace part(s).

⚠ DANGER ⚠

Gas conversion must be performed by qualified service personnel using a factory-supplied conversion kit. Failure to use the proper conversion kit can cause fire, explosion, property damage, carbon monoxide poisoning, personal injury, or death.

If gas conversion (natural gas to propane or propane to natural gas) is required, convert the unit in accordance with the gas conversion manual found at www.reznorhvac.com. When conversion is complete, verify that the input rate is correct.

Burner Air Shutter Adjustment

⚠ DANGER ⚠

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

NOTE: Air shutters are required on propane gas units but are optional on natural gas units.

1. Operate heater for about 15 minutes with air shutters open.

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

2. Turn slotted screw that moves air shutters and adjusts all burners simultaneously on end manifold bracket—clockwise to open shutters or counterclockwise to close shutters. Close air shutters and observe flame for yellow-tipping.

NOTE: A limited amount of yellow-tipping is permissible for liquefied petroleum gases. Natural gas should not display any yellow-tipping.

3. Open air shutters until yellow disappears.

Adjust Heat Stage Controllers (Option AG41 or AG42, Model HRPD)

Model HRPD units with option AG41 and AG42 have heat stage controllers that control operation of the two-stage furnace based on outside air temperature setpoints. Proper setpoints are important to ensure that the modulating furnace (**Heat Stage 1**) is always in control and avoids cycling. The proper setpoint for each controller must be determined from basic design information as follows:

1. Calculate controller settings for **Heat Stage 2** and **Heat Stage 3** in a system with two furnace sections using the following formulas in which T_{SP} = setpoints of heat stage controllers (T_{SP2} and T_{SP3}), T_{SA} = desired supply air temperature, and T_D = design (minimum) entering air temperature:

$$\text{Setpoint for heat stage 2: } T_{SP2} = T_{SA} - 0.46 (T_{SA} - T_D)$$

$$\text{Setpoint for heat stage 3: } T_{SP3} = T_{SA} - 0.73 (T_{SA} - T_D)$$

NOTE: EXAMPLE: With 3,600 CFM, power-vented, 100% outside air, -10°F outdoor winter design, and 75°F desired supply air, $T_{SP2} = 75 - [0.46 \times (75 - (-10))] = 75 - (0.46 \times 85) = 35.9$ and $T_{SP3} = 75 - [0.73 \times (75 - (-10))] = 75 - (0.73 \times 85) = 12.9$. Set Heat #2 controller to 36°F and Heat #3 controller to 13°F .

ADJUSTMENTS—CONTINUED

Adjust Heat Stage Controllers (Option AG41 or AG42, Model HRPD)—Continued

2. Locate heat stage controllers marked **Heat #2** and **Heat #3** in inlet air section.

NOTE: The same type of controller may also be used as the optional high ambient limit control (option BN2) and as the mixed air controller that is part of air control options AR12, AR13, AR15, and AR16.

3. Adjust each controller to setpoint as determined by calculation in step 1.

MAINTENANCE

WARNING

If you turn OFF the power supply, turn OFF the gas.

CAUTION

When cleaning, wearing eye protection is recommended.

NOTE: Use only factory-authorized replacement parts.

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 4 months. If the furnace is operating in an area where an unusual amount of dust, soot, or other impurities are present in the air, more frequent inspection is recommended.

Service Checklist

The following section is designed to aid a qualified service person in maintaining and servicing this equipment. At a minimum, perform the following annually:

- ☐ Inspect filters and clean or replace as necessary.
- ☐ Inspect blower and belt—check belt for tension, wear, and alignment (adjust or replace as needed) and clean dirt from blower and motor.
- ☐ Check gas valve to ensure that gas flow is being shut off completely.
- ☐ Clean heat exchanger both internally and externally.
- ☐ Check pilot burner and main burners for scale, dust, or lint accumulation and clean as necessary.
- ☐ Clean all dirt and grease from primary and secondary combustion air openings.
- ☐ **Power vent:** Check flue products outlet and clean as necessary.
- ☐ **Gravity vent:** Check vent cap or optional vent system and replace any parts that do not appear sound.
- ☐ Check main burner ports, carryover assemblies, and orifices for cleanliness.
- ☐ Check wiring for any damaged wire—replace damaged wiring (refer to [Electrical Connections](#) section for wiring requirements).

Maintenance Procedures

Combination Gas Valve Maintenance

WARNING

The combination gas valve is the prime safety shutoff. All gas supply lines must be free of dirt or scale before connecting them to the unit to ensure positive closure.

Inspect the combination gas valve, carefully remove any external dirt accumulation, and check wiring connections. Check the valve annually to ensure that the valve is shutting off gas flow completely as follows:

1. Close manual shutoff valve to prevent flow to combination gas valve.

NOTE: Use a water column manometer that is readable to the nearest tenth of an inch.

2. Connect manometer to inlet pressure tap on combination gas valve (see [Figure 23](#)).
3. Observe manometer for 2 to 3 minutes—no gas pressure should be indicated.
 - a. If manometer indicates any gas pressure, manual shutoff valve must be replaced or repaired before combination gas valve can be checked.
 - b. If manometer does not indicate gas pressure, slowly open manual shutoff valve.
4. Close manual shutoff valve and observe manometer— no loss of gas pressure should be indicated. If loss of pressure is indicated, replace combination gas valve before furnace is restored to operation.

Burner Rack Maintenance

Remove, disassemble, clean, reassemble, and re-install burner rack as follows:

1. Remove burner rack:
 - a. Turn OFF gas and electric supply.
 - b. Remove control access side panel.
 - c. Disconnect any pilot lines and flame sensor leads.
 - d. Mark and disconnect electric valve leads.
 - e. Uncouple union in gas supply.
 - f. Remove sheet metal screws in top corners of burner rack assembly.
 - g. Pull drawer-type burner rack out of furnace.
2. Disassemble burner rack:

NOTE: Natural gas burner racks manufactured *before* MAR 1995 may 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.

- a. For natural gas burner rack, remove flash carryover system from manifold end of burner rack.
- b. For propane gas burner rack:
 - (1) Break lighter tube connection at regulator and remove lighter tube orifice supply tubing.
 - (2) Remove retaining screws in drip shield and remove shield.
 - (3) Remove retaining screws and slide out lighter tube.
- c. Pull main burners horizontally away from injection opening and lift out.
- d. Remove manifold bracket screws and remove manifold.
- e. Remove burner orifices.
- f. Remove screws and lift out pilot burner.

MAINTENANCE—CONTINUED

Maintenance Procedures—Continued

Burner Rack Maintenance—Continued

3. Clean burner rack in accordance with instructions in [Cleaning Pilot and Burners](#) section.
4. Re-assemble and re-install burner rack by reversing above steps, being careful not to create any unsafe conditions.

Cleaning Pilot and Burners

⚠ WARNING ⚠

To prevent injury when cleaning pilot and burners, wearing eye protection is recommended.

⚠ CAUTION ⚠

To prevent damage to pilot orifice, do not ream the orifice.

If the pilot flame appears short and/or yellow, check the pilot orifice for blockage caused by lint or dust accumulation.

1. Remove the pilot orifice and clean it using compressed air.
2. Check and clean the aeration slot in the pilot burner.
3. Clean the metal sensing probe and the pilot hood with an emery cloth and wipe off the ceramic insulator.
4. Check the spark gap (see [Figure 24](#)), which should be maintained to 7/64 inch.

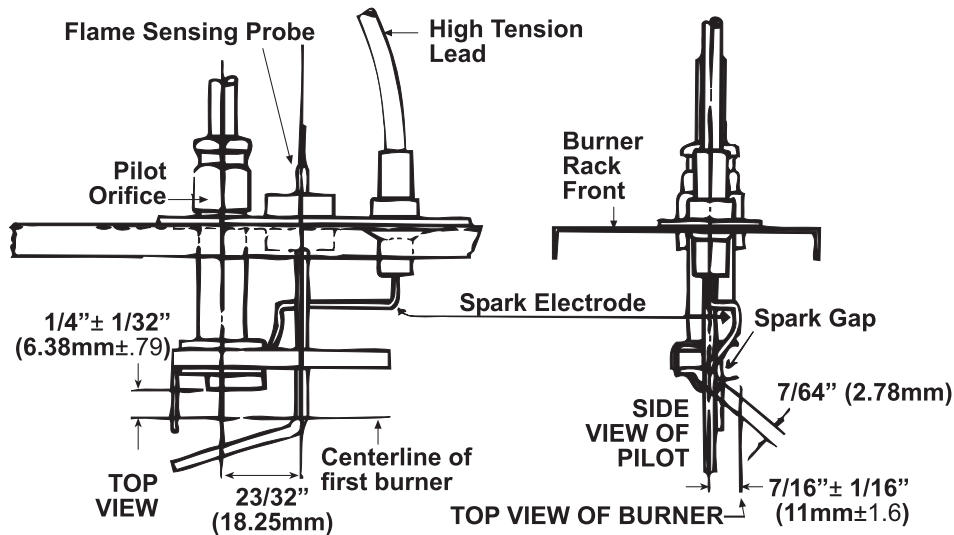


Figure 24. Pilot Assembly Spark Gap

5. After the pilot is cleaned, blow away any dirt using compressed air.
6. Clean the main burners and burner orifices using compressed air.

⚠ CAUTION ⚠

When cleaning burner ports, do not use anything that might change the port size.

7. Use an air nozzle to blow out scale and dust accumulation from the burner ports. Alternate blowing compressed air through the burner ports and then through the venturi. Use a fine wire to dislodge any stubborn particles from the burner ports.
8. Clean the burner rack carryover systems using compressed air.

Spark Ignition System Maintenance

⚠ WARNING ⚠

Due to high voltage on pilot spark wire and pilot electrode, do not touch when energized.

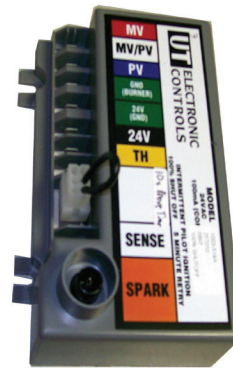
NOTE: When checking for spark with the pilot burner assembly removed from the burner rack, the pilot assembly must be grounded to the heater for proper spark.

1. If no spark occurs, check the following:
 - a. Using microammeter, measure voltage between terminals TH and 7 on ignition controller. Voltage should be at least 20V and no higher than 32V. Refer to [TROUBLESHOOTING](#) section if no voltage is observed.
 - b. Check for short to ground in high tension lead and/or ceramic insulator.
 - c. Verify that pilot spark gap (see [Figure 24](#)) is approximately 7/64 inch.
 - d. If the above conditions are normal and no spark occurs, replace the ignition controller.

NOTE: If replacing an earlier model of ignition controller (see [Figure 25](#)), order a replacement kit (PN 257472 for a unit with recycling gas control option AH2 or PN 257473 for a unit with gas control with lockout option AH3). Option codes are listed on the unit wiring diagram.



RECYCLING IGNITION CONTROLLER
FOR GAS CONTROL OPTION AH2,
UTEC MODEL 1003-638A
(PN 257009): REPLACE WITH
REPLACEMENT KIT (PN 257472)



IGNITION CONTROLLER WITH
LOCKOUT FOR GAS CONTROL
OPTION AH3, UTEC MODEL 1003-514
(PN 257010): REPLACE WITH
REPLACEMENT KIT (PN 257473)

Figure 25. Obsolete Ignition Controllers

2. If the main gas valve fails to open with a normal full-size pilot flame established, check the following:
 - a. If voltage between black and brown leads on main gas valve is 20–32 VAC and there is no main gas flow with built-in manual valve in FULL OPEN position, main valve is defective.
 - b. If there is no voltage between black and brown leads on main gas valve, check for disconnected or shorted flame sensor lead or flame sensor probe.
3. If the above conditions are normal and main gas flow is still off, the ignition controller is probably defective. Do not attempt to service the ignition controller as it does not contain any replaceable components.

MAINTENANCE—CONTINUED

Maintenance Procedures—Continued

Heat Exchanger Cleaning

1. Clean heat exchanger outer surfaces (circulating air side):
 - a. Gain access by removing inspection panels in ductwork or remove ductwork.

NOTE: If the heater has been converted to high CFM in accordance with [High CFM Conversion](#) section, the baffles will have already been removed.

- b. Remove baffles between heat exchanger tubes in accordance with [Reverse Airflow Conversion](#) section.
 - c. Remove accumulated dust and grease deposits from heat exchanger tubes and baffles using brush and/or air hose.
 - d. Re-install baffles in accordance with [Reverse Airflow Conversion](#) section.
 - e. Secure ductwork as necessary.
2. Clean heat exchanger inner surfaces (combustion gas side):

NOTES:

- For cleaning the inner surfaces of the heat exchanger, an air hose, a long (18- to 24-inch) stiff brush of 1/2-inch diameter 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. High-efficiency furnaces manufactured before MAR 1995 have a C prefix in their model designation. All furnaces manufactured after FEB 1995 are designed for high-efficiency and include the heat exchanger V-baffles.
-

- a. Remove burner rack assembly in accordance with [Burner Rack Maintenance](#) section.
 - b. Remove heat exchanger V-baffles (see [Figure 26](#)):
 - (1) Remove ends of flue gas collection box.
 - (2) On control side of furnace, remove venter assembly and flue outlet duct to gain access to collection box end.
 - (3) For model RP unit sizes 125–300, remove screw that secures one tube baffle retaining angle on each inside wall of collection box and remove angle.
 - (4) For model RP unit size 400, remove inner baffle from flue collection box: on control side, align inner baffle with slot in collection box edge and pull inner baffle until it clears heat exchanger. Remove screw at each end and slide flue diverter out of furnace.
 - (5) Pull V-baffles out of heat exchanger.
 - c. Clean inner surfaces using furnace brush or piece of heavy wire to which piece of steel wool is attached. Scrub tube walls to remove any accumulated dust, rust, and/or soot.
 - d. Clean V-tubes and reassemble heat exchanger.
 - e. Install burner rack assembly in accordance with [Burner Rack Maintenance](#) section.
3. Check furnace for proper operation.

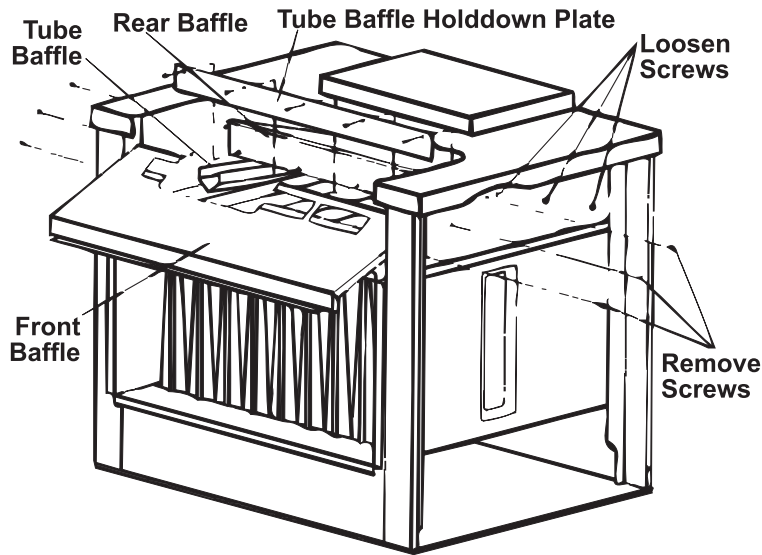


Figure 26. Heat Exchanger V-Baffles Removal

TROUBLESHOOTING

General Troubleshooting

Table 20. General Troubleshooting

Symptom	Probable Cause	Remedy
A. Venter motor will not start on power-vented unit	1. No power to furnace	Turn ON power and check supply fuses or circuit breaker
	2. No 24V power to venter relay	Turn up thermostat and check control transformer output Check for loose or improper wire connections
	3. Defective venter relay	Replace defective part
	4. Defective motor or capacitor	Replace defective part
B. Pilot will not light on power-vented unit with venter operating	1. Manual valve not open	Open manual valve
	2. Air in gas line	Bleed gas line
	3. Dirt in pilot orifice	Remove pilot orifice and clean with compressed air or solvent
	4. Gas pressure too high or too low	Adjust gas pressure (refer to Measure and Adjust Manifold (Outlet) Gas Pressure section)
	5. Kinked pilot tubing	Replace tubing
	6. Pilot valve does not open	If 24V power is available at valve, replace valve
	7. No spark	
	a. Loose wire connections	Ensure that all wires connections are solid
	b. Transformer failure	Ensure that 24V power is available
	c. Incorrect spark gap	Maintain spark gap at 7/64 inch
	d. Spark cable shorted to ground	Replace worn or grounded spark cable
	e. Spark electrode shorted to ground	Replace pilot if ceramic spark electrode is cracked or grounded
	f. Drafts affecting pilot	Ensure that all panels are in place and are tightly secured to prevent drafts at pilot
	g. Ignition control not grounded	Ensure that ignition control is grounded to furnace chassis
	h. Faulty ignition controller	If 24V power is available to ignition controller and all other causes have been eliminated, replace ignition control
	8. Optional lockout device interrupting control circuit due to above causes	Reset lockout by interrupting control at thermostat
	9. Faulty combustion air proving switch	Replace combustion air proving switch

TROUBLESHOOTING—CONTINUED

General Troubleshooting—Continued

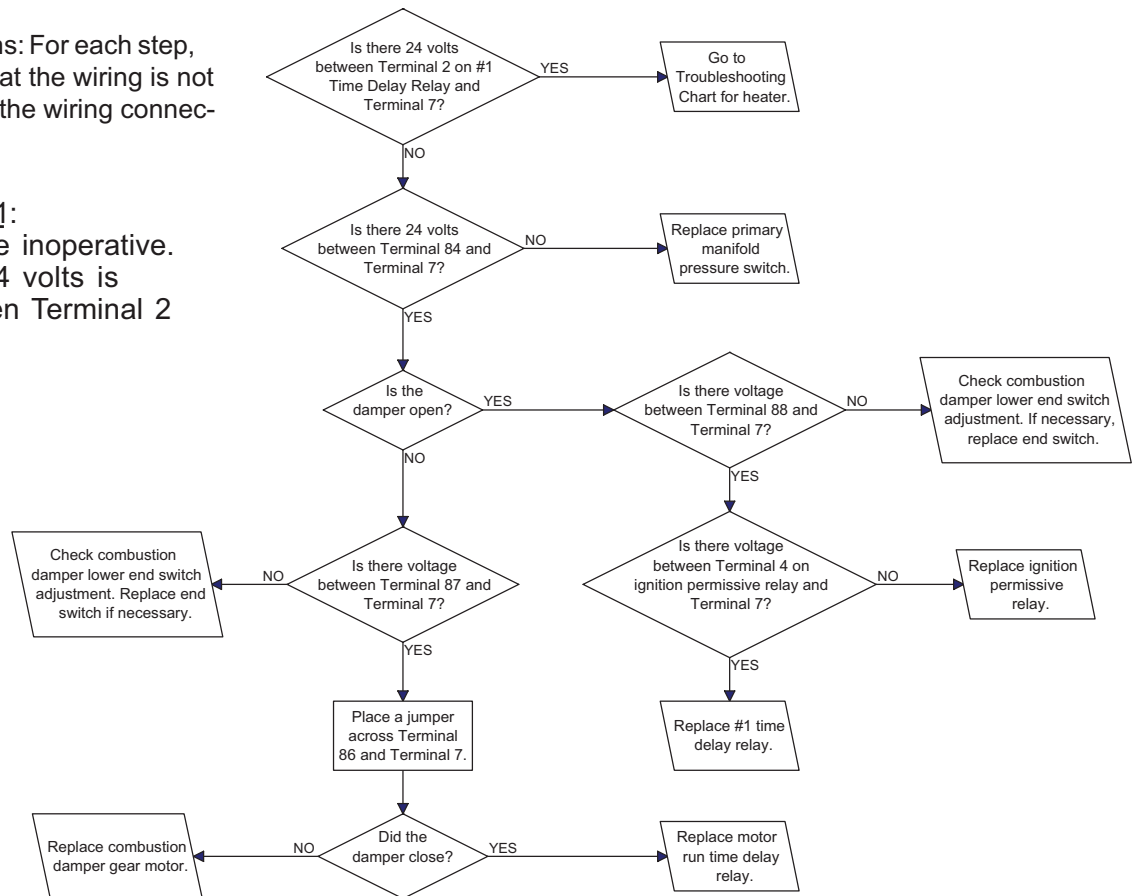
Table 20. General Troubleshooting —Continued		
Symptom	Probable Cause	Remedy
C. Pilot lights but main valve will not open	1. Manual valve not open	Open manual valve
	2. Main valve not operating	
	a. Defective valve	If 24V power is available at valve connections and valve remains closed, replace valve
	b. Loose wire connections	Check and tighten all wiring connections
	3. Ignition control does not power main valve	
	a. Loose wire connections	Check and tighten all wiring connections
	b. Flame sensor grounded, pilot lights, and spark continues	Ensure that flame sensor lead is not grounded and that insulation or ceramic is not cracked; replace as required
	c. Incorrect gas pressure	Adjust gas pressure (refer to Measure and Adjust Manifold (Outlet) Gas Pressure section)
	d. Cracked ceramic at sensor	Replace sensor
D. Insufficient heat with heater operating	e. Faulty ignition controller	If all checks listed in Spark Ignition System Maintenance section indicate no other cause, replace ignition controller (do not attempt to repair ignition controller, which has no field-replaceable parts)
	f. Poor microamp signal	Adjust pilot regulator
	1. Dirty filters in blower system	Clean or replace filters
	2. Incorrect manifold pressure	Check manifold pressure (refer to Measure and Adjust Manifold (Outlet) Gas Pressure section)
	3. Limit control cycling on	Check air throughput
E. Cold air at startup	4. Improper thermostat location or adjustment	Refer to thermostat manufacturer's instructions
	5. Belt slipping on blower	Adjust belt tension
F. Cold air during operation	1. Fan control improperly wired	Ensure that wiring connections are in accordance with wiring diagram
	2. Defective fan control	Replace fan control
F. Cold air during operation	1. Incorrect manifold pressure	Check manifold pressure (refer to Measure and Adjust Manifold (Outlet) Gas Pressure section)
	2. Blower set for too low temperature rise	Decrease blower speed or increase static pressure

Troubleshooting Bypass Combustion Air Damper Safety Circuit on Units with Option AG39, AG40, or AG42

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

Symptom - Part 1:

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



Symptom - Part 2:

Steady call for heat - burner cycles.

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

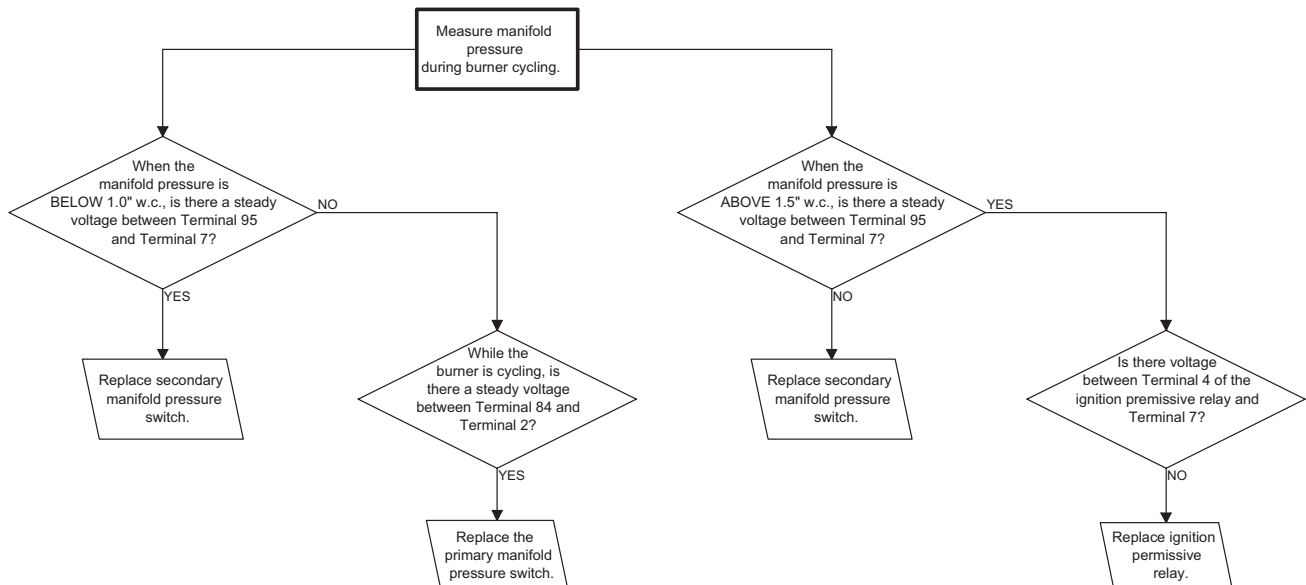


Figure 27. Troubleshooting Guide for Checking Bypass Combustion Air Damper Safety Circuit on Units with Option AG39, AG40, or AG42

INSTALLATION RECORD (TO BE COMPLETED BY INSTALLER)

Model	Serial No.	Date of Installation	Notes
	Installer	Distributor	
Name			
Company			
Address			
Phone No.			

For more information on Reznor HVAC products:

- Contact your local Reznor representative at 1-800-695-1901
- Refer to the manuals and additional consumer materials found at www.reznorhvac.com

