REZNOR®

Revision: RP-HRPD-IOM (01-23) 132210-D

Supersedes: RP-HRPD-IOM (10-22) 132210-C

OUTDOOR DUCT FURNACE INSTALLATION, OPERATION, AND MAINTENANCE

MODELS RP AND HRPD

RP

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.

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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.
- 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 furnaces are 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.
- Model HRPD is dual model RP furnaces configured for higher CFM capacity.

References

Table 1. Related Technical Manuals Available from Factory Distributor

Type	Form*	PN
Replacement parts	RP-HRPD-RPB-RPBL-RPL	263984
Maxitrol amplifier replacement kit installation	OPT-AG7,8,9,9H	262319
Ignition controller replacement kit installation	OPT-IGN-CNTRL	134704
Gas conversion	OPT-GC	143147

*Also available at **www.reznorhvac.com**.

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.

Important Safety Information—Continued

⚠ 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.**

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 NFPA/ANSI Z223.1 (latest edition), *National Fuel Gas Code*. A Canadian installation must be in accordance with CSA B149.1, *Natural Gas and Propane Installation Code*. 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.

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).

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.

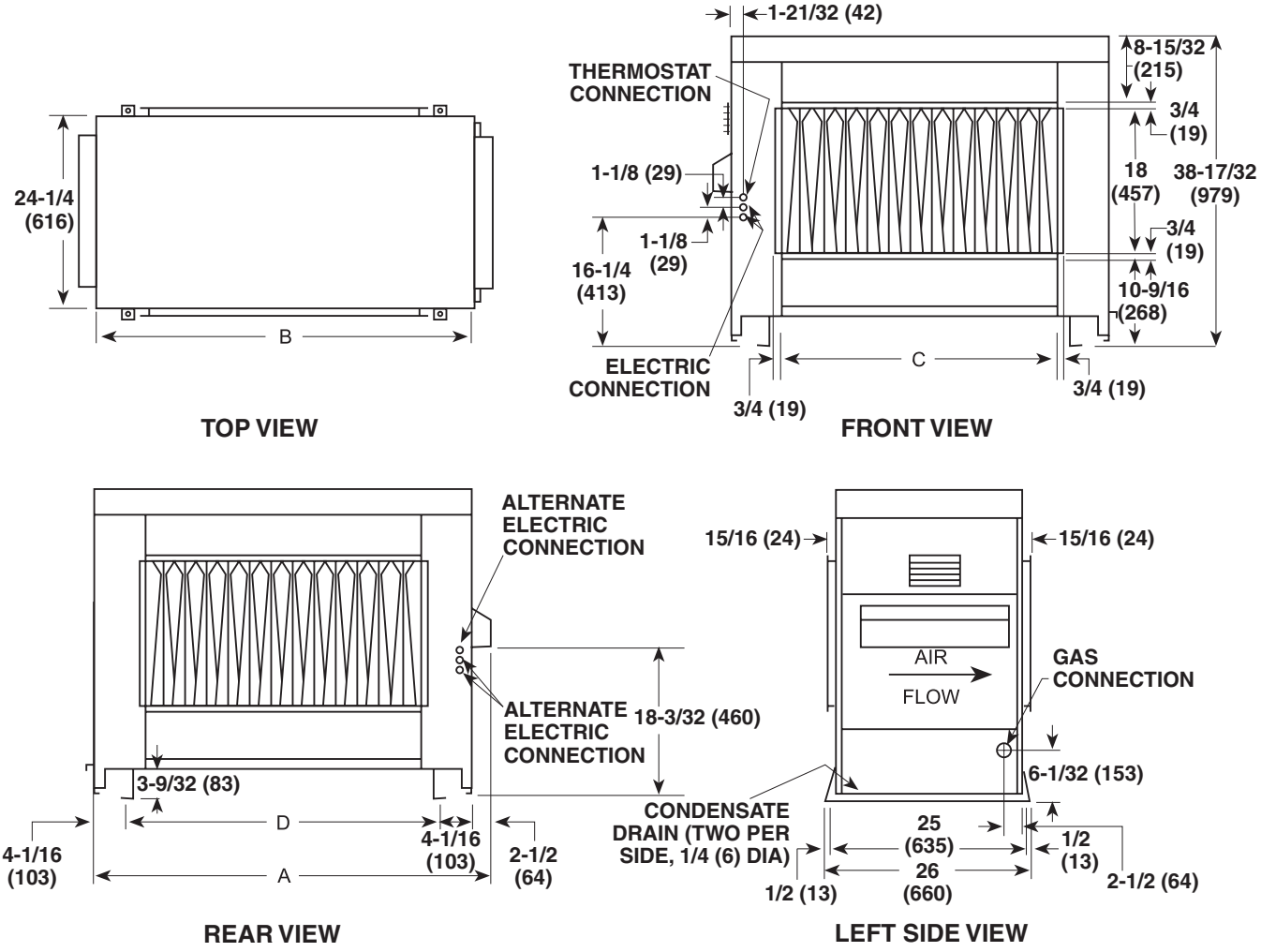


Figure 1. RP Dimensions (Refer to Table 2)

Table 2. RP Dimensions

Dimension (See Figure 1)	Unit Size					
	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.

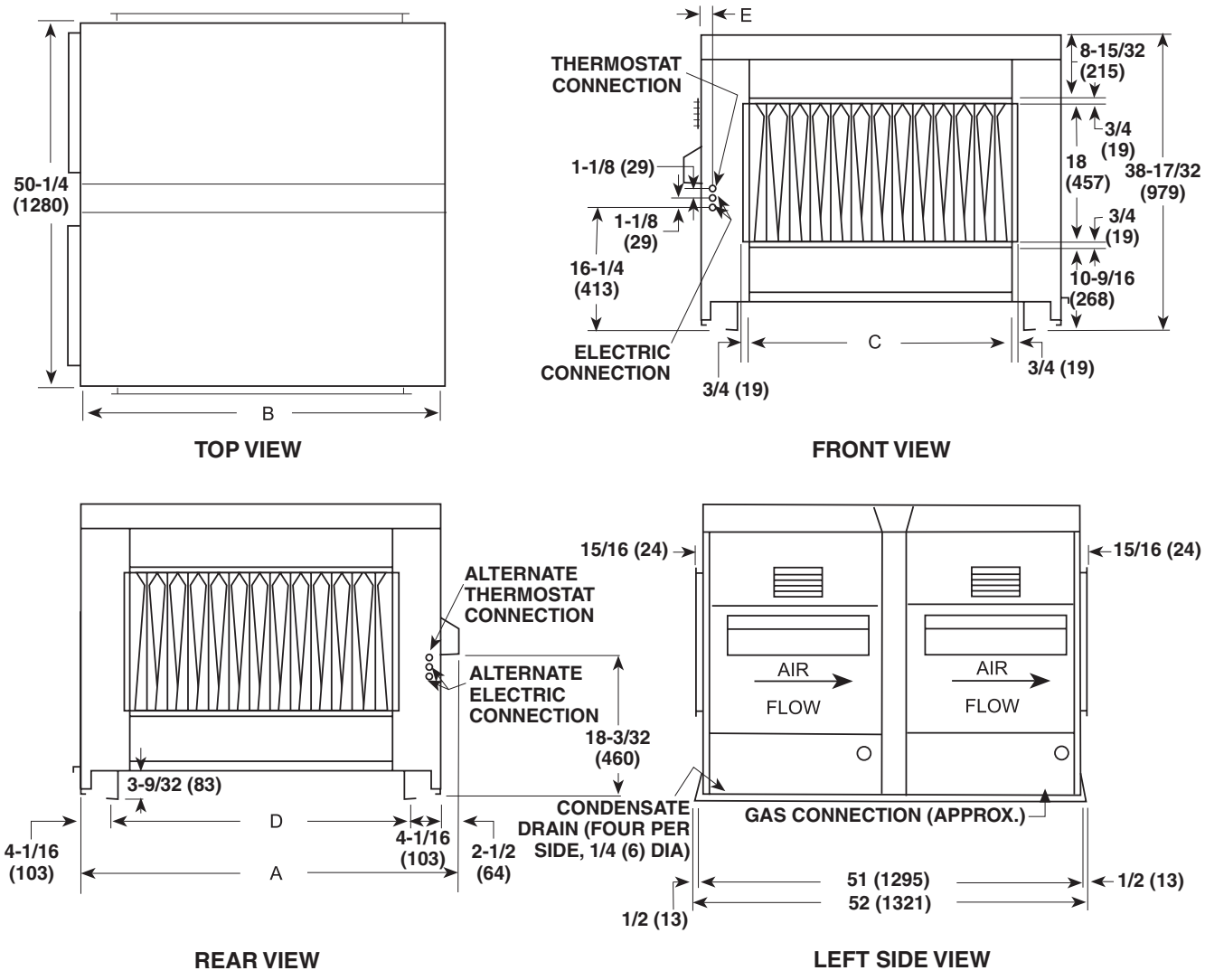


Figure 2. HRPD Dimensions (Refer to Table 3)

Table 3. HRPD Dimensions

Dimension (See Figure 2)	Unit Size					
	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)				

Weights

Before installation, check the supporting structure to ensure that it has sufficient load-carrying capacity to support the weight of the unit. Refer to **Table 4**, which lists unit weight based on unit size.

Table 4. Weights

Model	RP Unit Size					
	125	150, 175	200, 225	250, 300	350	400
	HRPD Unit Size					
	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)

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 5** are provided.

Table 5. 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.

Unit Location

⚠ CAUTION ⚠

Do not locate the heater where it may be exposed to water spray, rain, or dripping water.

- 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 5**.
- 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.

Hazards of Chlorine

NOTE: Remember, chlorine is heavier than air. This fact should be kept in mind when determining the installation location of heaters and building exhaust systems.

The presence of chlorine vapors in the combustion air of heating equipment presents a potential corrosion hazard. Chlorine, found usually in the form of Freon or degreaser vapors, when exposed to flame will precipitate from the compound and form a solution with any condensation present in the heat exchanger or associated parts. The result is hydrochloric acid, which readily attacks all metals, including 300 grade stainless steel. Care should be taken to separate these vapors from the combustion process. This may be done by wise location of the unit with regard to exhausters or prevailing wind directions.

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.

Shipped-Separate Parts

- Check to see if there are any field-installed options that need to be connected to the furnace prior to installation.
- Shipped-separate options could include a gas shutoff valve, a vertical vent terminal, a thermostat, an optional control, and disconnect switch.
- Some gas control options will have parts either shipped loose with the heater or shipped separately. If the unit is equipped with any of the gas control options listed in **Table 6**, ensure that these parts are available at the job site.

Table 6. Shipped-Separate Parts for Gas Control Options

Application	Option	Part(s)
Heating	AG7	Thermostat (PN 48033)
Makeup air	AG3, AG4	Control switch (PN 29054)
	AG8	Control switch (PN 29054); sensor and mixing tube (PN 48041)
	AG9	Control switch (PN 29054); remote temperature selector (PN 48042); sensor and mixing tube (PN 48041)
	AG15, AG17	Control switch (PN 29054); remote temperature selector (PN 115848); stage adder module (PN 115849); discharge air sensor holder (PN 115850); discharge air sensor holder bracket (PN 213612)
	AG39, AG41	Remote temperature selector (PN 174849); temperature sensor (PN 133228); mixing tube (PN 90323)
NOTE: If an optional remote console is ordered, the control switch and temperature selector may be mounted on the console.		

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 7**. 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 7. High Air Throughput

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

⚠ 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.

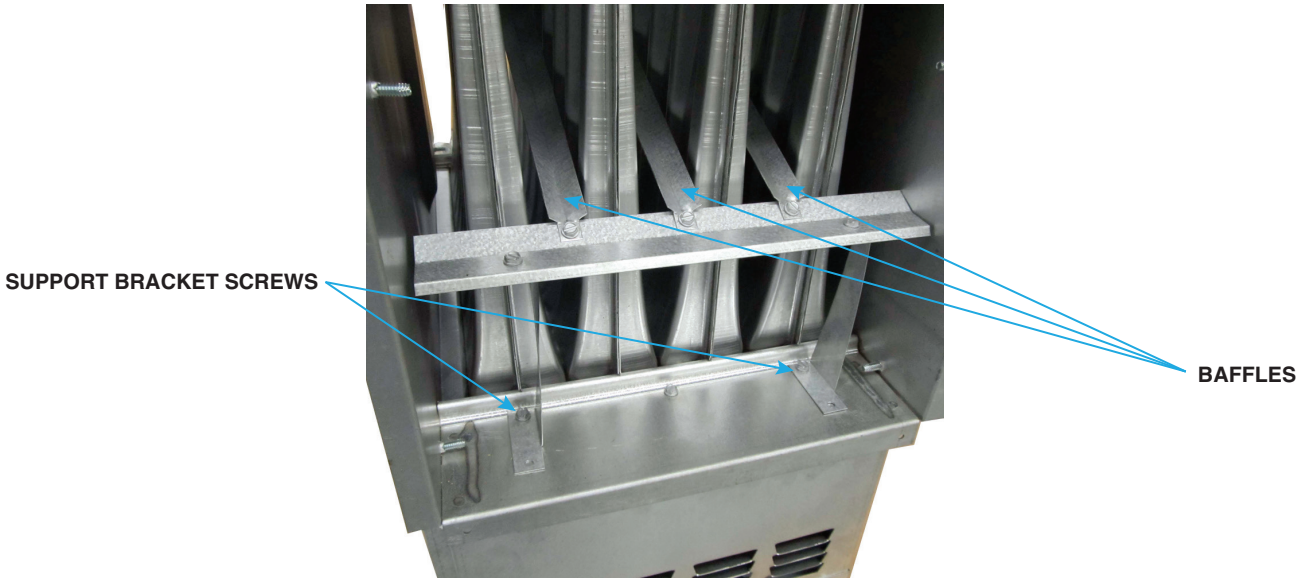


Figure 3. Heat Exchanger Baffle Removal

Pre-Installation Modifications—Continued

High CFM Conversion—Continued

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.

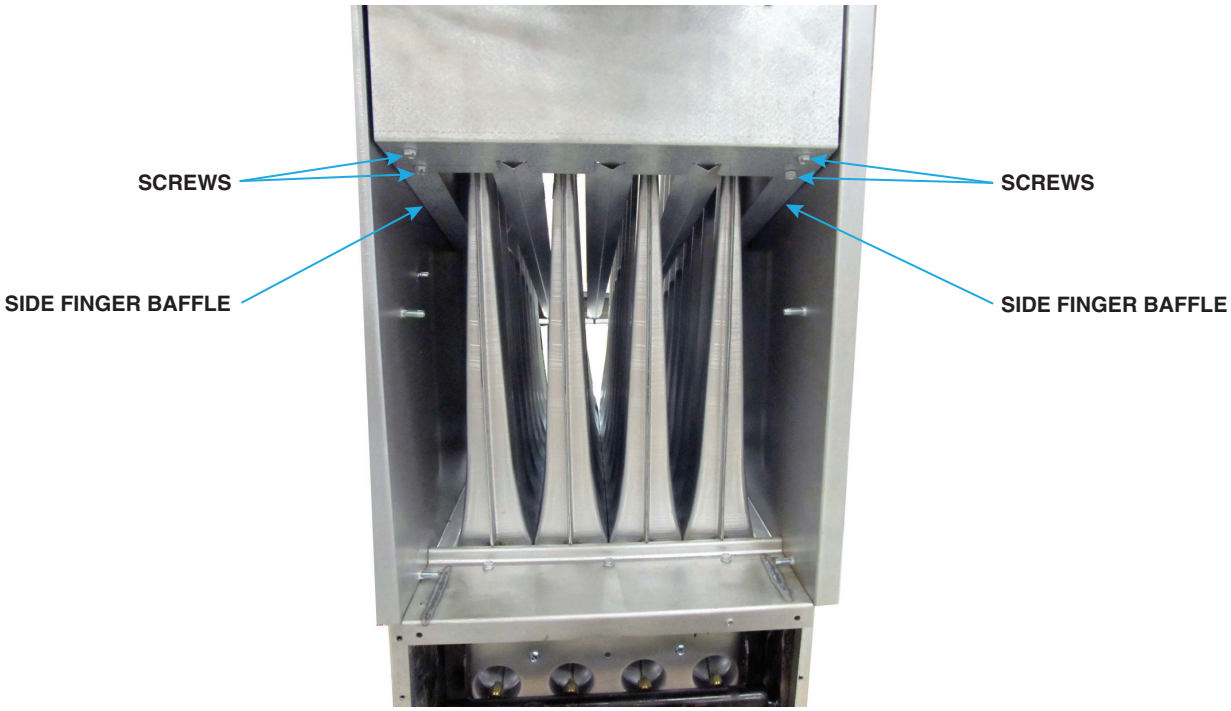


Figure 4. Side Finger Baffle Removal

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 7**.

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:

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.

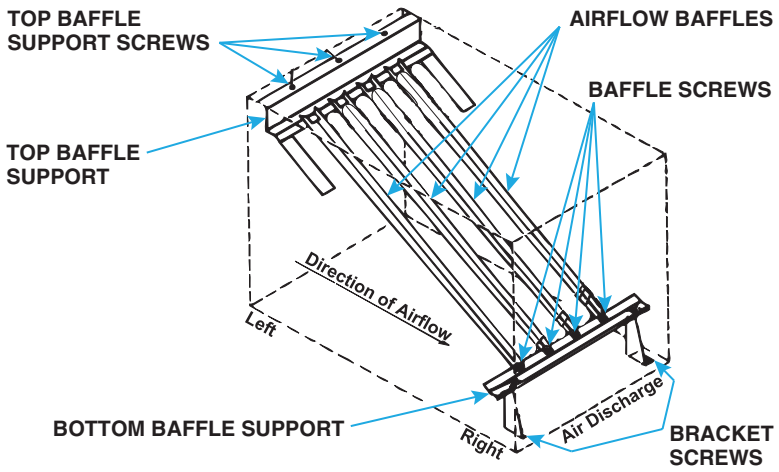


Figure 6. Airflow Baffles

Mounting

⚠ DANGER ⚠

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.

⚠ CAUTION ⚠

Furnaces must be level.

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 static pressure within the ranges specified on the heater rating plate.

Duct Connections—Continued

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.
- **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.
- **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.
- **Supply air duct/furnace horizontal connection:** The seal between the furnace and the duct must be mechanical using U-type flanges on the top and bottom of the connecting duct to to ensure tight joints and an airtight fit. Refer to **Figure 7** and perform the following steps:
  a. Ensure that flanges on the 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 making connection.
  d. Form U-channels to seal sides (see DETAIL A) and drill and lock with sheet metal screws.
- **Connection dimensions:** connection dimensions (inches (mm)) are shown in **Figure 8** and listed in **Table 8**.

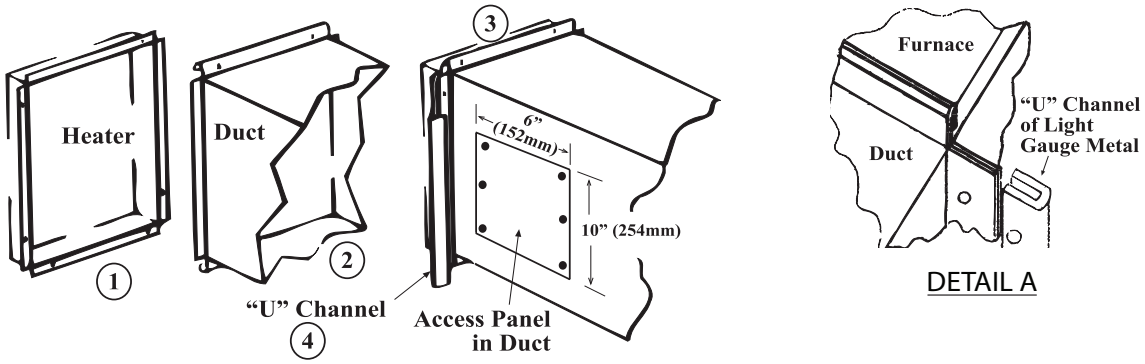


Figure 7. Connecting Ductwork to Furnace

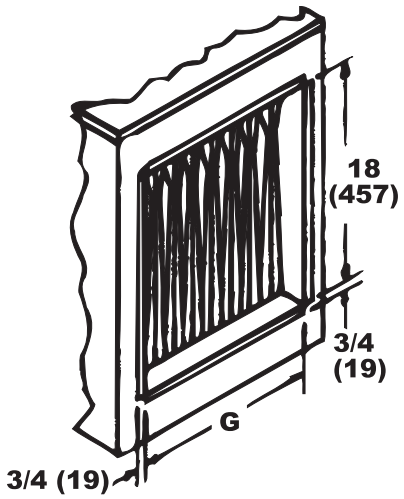


Figure 8. Ductwork Connection Dimensions (Refer to Table 8)

Table 8. Ductwork Connection Dimensions

Unit Size		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

- Makeup air options AG3 and AG4 (refer to **Optional Ductstat with Capillary Tubing (Options AG3 and AG4)** section) have a ductstat with a capillary sensor that is factory-installed in the unit discharge.
- Makeup air options AG8, AG9, AG15, AG17, AG39, AG40, AG41, and AG42 require field-installation of the sensor in the discharge ductwork.
- Options AG15 and AG17 include a box and sensor holder. Options AG8, AG9, AG39, and AG41 include a sensor and mixing tube.
- On units with option AG40 or AG42, the discharge sensor is field-supplied.
- Follow the instructions below to install the sensor in the ductwork.

1. Determine distance of sensor from unit:
   a. Ensure that there is sufficient distance from outlet to have good mixture of discharge air temperature.

NOTES:

- **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).**
- **Locate the sensor a minimum of 96 inches (2,435 mm) from the outlet of the unit.**
- **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.**

   b. Refer to following formula for calculating sensor placement. This example assumes cross-sectional dimensions for supply ductwork of 24 × 12 inches (610 × 305 mm):

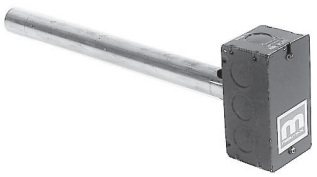
Duct Connections—Continued

Discharge Air Temperature Sensor Installation—Continued

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

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

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.
3. Secure sensor in ductwork:
   a. For units with option AG3 or AG4, sensor is factory-installed.
   b. For units with option AG8, AG9, AG15, AG17, AG39, or AG41:
      (1) Position of sensor in duct is also important—mixing tube shown in **Figure 9**, DETAIL A is 12 inches (305 mm) long and holder shown in **Figure 9**, DETAIL B extends 9-3/16 inches (233 mm) into ductwork.
      (2) Turn holder so that element is shielded from direct airflow and will sense air temperature as it flows through holes in holder.
      (3) At selected ductwork location, mark diamond-shaped hole—approximately 1 × 1 inch (25 × 25 mm—required for sensor holder or round hole required for mixing tube and cut hole no larger than necessary.
      (4) For units with option AG8, AG9, AG39, or AG41, slide mixing tube (see **Figure 9**, DETAIL A) into ductwork and attach sensor.
      (5) For units with AG15 or AG17, push element into clip in holder (see **Figure 9**, DETAIL B), slide holder into ductwork, and position holder so that it shields sensor from direct airflow. Secure box portion of holder to ductwork using four field-supplied #6 sheet metal screws.
   c. For units with option AG40 or AG42, install field-supplied sensor in accordance with instructions provided with sensor.
4. Connect sensor wires:
   a. For units with option AG15 or AG17:
      (1) Determine where sensor wire should enter box and remove knockout.
      (2) Secure field-supplied cable connector to box, connect sensor wire, and install box cover.
   b. For all options, ensure that all sensor wires are connected in accordance with wiring diagram provided with unit.



DETAIL A: OPTIONS AG8, AG9, AG39, AND AG41

DETAIL B: OPTIONS AG15 AND AG17

Figure 9. Discharge Air Temperature Sensor and Holder

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 9** and **Table 10** list the approved temperature rise range with the required CFM and the internal pressure drop for each size of unit.

Table 9. Model RP Pressure Drop and Temperature Rise

Unit Size	Temperature Rise*				
	50°F	60°F	70°F	80°F	90°F
	CFM/Pressure Drop				
125	1840/0.50	1535/0.33	1315/0.25	1150/0.21	1020/0.18
150	2210/0.38	1840/0.26	1580/0.19	1380/0.15	1225/0.12
175	2580/0.52	2150/0.35	1840/0.26	1610/0.19	1430/0.16
200	2945/0.42	2455/0.28	2105/0.22	1840/0.17	1635/0.14
225	3315/0.53	2765/0.36	2370/0.27	2070/0.22	1840/0.17
250	3685/0.40	3070/0.28	2630/0.23	2300/0.22	2045/0.21
300	4420/0.58	3685/0.39	3160/0.29	2765/0.25	2455/0.22
350	5160/0.65	4300/0.44	3685/0.31	3225/0.25	2865/0.23
400	5895/0.70	4915/0.50	4210/0.30	3685/0.30	3275/0.20

*80% thermal efficient.

Table 10. Model HRPD Pressure Drop and Temperature Rise

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

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 10**.

Duct Connections—Continued

Duct Furnace Blower Connections—Continued

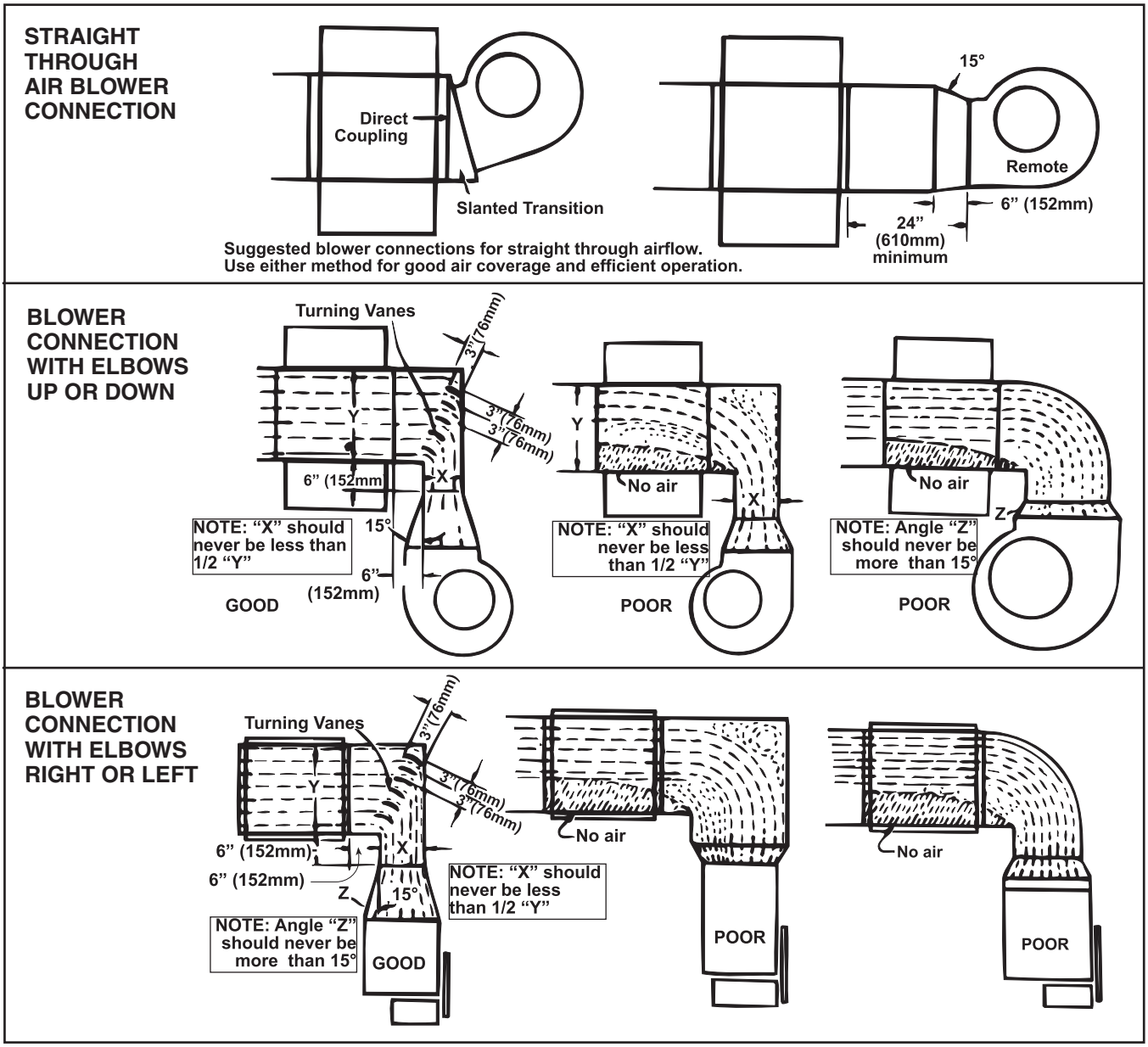


Figure 10. Duct Furnace Blower Connections

Bypass Duct Construction

When the air throughput CFM is greater than desirable or permissible for the unit, a bypass duct (see **Figure 11**) 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:

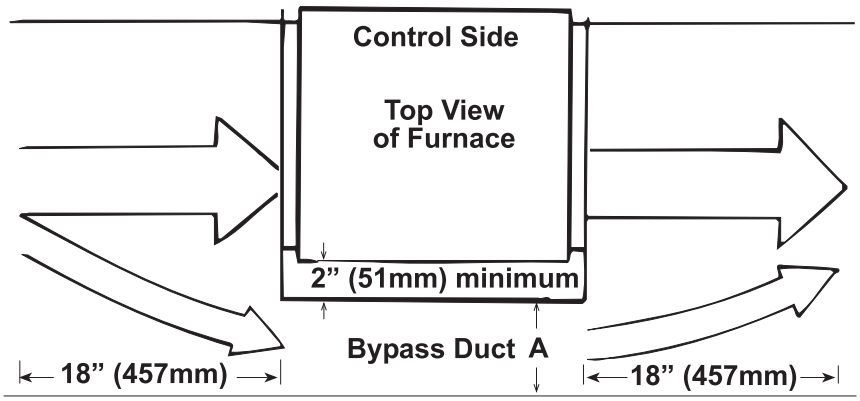


Figure 11. Bypass Duct Dimensions

1. Refer to **Table 9** or **Table 10** to determine pressure drop and allowable CFM for furnace being installed. For example: model RP unit size **150** @ 5**0°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 11** 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 11. 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 11**.

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.

Venting Connections

- Locate power-vented furnaces so that flue discharge is not directed at fresh air inlets. The flue discharge openings are located on the side of the furnace just above the control access panel. The position of this opening discourages recirculation of combustion products and provides for furnace operation in all normal weather conditions.
- **Optional vertical flue discharge (option CC3):** These power vented furnaces are certified with 4 feet of vertical pipe connected as shown in **Figure 12**, DETAIL A. The distance is measured from the top of the unit to the bottom of the vent cap. The vent pipe and supports are field-supplied. Optional vertical vent piping provides compliance with local codes that require either 10-foot horizontal or 4-foot vertical clearance between the flue outlet and the fresh air intake of the heating system and/or building. The option package (PN 45021) includes the 5-inch vent cap, the adapter assembly, and the seal plate as shown in **Figure 12**, DETAIL B. Attach venter seal plate and oval adapter assembly with sheet metal screws. Use venter seal plate as drill template.

Venting Connections—Continued

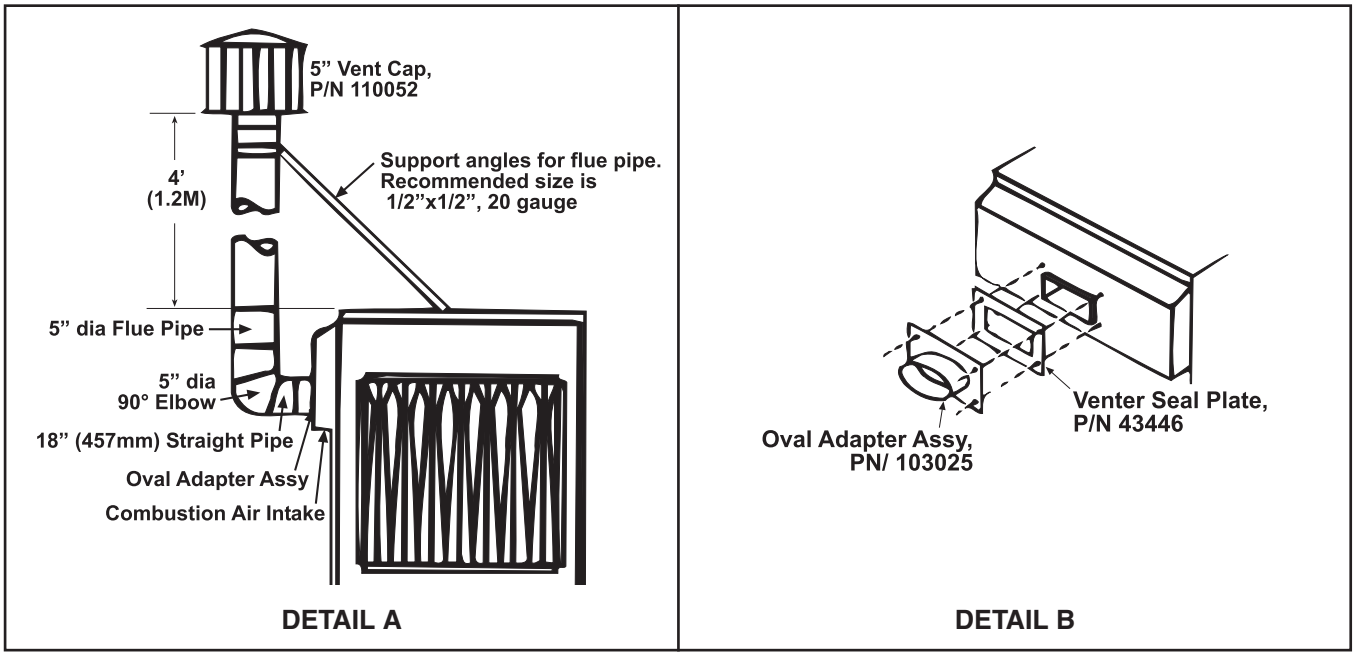


Figure 12. Optional Vertical Flue Discharge

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.

NOTES:

Supply pressure higher than 1/2 psi requires the installation of an additional service regulator external to the unit.

PRESSURE TESTING SUPPLY PIPING

- **Test pressures *above* 1/2 psi—disconnect the heater and manual valve from the gas supply line to be tested. Cap or plug the supply line.**
- **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.**

- 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 (refer to **Installation Codes** section).
- Gas supply piping installation should conform with good practice and with local codes.

- 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 12**. When sizing supply lines, consider possibilities of future expansion and increased requirements. Refer to *National Fuel Gas Code* for additional information on line sizing.

Table 12. Gas Supply Line Sizes

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

Supply Piping Connections

- Install a ground joint union and manual shutoff valve upstream of the unit control system. The 1/8-inch plugged tapping in the shutoff valve provides connection for the supply line pressure test gauge. The *National Fuel Gas Code* requires the installation of a trap with a minimum 3-inch drip leg. Local codes may require a longer drip leg, typically 6-inch (see **Figure 13**, DETAIL A).
- Gas connection location and requirements are shown in **Figure 13**, DETAIL B.
- Install the gas supply piping so that when the union is disconnected, the supply pipe will not interfere with the removal of the burner rack (see **Figure 13**, DETAIL C). The burner rack slides out of the control side of the furnace.
- Seal the opening for the gas supply pipe with the grommet provided.
- After all connections are made, disconnect the pilot supply at the control valve and bleed the system of all air. Reconnect the pilot line and leak test all connections by brushing on a soap solution.
- Gas connections sizes are listed in **Table 13**.

Piping Connections—Continued

Supply Piping Connections—Continued

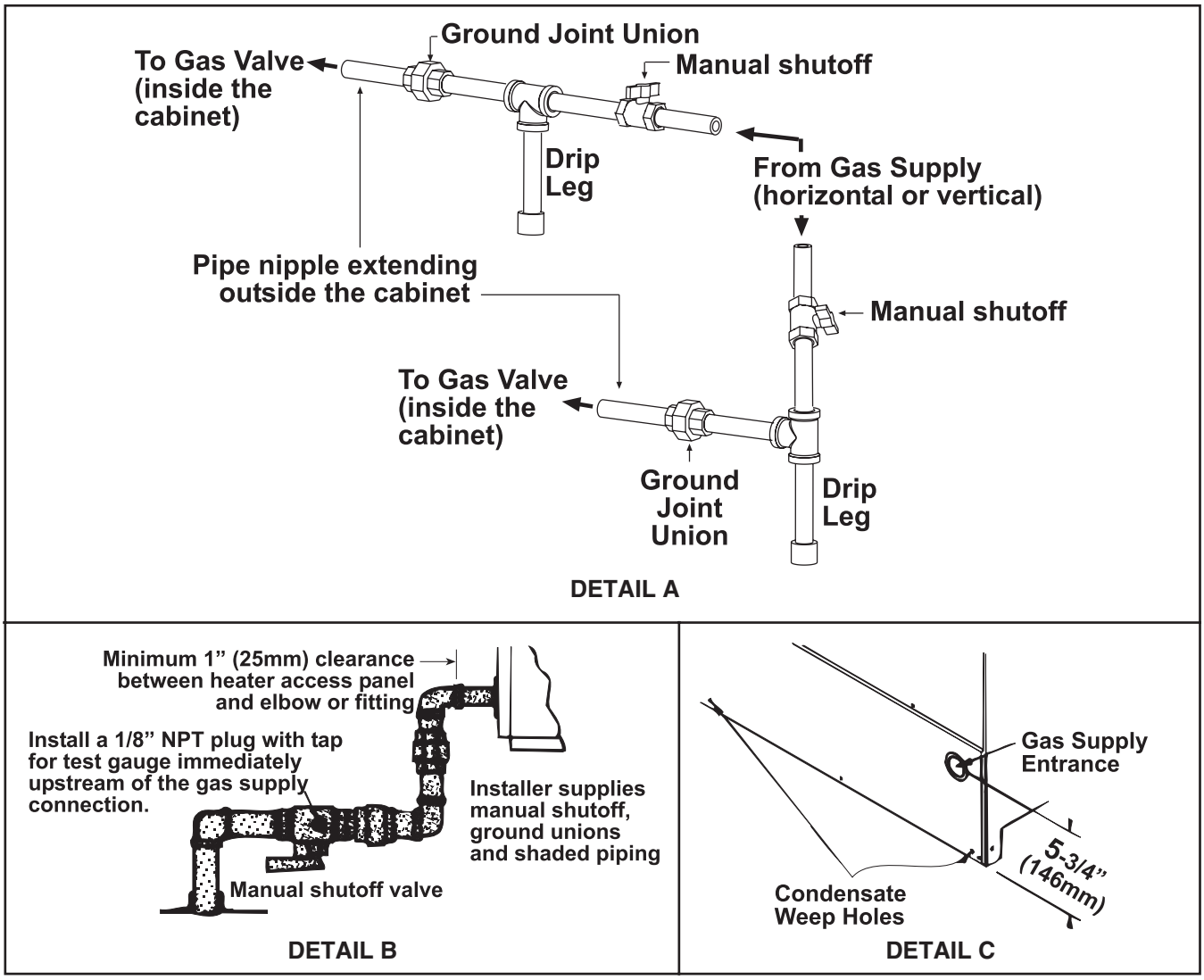


Figure 13. Gas Connections

Table 13. Gas Connection Sizes

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

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

Electrical Connections

⚠ CAUTION ⚠

- **If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C, except for 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 150°C.**
- **All external wiring must be within approved conduit and have a minimum temperature rise of 60°C.**
- **Keep electric and gas supply components clear of service panels.**

NOTE: Ensure that all wiring is in accordance with the wiring diagram provided with the unit. Electrical options are identified on this wiring diagram. Refer to separate instruction sheets for any optional equipment provided.

- 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) or, in Canada, the *Canadian Electric Code*, Part 1 (CSA C.22.1).
- Check any local ordinances or gas company requirements that apply.
- 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

- Refer to **Table 14** for amp ratings of optional controls. Refer to **Table 15** for the recommended maximum length and minimum gauge of control wiring.

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.	

Table 15. 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)

Electrical Connections—Continued

Control Wiring—Continued

- **Thermostat:** 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.

⚠ 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 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.

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.

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 16** for approximate water column negative pressure readings and combustion air proving switch setpoints for sea level operating conditions.

Table 16. Combustion Air Proving Switch Settings at Sea Level Operating Conditions

Unit Size		Factory Setpoint	Startup Cold	Equilibrium
RP Models	HRPD Models			
Units *Without* Option AG39, AG40, AG41, or AG42				
All		–0.58 (±0.05) IN WC	–1.05 IN WC	–0.73 IN WC
Units *with* Option AG39, AG40, AG41, 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

Optional Two-Stage Control (Heating Only Application)

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.

Optional Two-Stage Control (Makeup Air Application)

- 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 and 75°F. In all applications, the allowable temperature rise of the furnace in the installation dictates the limits of the ductstat temperature setting.
- There are two methods of achieving multiple-stage makeup air operation. In addition, for each of these methods, there are two types of control mechanisms. Consult the wiring diagram on the furnace to identify the optional control system: option AG3, AG4, AG15, or AG17.

Optional Two-Stage Control (Makeup Air Application)—Continued

- **Option AG3 or AG15:** Comparable to the two-stage heating units. Instead of control from a two-stage room thermostat, the discharge air temperature is monitored and the two-stage gas valve is controlled by a two-stage ductstat. When the discharge air temperature drops to the setpoint, low fire is energized. If low fire cannot satisfy the ductstat setting, high fire is energized. Model HRPD includes two furnace sections, and each section is equipped with a two-stage gas valve. Set the ductstat as indicated in **Table 17**.
- **Option AG4 or AG17 (model HRPD only):** Each furnace in the package is equipped with a single-stage gas valve. The single-stage gas valves are staged by a two-stage ductstat. The furnaces are staged in sequence. This concept will achieve two-stage control. Set the ductstat as indicated in **Table 17**.

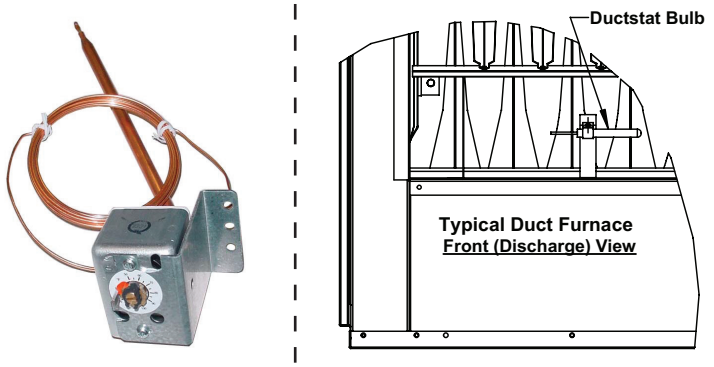
Table 17. Recommended Settings for Two-Stage Makeup Air Control

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)			
AG4	HRPD	2	70°F	—	66°F full rate (both furnaces)→ 70°F shutdown (furnace 1)→ 74°F shutdown (furnace 2)			
AG15*	RP	1	—			74°F	8°F	4°F
	HRPD**	2	—			74°F	14°F	10°F, 6°F, 4°F
AG17*	HRPD	2	—			74°F	8°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).

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

- Depending on the option selection, the factory-installed sensor is either field-connected by capillary tubing to the unit-mounted ductstat (see **Figure 14**, DETAIL A), which is factory-set at 70°F, or electrically-connected to a remote field-installed electronic temperature selector (see **Figure 14**, DETAIL B).



DETAIL A: OPTIONS AG3 AND AG4

(A) Remote Temperature Selector

(B) Stage-Adder Module

DETAIL B: OPTIONS AG15 AND AG17

Figure 14. Ductstat Options

Optional Ductstat with Capillary Tubing (Options AG3 and AG4)

The unit-mounted ductstat shown in **Figure 14**, DETAIL A has an adjustable range between 0°F and 100°F with a fixed differential of 3°F. Due to different CFM settings and outside air temperatures, the average downstream outlet temperature may not match the ductstat setting exactly. After the installation is complete, adjust the setpoint of the ductstat to achieve the desired average outlet air temperature.

Optional Ductstat with Electronic Remote Setpoint Module (Options AG15 and AG17)

- The field-installed sensing probe is field-wired to the remote temperature selector shown in **Figure 14**, DETAIL B, which has a temperature operating range to 130°F. The remote modules and sensing probe are shipped separately for field-installation. Follow the wiring diagram provided with the unit and the manufacturer's instructions for wiring and installation. Depending on the staging provided, there will be one module for selecting temperature and either one or two stage-adder modules.

⚠ CAUTION ⚠

Ensure that the heat/cool selector switch on the remote temperature selector is positioned to *Heat*.

Optional Electronic Modulation

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.

The type and capability of the electronic modulation system depends on the option selected. Electronic modulation options are identified by a suffix to the serial No. printed on the heater rating plate. AG7 is identified as MV-1, AG8 is identified as MV-3, AG9 is identified as MV-4, AG21 is identified as MV-A, AG39 is identified as MP-1, and AG40 is identified as MP-2. AG39 and AG40 are available only on model RP. AG41 is identified as MP3 and AG42 is identified as MP4. Both AG41 and AG42 apply to model HRPD.

Electronic Modulation Between 50% and 100% Firing Rate (Options AG7, AG8, and AG9)

- 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 wiring diagram provided with the furnace for proper wiring connections.
- Electronic modulation for heating that is controlled by a specially-designed room thermostat (60–85°F) is identified as option AG7.
- Electronic modulation for makeup air application that is controlled by a duct sensor and temperature selector (55–90°F) is identified as option AG8 or AG9. The temperature selector setting for option AG8 is on the amplifier (see **Figure 15**). Option AG9 has a remote temperature selector. Both systems are available with an override thermostat.

AMPLIFIER SIGNAL CONDITIONER

Figure 15. Maxitrol Amplifier and Signal Conditioner

Optional Electronic Modulation—Continued

Computer-Controlled Electronic Modulation Between 50% and 100% Firing Rate (Option AG21)

- With option AG21, the furnace is equipped with a Maxitrol signal conditioner (see **Figure 15**) 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 (Options AG39 and AG41)

NOTE: Option AG39 is available only with model RP natural gas units and is not available on unit size 350. Option AG41 is available only with model HRPD natural gas units and is not available on unit size 700.

- Depending on its size, a furnace equipped with option AG39 or AG41 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.
- The gas train (see **Figure 16**) 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 15**) with a corresponding remote temperature dial.

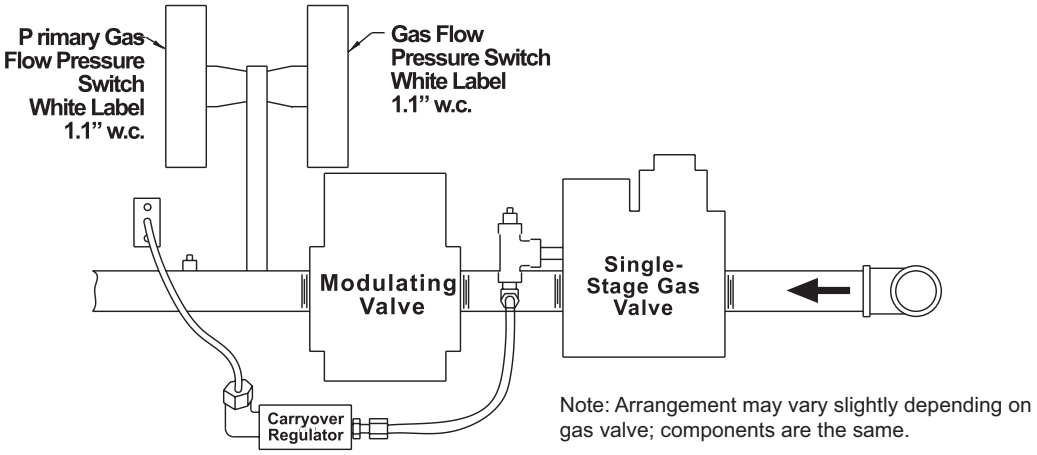


Figure 16. Options AG39, AG40, AG41, and AG42 Manifold Arrangement

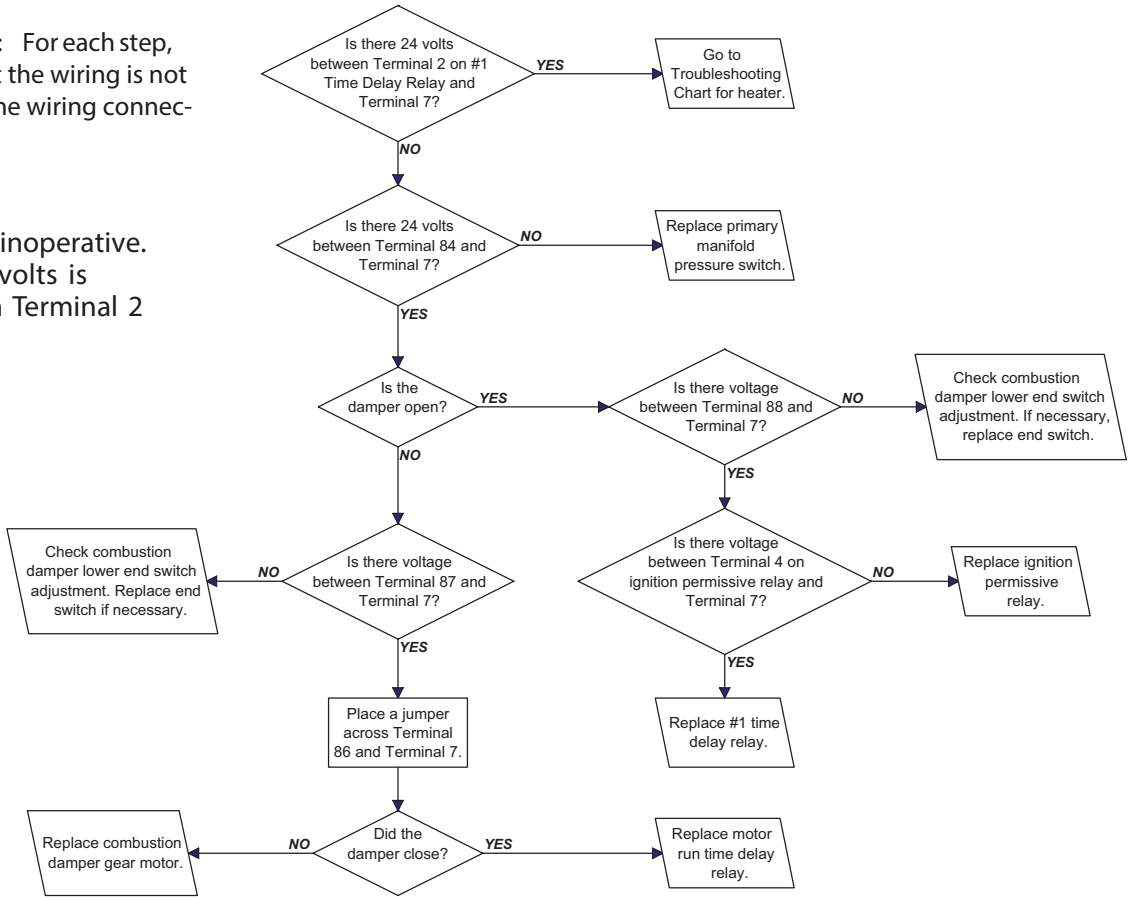
- The gas supply (refer to pressure requirements in **Table 18**) connects to the single-stage gas valve. To compensate for additional pressure loss through the modulating valve, the single-stage gas valve has a custom outlet pressure setting higher than when it is used on a standard gas manifold. The pilot tubing connects to the pilot port on the single-stage gas valve. Refer to **Figure 17** for troubleshooting options AG39 and AG41.

Table 18. Options AG39, AG40, AG41, and AG42 Pressure Requirements

Unit Size		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

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.

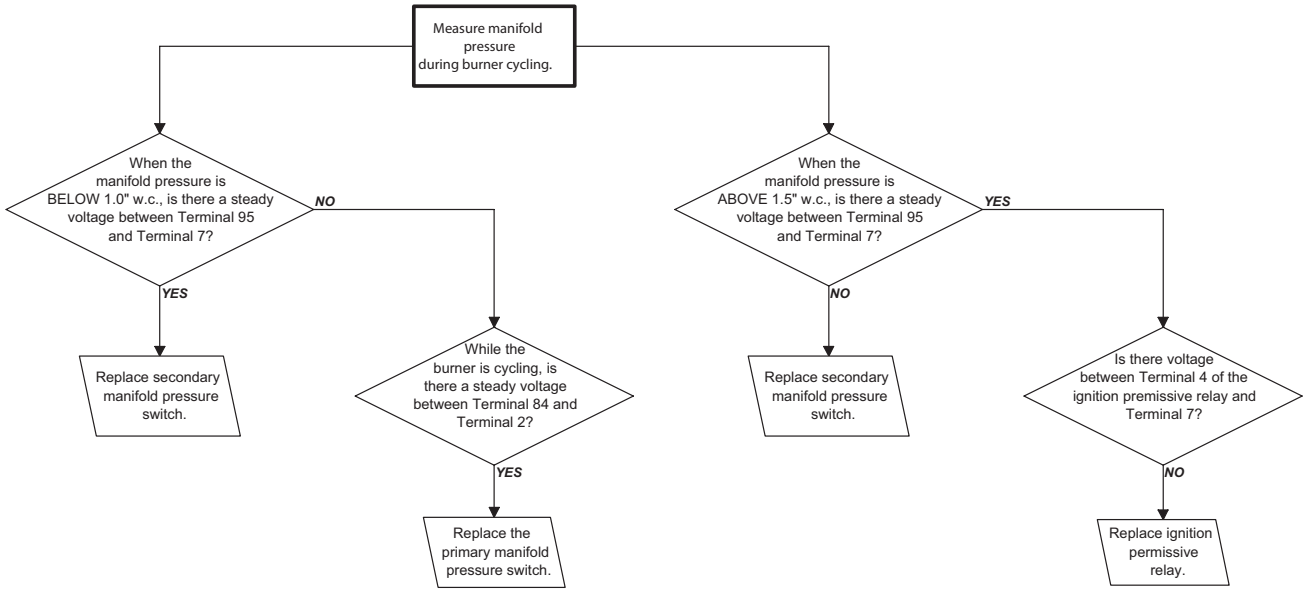


Figure 17. Troubleshooting Guide for Checking Bypass Combustion Air Damper Safety Circuit on Units with Option AG39, AG40, AG41, or AG42

Optional Electronic Modulation—Continued

Electronic Modulation Between 20–28% and 100% Firing Rate (Options AG39 and AG41)—Continued

- 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.
- **Sensor:** The duct temperature sensor and mixing tube are shipped loose for field installation in the dicharge duct. Refer to the **Discharge Air Temperature Sensor Installation** section for instructions on locating the sensor in the ductwork.
- This uniquely-designed modulation system requires combustion air pressure settings different from the standard system. Refer to **Table 16** for the approximate combustion air proving switch settings at sea-level operation.

Electronic Modulation Between 20–28% and 100% Firing Rate (Options AG40 and AG42)

NOTE: Option AG40 is available only with model RP natural gas units and is not available on unit size 350. Option AG42 is available only with model HRPD natural gas units and is not available on unit size 700.

- Depending on its size, a furnace equipped with option AG40 or AG42 has a 20–28% turndown ratio.
- With option AG40 or AG42, the furnace is equipped with a Maxitrol signal conditioner (see **Figure 15**) 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 or AG41 except that with computer control, the temperatures are selected through the software and there is no temperature selector or duct sensor.
- **Sensor:** The sensor is field-supplied.
- Refer to **Table 18** for options AG40 and AG41 pressure requirements and to **Figure 17** for troubleshooting options AG40 and AG41.
- This uniquely-designed modulation system requires combustion air pressure settings different from the standard system. Refer to **Table 16** for the approximate combustion air proving switch settings at sea-level operation.

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 18**) 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.

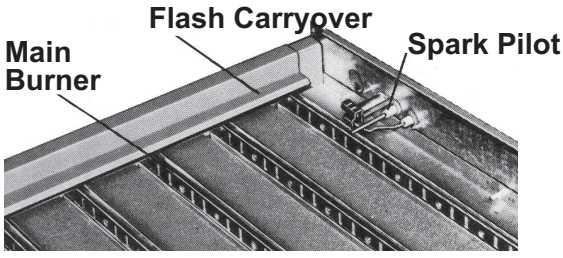


Figure 18. Typical Burner Rack with Spark Pilot

- **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 microampmeter. With pilot flame proven, the ignition controller energizes the main gas valve.

Burners and Carryover System

- **Burners:** 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.

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.

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

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 19**).

Table 19. 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

Measuring manifold gas pressure cannot be done until the heater is in operation (refer to **Startup** section).

- **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.

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

- **Minimum natural gas supply pressure:** Requirements vary based on size of 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 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) is recommended rather than a spring-type gauge due to the difficulty of maintaining calibration of a spring-type gauge.

1. With the manual valve (on the combination valve) positioned to prevent flow to the main burners, connect a manometer to the 1/8-inch pipe outlet pressure tap in the valve.
2. Open the valve and operate the heater. Measure the gas pressure to the manifold. To measure the low-stage pressure on units equipped with a two-stage valve, disconnect the wire from the HI terminal on the valve. Be sure to reconnect the wire.

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

High Elevation (>2,000 Feet/609 Meters) Installations

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.**

Measure and Adjust Manifold (Outlet) Gas Pressure—Continued

High Elevation (>2,000 Feet/609 Meters) Installations—Continued

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 20**) for installation elevation.

Table 20. High Elevation Burner Orifices

Installation Elevation (Feet (Meters))	Installation Location	RP Unit Size	Natural Gas		Propane	
			PN	Orifice Size	PN	Orifice Size
2001–3000 (611–915)	US	125, 175, 225, 300, 350, 400	84437	#42	11834	#54
		150,250	38678	#45	11830	#55
		200	11833	#44	11830	#55
2001–4500 (611–1373)	Canada	125, 175, 225, 300, 350, 400	11828	#43	11834	#54
		150,250	38678	#45	11830	#55
		200	11833	#44	11830	#55
3001–4000 (916–1220)	US	125, 175, 225, 300, 350, 400	11828	#43	11834	#54
		150,250	38678	#45	11830	#55
		200	11833	#44	11830	#55
4001–5000 (1221–1525)	US	125, 175, 225, 300, 350, 400	11828	#43	11834	#54
		150,250	38678	#45	11830	#55
		200	11833	#44	11830	#55
5001–6000 (1526–1830)	US	125, 175, 225, 300, 350, 400	11828	#43	97360	1.35 mm
		150,250	16590	#46	39658	#56
		200	38678	#45	39658	#56
6001–7000 (1831–2135)	US	125, 175, 225, 300, 350, 400	11833	#44	97360	1.35 mm
		150,250	84853	#47	39658	#56
		200	38678	#45	39658	#56
7001–8000 (2136–2440)	US	125, 175, 225, 300, 350, 400	11833	#44	11830	#55
		150,250	84853	#47	39658	#56
		200	16590	#46	39658	#56
8001–9000 (2441–2745)	US	125, 175, 225, 300, 350, 400	38678	#45	11830	#55
		150, 250	40414	#48	39658	#56
		200	84853	#47	39658	#56
9001–10,000 (2746–3045)	US	125, 175, 225	16590	#46	11830	#55
		150, 250	40414	#48	39658	#56
		200	84853	#47	39658	#56
		300, 350, 400	38678	#45	11830	#55

3. Unthread existing gas orifices from gas manifold.

⚠ DANGER ⚠

- **Do not use Teflon tape or pipe joint compound on the orifice threads. The hole in the orifice may become blocked and may cause fire, explosion, property damage, carbon monoxide poisoning, personal injury, or death.**
- **Use only using factory-supplied orifices. Do not attempt to drill out orifices in the field. Improperly drilled orifices may cause fire, explosion, carbon monoxide poisoning, personal injury, or death.**

4. Thread replacement gas orifices into gas manifold. To prevent cross-threading, hand-tighten orifices into gas manifold until snug and then tighten one-half to one turn using wrench.

⚠ DANGER ⚠

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

5. 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).

Conversion to LP (Propane)

⚠ DANGER ⚠

Conversion to LP (propane) gas 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 LP (propane) conversion is required, convert the unit in accordance with form ***OPT-GC*** listed in **Table 1**. 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.

NOTES:

- **A limited amount of yellow-tipping is permissible for liquefied petroleum gases. Natural gas should not display any yellow-tipping.**
- **When making the adjustment, close the air shutters no more than is necessary to eliminate the problem condition.**

- Air shutters are required on propane gas units but are optional on natural gas units. A slotted burner air adjustment screw on the end manifold bracket moves the air shutters and adjusts all burners simultaneously. Turn the adjustment screw clockwise to open the air shutter or counterclockwise to close the air shutter.
- After the furnace has been in operation for 15 minutes, close the air shutter until the flame turns yellow. Open the shutter until yellow disappears.

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

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**:

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

   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.

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.

⚠ 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. To ensure positive closure, all gas supply lines must be free of dirt or scale before connecting the unit.

Remove external dirt accumulation and check wiring connections. The combination gas valve must be checked annually as follows to ensure that the valve is completely shutting off gas flow.

1. Locate 1/8-inch FPT INLET pressure tap on combination gas valve (see **Figure 19**).

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

2. With field-installed manual valve closed to prevent flow to gas valve, connect manometer to 1/8-inch FPT INLET pressure tap (see **Figure 19**).
3. With field-installed manual valve closed, turn up thermostat to fire unit and to allow unit to go through one trial for ignition.

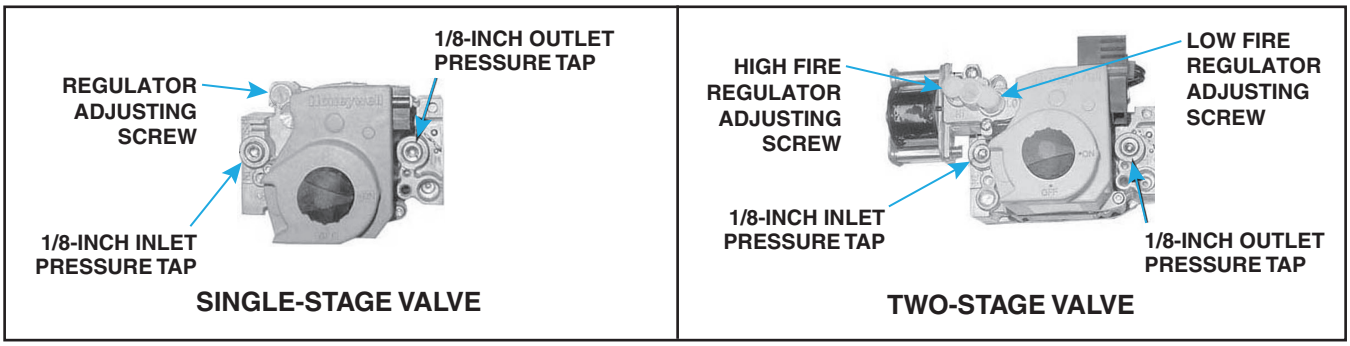


Figure 19. Combination Gas Valve Test Connections

4. Reset thermostat to shut OFF unit and observe manometer for 2 to 3 minutes for indication of gas pressure. No pressure should be indicated on manometer. If manometer indicates gas pressure, field-installed manual gas valve must be replaced or repaired before combination gas valve can be checked.
5. If manometer does not indicate gas pressure, slowly open field-installed manual gas valve. After manometer indicates that gas pressure has reached equilibrium, close manual shutoff valve.

NOTE: Refer to Gas Supply Pressure section for operational pressure settings and to Measure and Adjust Manifold (Outlet) Gas Pressure section for instructions on checking pressure settings.

6. Observe gas pressure on manometer. There should be no loss of gas pressure. If manometer indicates loss of gas pressure, replace combination gas valve before placing heater in 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.
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.

Maintenance Procedures—Continued

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 20**), which should be maintained to 7/64 inch.

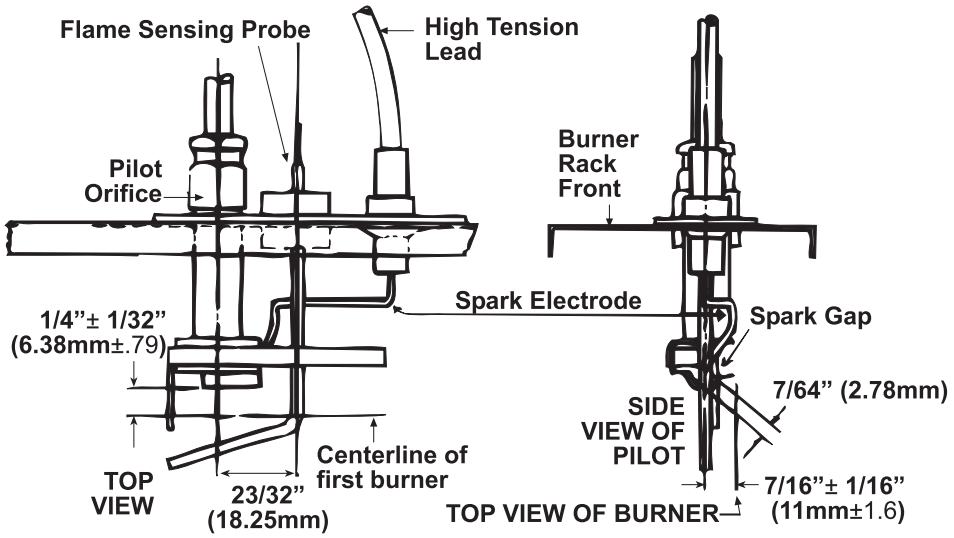


Figure 20. Pilot Assembly Spark Gap

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.

⚠ 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 microampmeter, 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 20**) 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 21), 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 21. 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.

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.

Maintenance Procedures—Continued

Heat Exchanger Cleaning—Continued

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 22**):
      (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.

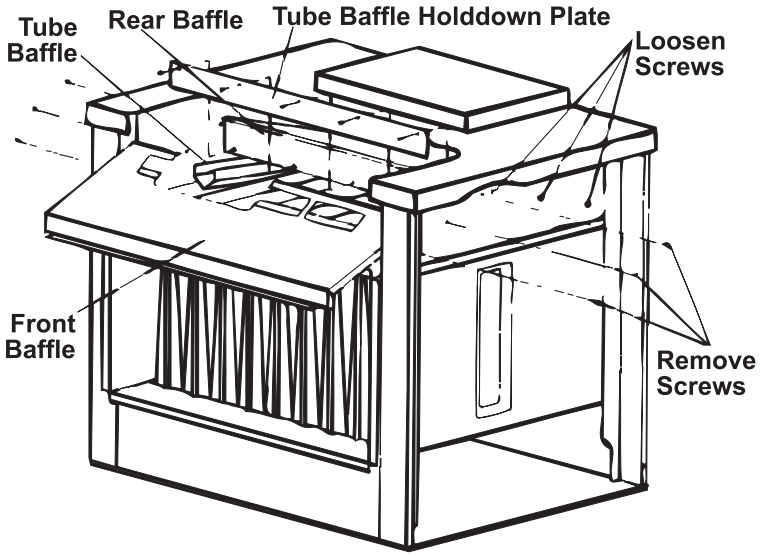


Figure 22. Heat Exchanger V-Baffles Removal

TROUBLESHOOTING

NOTE: If the furnace is equipped with electronic modulation option AG39, AG40, AG41, or AG42, see Figure 17 for additional troubleshooting guidelines.

Table 21. 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
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
	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
D. Insufficient heat with heater operating	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
	4. Improper thermostat location or adjustment	Refer to thermostat manufacturer's instructions
	5. Belt slipping on blower	Adjust belt tension
E. Cold air at startup	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

INSTALLATION RECORD (TO BE COMPLETED BY INSTALLER)

Installer:

Name _____

Company _____

Address _____

_____

Phone _____

Distributor (company from which the unit was purchased):

Company _____

Contact _____

Address _____

_____

Phone _____

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

Specific installation notes (i.e., location, amps, gas pressure, temperature, voltage, adjustments, warranty, etc.):

_____

_____

_____

BUILDING OWNER OR MAINTENANCE PERSONNEL:

For service or repair:

Contact the Installer listed above.

If you need additional assistance, contact the Distributor listed above.

For more information, contact your Factory Representative.

RP-HRPD-IOM (01-23) 132210-D