INSTALLATION / OPERATION / MAINTENANCE

Applies to: **Model RP and Model HRPD Outdoor Duct Furnaces**

Model RP

Model HRPD

⚠ WARNING:

FIRE OR EXPLOSION HAZARD

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

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

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

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

— **WHAT TO DO IF YOU SMELL GAS**

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

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

Table of Contents

1.0 General

1.1 Hazard Labels and Notices

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

Definitions of HAZARD INTENSITY LEVELS used in this Manual

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

WARNING

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

WARNING

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

WARNING

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

1.2 General Installation Information

Installation should be done by a qualified agency in accordance with the instructions in this manual and in compliance with all codes and requirements of authorities having jurisdiction. The instructions in this manual apply to duct furnace Model RP and Model HRPD.

1.3 Warranty

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

WARRANTY: Warranty is void if.....

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

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

c. Unit is installed without proper clearances to combustible materials or without proper ventilation and air for combustion. (Paragraphs 2.2 & 4.2.)

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

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.)

1.4 Installation Codes

The outdoor duct furnace models in this manual are design-certified to ANSI and CSA standards by the Canadian Standards Association. All models are approved for installation in the United States and in Canada. All furnaces are approved for use with either natural gas or propane. The type of gas for which the furnace is equipped and the correct firing rate are shown on the rating plate attached to the unit. Electrical characteristics are shown on the unit rating plate.

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

WARNING

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 manufacturer's authorization. Without factory authorization, the warranty is void, and the manufacturer disclaims any responsibility for the duct furnace and/or the application.

2.0 Furnace Location

2.1 General Recommendations

A duct furnace is designed for connection to an inlet and an outlet duct and depends on an external air handler. Location must comply with the clearances listed in Paragraph 4.2. There are a variety of factors, such as system application, building structure, dimensions, and weight, that contribute to selecting the location. Read the installation information in this manual and select a location that complies with the requirements.

2.2 Combustion Air Requirements

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

Hazards of Chlorine

The presence of chlorine vapors in the combustion air of gas-fired heating equipment presents a potential corrosion hazard. Chlorine will, when exposed to flame, precipitate from the compound, usually freon or degreaser vapors, and go into solution with any

2.0 Furnace Location (cont'd)

2.2 Combustion Air Requirements (cont'd)

condensation that is present in the heat exchanger or associated parts. The result is hydrochloric acid which readily attacks all metals including 300 grade stainless steel.

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

3.0 Uncrating and Preparation

3.1 Uncrating and Inspecting

This furnace was test operated and inspected at the factory prior to crating and was in operating condition. If the furnace has incurred any damage in shipment, document the damage with the transporting agency and immediately contact an authorized factory 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 be sure that they are compatible with the gas and electric supplies at the installation site.

3.2 Preparing the Furnace for Installation

3.2.1 Shipped-Separate Components

Read this booklet and become familiar with the installation requirements of your particular furnace. If you do not have knowledge of local requirements, check with the local gas company or any other local agencies who might have requirements concerning this installation. Before beginning, make preparations for necessary supplies, tools, and manpower.

Check to see if there are any field-installed options that need to be assembled to the furnace prior to installation.

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

Application	Option	Shipped Separate Components
Heating -- Gas Control	**AG7**	Thermostat, **P/N 48033**
Makeup Air -- Gas Control Options **(NOTE:** If an optional remote console is ordered, the control switch and temperature selector may be mounted on the console.)	**AG3, AG4**	Control Switch, **P/N 29054**
	AG8	Control Switch, **P/N 29054;** Sensor & Mixing Tube, **P/N 48041**
	AG9	Control Switch, **P/N 29054;** Remote Temperature Selector, **P/N 48042;** Sensor & Mixing Tube, **P/N 48041**
	AG15	Control Switch, **P/N 29054**; Remote Temperature Selector, **P/N 115848**; Stage Adder Module, **P/N 115849** - (1) for RP or (3) for HRPD; Discharge Air Sensor Holder, **P/N 115850;** Discharge Air Sensor Holder Bracket, **P/N 213612**
	AG17	Control Switch, **P/N 29054**; Remote Temperature Selector, **P/N 115848**; Stage Adder Module, **P/N 115849**; Discharge Air Sensor Holder, **P/N 115850;** Discharge Air Sensor Holder Bracket, **P/N 213612**
	AG39, AG41	Remote Temperature Selector, **P/N 174849**; Temperature Sensor, **P/N 133228**; Mixing Tube, **P/N 90323**

Other shipped-separate options could include a gas shutoff valve, a vertical vent terminal, a thermostat, an optional control, and/or a disconnect switch.

Check to see if there are any field-installed options that need to be assembled to the furnace prior to installation.

3.2.2 Instructions for Reversing Airflow by Changing Direction of Heat Exchanger Air Baffles - Model RP

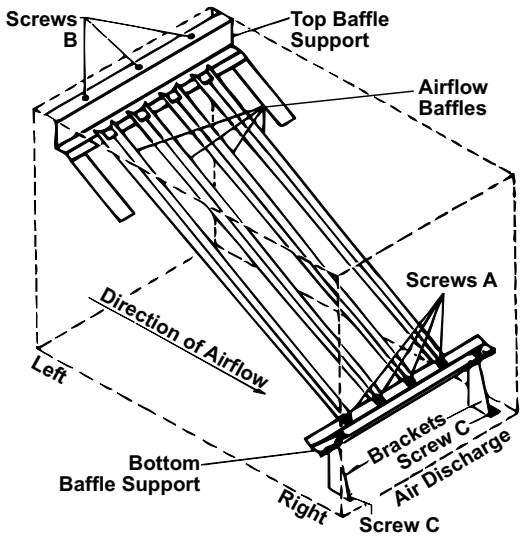
Model RP duct furnaces are equipped with directional air baffles between the heat exchanger tubes as shown in **FIGURE 1**. Facing the control compartment of the furnace, the standard direction of airflow is from left to right.

If the installation requires direction of airflow from right to left when facing the control compartment, follow the instructions in **FIGURE 1** to reposition the directional air baffles at the installation site.

FIGURE 1 - Model RP Heat Exchanger with Directional Air Baffles

Instructions for repositioning baffles to reverse airflow direction

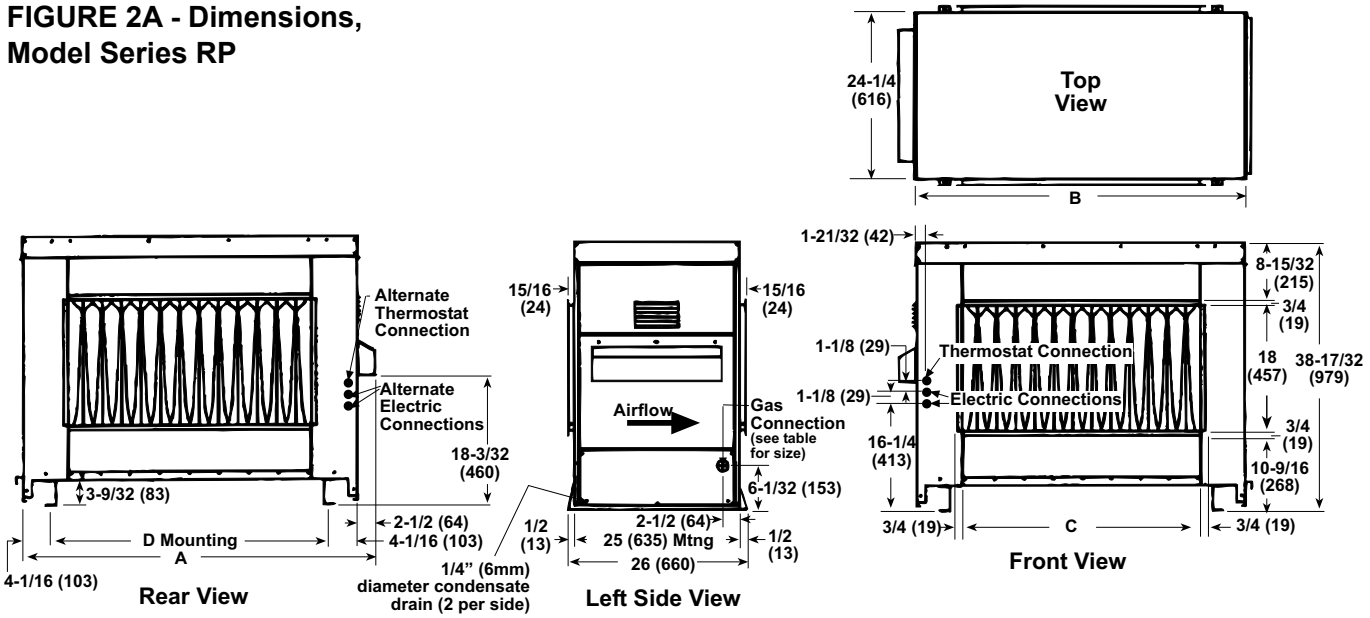
1) Remove Screws "A".
2) Lift each baffle slightly and slide forward removing each individual baffle completely from the heat exchanger.
3) Remove the top baffle support. Re-use screws "B" and install the top baffle support on the opposite end of the heat exchanger.
4) Re-install the bottom baffle support and brackets on the opposite end of the heat exchanger.
5) Reverse Steps 1 and 2 -- re-installing all of the baffles.



4.0 Dimensions and Clearances

4.1 Dimensions

FIGURE 2A - Dimensions, Model Series RP



Model Series RP Dimensions - inches ± 1/8 / mm ±3										
RP	**A**	**B**	**C**	**D**		**RP**	**A**	**B**	**C**	**D**
125	30-15/16	28-1/2	15-1/4	20-5/16		**125**	786	648	387	516
150, 175	36-7/16	34	20-3/4	25-13/16		**150, 175**	914	864	527	656
200, 225	41-15/16	39-1/2	26-1/4	31-5/16		**200, 225**	1065	1003	667	795
250	50-3/16	47-3/4	34-1/2	39-9/16		**250**	1275	1213	876	1005
300	50-3/16	47-3/4	34-1/2	39-9/16		**300**	1275	1213	876	1005
350	55-11/16	53-1/4	40	45-1/16		**350**	1414	1353	1016	1145
400	61-3/16	58-3/4	45-1/2	50-9/16		**400**	1554	1492	1156	1284

Gas Connection (inches)		
RP	**Natural**	**Propane**
125	1/2"	1/2"
150, 175	1/2"	1/2"
200, 225	1/2"	1/2"
250	1/2"	1/2"
300	3/4"	1/2"
350	3/4"	1/2"
400	3/4"	1/2"

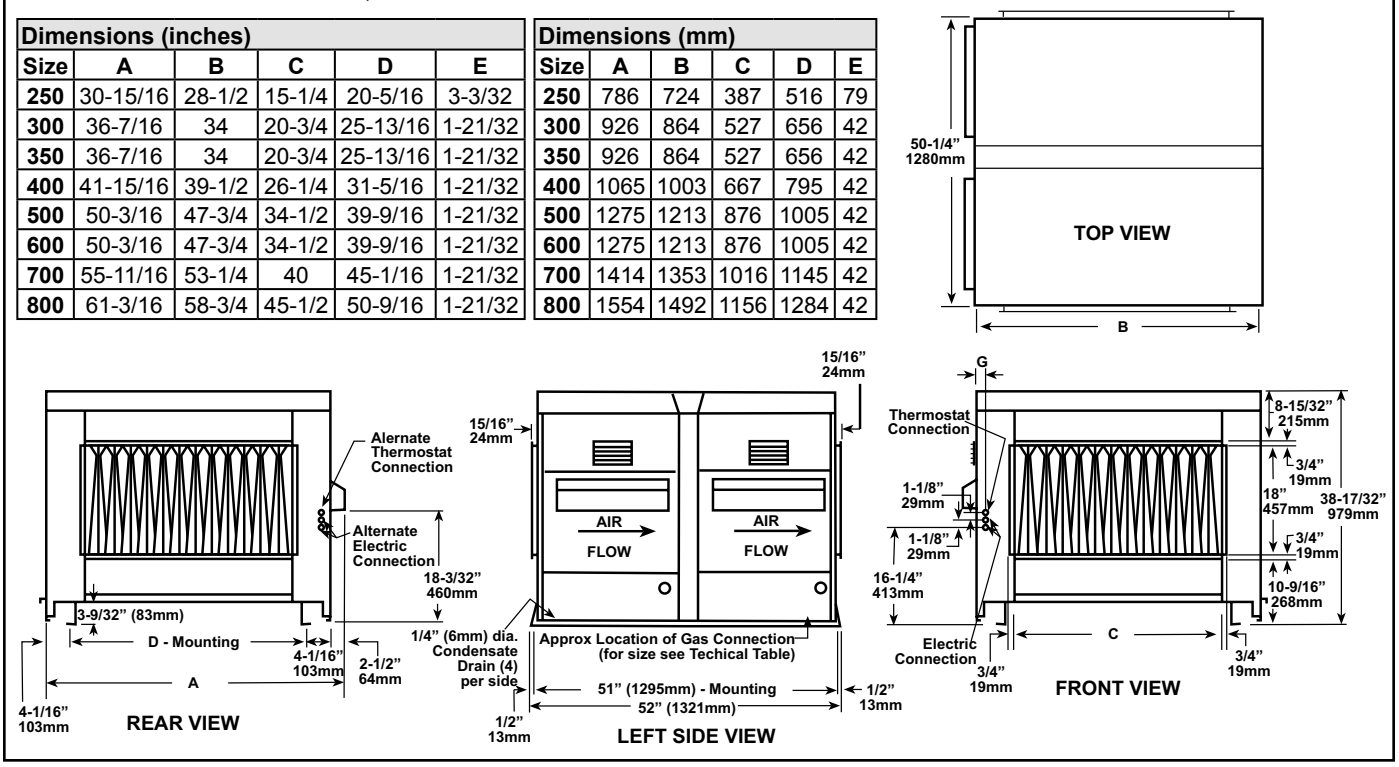
4.0 Dimensions and Clearances (cont'd)

4.1 Dimensions (cont'd)

FIGURE 2B - Dimensions, Model Series HRPD

Dimensions (inches)					
Size	**A**	**B**	**C**	**D**	**E**
250	30-15/16	28-1/2	15-1/4	20-5/16	3-3/32
300	36-7/16	34	20-3/4	25-13/16	1-21/32
350	36-7/16	34	20-3/4	25-13/16	1-21/32
400	41-15/16	39-1/2	26-1/4	31-5/16	1-21/32
500	50-3/16	47-3/4	34-1/2	39-9/16	1-21/32
600	50-3/16	47-3/4	34-1/2	39-9/16	1-21/32
700	55-11/16	53-1/4	40	45-1/16	1-21/32
800	61-3/16	58-3/4	45-1/2	50-9/16	1-21/32

Dimensions (mm)					
Size	**A**	**B**	**C**	**D**	**E**
250	786	724	387	516	79
300	926	864	527	656	42
350	926	864	527	656	42
400	1065	1003	667	795	42
500	1275	1213	876	1005	42
600	1275	1213	876	1005	42
700	1414	1353	1016	1145	42
800	1554	1492	1156	1284	42



4.2 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 above the surrounding ambient temperature is not exceeded.

Clearance is also required to sides of furnace for service.

Required Clearances						
Models		**Top**	**Sides***		**Bottom**	
			Control	Opposite Controls	To Combustibles	To Non-Combustibles
RP, HRPD Series	inches	36	Width of furnace plus 6	6	0	0
	mm	914	Width of furnace plus 152	152	0	0
* Provide clearance as shown for safety, for combustion air, and for service.						

5.0 Mounting

Weights

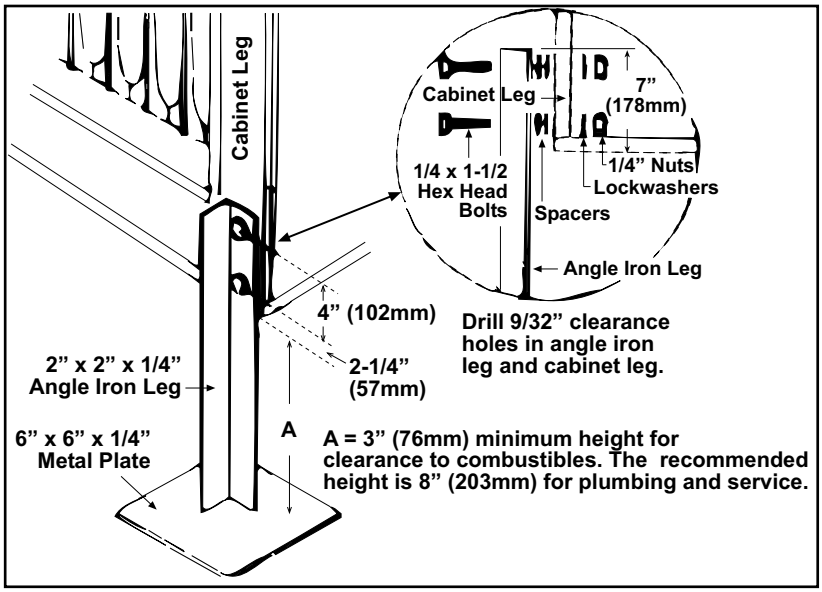
Before installing the furnace, check the supporting structure to be used to verify that it has sufficient load-carrying capacity to support the weight of the unit. Lifting holes are provided at each of the four corners of the mounting support rails. Use spreader bars when lifting to prevent chains or cables from damaging the cabinet. Furnaces must be level.

Model	**Approximate Net Wt (lbs)**									**Approximate Net Wt - kg**								
RP by Size	**125**	**150**	**175**	**200**	**225**	**250**	**300**	**350**	**400**	**125**	**150**	**175**	**200**	**225**	**250**	**300**	**350**	**400**
	201	217	217	247	247	295	295	333	361	91	98	98	112	112	134	134	151	164
HRPD by Size	**250**	**300**	**350**	**400**	**500**	**600**	**700**	**800**		**250**	**300**	**350**	**400**	**500**	**600**	**700**	**800**	
	402	434	434	494	590	590	666	722		182	196	196	224	268	268	302	328	

Mounting Models RP, HRPD - These furnaces may be placed directly on a slab or roof where support is adequate. Support rails provide required clearance from combustibles. See mounting requirements in **FIGURE 3**.

FIGURE 3 - Field-Fabricated Supports

NOTE: Drawing is not proportional; comply with dimensions as written.



6.0 Mechanical

6.1 Gas Piping and Pressures

WARNING

This appliance is equipped for a maximum gas supply pressure of 1/2 psi, 3.4 kPa, or 14 inches water column. Supply pressure higher than 1/2 psi requires installation of an additional service regulator external to the unit.

PRESSURE TESTING SUPPLY PIPING

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

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

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

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

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

Install a ground joint union and manual shutoff valve upstream of the unit control system, as shown in **FIGURE 4A**. The 1/8" plugged tapping in the shutoff valve provides connection for supply line pressure test gauge. The National Fuel Gas Code requires the installation of a trap with a minimum 3" drip leg. Local codes may require a minimum drip leg longer than 3" (typically 6").

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

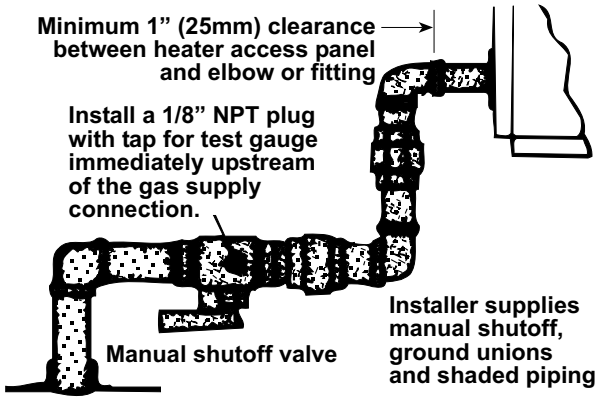
WARNING

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

6.0 Mechanical (cont'd)

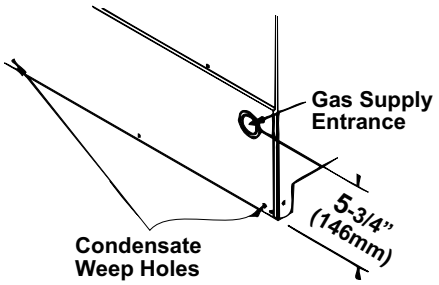
6.1 Gas Piping and Pressures (cont'd)

FIGURE 4A - Gas Connection Requirements



Gas Connection to Single-Stage Valve (Not Gas Supply Line Size)		
RP	**75-250**	**300-400**
HRPD	**250-500**	**600-800**
Natural Gas	1/2"	3/4"
Propane	1/2"	1/2"

FIGURE 4B - Gas Connection Location - Model Series RP and HRPD (Multiple furnaces require one connection; see FIGURE 2B for approximate location.)



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

Gas Supply Sizing

Capacity of Piping												
Cubic Feet per Hour based on 0.3" w.c. Pressure Drop												
Specific Gravity for Natural Gas -- 0.6 (Natural Gas -- 1000 BTU/Cubic Ft)												
Specific Gravity for Propane Gas -- 1.6 (Propane Gas -- 2550 BTU/Cubic Ft)												
Length of Pipe	Diameter of Pipe											
	1/2"		3/4"		1"		1-1/4"		1-1/2"		2"	
	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane
20'	92	56	190	116	350	214	730	445	1100	671	2100	1281
30'	73	45	152	93	285	174	590	360	890	543	1650	1007
40'	63	38	130	79	245	149	500	305	760	464	1450	885
50'	56	34	115	70	215	131	440	268	670	409	1270	775
60'	50	31	105	64	195	119	400	244	610	372	1105	674
70'	46	28	96	59	180	110	370	226	560	342	1050	641
80'	43	26	90	55	170	104	350	214	530	323	990	604
90'	40	24	84	51	160	98	320	195	490	299	930	567
100'	38	23	79	48	150	92	305	186	460	281	870	531
125'	34	21	72	44	130	79	275	168	410	250	780	476
150'	31	19	64	39	120	73	250	153	380	232	710	433
175'	28	17	59	36	110	67	225	137	350	214	650	397
200'	26	16	55	34	100	61	210	128	320	195	610	372
Note: When sizing supply lines, consider possibilities of future expansion and increased requirements.												
Refer to National Fuel Gas Code for additional information on line sizing.												

Manifold or Orifice (Valve Outlet) Pressure Settings

Measuring manifold gas pressure cannot be done until the heater is in operation. It is included in the steps of the "Check-Test-Start" procedure in Paragraph 9.0 The following warnings and instructions apply.

WARNING

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

For Natural Gas: When the heater leaves the factory, the combination valve is set so that the outlet gas pressure of a single-stage valve or high fire of a two-stage valve is regulated to 3.5" w.c. Low fire on a two-stage valve is set to 1.8" w.c. Inlet supply pressure to the valve must be a minimum of 5" w.c. or **as noted on the rating plate** and a maximum of 14" w.c. **NOTE: Always check the rating plate for minimum gas supply pressure.** Minimum supply pressure requirements vary based on size of burner and the gas control option. Most units require a minimum of 5" w.c. of natural gas as stated above, but Sizes 350 and 400 with electronic modulation require a minimum of 6" w.c. natural gas supply pressure. Sizes 300 and 350 with mechanical modulation require 7" w.c.

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

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

Instructions to Check Valve Outlet (Manifold) Pressure:

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

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

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

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

6.2 Venting

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

Optional Vertical Flue Discharge (Option CC3)

These power vented furnaces are certified with four feet of vertical pipe attached as shown in **FIGURES 5A** and **5B**. The distance is measured from the top of the unit to the bottom of the vent cap. The option package includes the 5" vent cap, the adapter assembly and the seal plate. The vent pipe and supports are field supplied.

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

FIGURE 5A - Installation of Adapter for Optional Vertical Flue Discharge (Option CC3, P/N 45021)

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

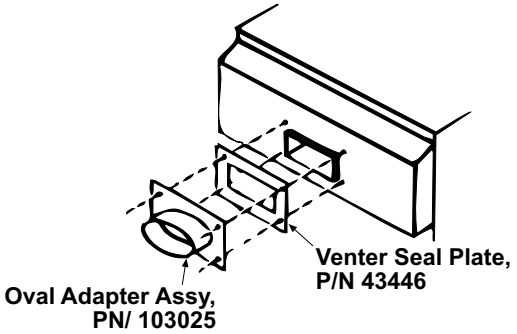
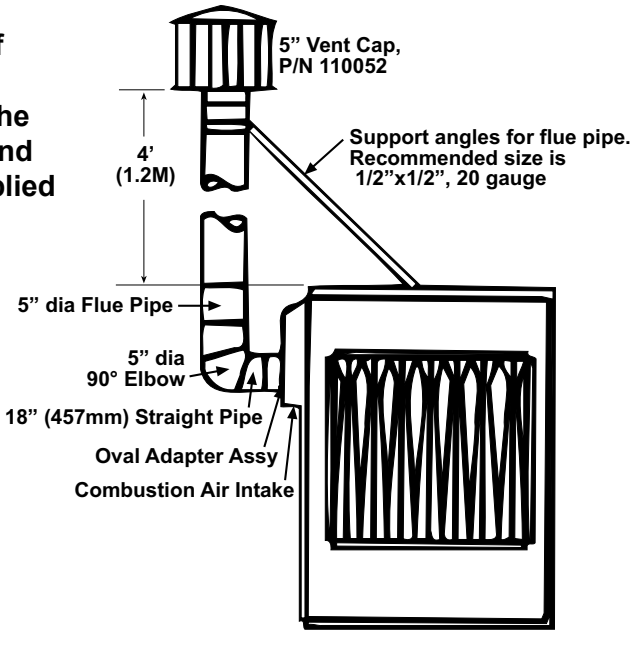


FIGURE 5B - Installation of the Vent Cap (included in the option pkg) and the field-supplied piping and supports



6.0 Mechanical (cont'd)

6.3 Duct Furnace Airflow

6.3.1 Pressure Drop and Temperature Rise by Size

The duct furnace must be installed on the positive pressure side of the field supplied blower. The air throughput must be within the CFM range stated on the heater rating plate. The air distribution must be even over the entire heat exchanger. Turning vanes should be used in elbows or turns in the air inlet to ensure proper air distribution (See Paragraph 6.3.2). If it is determined that the blower CFM is greater than allowed or desirable, see Paragraph 6.3.3 for instructions on determining the correct size of bypass duct required. To determine temperature rise, the inlet and outlet air temperatures should be measured at points not affected by heat radiating from the heat exchanger. The charts below show the approved temperature rise range with the required CFM and the internal pressure drop for each size of unit.

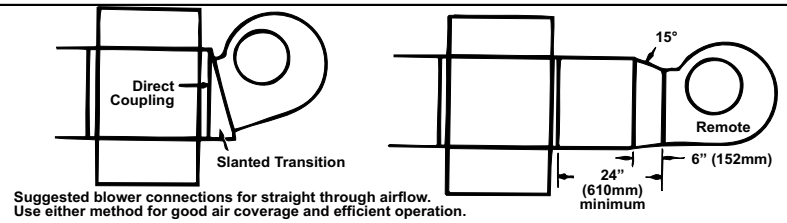
Model RP (80% thermal efficient)																		
Size	**125**		**150**		**175**		**200**		**225**		**250**		**300**		**350**		**400**	
Temp Rise	CFM	P.D.	CFM	P.D.	CFM	P.D.	CFM	P.D.	CFM	P.D.	CFM	P.D.	CFM	P.D.	CFM	P.D.	CFM	P.D.
50°F	1840	0.50	2210	0.38	2580	0.52	2945	0.42	3315	0.53	3685	0.40	4420	0.58	5160	0.65	5895	0.7
60°F	1535	0.33	1840	0.26	2150	0.35	2455	0.28	2765	0.36	3070	0.28	3685	0.39	4300	0.44	4915	0.5
70°F	1315	0.25	1580	0.19	1840	0.26	2105	0.22	2370	0.27	2630	0.23	3160	0.29	3685	0.31	4210	0.3
80°F	1150	0.21	1380	0.15	1610	0.19	1840	0.17	2070	0.22	2300	0.22	2765	0.25	3225	0.25	3685	0.3
90°F	1020	0.18	1225	0.12	1430	0.16	1635	0.14	1840	0.17	2045	0.21	2455	0.22	2865	0.23	3275	0.2

Model HRPD																
SIZE	**250**		**300**		**350**		**400**		**500**		**600**		**700**		**800**	
Temp Rise	CFM	PD	CFM	PD	CFM	PD	CFM	PD	CFM	PD	CFM	PD	CFM	PD	CFM	PD
40°F	4630	1.97	5556	1.45	6481	2.02	7407	1.70	9259	1.53	11111	2.14	12963	2.09	14815	2.09
50°F	3704	1.26	4444	0.92	5185	1.29	5926	1.09	7407	0.98	8889	1.37	10370	1.34	11852	1.34
60°F	3086	0.88	3704	0.64	4321	0.90	4938	0.76	6173	0.68	7407	0.95	8642	0.93	9877	0.93
70°F	2646	0.64	3175	0.47	3704	0.66	4233	0.56	5291	0.50	6349	0.70	7407	0.68	8466	0.68
80°F	2315	0.49	2778	0.36	3241	0.51	3704	0.43	4630	0.38	5556	0.54	6481	0.52	7407	0.52
90°F	2058	0.39	2469	0.29	2881	0.40	3292	0.34	4115	0.30	4938	0.42	5761	0.41	6584	0.41
100°F	1852	0.32	2222	0.23	2593	0.32	2963	0.27	3704	0.24	4444	0.34	5185	0.33	5926	0.33

6.3.2 Duct Furnace Blower Connections

Proper arrangement 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 is required. Blowers should be bottom horizontal discharge when coupled to the duct furnace. When a top horizontal discharge blower is connected to the duct furnace, be sure 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 assure an even flow of air across the heat exchanger.

FIGURE 6A - Straight Through Air



Suggested blower connections for straight through airflow.
Use either method for good air coverage and efficient operation.

FIGURE 6B - With Elbows Up or Down

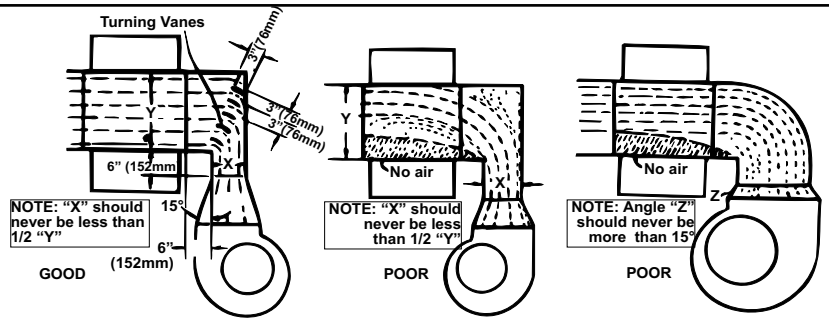
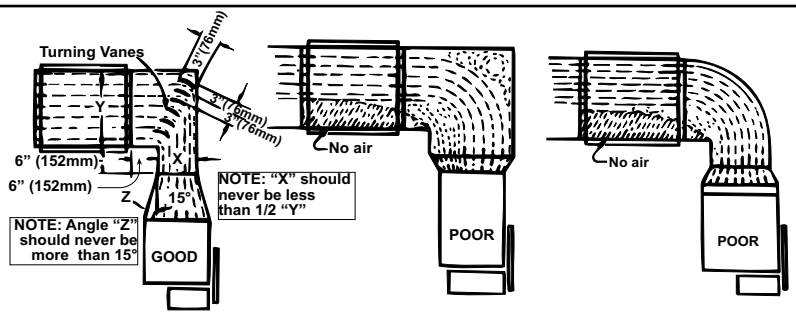


FIGURE 6C - With Elbows Right or Left



WARNING

The furnace must be installed on the positive pressure side of the air-circulating blower. See Hazard Levels, page 2.

6.3.3 Constructing a Bypass Duct

When the CFM of air throughput is greater than desirable or permissible for the unit, a bypass duct may be constructed. Follow these instructions to determine the correct size of the bypass duct.

Directions for Sizing Bypass Duct

1) From the tables in on page 10, find the pressure drop (P.D.) and the allowable CFM for the furnace that is being installed.

   Example: Standard Size RP150 @ 50°F temperature rise - P.D. .38; CFM 2210

2) Subtract the allowable CFM from the actual CFM of the installation to determine how much air must be diverted through the bypass duct.

   Example: Blower CFM 3000
   Allowable CFM -2210
   Bypass CFM 790

3) Go to the column in the Bypass CFM Chart that is closest to the pressure drop through the heater. Move down in that column until you find the CFM closest to the answer in Step 2).

   Example: P.D. .40; Bypass CFM 900

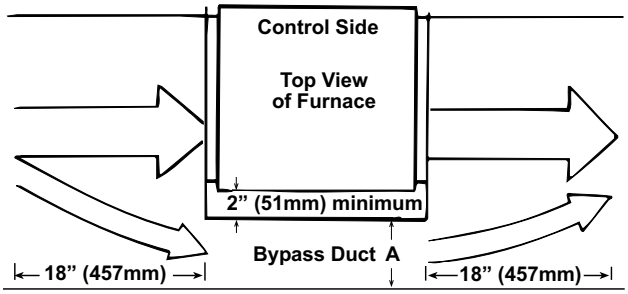
4) Move to the left column to find out the required size of the bypass duct.

   Example: Bypass Duct Size is 3"

Depth of the bypass duct is 18" on both inlet and outlet ends. Bypass duct must be located on side opposite controls and 2" from the heat exchanger side panel.

NOTE: Not all capacities are covered in this chart. If your installation is not covered, the correct size may be determined by consulting the factory representative.

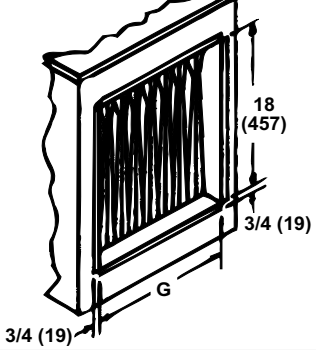
FIGURE 7 - Bypass Duct



Bypass CFM										
"A" Width		Pressure Drop through the Furnace								
inches	mm	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
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

6.3.4 Duct Connections

FIGURE 8 - Duct Connection Dimensions for Horizontal Discharge - inches (mm)



RP	HRPD	G
75, 100	**--**	12-1/2 (318)
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)

Requirements and Suggestions for Connecting and Installing Ducts

- **Type of Ductwork** - The type of duct installation to be used depends in part on the type of construction of the roof (whether wood joist, steelbar joist, steel truss, pre-cast concrete) and the ceiling (hung, flush, etc.).
- **Ductwork Material** - Rectangular duct should be constructed of not lighter than No. 26 U.S. gauge galvanized iron or No. 24 B & S gauge aluminum.
- **Ductwork Structure -** All duct sections 24 inches (610mm) or wider, and over 48 inches (1219mm) in length, should be cross broken on top and bottom and should have standing seams or angle-iron braces. Joints should be S and drive strip, or locked.
- **Through Masonry Walls** - No warm air duct should come in contact with masonry walls. Insulate around all air duct through masonry walls with not less than 1/2" (1" recommended) of insulation.

6.0 Mechanical (cont'd)

6.3 Duct Furnace Air Flow (cont'd)

6.3.4 Duct Connections (cont'd)

Requirements and Suggestions (cont'd)

- **Through Unheated Space** - Insulate all exposed warm air ducts passing through an unheated space with at least 1/2" (1" is recommended) of insulation.
- **Duct Supports** - Suspend all ducts securely from building members. Do not support ducts from unit duct connections.
- **Duct Sizing** - Proper sizing of the supply air ductwork is necessary to ensure a satisfactory heating installation. The recognized authority for such information is the Air Conditioning Contractors Association, 2800 Shirlington Road, Suite 300, Arlington, VA 22206 (www.acca.org). A manual covering duct sizing in detail may be purchased directly from them.
- **Removable Panels** - The ducts should have removable access panels on both upstream and downstream sides of the furnace. These openings must be accessible when the furnace is in service and should be a minimum of 6" x 10" in size so smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The covers for the openings must be attached in such a manner as to prevent leakage. See **FIGURE 9A**.
- **Horizontal Discharge Duct Length -** A minimum horizontal duct run of 24" (610mm) 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. Duct connection should be made with "U" type flanges on the top and bottom of the connecting duct. Slide the duct over the flanges of the heater giving an airtight fit. Provide "U" type channels for the other side flanges to ensure tight joints. Use sheetmetal screws to fasten ducts and "U" channels to the furnace flange. See **FIGURES 9A and 9B**.

CAUTION: Joints where supply air ducts attach to the furnace must be sealed securely to prevent air leakage. Leakage can cause poor combustion, pilot problems, shorten heat exchanger life, and cause poor performance.

FIGURE 9A - Connecting Supply Air Duct to the Furnace

(1) Flanges on the furnace (heat exchanger) turn out as shown. (2) Shape duct connection as shown -- "U" on top and bottom; "L" on sides. (3) Slide "U" channels over furnace top and bottom flanges making connection. (4) Form "U" channels to seal sides. **Drill and lock with sheetmetal screws.**

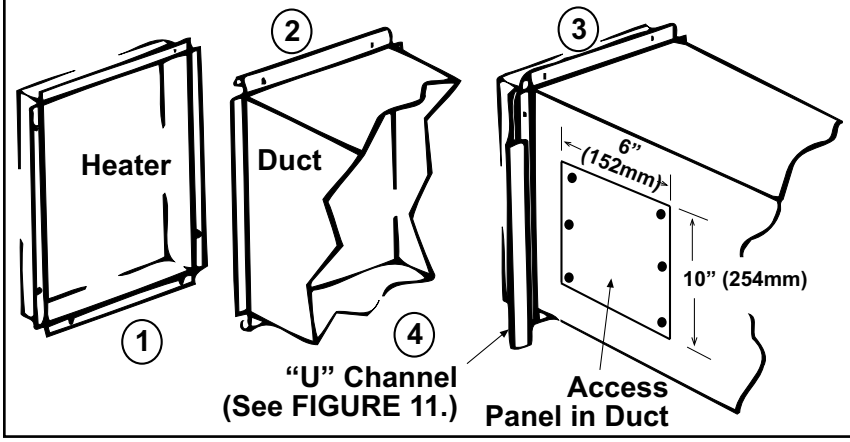
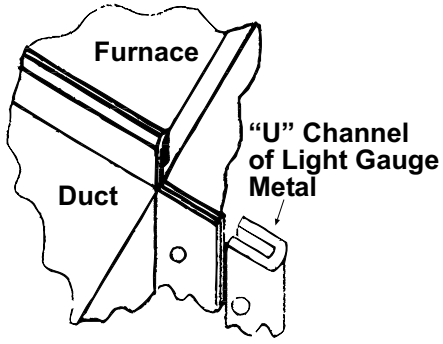


FIGURE 9B - "U" Channel Duct Connection



6.3.5 Discharge Air Sensor for Makeup Air Application

Makeup air Options AG3 and AG4 have a unit mounted ductstat with a capillary sensor that is factory-installed in the unit discharge (See Paragraph 8.4.3).

Makeup air Options AG15, AG17, AG8, AG9, AG39, AG40, AG41, and AG42 require field installation of the sensor in the discharge ductwork.

Option AG15 and AG17 use the box and sensor holder in **FIGURE 10A**.

Options AG8, AG9, AG39, and AG41 include a sensor and mixing tube like the one illustrated in **FIGURE 10B**. Options AG40 and AG42 require a field-supplied sensor.

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

For control information, see Paragraph 8.4.

Instructions for Installing Discharge Air Sensor in the Ductwork

FIGURE 10A - Discharge Air Sensor Holder, P/N 115850, used in Makeup Air Option AG15 & AG17

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

FIGURE 10B - A Discharge Air Sensor and Mixing Tube are used in Electronic Modulation Options AG8, AG9, AG39, & AG41

1. Depending on the option, the sensor will be as shown in **FIGURE 10A,** in **FIGURE 10B,** or field-supplied for Option AG40 or AG42. See Paragraph 3.2 for a list of shipped-separate components by option code.
2. Determine a location in the ductwork to install the sensor.

   Select a location a sufficient distance from the outlet to provide a good mixture of discharge air temperature. According to the latest edition of AMCA Standard 201, in straight ducts, the air is typically well mixed a minimum of five equivalent duct diameters from the discharge of the unit with equivalent duct diameter defined s equal to the square root of 4AB/3.14. "A" and "B" are the duct cross-sectional dimensions.

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

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

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

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

   Do not mount the sensor in the ductwork after a split in the supply as that will cause loss of control in the duct that does not house the sensor.
3. The position of the sensor holder or mixing tube is important. The holder in **FIGURE 10A** will extend 9-3/16” (233mm) into the ductwork. The mixing tube in **FIGURE 10B** is 12" (305mm) long.

   In horizontal ductwork, locate the sensor assembly in the top, middle of the duct with the sensor probe extending vertically down into the center of the airstream.

   In vertical ductwork, locate the sensor assembly in the middle of the side of the duct that corresponds with the top middle of the discharge outlet.

   Turn the holder so that the element will be shielded from direct airflow and will sense the air temperature as it flows through the holes in the holder.

   At the selected location in the ductwork, mark the diamond-shaped hole [approximately 1” x 1” (25mm x 25mm)] required for the sensor holder or the round hole needed for the mixing tube. Cut the hole no larger than required.
4. **Options AG15 and AG17**- Push the element into the clip in the holder. Determine where the sensor wire should enter the box and remove the knockout. Slide the holder into the ductwork. Using four field-supplied No. 6 sheetmetal screws, attach the box portion of the holder to the ductwork. Attach a field-supplied cable connector to the box, connect the sensor wire, and attach the box cover.
   Options AG8, AG9, AG39, and AG41 - Slide the mixing tube into the ductwork and attach the sensor. Connect the wires as shown on the wiring diagram.
   Options AG40 and AG42 - Follow the instructions provided with the field-supplied sensor. Refer to the wiring diagram with the unit and the field-supplied sensor to connect the wires.

7.0 Electrical Supply and Connections

7.1 General

WARNING

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

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

7.2 Supply Voltage and Wiring

Check the rating plate on the heater for the supply voltage and current requirements. A separate line voltage supply with fused disconnect switch should be run directly from the main electrical panel to the furnace, making connection to leads in the junction box.

7.0 Electrical Supply and Connections (cont'd)

7.2 Supply Voltage and Wiring (cont'd)

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

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

Specific wiring diagrams that include standard and factory-installed options are included with the heater. **Typical wiring diagrams are on pages 15 and 16.**

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 limit control, optional bypass damper combustion air safety circuit (Option AG39, AG40, AG41, or AG42), and sensor lead wires which must be 150°C. See Hazard Levels, page 2.

Disconnect Switch

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

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

7.3 Thermostat and Control Wiring

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

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

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

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

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

Low voltage (24 volt) thermostats may be equipped with heat anticipators which level out unit cycling for optimum temperature control. Set anticipator at full load control AMPS.

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

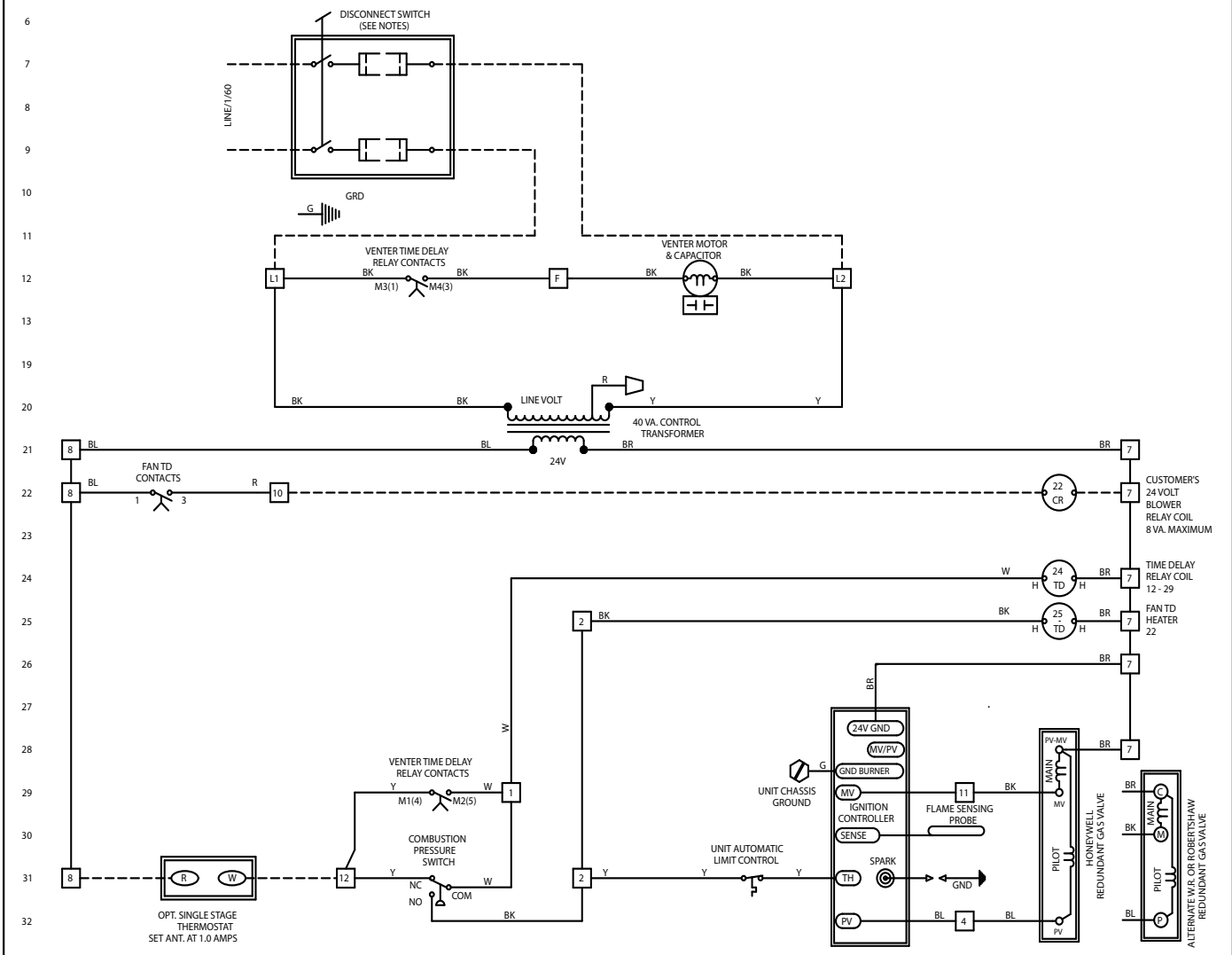
24V Controls - Maximum Amps **(24V Transformer has 20VA capacity)**
Single-Stage Valve - .6
Two-Stage Valve - .6
Maxitrol System - .5
Spark Ignition System - .1
Fan Control Coil - .12
Time Delay Relay Heater - .1
Relay Coil - .12

Control Wiring

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

7.4 Typical Wiring Diagrams

FIGURE 11A - Power-Vented Furnace with Standard Single-Stage Gas Valve, W.D. 274956



OPERATING SEQUENCE
- SET THERMOSTAT AT LOWEST SETTING.
- TURN ON POWER AND MANUAL GAS VALVE TO UNIT.
- SET THERMOSTAT AT DESIRED SETTING.
  - FIRING RATE IS CONTROLLED BY THE SINGLE STAGE THERMOSTAT.
  - BLOWER MOTOR OPERATES FROM FAN TIME DELAY.

FIRING SEQUENCE:
- ON A CALL FOR HEAT BY THE THERMOSTAT.
  - THE VENTER MOTOR IS ENERGIZED AFTER A 15 SECOND (APPROX.) TIME DELAY.
- VENTER FLOW SWITCH SWITCHES FROM N.C. TO N.O. CONTACTS ENERGIZING THE PILOT GAS VALVE AND SPARK GAP TO PRODUCE A PILOT FLAME ON EACH OPERATING CYCLE. THE SENSING PROBE PROVES THE PRESENCE OF THE PILOT FLAME AND ENERGIZES THE SAFETY SWITCH PORTION OF THE CONTROL. THE SWITCH ACTION DE-ENERGIZES THE SPARK GAP AND ENERGIZES THE MAIN VALVE. THE MAIN GAS IGNITES AND UNIT FIRES AT FULL RATE.
- IF THE FLAME IS EXTINGUISHED DURING MAIN BURNER OPERATION, THE SAFETY SWITCH CLOSES THE MAIN VALVE. IF THE PILOT IS NOT ESTABLISHED WITHIN 120 SEC. THE UNIT LOCKS OUT FOR ONE HOUR, UNLESS IT IS RESET BY INTERRUPTING POWER TO THE CONTROL CIRCUIT. (SEE LIGHTING INSTRUCTIONS)

NOTE
- THE FOLLOWING CONTROLS ARE SUPPLIED BY REZNOR FOR FIELD INSTALLATION: NONE
- THE FOLLOWING CONTROLS ARE SUPPLIED AS OPTIONAL EQUIPMENT: THERMOSTAT
- DOTTED WIRING AND THE FOLLOWING CONTROLS ARE SUPPLIED AND INSTALLED BY OTHERS: BLOWER RELAY
- CAUTION: IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRING MATERIAL HAVING A TEMPERATURE RATING OF AT LEAST 105 DEGREES C., EXCEPT FOR ENERGY CUTOFF OR SENSOR LEAD WIRE WHICH MUST BE 150 DEGREES C.
- LINE AND BLOWER MOTOR BRANCH CIRCUIT WIRE SIZE SHOULD BE OF A SIZE TO PREVENT VOLTAGE DROP BEYOND FIVE PERCENT OF SUPPLY LINE VOLTAGE.
- USE #14 GA. WIRE FOR LINE AND MOTOR WIRING ON THREE PHASE UNIT.
- USE #18 GA. WIRE FOR 24 VOLT CONTROL WIRING ON UNIT.
- ON 208/230V. UNITS THE CONTROL TRANSFORMER HAS A DUAL VOLTAGE PRIMARY. FOR 230V. UNITS USE BLACK AND YELLOW LEADS (CAP RED). FOR 208V. UNITS USE BLACK AND RED LEADS (CAP YELLOW). ON 115/460V. UNITS THE CONTROL TRANSFORMER IS A SINGLE VOLTAGE PRIMARY. FOR 115/460V. UNITS USE BLACK AND YELLOW LEADS.
- WHEN PROVIDING OR REPLACING FUSES IN THE FUSIBLE DISCONNECT SWITCH USE DUAL ELEMENTS TIME DELAY FUSES AND SIZE ACCORDING TO 1.25 TIMES THE MAXIMUM TOTAL INPUT AMPS.
- DISCONNECT SWITCH IS FIELD FURNISHED OR AVAILABLE FROM FACTORY AS AN OPTION.

FACTORY WIRING
FIELD WIRING
OPTIONAL FACTORY WIRING
OPTIONAL FIELD WIRING

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

FIELD CONTROL WIRING

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

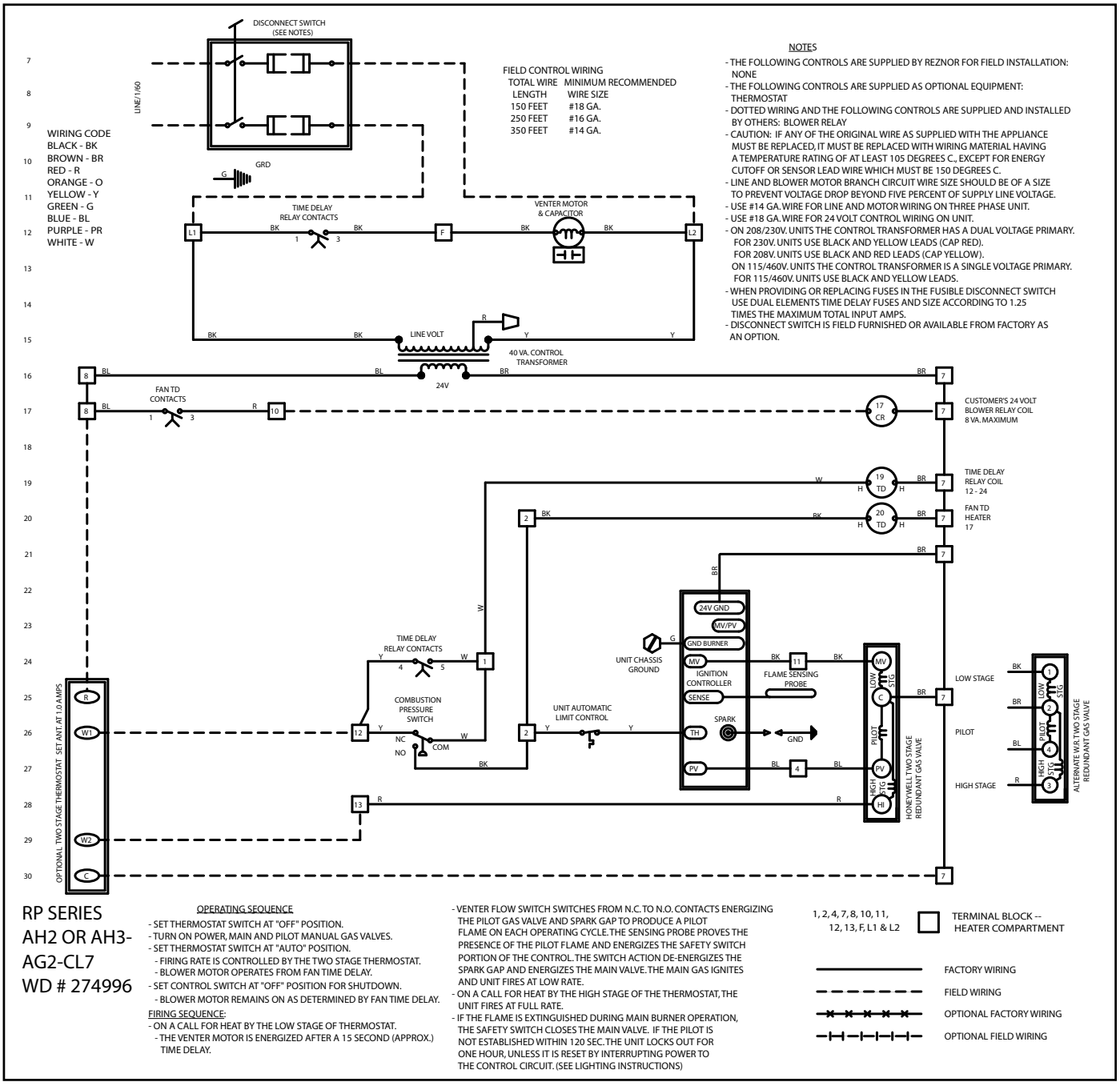
1, 2, 4, 7, 8, 10, 11, 12, F, L1 & L2 — TERMINAL BLOCK -- HEATER COMPARTMENT

RP SERIES AH2 OR AH3-AG1-CL1 WD # 274956 REV. #1

7.0 Electrical Supply and Connections (cont'd)

7.4 Typical Wiring Diagrams (cont'd)

FIGURE 11B - Power-Vented Furnace with Optional Two-Stage Gas Valve, W. D. 274996



8.0 Controls

Service NOTES: To replace the fan control on units manufactured prior to 11/04, a replacement kit is required. Order **P/N 209184**. Prior to 10/03, the fan control was optional. Check the wiring diagram on the furnace.

8.1 Fan Control

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

8.2 Limit Control

The heater is equipped with a non-adjustable high limit switch which shuts off the gas in the event of motor failure, lack of air due to dirty filters, or restrictions at the inlet or outlet of the unit. See Paragraph 9.3 for limit control check.

8.3 Combustion Air Proving Switch

The combustion air proving switch, which ensures that proper combustion airflow is available is a pressure switch. The switch is a single-pole, double-throw switch, which 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 pressure 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.

DANGER

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

8.4 Gas Controls

8.4.1. Operating Valve

WARNING

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

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

8.4.2 Optional Two-Stage Operation - Heating Only

The standard combination control valve is replaced with a two-stage combination gas control valve providing for low fire or high fire operation controlled by a two-stage thermostat. First stage (low fire) is factory set (not field adjustable). Both high and low stages are controlled by a Servo regulator, maintaining constant gas input under wide variations in gas supply pressure. See instructions packed with the unit for specific gas valve specifications, wiring, and operating instructions.

8.4.3 Optional Two-Stage Operation - Makeup Air

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 the 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 discharge an outlet 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.

Depending on the option selection, the sensor is either connected by capillary tubing to the unit-mounted ductstat (**FIGURES 12A and 12B**) or electrically connected to a remote electronic temperature selector (**FIGURE 13**). See Paragraph 6.3.5 for instructions on locating the sensor in the ductwork.

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 AG 3, 15, 4, or 17).

The first method, identified by Options AG3 or AG15 is applicable to both Model RP and HRPD and is comparable to the two-stage heating units. Instead of control from a two-stage room thermostat, the discharge air temperature is monitored and the two-stage gas valve is controlled by a two-stage ductstat. When the discharge air temperature drops to the setpoint, low fire is energized. If low fire cannot satisfy the

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

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 (**FIGURE 12A or 13**) as indicated in **TABLE A, below**.

The second method of multiple-stage makeup air operation is applicable only to Model HRPD and is identified as Option AG4 or AG17. 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 B**.

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

(1) the ductstat with temperature selector and attached capillary sensor is factory installed (Option AG3 and AG4; see **FIGURE12A, or**

(2) a sensing probe must be field installed in the heater discharge (See **Paragraph 6.3.5).** The sensing probe is wired to a remote, field-installed, electronic temperature selector (**FIGURE 13**).

TABLE A - Recommended Settings for Staging Application - Options AG3 and AG15

Option	No. of Furnaces	Ductstat Settings - Set ***the*** Ductstat (See **FIGURE 12A**) 1st	2nd	Sequence of Staging with these settings
AG3	1	70°F	--	66°F High Stage ► 70°F Low Stage ► 74°F Shutdown
	2	70°F	64°F	60°F High Stage Both Furnaces ► 64°F Low Stage 2nd Furnace ► 68°F Shutdown 2nd furnace ► 70°F Low Stage 1st furnace ► 74°F Shutdown 1st furnace

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

Option	No. of Furnaces	Temperature Selector (A350) Setpoint	Differential	Stage Adder (S350) Offset Settings (Refer to **FIGURE 13**)			
AG15	1	74°F	8°F	4°F	--	--	
	2	74°F	14°F	10°F	6°F	4°F	

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

TABLE B - Recommended Settings for Staging Application - Options AG4 and AG17

Option	No. of Furnaces	Ductstat Settings - Set ***the*** Ductstat (See **FIGURE 12A**) i 1st	2nd	Sequence of Staging with this setting
AG4	2	70°F	--	66°F Full Rate Both Furnaces ► 70°F Shutdown 1st Furnace ► 74°F Shutdown 2nd furnace

Options AG17 - Adjust the setpoint and the differential of the temperature selector (Johnson #A350). Adjust the offset potentiometer on each of the stage adder modules (Johnson #S350). The settings listed below will provide the same sequence of staging as shown above for Option AG4. Follow the manufacturer's instructions provided. **IMPORTANT:** Set the temperature selector and each stage adder module to "HEAT". Follow the wiring diagram to obtain proper sequencing.

Option	No. of Furnaces	Temperature Selector (A350) Setpoint	Differential	Stage Adder (S350) Offset Settings (Refer to illustration in **FIGURE 13**)
AG17	2	74°F	8°F	4°F

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

Optional Ductstat with Capillary Tubing (Options AG3 and AG4) - These makeup air control options use a ductstat (See **FIGURE 12A**) with an adjustable range from 0° to 100°F with a fixed differential of 3°. 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, re-adjust the setpoint of the ductstat to achieve the desired average discharge air temperature. In general, makeup air applications are usually adjusted to discharge an outlet air temperature between 65°F and 75°F.

Optional Ductstat with Electronic Remote Setpoint Module (Options AG15 and AG17) - These two-stage makeup air options that are controlled from a sensing probe with a remote electronic temperature selector that has a temperature operating range

to 130°F. The sensing probe and remote modules (**FIGURE 13**) are shipped separately for field installation. Follow the instructions Paragraph 6.3.5 for installing the sensor. Refer to the wiring diagram with the unit and the manufacturer's instructions for wiring and installing the remote modules. **CAUTION: Make sure heat/cool selector switch is set on "HEAT".** Depending on the staging provided, there will be one module for selecting temperature and either one or two stage-adder modules.

See **TABLE A or B, page 18,** for recommended settings and staging sequence of two-stage options.

FIGURE 12A - Ductstat Control in Option AG3 and AG4

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

Factory set at 70°F

FIGURE 12B - Ductstat Bulb (factory installed)

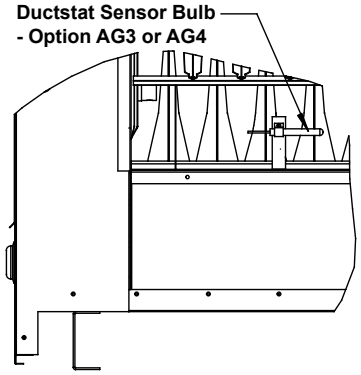


FIGURE 13 - Remote Temperature Selector (A) and Stage-Adder Module (B) In Gas Control Options AG15 and AG17

NOTE: Model HRPD with Option AG15 uses three stage adder modules.

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

8.4.4 Optional Electronic Modulation

The type and capability of the electronic modulation system, depends on the option selected. Electronic modulation options are identified by a suffix to the Serial No. printed on the heater rating plate. AG7 is identified as MV1; AG8 is identified as MV3; AG9 is identified as MV4; AG21 is identified as MVA; AG39 is identified as MP1; and AG40 is identified as MP2. 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.

Installation NOTE: Model RP 350 and 400 and Model HRPD 350, 400, 500, 600, 700, and 800 with electronic modulation require a minimum of 6" w.c. natural gas supply pressure.

FIGURE 14A - Amplifier in Options AG7, AG8, and AG9

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

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

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

Refer to the wiring diagram supplied with the furnace for proper wiring connections. Electronic modulation for heating controlled by a specially designed room thermostat (60°-85°F) is identified as Option AG7. Electronic modulation control systems for makeup

8.0 Controls (cont'd)

8.4 Gas Controls (cont'd)

FIGURE 14B - Maxitrol Signal Conditioner in Options AG21, AG40, & AG42

8.4.4 Optional Electronic Modulation (cont'd)

air applications controlled by a field-installed duct sensor (See Paragraph 6.3.5.) and temperature selector (55-90°F) are identified as either Option AG8 or Option AG9. The temperature selector setting for Option AG8 is on the amplifier; Option AG9 has a remote temperature selector. Both systems are available with an override thermostat.

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

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

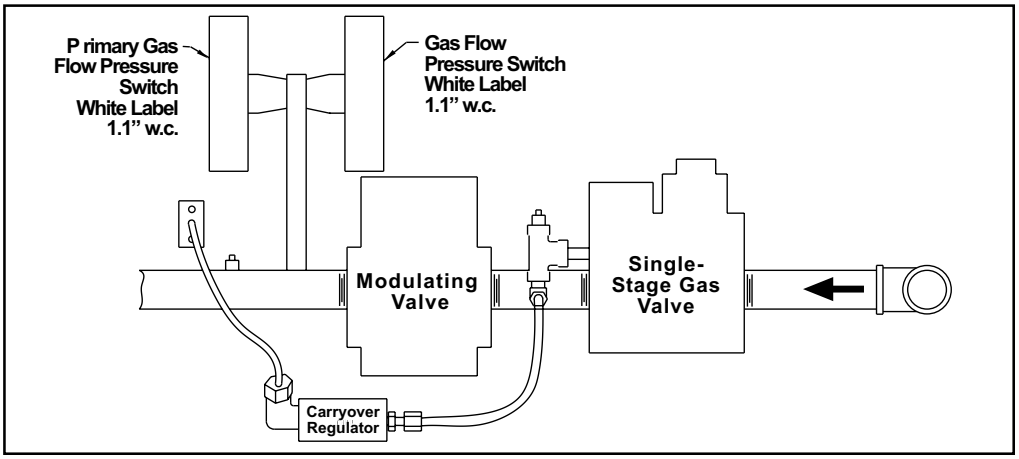
Electronic Modulation between 20-28% and 100% Firing Rate - Options AG39 & AG40 (<u>natural gas</u> only <u>Model RP only</u>; not available on Size 350) and Options AG41 & AG42 (natural gas only Model HRPD; not available on Size 700)

Depending on the size, furnaces equipped with electronic modulation Option AG39, AG40, AG41, or AG42, have a 20-28% turndown ratio. The furnace will ignite at any input rate in the available range and will maintain average thermal efficiencies equal to or greater than the thermal efficiency at full fire.

Model / Size		Maximum Turndown	MBH Inlet Range	Inlet Pressure to Modulating Valve	Gas Supply Pressure Required
RP 125	HRPD 250	20%	25-125	3.9" w.c.	5" w.c.
RP 150	HRPD 300	27%	40.3-150	3.7" w.c.	5" w.c.
RP 175	HRPD 350	23%	40.3-175	3.7" w.c.	5" w.c.
RP 200	HRPD 400	26%	51.8-200	3.9" w.c.	5" w.c.
RP 225		23%	51.8-225	3.9" w.c.	5" w.c.
RP 250	HRPD 500	28%	69-250	4.0" w.c.	5" w.c.
RP 300	HRPD 600	23%	69-300	4.0" w.c.	5" w.c.
RP 400	HRPD 800	25%	100-400	4.4" w.c.	6" w.c

The gas train includes a single-stage gas valve, a modulating valve, and two gas pressure switches. The burner rack is equipped with one flash carryover and a regulated gas lighter tube system. The carryover lighter tube receives its gas supply through the regulator, simultaneously with the gas to the burner. Control of the system is through a Maxitrol amplifier with a corresponding remote temperature dial

FIGURE 15 - Option Manifold Arrangement



Description of Operation - Options AG39, AG40, AG41, AG42

The gas supply (see pressure requirements in the table above) connects to the single-stage gas valve. To compensate for additional pressure loss through the modulating valve, the single-stage gas valve has a custom outlet pressure setting higher than when it is used on a standard gas manifold. The pilot tubing connects to the pilot port on the single-stage gas valve. When the valve receives a call for heat from the amplifier and pilot is established, gas flow from the single-stage valve goes to both the modulating valve and the regulated lighter tube system. When the signal from the amplifier to the modulating valve requires less-than-high fire operation, the modulating valve functions to lessen the gas flow to the burner to reduce the input rate to that required to maintain the desired temperature. When the input rate is reduced enough to decrease the gas pressure to 1.1" w.c., the primary gas pressure switch in

the manifold activates the gear motor that controls the bypass damper in the venter/ combustion air system. The bypass damper opens diverting some of the incoming air directly into the flue duct, reducing airflow through the burner. Safety switches monitor the position of the bypass damper. When the gas pressure increases above 1.1" w.c., the bypass damper closes.

Combustion Air Pressure Switch Setting

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

RP with AG39 or AG40	HRPD with AG41 or AG42	Startup Cold	Equilibrium at Full Rate	Factory Setting
Sizes 125-225	Sizes 250 - 400	-1.3" w.c.±0.2	-1.05" w.c.±0.1	-0.58" w.c.±0.05
Sizes 250-400	Sizes 500 - 800	-1.2" w.c.±0.2	-0.95" w.c.±0.1	-0.58" w.c.±0.05

Sensor Location

The duct temperature sensor and mixing tube are shipped loose for field installation in the dicharge duct. See Paragraph 6.3.5 for instructions on locating the sensor in the ductwork.

The sensor for Opiton AG40 and AG42 is field suppleid. Follow the guidelines in Paragraph 6.3.5 and the manufacturer's instrucitons.

Set Heat Stage Controllers - applies to HRPD 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 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. Follow the steps and example to determine appropriate setpoints. Follow the instructions to locate and set the controllers.

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

T_{SP} = Setpoints of Heat Stage Controllers (T_{SP2} and T_{SP3})
T_{SA} = Desired Supply Air Temperature
T_D = Design (minimum) Entering Air Temperature

Formulas for two furnace sections:
Setpoint for Heat **Stage 2**: $T_{SP2} = T_{SA} - 0.46 (T_{SA} - T_D)$
Setpoint for Heat **Stage 3**: $T_{SP3} = T_{SA} - 0.73 (T_{SA} - T_D)$

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

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

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

Set Stage Heat #2 Controller to 36°F

Set Stage Heat #3 Controller to 13°F

Locate and Set the Heat Stage Controllers

1. In the inlet air section, locate the heat stage controllers. The same type of controller may also 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). Identify the controllers marked Heat #2 and Heat #3.
   2 Furnaces (Model HRPD) - Identify controllers marked Heat #2 and Heat #3 .
2. Adjust each controller to the setpoint as determined in the calculation.

Wiring and Service

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

This is a unique system which includes custom-built components and custom settings. If service is required, follow the general troubleshooting guide on page 28 and the special troubleshooting guide on page 22.

Computer Controlled Electronic Modulation between 20-28%, Options AG40 and AG42

The heater functions and is equipped in the same way as for Option AG39 except that with computer control the temperatures are selected through the field-supplied software and there is no temperature selector or duct sensor.

With this option the furnace is equipped with a Maxitrol signal conditioner (**FIGURE 14B**) which accepts an input signal of either 4-20 milliamps or 0-10 volts from a customer-supplied control device such as a computer. With the dip switches on the conditioner in the "on" positions, the conditioner accepts a 4-20 milliamp signal. In the "off" positions, the conditioner accepts a 0-10V signal. The conditioner converts the signal to the 0 to 20 volt DC current required to control the modulating valve.

8.4 Gas Controls (cont'd)

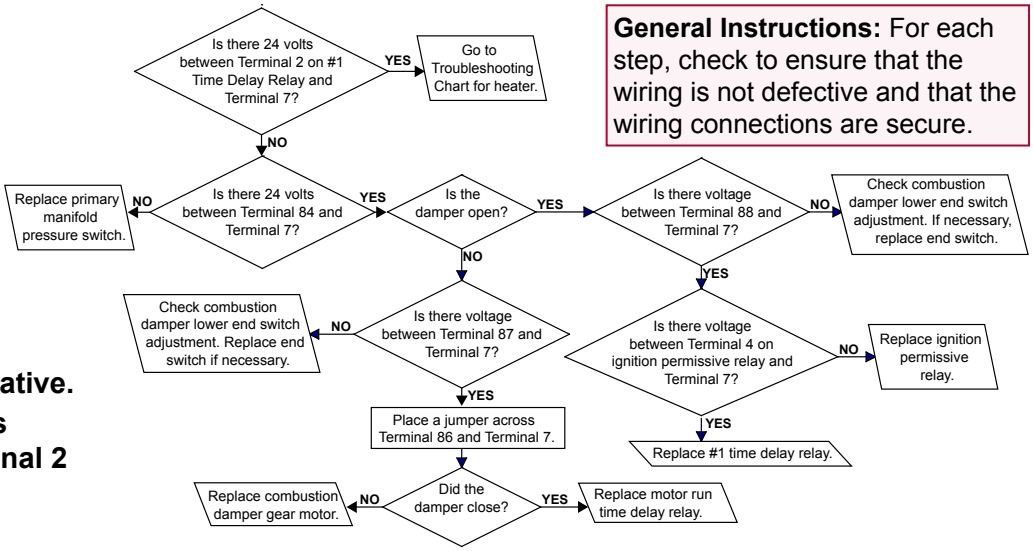
8.4.5 Optional Electronic Modulation (cont'd)

Troubleshooting Guides for Checking Bypass Combustion Air Damper Safety Circuit with Option AG39, AG40, AG41, or AG42

Symptom - Part 1:

Main burners are inoperative.

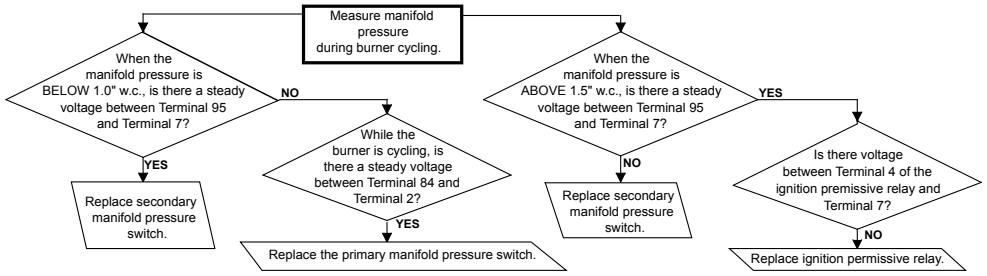
Assumes that 24 volts is available between Terminal 2 and Terminal 7.



Symptom - Part 2:

Steady call for heat - burner cycles.

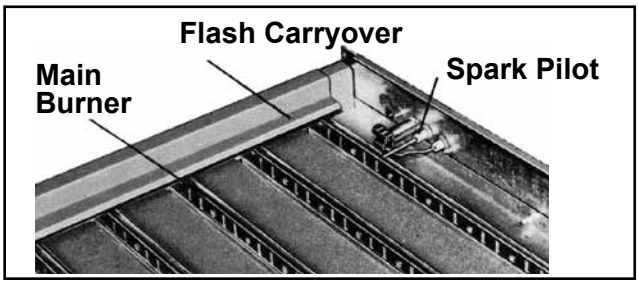
Assumes constant voltage between Terminals 11 and 7 and Terminals 2 and 7.



8.5 Pilot and Ignition Systems

The horizontal pilot is located in the control end of the burner rack and is accessible after the control compartment panel has been removed. All pilots are target type with lint-free feature. Pilot gas pressure should be the same as supply line pressure. (See Paragraph 6.1.) If required, adjust the pilot flame length to approximately 1-1/4" with pilot adjustment screw in control valve body.

FIGURE 16 - Burner Rack with Spark Pilot



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

Intermittent Spark Ignition Safety Pilot Systems - There are two types of intermittent spark pilots -- one type shuts off the pilot gas flow between the cycles and the other not only shuts off the pilot gas flow between cycles but also has a lockout device that stops the gas flow to the pilot if the pilot fails to light in 120 seconds. This lockout feature has a 1-hour retry or requires manual reset by interruption of the thermostat circuit. Propane units installed in Canada require the spark ignition system with the lockout device. Refer to the wiring diagram supplied with the heater for pilot system identification and wiring. Spark pilot without lockout is designated as Option AH2; with lockout as Option AH3.

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

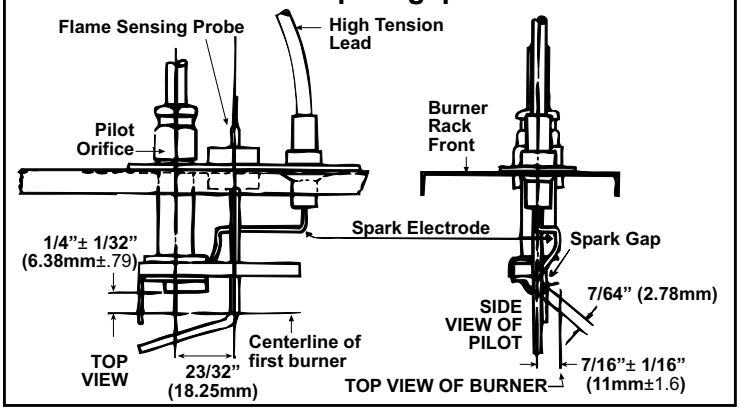
FIGURE 17 - Ignition Controller

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

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

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

FIGURE 18 - Maintain spark gap of 7/64"



If no spark occurs, check the following:

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

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

c) Pilot spark gap should be approximately 7/64".

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

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

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

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

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

When the above conditions are normal and the main gas flow is still off, the ignition controller is probably defective.

8.6 Burners and Carryover System

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

Natural gas burner racks (except when equipped with electronic modulation Option AG39, AG40, AG41, or AG42; see Paragraph 8.4) are equipped with two flash carryovers. Propane gas burners are equipped with one flash carryover and a regulated gas lighter tube system.

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

8.7 Burner Air Adjustment

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

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

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

DANGER

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

9.0 Commissioning and Startup

9.1 Check the installation prior to startup:

☐ Be certain the electrical supply matches voltage rating of the furnace. (Refer to the rating plate.)

☐ Check all field wiring against the wiring diagram. Be sure that wire gauges are as required for the electrical load.

☐ Be certain that the electrical entrances are sealed against the weather.

☐ Check that fuses or circuit breakers are in place and sized correctly.

☐ Verify that the condensate drain holes in the corners of the cabinet are open.

☐ Check clearances from combustibles. Requirements are shown in Paragraph 4.2.

☐ Check piping for leaks and proper gas line pressure. Bleed gas lines of trapped air. See Paragraph 6.1.

a) Turn manual shutoff valve to off position.
b) Turn gas supply on.
c) Observe gas meter for movement, or
d) Attach pressure gauge readable to .1" w.c. and after turning gas on for ten seconds, turn gas supply off. No change in pressure should occur over a three-minute period.
e) If either c) or d) above indicate a leak, locate leak by brushing a soapy solution on all fittings. Bubbles will appear at a leak. Repair and repeat tests.

☐ Check to make sure that flue discharge openings are free from obstructions.

9.2 Startup

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

Operating Sequence

1) Set the thermostat switch at its lowest setting.
2) Turn on power, main and manual gas valves.
   (a) Firing rate is controlled by the thermostat.
   (b) Blower motor operates from fan time delay.
3) Set thermostat switch at desired setting.
4) Thermostat calls for heat
   (a) The venter motor is energized after 15-second (approximate) time delay.
   (b) Venter flow switches from N.C. to N. O. contacts, energizing the pilot gas valve and spark gap to produce a pilot flame on each operating cycle. The sensing probe proves the presence of the pilot flame and energizes the safety switch portion of the control. The switch action de-energizes the spark gap and energizes the main valve. The main gas ignites and the unit fires at full rate.
5) If the flame is extinguished during main burner operation, the safety switch closes the main valve and recycles the spark gap. On a unit equipped with a controller with lockout, if the pilot is not established within 120 seconds (approximately), the unit locks out for one hour, unless reset by interrupting the power to the control circuit (See Lighting Instructions).

9.3 Check Installation After Startup

☐ With the unit in operation, measure manifold gas pressure. Manifold pressure for natural gas should be 3.5" w.c. and 10" w.c. for propane gas. See Paragraph 6.1.

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

☐ Observe burner flame at full fire. Natural gas flame should be about 1-1/2" in height with blue coloring. Propane gas flame should be approximately the same length with blue coloring. Yellow tipping may appear on propane gas. If yellow extends beyond 1/2 to 3/4", adjust air shutters. See Paragraph 8.7.

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

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

DANGER

The gas burner in this gas-fired equipment is designed and equipped to provide safe, complete combustion. However, if the installation does not permit the burner to receive the proper supply of combustion air, complete combustion may not occur. The result is incomplete combustion which produces carbon monoxide, a poisonous gas that can cause death. Safe operation of indirect-fired gas burning equipment requires a properly operating vent system which vents all flue products to the outside atmosphere. FAILURE TO PROVIDE PROPER VENTING WILL RESULT IN A HEALTH HAZARD WHICH COULD CAUSE SERIOUS PERSONAL INJURY OR DEATH. Always comply with the combustion air requirements in the installation codes and instructions. Combustion air at the burner should be regulated only by manufacturer-provided equipment. NEVER RESTRICT OR OTHERWISE ALTER THE SUPPLY OF COMBUSTION AIR TO ANY HEATER.

10.0 Maintenance and Service

WARNING

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

This unit will operate with a minimum of maintenance. To ensure long life and satisfactory performance, a furnace that is operating under normal conditions should be inspected every four months. If the furnace is operating in an area where an unusual amount of dust or soot or other impurities are present in the air, more frequent inspection is recommended.

10.1 Maintenance Schedule

CAUTION: When cleaning, wearing eye protection is recommended.

NOTE: Use only factory-authorized replacement parts.

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

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

10.2 Maintenance Procedures

10.2.1 Gas Valve

WARNING

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

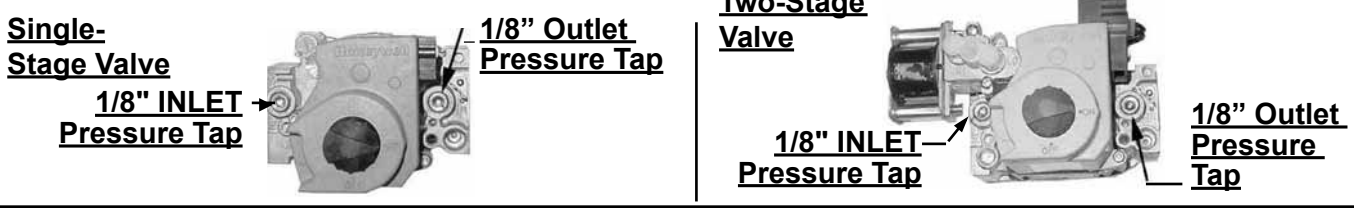
Remove external dirt accumulation and check wiring connections.

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

Instructions:

1) Locate the 1/8” FPT **INLET** pressure tap on the combination valve (**FIGURE 19**).

FIGURE 19 - Top View of Gas Valves



10.0 Maintenance and Service (cont'd)

10.2 Maintenance Procedures (cont')

10.2.1 Gas Valve (cont'd)

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

3) With the field-installed manual valve remaining closed, turn the thermostat up to fire the unit and allow the unit to go through one trial for ignition. Reset the thermostat to shut the unit off. Observe the manometer for two to three minutes for an indication of gas pressure. No pressure should be indicated on the manometer. **If the manometer indicates a gas pressure**, the field-installed manual gas valve must be replaced or repaired before the combination gas valve can be checked.

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

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

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

10.2.2 Burner Rack Removal Instructions

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

To disassemble the burner rack:

1. Remove Carryover System --

   Natural Gas - remove the flash carryover system from the "manifold end" of the burner rack

   NOTE: Natural gas burner racks manufactured prior to 3/95 have a lighter tube carryover system. Break the lighter tube connection at the orifice and remove the supply tubing, the drip shield and the lighter tube.

   Propane Gas - break the lighter tube connection at the regulator and remove the lighter tube orifice supply tubing; remove the retaining screws in the drip shield and the shield; remove the retaining screws and slide out the lighter tube.
2. Pull main burners horizontally away from injection opening and lift out.
3. Remove manifold bracket screws and remove manifold.
4. Remove the main burner orifices.
5. Remove screws and lift out pilot burner.

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

10.2.3 Cleaning Pilot and Main Burners

In the event the pilot flame is short and/or yellow, check the pilot orifice for blockage caused by lint or dust accumulation. Remove the pilot orifice and clean with air pressure. DO NOT REAM THE ORIFICE. Check and clean the aeration slot in the pilot burner. Clean the metal sensing probe and the pilot hood with an emery cloth and wipe off the ceramic insulator. Check the spark gap; spark gap should be maintained to 7/64". After the pilot is cleaned, blow any dirt away with compressed air.

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

Clean the burner rack carryover systems with air pressure.

10.2.4 Clean the Heat Exchanger

To clean the outer surfaces (circulating air side) of the heat exchanger, gain access by removing the inspection panels in the ductwork or remove the ductwork. There are baffles between the heat exchanger tubes as shown in **FIGURE 20**. (**NOTE**: If the heater has been converted to high CFM (see **APPENDIX,** page 29, and Label on the unit), these baffles will have already been removed.)

To clean the outside of the tubes and the baffles, remove each baffle individually. To remove the baffles, remove the screws marked "A" in **FIGURE 20**, and slide each baffle forward. Use a brush and/or an air hose to remove accumulated dust and grease deposits from the heat exchanger tubes and the baffles. Re-install the baffles by sliding them into the rear slot and replacing the screw.

The inner surfaces (combustion air side) of the heat exchanger can be reached for cleaning with the burner rack removed. (See Paragraph 10.2.2.) An air hose, an 18-24" long, 1/2" diameter furnace brush (or heavy wire with steel wool securely attached), a flashlight, and a mirror are needed. Furnaces designed to provide high efficiency heating have "V" shaped baffles in the top of each heat exchanger tube. Follow the instructions below to remove the "V" baffles when cleaning the inner surfaces of the heat exchanger.

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

Instructions to Remove Heat Exchanger "V" Baffles:

1) Remove the ends of the flue gas collection box. On the control side of the furnace, remove the venter assembly and the flue outlet duct to gain access to the collection box end.
2) **Sizes 125-300** -- Remove one of the tube baffle retaining angles on each inside wall of the collection box. Each tube baffle angle has one screw.

   Size 400 -- Remove the inner baffle from the flue collection box. On the control side, align the inner baffle with the slot in the collection box edge. Pull the inner baffle until it clears the heat exchanger. Remove the screw at each end and slide the flue diverter out of the furnace.
3) Pull the "V" baffles out of the heat exchanger.

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

FIGURE 20 - When cleaning outer heat exchanger surface remove directional air baffles. Remove Screws "A" and slide baffles out. Clean and replace all baffles.

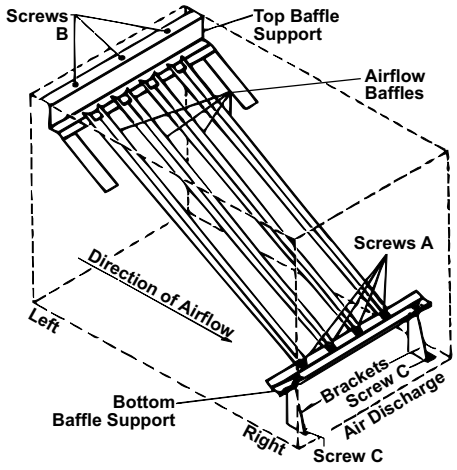
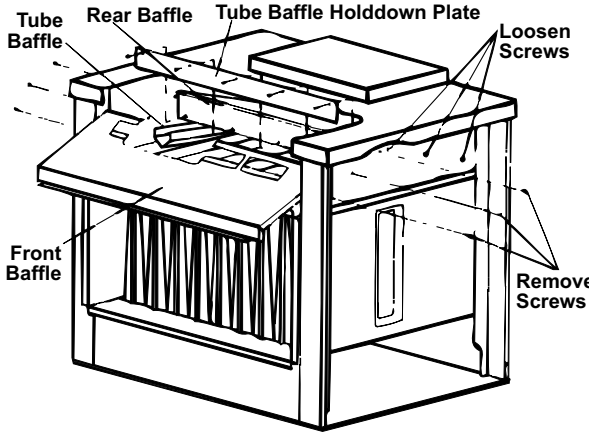


FIGURE 21 - Remove "V" Baffles to Clean Inner Surface of Heat Exchanger Tubes



10.0 Maintenance and Service (cont'd)

10.3 Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Venter motor will not start (power-vented system)	**1.** No power to the furnace.	**1.** Turn on power, check supply fuses or circuit breaker.
	2. No 24-volt power to venter relay.	**2.** Turn up thermostat, check control transformer output. Check for loose or improper wire connections.
	3. Venter relay defective.	**3.** Replace.
	4. Defective motor or capacitor.	**4.** Replace defective part.
Pilot will not light (Venter operating on power-vented models)	**1.** Manual valve not open.	**1.** Open manual valve.
	2. Air in gas line.	**2.** Bleed gas line.
	3. Dirt in pilot orifice.	**3.** Remove and clean with compressed air or solvent (do not ream).
	4. Gas pressure too high or too low.	**4.** Adjust supply pressure. (See Paragraph 6.1).
	5. Kinked pilot tubing.	**5.** Replace tubing.
	6. Pilot valve does not open.	**6.** If 24 volt available at valve, replace valve.
	7. No spark:	**7.**
	a) Loose wire connections	**a)** Be certain all wires connections are solid.
	b) Transformer failure.	**b)** Be certain 24 volts is available.
	c) Incorrect spark gap.	**c)** Maintain spark gap at 7/64".
	d) Spark cable shorted to ground.	**d)** Replace worn or grounded spark cable.
	e) Spark electrode shorted to ground.	**e)** Replace pilot if ceramic spark electrode is cracked or grounded.
	f) Drafts affecting pilot.	**f)** Make sure all panels are in place and tightly secured to prevent drafts at pilot.
	g) Ignition control not grounded.	**g)** Make certain ignition control is grounded to furnace chassis.
	h) Faulty ignition controller.	**h)** If 24 volt is available to ignition controller and all other causes have been eliminated, replace ignition control.
	8. Optional lockout device interrupting control circuit by above causes.	**8.** Reset lockout by interrupting control at thermostat.
	9. Faulty combustion air proving switch.	**9.** Replace combustion air proving switch.
Pilot lights, main valve will not open	**1.** Manual valve not open.	**1.** Open manual valve.
	2. Main valve not operating.	**2.**
	a) Defective valve.	**a)** If 24 volt is measured at valve connections and valve remains closed, replace valve.
	b) Loose wire connections.	**b)** Check and tighten all wiring connections.
	3. Ignition control does not power main valve.	**3.**
	a) Loose wire connections.	**a)** Check and tighten all wiring connections.
	b) Flame sensor grounded. (Pilot lights - spark continues)	**b)** Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required.
	c) Gas pressure incorrect.	**c)** Set supply pressure at 5" to 8" w.c. for natural gas and 11" w.c. for propane.
	d) Cracked ceramic at sensor.	**d)** Replace sensor.
	e) Faulty ignition controller.	**e)** See Paragraph 8.5. If all checks indicate no other cause, replace ignition controller. **Do not** attempt to repair the ignition controller. This device has no field replaceable parts.
	f) Poor microamp signal	**f)** Adjust pilot regulator
No heat (Heater Operating)	**1.** Dirty filters in blower system.	**1.** Clean or replace filters.
	2. Incorrect manifold pressure or orifices.	**2.** Check manifold pressure (See Paragraph 6.1).
	3. Cycling on limit control.	**3.** Check air throughput (See Paragraph 6.3).
	4. Improper thermostat location or adjustment.	**4.** See thermostat manufacturer's instructions.
	5. Belt slipping on blower	**5.** Adjust belt tension
Cold air On Start-up	**1.** Fan control improperly wired	**1.** Connect as per wiring diagram.
	2. Defective fan control.	**2.** Replace fan control.
During Operation	**3.** Incorrect manifold pressure.	**3.** Check manifold line pressure (See Paragraph 6.1).
	4. Blower set for too low temperature rise.	**4.** Slow down blower or increase static pressure.

APPENDIX — Converting Model RP Duct Furnace for Lower Temperature Rise and Higher CFM Application

WARNING

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, explosion or production of carbon monoxide may result causing 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.

WARNING

The instructions in this sheet are designed to prepare a duct furnace for increased air throughput conversion prior to installation. If your duct furnace is installed, for your safety, turn off the gas and the electric before servicing.

Description/Application

This duct furnace was factory assembled with the air throughput range listed on the rating plate. The conversion in these instructions will change the air throughput range as specified in the table below.

Model and Size	High Air Throughput (CFM)	
	MAXIMUM	MINIMUM
RP 125	4605	1225
RP 150	5530	1475
RP 175	6450	1720
RP 200	7370	1965
RP 225	8295	2210
RP 250	9215	2455
RP 300	11060	2945
RP 350	12900	3440
RP 400	14745	3930

NOTE: If airflow is being reversed or other field-installed options apply, refer to the information in Paragraph 3.2 before performing this conversion.

Instructions

Verify the size on the heater rating plate. After confirming that the conversion is appropriate for the unit, follow the instructions.

1. **Fill in the Field Conversion Label** - Remove the conversion label, **P/N 263310**, from the literature bag. Complete the information.

FIGURE 22 - Fill in the Information on the Conversion Label

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

2. **Remove the Heat Exchanger Baffles** - Refer to **FIGURE 23** and identify the air baffles to be removed. Remove the screws from the support brackets and slide the entire baffle assembly out of the heat exchanger. Reinstall the screws to plug the holes.

Converting Model RP Duct Furnace for Lower Temperature Rise and Higher CFM Application (cont'd)

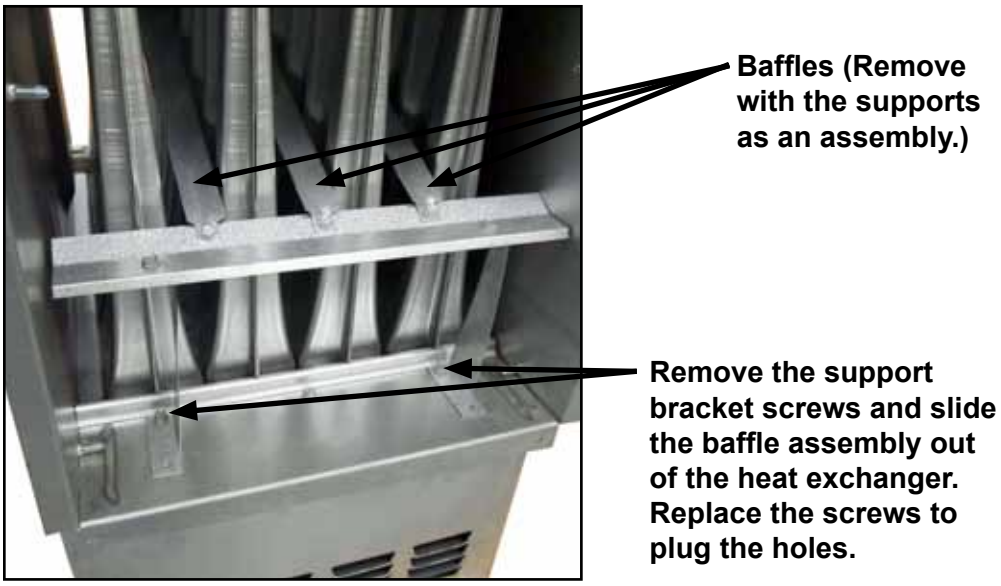


FIGURE 23 - Discharge Air End of the Heat Exchanger showing the Baffle Assembly to be Removed

3. Remove the Side Finger Baffles – Refer to **FIGURE 24** showing the entering air side of the heat exchanger (baffles shown in **FIGURE 23** have already been removed). Identify the side finger baffles. Remove both side baffles; each baffle is attached with two screws.

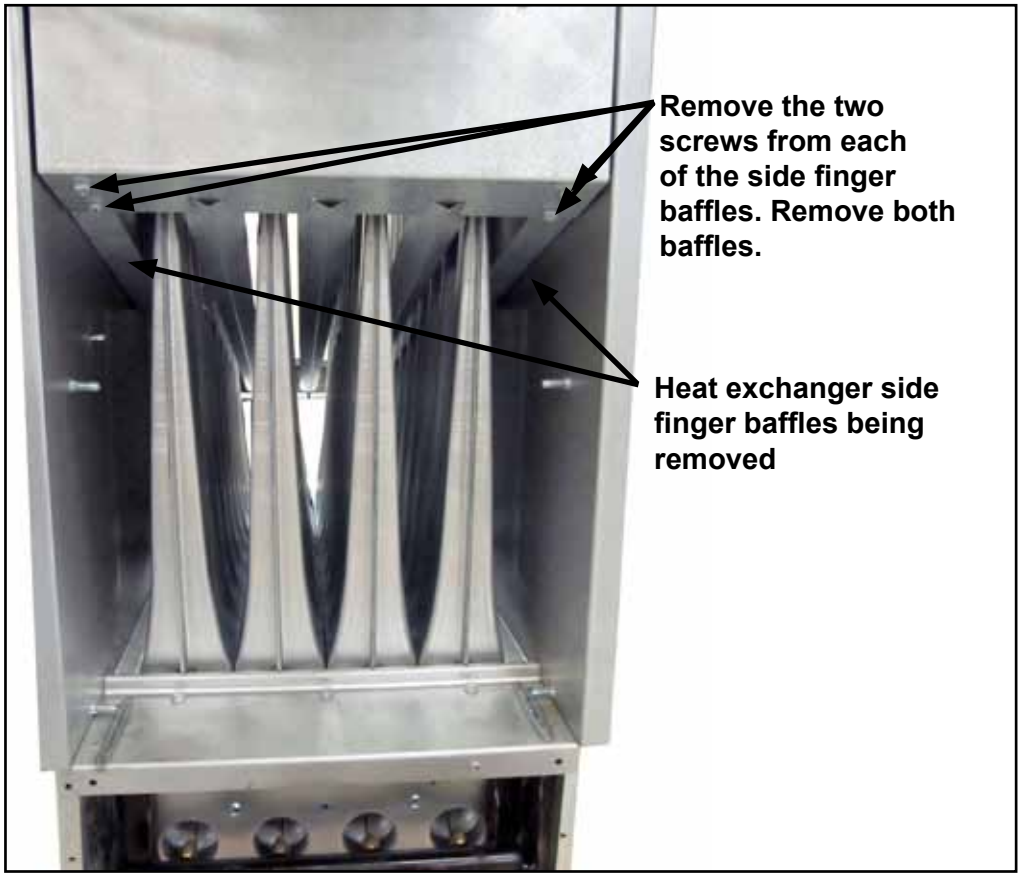


FIGURE 24 - Entering Air End of the Heat Exchanger showing the Side Finger Baffles to be Removed

Conversion is complete.

4. Select a location adjacent to the rating plate for the conversion label. Being sure the surface is clean and dry, adhere the conversion label that was completed in Step 1.

Test for proper operation. Be sure to comply with the air throughputs in the table on page 29.

INDEX

INSTALLATION RECORD - to be completed by the installer:

Installer:

Name _____

Company _____

Address _____

_____

_____

Phone _____

Distributor (company from which the unit was purchased):

Company _____

Contact _____

Address _____

_____

_____

Phone _____

Model _____ Serial No._____Date of Installation _____

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

_____

_____

_____

BUILDING OWNER OR MAINTENANCE PERSONNEL:

For service or repair

- Contact the installer listed above.
- If you need additional assistance, contact the Distributor listed above.
- For more information, contact your Factory Representative.

O'Fallon, MO I Printed in U.S.A. (5/16)

Form I-RP/HRPD (5-16), PN 132210R16