REZNOR®

Revision: X-IOM (10-23) 150491-G

Supersedes: X-IOM (04-23) 150491-F

INDOOR DUCT FURNACE INSTALLATION, OPERATION, AND MAINTENANCE

MODEL X

⚠ DANGER ⚠

FIRE OR EXPLOSION HAZARD

- **Failure to follow safety warnings exactly could result in serious injury, death, or property damage.**
- **Improper installation, adjustment, alteration, service, or maintenance can cause serious injury, death, or property damage.**
- **Installation and service must be performed by a qualified installer, service agency, or the gas supplier.**
- **Be sure to read and understand the installation, operation, and service instructions in this manual.**
- **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**

WHAT TO DO IF YOU SMELL GAS

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

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

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GENERAL INFORMATION

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

References

Table 1. Related Technical Manuals Available from Factory Distributor

Type	Form*	PN
Replacement parts	P-X-XE-RX-RXE	264000
Maxitrol amplifier replacement kit installation	OPT-AG7,8,9,9H	262319
Replacement gas valves	P-VALVES	263995
Gas conversion	OPT-GC	143147
Ignition controller replacement kit installation	OPT-IGN-CNTRL	134704
Power vent kit installation	X-CA1,2,3,4	136958

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

Important Safety Information

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

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

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

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

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

⚠ DANGER ⚠

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

⚠ WARNING ⚠

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

NOTES:

- **Installation should be done by a qualified agency in accordance with the instructions in this manual and in compliance with all codes and requirements of authorities having jurisdiction.**
- **The instructions in this manual apply only to model X duct furnaces.**

Warranty

NOTE: 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.

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

- 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.
- Wiring is not in accordance with the diagram provided with the unit.
- Unit is installed without proper clearances to combustible materials or is located in a confined space without proper ventilation and air for combustion (refer to **Combustion Air Requirements** and **Clearances** sections).
- Furnace air throughput is not adjusted within the range specified on the rating plate.
- Duct furnace is installed in a process or drying application without factory authorization. Any use in a process or drying application voids agency certification.

Installation Codes

- The duct furnaces covered in this manual are design-certified by the Canadian Standards Association to ANSI Z83.8a and CSA 2.6 for use with either natural or propane gas.
- 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* (NFPA54/ANSI Z223.1, latest edition). A Canadian installation must be in accordance with the *Installation Code for Gas Burning Appliances and Equipment* (CAN/CGA B149.1). This code is available from CSA Information Services, 1-800-463-6727. Local authorities having jurisdiction should be consulted before installation is made to verify local codes and installation procedure requirements.
- **Special installations (aircraft hangars/garages):** Installations in aircraft hangars should be in accordance with the *Standard for Aircraft Hangars* (ANSI/NFPA No. 409, latest edition), in public garages in accordance with the *Standard for Parking Structures*, (ANSI/NFPA No. 88A, latest edition), and for repair garages in accordance with the *Standard for Repair Garages* (ANSI/NFPA No. 88B, latest edition). The latest edition of ANSI/NFPA-88 specifies that overhead heaters must be installed at least 8 feet above the floor. In Canada, installations in aircraft hangars should be in accordance with the requirements of the enforcing authorities and in public garages in accordance with CSA B149 codes.

Dimensions

NOTES:

Inches (mm)

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

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

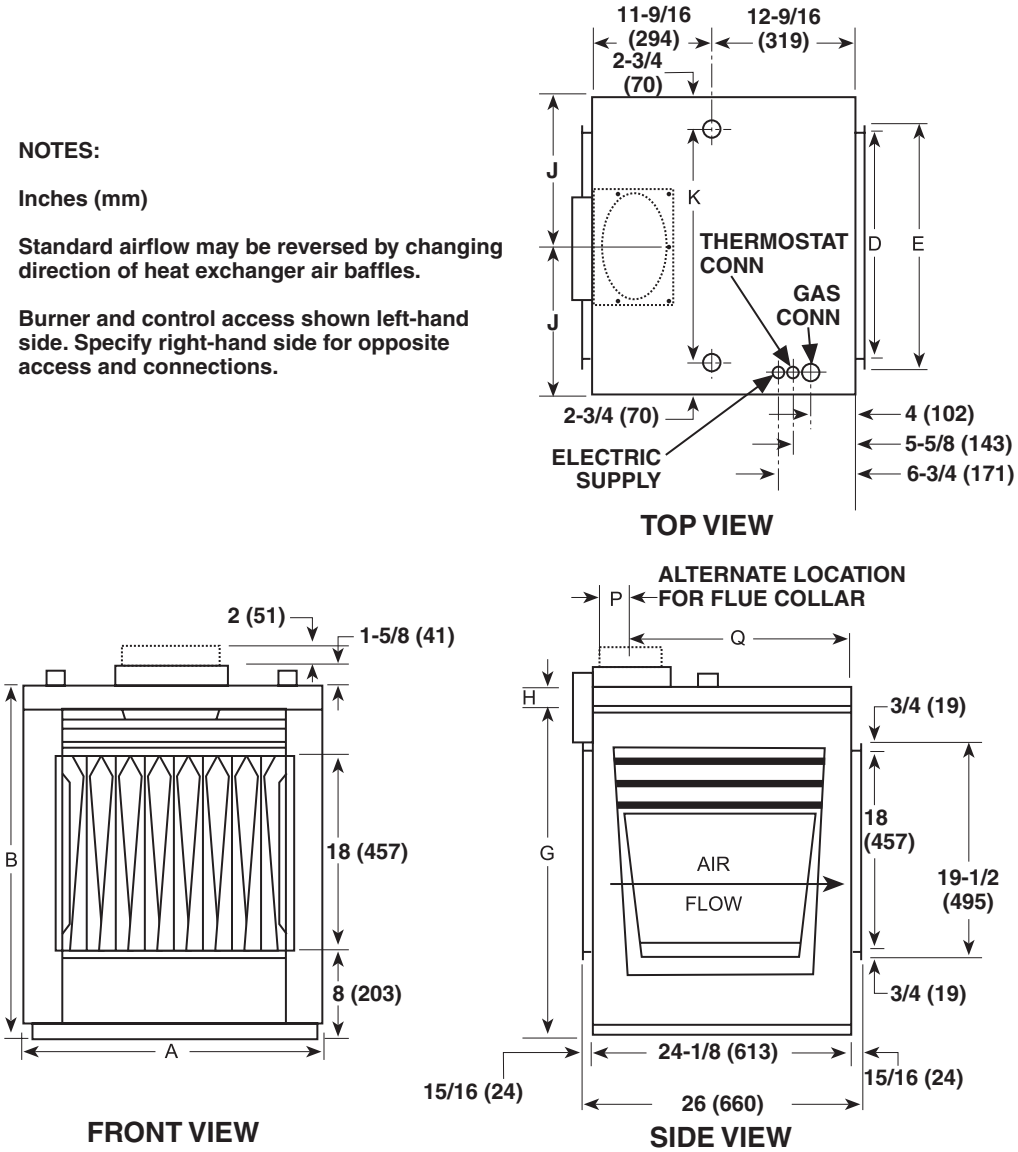


Figure 1. Dimensions

Dimensions—Continued

Table 2. Dimensions

Dimension (See Figure 1)	Unit Size (MBTUh)						
	75, 100	125	150, 175	200, 225	250, 300	350	400
	Inches (mm)						
A	19-1/4 (489)	22 (559)	27-1/2 (699)	33 (838)	41-1/4 (1048)	46-3/4 (1188)	52-1/4 (1327)
B	32-1/4 (819)			35-1/4 (895)			
D	12-1/2 (318)	15-1/4 (387)	20-3/4 (527)	26-1/4 (667)	34-1/2 (876)	40 (1016)	45-1/2 (1156)
E	14 (356)	16-3/4 (425)	22-1/4 (565)	27-3/4 (705)	36 (914)	41-1/2 (1054)	47 (1194)
G	30-1/4 (768)			31-3/4 (806)			
H	2 (51)			3-1/2 (89)			
J	9-5/8 (244)	11 (279)	13-3/4 (349)	16-1/2 (419)	20-5/8 (524)	23-3/8 (594)	26-1/8 (664)
K	13-3/4 (349)	16-1/2 (419)	22 (559)	27-1/2 (699)	35-3/4 (908)	41-1/4 (1048)	46-3/4 (1187)
P	3-1/2 (89)			5 (127)			
Q	20-3/4 (527)			19-1/4 (489)			

Weights

Table 3. Weights

Unit Size (MBTUh)									
75, 100	125	150	175	200	225	250	300	350	400
Net Weight (Pounds (kg))									
150 (68)	163 (74)	182 (83)	186 (84)	224 (102)	231 (105)	276 (125)	286 (130)	320 (145)	355 (161)

Clearances

The unit must be installed so that clearances are provided for combustion air space, for convenient installation and burner control service, and for proper spacing from combustible construction. Clearance to combustibles is defined as the necessary minimum distance from the heater to a surface or object that ensures that a surface temperature does not exceed 90°F above the surrounding ambient temperature. **Table 4** lists required clearances.

Table 4. Clearances

Unit Surface	Minimum Clearance (Inches (mm))
Top	6 (152)
Control side	6 (152) + width of furnace*
Side opposite controls	6 (152)
Bottom, to combustibles	3 (76)
Bottom, to noncombustibles	0 (0)

*To have sufficient space to remove the drawer-type burner rack.

Unit Location

⚠ WARNING ⚠

Avoid installing a furnace in extremely drafty areas. Extreme drafts can shorten the life of the heat exchanger and/or cause safety problems.

- A duct furnace is designed for connection to an inlet and an outlet duct and depends on an external air handler. Location must be in accordance with **Clearances** section.
- 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.

Combustion Air Requirements

⚠ WARNING ⚠

The unit is designed to take combustion air from the space in which it is installed and is not designed for connection to an outside combustion air intake duct. Connecting this furnace to an outside combustion air intake duct voids the warranty and could cause hazardous operation.

- The unit is designed to take combustion air from the space in which it is installed. The air that enters into the combustion process is vented to the outdoors. Sufficient air must enter the equipment location to replace the air exhausted through the vent system.
- Modern construction methods involve a greater use of insulation, improved vapor barriers, and weather-stripping. The result is that buildings are generally much tighter structurally than they have been in the past. The combustion air supply for gas-fired equipment can be affected by these construction conditions because infiltration that would have existed in the past may not be adequate. Extensive use of exhaust fans aggravates the situation. In the past the filtration of outside air assumed in heat loss calculations (one air change per hour) was assumed to be sufficient. However, current construction methods may now require the introduction of outside air into the room or building through wall openings or ducts.
- Under all conditions, enough air must be provided to ensure that there will not be a negative pressure condition within the equipment room or space. A positive seal must be made in all return-air connections and ducts.
- Requirements for combustion air and ventilation air depend upon whether the unit is located in a confined or unconfined space. A ***confined*** space is defined as a space whose volume is <50 cubic feet per 1,000 BTUh of the installed appliance input rating. An ***unconfined*** space is defined as a space whose volume is ≥50 cubic feet per 1,000 BTUh of the installed appliance input rating.
- Even a slight leak can create a negative pressure condition in a confined space and can affect combustion. Do not install a unit in a confined space without providing wall openings leading to and from the space. Depending on the combustion air source, provide openings near the floor and ceiling for ventilation and air for combustion as shown in **Figure 2** and as listed in **Table 5**.

NOTE: For further details or other approved methods on supplying combustion air to a confined space, refer to the *National Fuel Gas Code* (ANSI Z223.1a, latest edition).

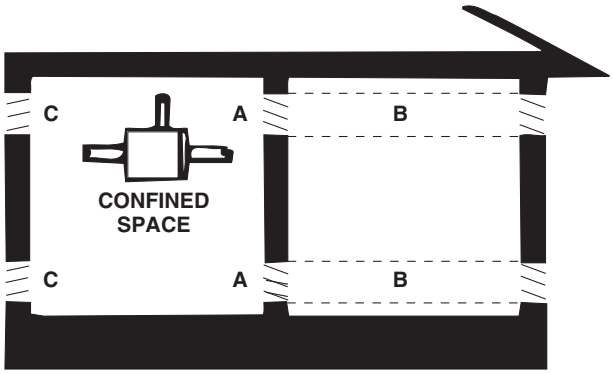


Figure 2. Confined Space Combustion Air Openings (Refer to Table 5)

Combustion Air Requirements—Continued

Table 5. Determining Confined Space Combustion Air Requirements

Letter*	Air Source	Required Opening Size	Calculate Combustion Air Requirements
A	Air inside building	1 square inch free area per 1000 BTUh Never <100 square inches free area for each opening	Add total BTUh of all appliances in confined space and divide by figures at left for square inch free area size of each (top and bottom) opening
B	Outside air through duct	1 square inch free area per 2000 BTUh	
C	Direct outside air	1 square inch free area per 4000 BTUh	

*See **Figure 2**.

Hazards of Chlorine

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

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

INSTALLATION

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

Unpacking and Inspection

- The unit was test-operated and inspected at the factory prior to crating and was in operating condition.
- If, upon removing it from its crate, the unit has been found to have incurred any damage in shipment, document the damage with the transporting agency and contact an authorized Factory Distributor. If you are an authorized Distributor, follow the FOB freight policy procedures.

Pre-Installation Checklist

- ❑ Check the rating plate for the gas specifications and electrical characteristics of the furnace to ensure that they are compatible with the gas and electric supplies at the installation site.
- ❑ Read this manual and become familiar with the installation requirements of your particular furnace.
- ❑ If you do not have knowledge of local requirements, check with the local gas company or any other local agencies who might have requirements concerning this installation.
- ❑ Check to see if there are any field-installed options that need to be assembled/installed prior to unit installation.
- ❑ Shipped-separate options could include a gas shutoff valve, a vent damper, a condensate drain fitting, a thermostat, a power venter, and/or a disconnect switch.
- ❑ Some gas control options will either have parts shipped loose with the unit or shipped separately. If the unit is equipped with any of the options listed in **Table 6**, ensure that these parts are available at the installation site.

Table 6. Gas Control and Makeup Air Control Options		
Type	**Option**	**Included Components (PN)**
Gas control	AG7	Thermostat (48033)
Makeup air control	AG3	Control switch (29054)
	AG8	Temperature sensor and mixing tube (48041), control switch (29054)
	AG9	Remote temperature selector (48042), temperature sensor and mixing tube (48041), control switch (29054)
	AG15	Remote temperature selector (115848), stage adder module (115849), control switch (29054), discharge air sensor holder (115850), discharge air sensor holder bracket (213612)

Pre-Installation Modifications

High CFM Conversion

This unit was factory assembled with the air throughput range listed on the rating plate. If the application requires a higher CFM than listed on the rating plate, the unit may be converted for lower temperature rise and higher CFM. The conversion will change the air throughput range as specified in **Table 7**. Verify the unit size on the heater rating plate and, after confirming that this conversion is correct for the unit, perform the following procedure:

Table 7. High Air Throughput											
Minimum or Maximum	**Unit Size (MBTUh)**										
	75	**100**	**125**	**150**	**175**	**200**	**225**	**250**	**300**	**350**	**400**
	CFM										
Minimum	735	980	1225	1475	1720	1965	2210	2455	2945	3440	3930
Maximum	2765	3685	4605	5530	6450	7370	8295	9215	11,060	12,900	14,745

⚠ DANGER ⚠

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

NOTE: Before performing this conversion, determine if airflow is being reversed or if other field-installed options apply.

Pre-Installation Modifications—Continued

High CFM Conversion—Continued

1. Remove heat exchanger baffles (see **Figure 3**):
   a. Remove support bracket screws and slide entire baffle assembly out of heat exchanger.
   b. Reinstall screws to plug holes.
   c. For unit sizes 75–100, conversion is complete. Proceed to step 3.

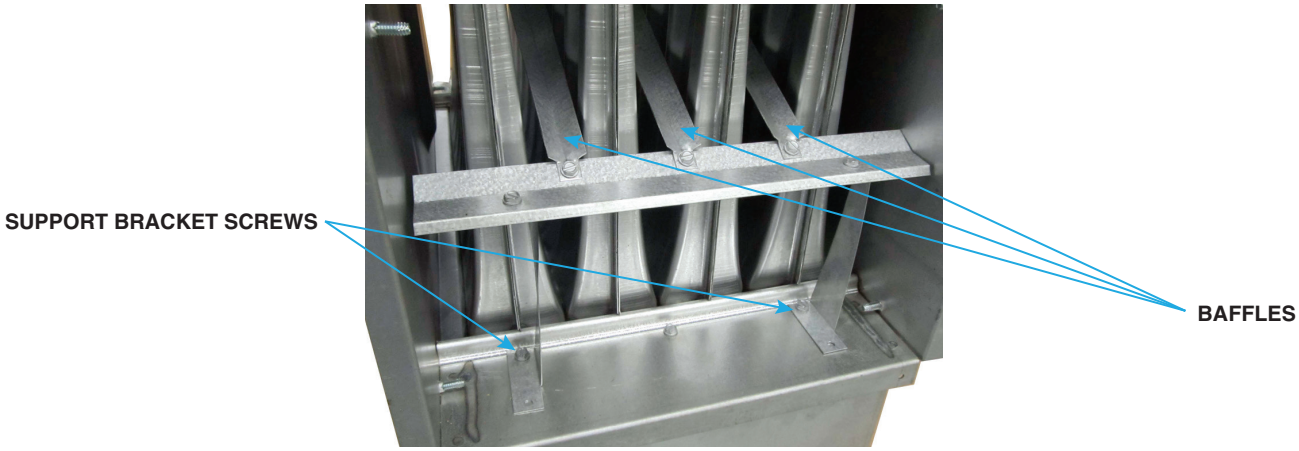


Figure 3. Heat Exchanger Baffle Removal

2. Remove side finger baffles on unit sizes 125–400 (see **Figure 4**):

NOTE: Do NOT remove the side finger baffles on unit sizes 75 and 100.

   a. At entering air side of heat exchanger, locate side finger baffles and remove two side finger baffle screws from each baffle.
   b. Remove both side finger baffles.

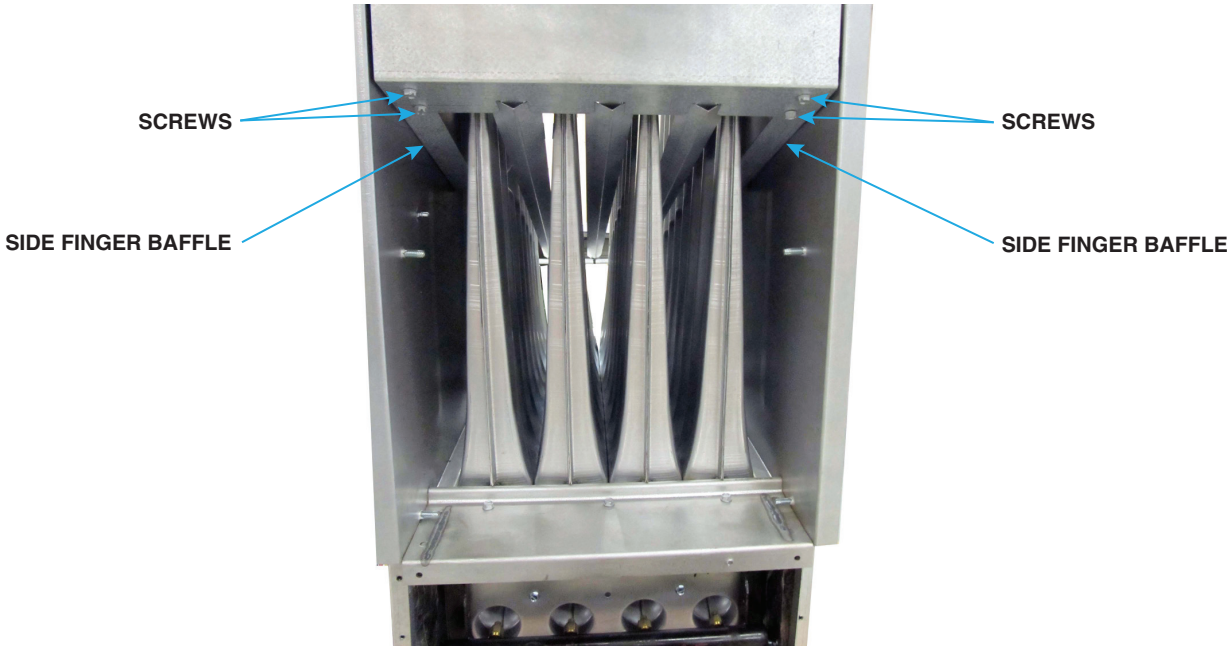


Figure 4. Side Finger Baffle Removal

3. Install field conversion label (see **Figure 5**):
   a. Fill in field conversion label (PN 263310) from literature bag.
   b. Adhere label to unit on clean dry surface adjacent to rating plate.
4. Test unit for proper operation ensuring that air throughput is in accordance with **Table 7**.

IMPORTANT

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

263310

Figure 5. Field Conversion Label

Reverse Airflow Conversion

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

1. Remove baffle screws (see **Figure 6**) and lift each airflow baffle slightly and slide forward. Remove all baffles from heat exchanger.
2. Remove top baffle support screws (see **Figure 6**) and remove top baffle support. Reposition and secure support on opposite end of heat exchanger using screws.
3. Remove bracket screws (see **Figure 6**) and remove bottom baffle support and bracket assembly. Reinstall bracket screws to plug holes in heat exchanger bottom. Reposition bottom baffle support and bracket assembly on opposite end of heat exchanger and secure using field-supplied sheet metal screws.
4. Reinstall airflow baffles removed in step 1 and secure using baffle screws.

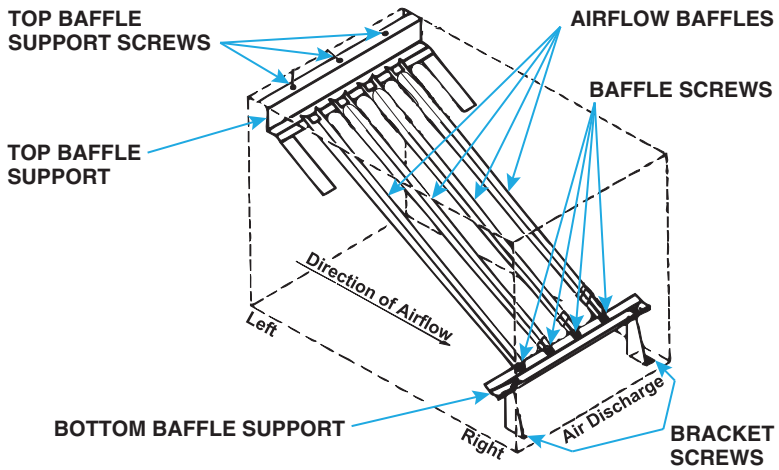


Figure 6. Airflow Baffles

Pre-Installation Modifications—Continued

Reverse Vent Outlet Direction

NOTE: The vent outlet may be horizontal or vertical.

Change orientation (vertical or horizontal) of the flue connection as follows (see **Figure 7**):

1. Remove screws that secure vent outlet.
2. Reverse position of vent outlet.
3. Secure vent outlet in reversed position using screws.

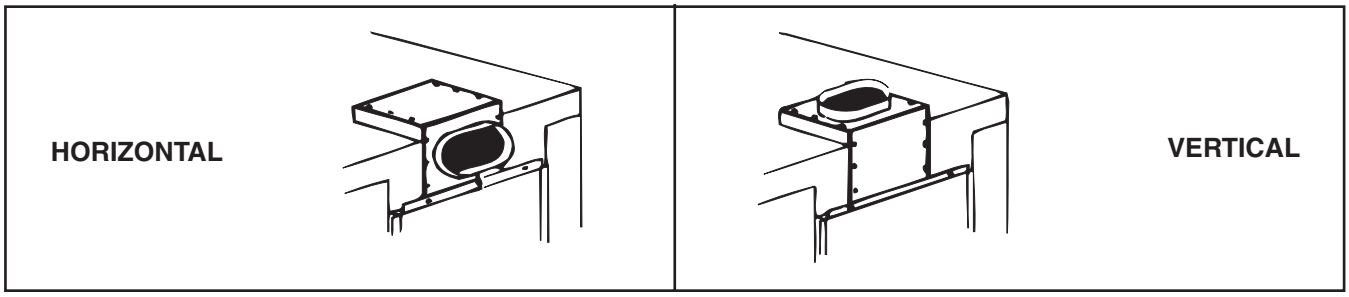


Figure 7. Vent Outlet Positions

Condensate Drain Installation

Condensate can form in the heat exchanger of furnaces installed as makeup air units or when installed downstream from a cooling coil. Under these conditions, a drain flange (option CS1, PN 31765) may be installed on the furnace bottom as follows:

NOTE: A 4-inch (102-mm) minimum clearance is required under the furnace if a 90-degree street elbow is used.

1. Install drain flange in bottom of furnace casing as shown in **Figure 8** and secure using two machine screws (#10-32 × 1-inch-long) and nuts.
2. Install 3/4-inch waste pipe nut in drain flange.
3. Seal all corners and four square holes in bottom pan edge using RTV sealant.
4. Terminate drain outside of building.

NOTE: Periodic cleaning of the condensate collector and disposal system is required.

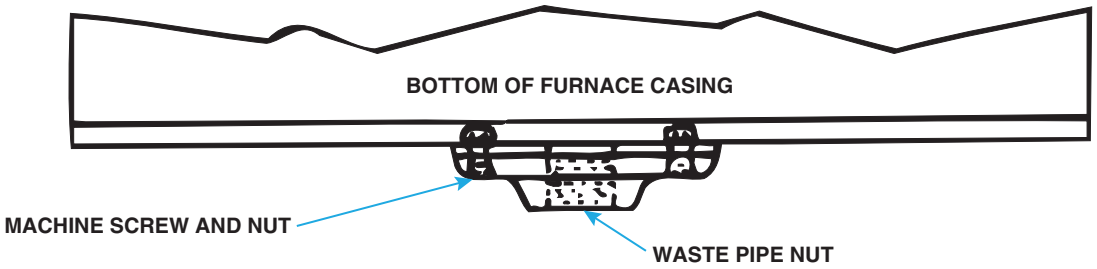


Figure 8. Condensate Drain

Mounting Furnace

⚠ WARNING ⚠

- **Before installing the furnace, check the supporting structure to be used to verify that it has sufficient load-carrying capacity to support the weight (refer to Weights section) of the unit.**
- **The furnace must be level for proper operation. DO NOT place or add additional weight to a suspended furnace.**

Suspension-Mounting

- The furnace is designed for two-point suspension. To determine the center line for the hangers, see hanger center line dimensions in **Figure 1**.
- At each suspension point, the furnace is factory-equipped with a free-turning, female, 1-inch NPT pipe hanger. Suspend the furnace by connecting each pipe hanger to a 1-inch threaded pipe as shown in **Figure 9**, DETAIL A.
- As an alternative method, the factory-installed pipe hanger may be removed and the heater may be suspended as shown in **Figure 9**, DETAIL B.

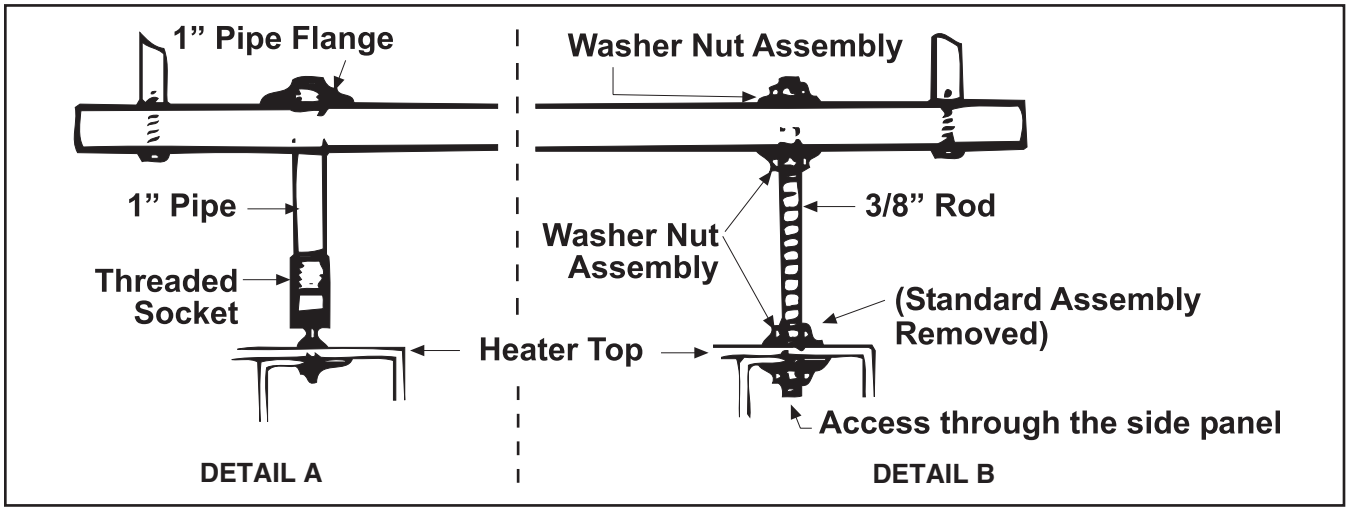


Figure 9. Suspension-Mounting

Base-Mounting

⚠ DANGER ⚠

When the furnace is base-mounted on combustible material, a minimum clearance of 3 inches (76 mm) is required. The field-fabricated supports used for base-mounting must be made of non-combustible material.

Base-mount the furnace using field-fabricated supports as shown in **Figure 10**.

Mounting Furnace—Continued

Base-Mounting—Continued

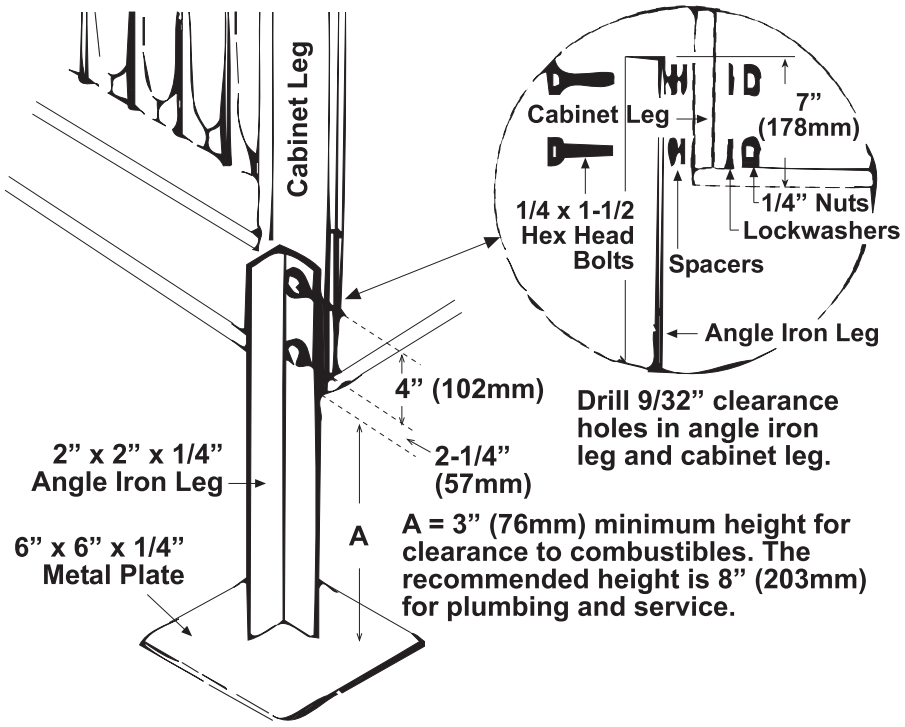


Figure 10. Base-Mounting

Duct Connections

⚠ CAUTION ⚠

- **Joints where ducts attach to furnace must be sealed securely to prevent air leakage into draft hood or burner rack area. Leakage can cause poor combustion, poor performance, and pilot problems and can shorten heat exchanger life.**
- **IMPORTANT: A minimum horizontal duct length of 18 inches (457 mm) is required at the furnace discharge before any vertical rise is made in front of the draft hood relief opening. This is required to prevent interference with the built-in draft hood.**

Ductwork Requirements

- **Type:** The type of duct installation to be used depends in part on the construction type of the roof (wood joist, steel bar joist, steel truss, or pre-cast concrete) and ceiling (hung, flush, etc.).
- **Material:** Rectangular duct should be constructed of not lighter than #26 US gauge galvanized iron or #24 B&S gauge aluminum.
- **Size:** Proper sizing of supply air ductwork is necessary to ensure a satisfactory heating installation. The recognized authority for such information is the Air Conditioning Contractors Association, 2800 Shirlington Road, Suite 300, Arlington, VA 22206 (**www.acca.org**). A manual covering duct sizing in detail may be purchased directly from them.
- **Structure:** All duct sections 24 inches (610 mm) or wider and over 48 inches (1,219 mm) in length should be cross-broken on top and bottom and should have standing seams or angle-iron braces.
- **Joints:** Should be S and drive strip or locked.

- **Ductwork through masonry walls:** No warm air duct should come in contact with masonry walls. Insulate around all air ducts through masonry walls with not less than 1/2 inch (1 inch is recommended) of insulation.
- **Ductwork through unheated space:** Insulate all exposed warm air ducts passing through an unheated space with at least 1/2 inch (1 inch is recommended) of insulation.
- **Supports:** Suspend all ducts securely from buildings members. Do not support ducts from unit duct connections.
- **Removable panels:** 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 × 10 inches 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 (refer to **Ductwork-to-Furnace Connections** section).
- **Supply air duct/furnace horizontal connection:** The seal between the furnace and the duct must be mechanical. The connection should be made using U-type flanges on the top and bottom of the connecting duct. Slide the duct over the flanges of the heater to provide an airtight fit. Provide U-channels for the other side flanges to ensure tight joints. Use sheet metal screws to fasten ducts and U-channels to the furnace flange (refer to **Ductwork-to-Furnace Connections** section).
- **Horizontal discharge duct length:** A minimum horizontal duct run of 18 inches (457 mm) ***is required*** before turns or branches are made in the duct system to prevent interference with the built-in draft hood.
- **Return air duct/furnace connection:** All return air ducts should be attached and sealed to the return air flanges to provide airtight connection.
- **Return air duct/grill size:** Ensure that return air ducting or grills have a free area equal to the return duct size connection.
- **Connection dimensions:** Connection dimensions (inches (mm)) are shown in **Figure 11** and listed in **Table 8**.

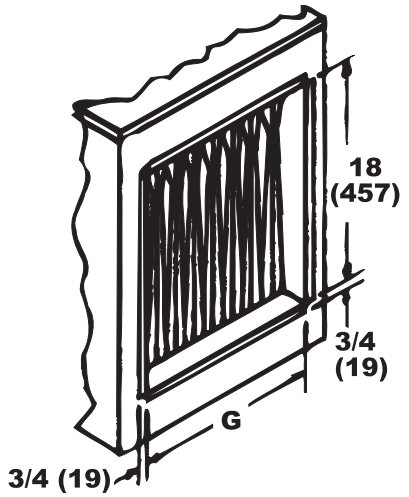


Figure 11. Ductwork Connection Dimensions (Refer to Table 8)

Table 8. Ductwork Connection Dimensions

Unit Size (MBTUh)	Dimension G*	
	Inches	mm
75, 100	12-1/2	318
125	15-1/4	387
150, 175	20-3/4	527
200, 225	26-1/4	667
250, 300	34-1/2	877
350	40	1016
400	45-1/2	1156

*See **Figure 11**.

Duct Connections—Continued

Duct Furnace Airflow

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

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

Temperature Rise	Unit Size (MBTUh)										
	75	100	125	150	175	200	225	250	300	350	400
	CFM/Pressure Drop (IN WC)										
80% Thermal Efficient											
50°F	1105/0.23	1475/0.43	1840/0.50	2210/0.38	2580/0.52	2945/0.42	3315/0.53	3685/0.40	4420/0.58	5160/0.65	5895/0.67
60°F	920/0.15	1225/0.29	1535/0.33	1840/0.26	2150/0.35	2455/0.28	2765/0.36	3070/0.28	3685/0.39	4300/0.44	4915/0.45
70°F	790/0.10	1050/0.21	1315/0.25	1580/0.19	1840/0.26	2105/0.22	2370/0.27	2630/0.23	3160/0.29	3685/0.31	4210/0.32
80°F	690/0.06	920/0.15	1150/0.21	1380/0.15	1610/0.19	1840/0.17	2070/0.22	2300/0.22	2765/0.25	3225/0.25	3685/0.25
90°F	610/0.04	815/0.11	1020/0.18	1225/0.12	1430/0.16	1635/0.14	1840/0.17	2045/0.21	2455/0.22	2865/0.23	3275/0.19
With Finger Baffles Removed											
20°F	2765/0.62	3685/1.08	4605/1.16	5530/0.85	6450/1.19	7370/1.00	8295/1.28	9215/0.90	11,060/1.26	12,900/1.23	14,745/1.23
30°F	1840/0.28	2455/0.5	3070/0.53	3685/0.39	4300/0.54	4915/0.45	5530/0.58	6140/0.41	7370/0.57	8600/0.56	9830/0.56
40°F	1380/0.16	1840/0.28	2300/0.28	2765/0.21	3225/0.29	3685/0.25	4145/0.31	4605/0.22	5530/0.32	6450/0.31	7370/0.31
50°F	1105/0.12	1475/0.16	1840/0.21	2210/0.15	2580/0.18	2945/0.16	3315/0.21	3685/0.15	4420/0.21	5160/0.19	5895/0.19
60°F	920/0.10	1225/0.14	1535/0.15	1840/0.12	2150/0.15	2455/0.12	2765/0.15	3070/0.11	3685/0.15	4300/0.14	4915/0.15
75°F	735/0.10	980/0.12	1225/0.12	1475/0.11	1720/0.12	1965/0.11	2210/0.12	2455/0.08	2945/0.11	3440/0.11	3930/0.11

Duct Furnace Blower Connections

⚠ WARNING ⚠

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

- Blowers should be bottom horizontal discharge when coupled to the duct furnace.
- When a top horizontal discharge blower is connected to the duct furnace, ensure that sufficient length of duct is provided to permit even flow of air at the end of the duct. Or, baffles may be inserted between the blower and the heater to assure an even flow of air across the heat exchanger.
- Proper arrangements of blower and duct furnace with respect to angle of approach of the duct connection and the arrangement of the discharge opening of the blower are shown in **Figure 12**.

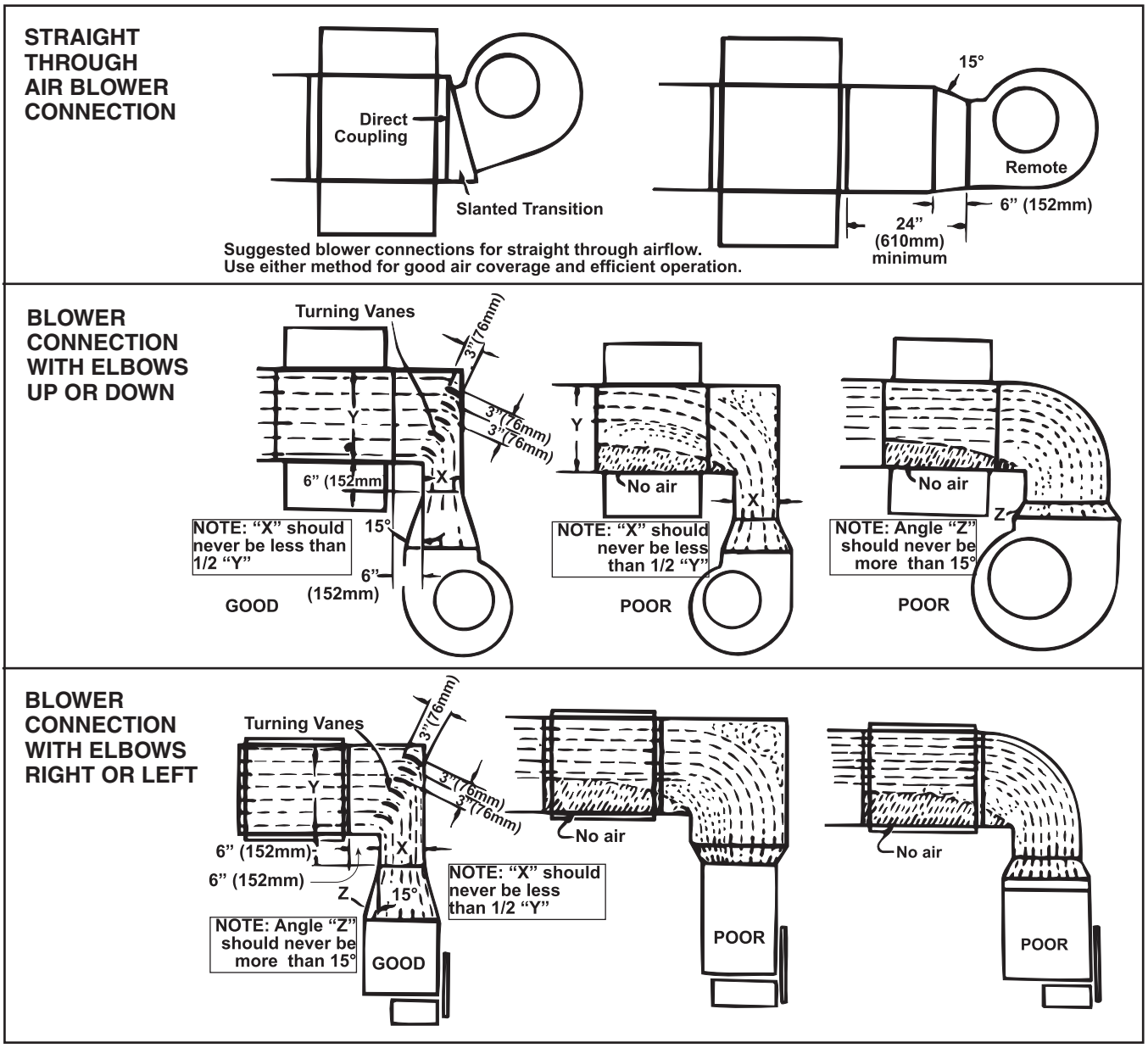


Figure 12. Duct Furnace Blower Connections

Bypass Duct Construction

When the air throughput CFM is greater than desirable or permissible for the unit, a bypass duct (see **Figure 13**) may be constructed. Locate the bypass duct on the side of the furnace opposite the controls and 2 inches from the heat exchanger side panel. Extend the bypass duct 18 inches (457 mm) beyond the furnace on both the inlet and outlet ends. Determine the correct size of the bypass duct as follows:

Duct Connections—Continued

Bypass Duct Construction—Continued

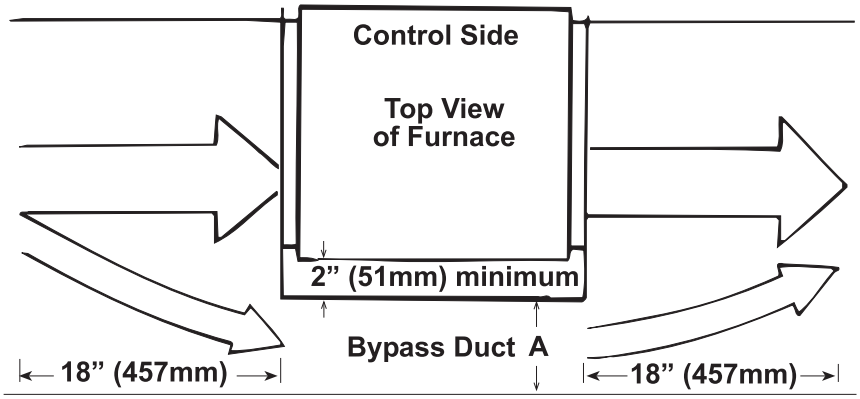


Figure 13. Bypass Duct Dimensions

1. Refer to **Table 9** to determine pressure drop and allowable CFM for furnace being installed. For example: unit size **150 @ 50°F** temperature rise = pressure drop of **0.38** and CFM of **2,210**.
2. Subtract allowable CFM from blower CFM to determine how much air must be diverted through bypass duct. For example: blower CFM of **3,000** – allowable CFM of **2,210** = bypass CFM of **790**.
3. Refer to **Table 10** to determine bypass duct size as follows:
   a. Go to column closest to pressure drop through heater.
   b. Move down to CFM closest (round up) to CFM determined in step 2.
   c. Move to left column to determine required bypass duct size. For example: in pressure drop column **0.40**, move down to bypass CFM row **900** and move left to dimension A column **3 inches (76 mm)**.

Table 10. Bypass Duct Size

Dimension A (Inches (mm))*	Pressure Drop Through Furnace								
	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
	Bypass CFM								
3 (76)	490	530	610	700	780	830	900	960	1010
4 (102)	630	750	870	980	1090	1160	1250	1310	1400
5 (127)	850	1010	1190	1300	1410	1520	1640	1730	1810
6 (152)	1050	1290	1480	1650	1800	1940	2090	2200	2320
7 (178)	1250	1510	1760	1960	2180	2320	2500	2650	2800
8 (203)	1490	1810	2100	2350	2560	2760	2940	3110	3290
9 (229)	1700	2100	2400	2700	2970	3200	3400	3600	3800
10 (254)	1920	2350	2760	3090	3650	4020	4300	4550	4800

*See **Figure 13**.

NOTE: Not all capacities are covered above. If your installation is not covered, consult your distributor or the factory representative to determine the appropriate size of the bypass duct.

Ductwork-to-Furnace Connections

⚠ CAUTION ⚠

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

See **Figure 14**, DETAIL A for numbers that refer to the following steps to connect the ductwork to the furnace:

1. Install flanges on heater turned out as shown.
2. Shape duct connection with U-channel on top and bottom and L-channel on sides as shown in **Figure 14**, DETAIL B.
3. Slide U-channel over heater flange to make connection as shown.
4. Form U-strips to seal ends as shown. Drill fastener holes and secure using sheet metal screws.

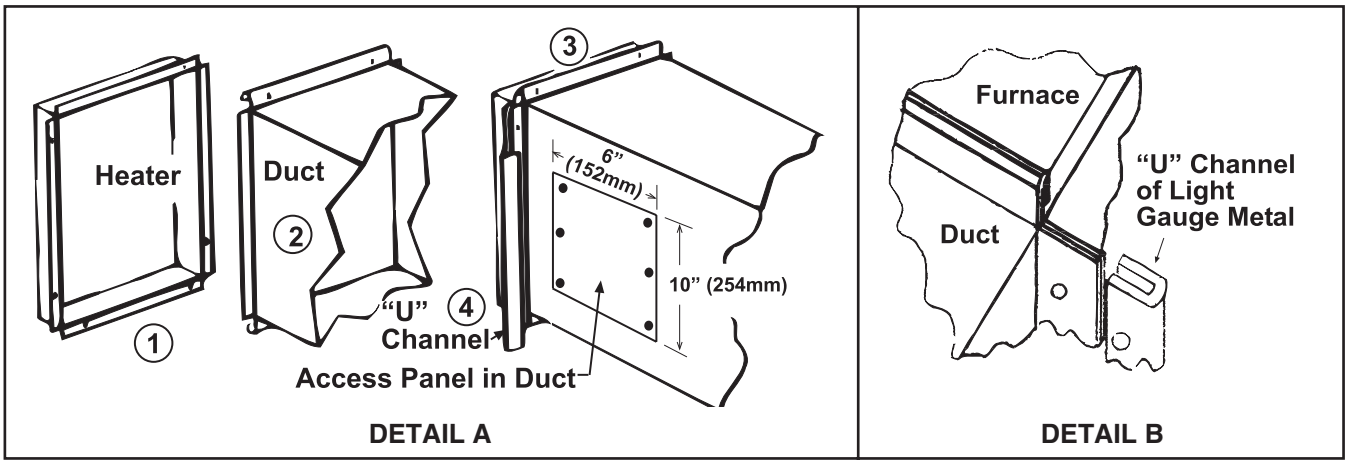


Figure 14. Connecting Ductwork to Furnace

Discharge Air Temperature Sensor Installation

- Makeup air option AG3 (refer to **Ductstat with Capillary Tubing (Option AG3)** section) has a unit mounted ductstat with a capillary sensor that is factory-installed in the unit discharge.
- Makeup air options AG8, AG9, and AG15 (see **Figure 15**) require field installation of the sensor in the discharge ductwork.
- Option AG15 includes a box and sensor holder. Options AG8 and AG9 include a sensor and mixing tube.
- Follow the instructions below to install the sensor in the ductwork.

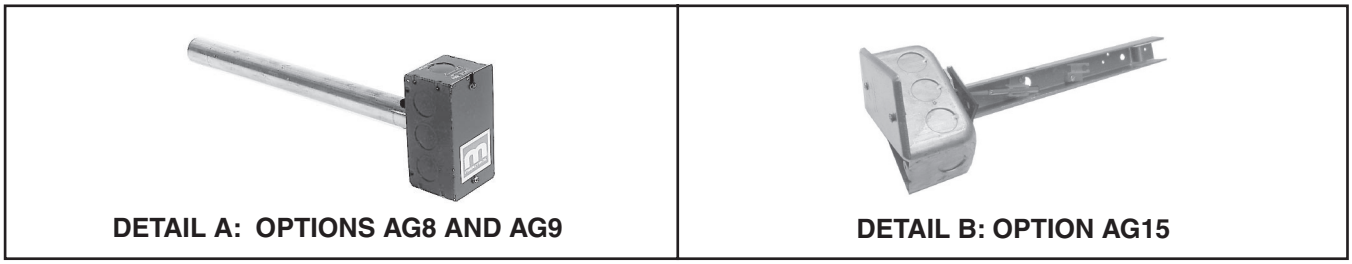


Figure 15. Discharge Air Temperature Sensor

NOTES:

- **According to the latest edition of AMCA Standard 201, in straight ducts, the air is typically well mixed a minimum of five equivalent duct diameters from the discharge of the unit with equivalent duct diameter defined as equal to the square root of 4AB/3.14 (A and B are duct cross-sectional dimensions).**
- **Locate the sensor a minimum of 96 inches (2,435 mm) from the outlet of the unit.**
- **If the length of the discharge duct is less than 8 feet (2.4 meters), a mixing vane is recommended for mixing the discharge air. Do not mount the sensor in the ductwork after a split in the supply as this will cause loss of control in the duct that does not house the sensor.**

Duct Connections—Continued

Discharge Air Temperature Sensor Installation—Continued

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

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

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

2. Determine orientation of sensor:
   a. In horizontal ductwork, position sensor assembly in top-middle of duct, with sensor probe extending vertically down into center of air stream.
   b. In vertical ductwork, position sensor assembly in middle of duct that corresponds with top-middle of discharge outlet.
3. Secure sensor in ductwork:
   a. Position of sensor in duct is also important—mixing tube shown in **Figure 15**, DETAIL A is 12 inches (305 mm) long and holder shown in **Figure 15**, DETAIL B extends 9-3/16 inches (233 mm) into ductwork.
   b. Turn holder so that element is shielded from direct airflow and will sense air temperature as it flows through holes in holder.
   c. At selected ductwork location, mark diamond-shaped hole—approximately 1 × 1 inch (25 × 25 mm—required for sensor holder or round hole required for mixing tube and cut hole no larger than necessary.
   d. For units with option AG8 or AG9, slide mixing tube (see **Figure 15**, DETAIL A) into ductwork and attach sensor.
   e. For units with option AG15, push element into clip in holder (see **Figure 15**, DETAIL B), slide holder into ductwork, and position holder so that it shields sensor from direct airflow. Secure box portion of holder to ductwork using four field-supplied #6 sheet metal screws.
4. Connect sensor wires:
   a. For units with option AG8 or AG9, ensure that all sensor wires are connected in accordance with wiring diagram provided with unit.
   b. For units with option AG15:
      (1) Determine where sensor wire should enter box and remove knockout.
      (2) Secure field-supplied cable connector to box, connect sensor wire, and install box cover.

Vent Connections

⚠ DANGER ⚠

- **Failure to provide proper venting could result in death, serious injury, and/or property damage. This furnace must be installed with a vent connection and a proper vent to the outside of the building. Install the vent in accordance with *Part 7, Venting of Equipment, of the National Fuel Gas Code* (ANSI Z223.1, latest edition) or an applicable provision of national, state, or local codes. A Canadian installation must be in accordance with the *Installation Code for Gas Burning Appliances and Equipment* (CSA B149.1) and applicable local codes.**
- **Safe operation of any gravity-vented gas-fired equipment requires a properly operating vent system, correct provision for combustion air (refer to Combustion Air Requirements section), and regular maintenance and inspection.**

Specific Venting Requirements

- Provide a minimum clearance of 18 inches between the drafthood relief opening and any obstruction. Do not expose the relief opening to wind drafts from any source such as from an overhead door or adjacent air handling equipment.
- The unit is equipped with a built-in draft diverter. Consequently, an external draft diverter MUST NOT be installed in the vent connector or any internal alterations made. Do not install a manual damper or other fixed restriction in the vent connector.
- Vent pipe should be 26-gauge (minimum) galvanized steel or other non-corrosive material. Double-wall type B vent pipe (such as Metalbestos or Amerivent) is recommended. Note that double-wall pipe is not available in a 9-inch diameter.
- Where it is necessary to run the vent pipe through an exterior wall of combustible materials, a suitable thimble must be used. The vent pipe shall have a clearance of at least 6 inches (152 mm) from combustible materials or as is specified by the double-wall vent pipe manufacturer.
- With the outlet of the heater in a horizontal position, it is recommended that a 12- to 18-inch (305- to 457-mm) piece of straight pipe be connected to the flue collar before installing an elbow. The horizontal vent pipe run should have a uniform rise of at least 1/4 inch per foot of horizontal run in the direction of discharge. The length of the lateral run must not exceed lengths shown in the vent tables of the *National Fuel Gas Code* or the *Canadian Installation Code for Gas Burning Appliances* (refer to **Table 11**).

Table 11. Maximum Permissible Vent Lengths

Vent Configuration	Vent Pipe Diameter (Inches)	Vertical Height of Vent (Feet (Meters))					
		6 (1.8)	8 (2.4)	10 (3.0)	15 (4.6)	20 (6.1)	30 (9.1)
		Maximum Horizontal Run (Feet (Meters))					
Double-wall type B connector and double-wall type B vent	5	6 (1.8)	8 (2.4)	10 (3.0)	16 (4.9)	20 (6.1)	20 (6.1)
	6			16 (4.9)		30 (9.1)	40 (12.2)
	7 or 8	6 (1.8)	16 (4.9)	20 (6.1)	30 (9.1)	30 (9.1)	40 (12.2)
	10 or 12						
Single-wall metal pipe	5	2 (0.6)	5 (1.5)	5 (1.5)	5 (1.5)	—	—
	6			10 (3.0)	10 (3.0)	10 (3.0)	
	7	2 (0.6)	10 (3.0)	15 (4.6)	15 (4.6)	15 (4.6)	
	8, 9, 10, or 12				20 (6.1)	20 (6.1)	

- Support horizontal runs every 6 feet (1.8 meters). Support vertical runs of type B double-wall vent pipe in accordance with the requirements of the pipe manufacturer. Support single-wall vertical pipe in accordance with accepted industry practices. Do not rely on the heater for support of either horizontal or vertical pipes. Use non-combustible supports.
- Vent connectors serving category I heaters shall not be connected into any portion of a mechanical draft system operating under positive pressure.
- Where it is necessary to use a long run of vent pipe, or where the vent pipe is exposed to cold air, condensation within the pipe may occur. There are two ways to overcome or eliminate this problem: **a)** prevent condensation by insulating the pipe so that the temperature of the flue products never drops below 250°F or **b)** use double-wall type B vent pipe, which is recommended for the reduction or elimination of condensate problems. Where extreme conditions are present and condensate is anticipated, install a trap for collecting condensate.
- The vent connection may be configured into a suitable permanent chimney or into a gas vent. The effective area of the vent connector, gas vent, or chimney, when connected to a single appliance, shall not be less than the area of the appliance draft hood outlet or shall be in accordance with approved venting methods. The effective area of the gas vent or chimney, when connected to more than one appliance, shall not be less than the area of the largest vent connector plus 50% of the areas of additional vent connectors or shall be in accordance with approved venting methods.
- The minimum permissible height of the vertical vent is 5 feet (1.5 meters) providing no horizontal vent pipe connector is used. If a horizontal vent connector is necessary, refer to **Table 11** or the *National Fuel Gas Code* or the *Canadian Installation Code for Gas Burning Appliances* for the maximum permissible length of a horizontal pipe run (vent connector) for a given vertical height of gas vent.
- The gas vent or chimney should extend at least 3 feet (1 meter) above the highest point where it passes through the roof of a building and at least 2 feet (0.6 meter) higher than any portion of a building or obstruction within a horizontal distance of 10 feet (3 meters).

Vent Connections—Continued

Specific Venting Requirements—Continued

- Install a vent cap on the end of the vent pipe to prevent rain or snow from entering the open end. For unit size 125, run the required 7-inch vent pipe and use a field-supplied increaser to attach an 8-inch vent cap.
- If the heater is installed in a space served by a large exhaust fan, ensure that the exhaust fan does not affect the operation of the heater or the satisfactory venting of its products of combustion.
- If a negative pressure exists, as evidenced by a downdraft, a factory-designed mechanical motor drive venter (option CA) should be installed (refer to **Power Venter (Option CA)** section). In severe negative pressure conditions, makeup air equipment may be necessary.

Vent Outlet

Refer to **Table 12** for the size and configuration of the vent outlet.

Table 12. Vent Outlet Size and Configuration

Unit Size (MBTUh)	Size (Inches)	Configuration
75	5	Round
100	6	Round
125	7	Oval
150, 175	8	Oval
200, 225	8	Round
250, 300	10	Oval
350, 400	12	Oval

Power Venter (Option CA)

⚠ CAUTION ⚠

DO NOT install the power venter without the venter adapter.

- The installation of a gravity-vented furnace in an area where horizontal venting is required or where negative building pressure inhibits gravity venting, requires an optional power venter (option CA).
- Use only a power venter provided by the furnace manufacturer and carefully follow the instructions included in the optional venter package. Use the venter adapter provided to connect the power venter to the heater.
- With the option CA power venter installed, the furnace may be vented either horizontally or vertically. Do not exceed the maximum vent lengths listed in **Table 13**.

Table 13. Maximum Vent Lengths for Units with Optional Power Venter

Vent Pipe Diameter (Inches)	Unit Size (MBTUh)							
	75–150	175	200	225	250	300	350	400
	Maximum Vent Length (Feet (Meters))*							
4	100 (30)	75 (23)	50 (15)	35 (11)	30 (9)	15 (4.6)	—	
6	—				100 (30)**		100 (30)	92 (28)

NOTE: The minimum vent length is 5 feet (1.5 meters).

*Reduce the vent pipe lengths as follows: 7 feet (2.1 meters) for each 45-degree elbow, 15 feet (4.6 meters) for each 90-degree elbow, and 10 feet (3 meters for each vent cap.

**If the venter outlet is 4-inch, connect a taper-type enlarger to the vent outlet when installing 6-inch vent pipe.

Vent Control Damper (Option AV7)

- The vent control damper (see **Figure 16**) is a motorized damper that will close when the heater is not operating. The vent damper option is applicable only on units with spark ignition with lockout (option AH3) and is shipped in a separate box. Follow the manufacturer's instructions to install it in the vent. Refer to the wiring diagram on the heater to make wiring connections.

Figure 16. Vent Control Damper (Option AV7)

- The wiring harness with the vent damper is 8 feet (2.4 meters) in length. The vent damper should be located as close to the heater as possible and cannot be more than 8 feet (2.4 meters) from the ignition controller.
- Due to a safety feature, the ignition controller, when used with a vent damper, will not operate a unit without a vent damper.

Piping Connections

Gas Supply Pressure

The unit is equipped for a maximum gas supply pressure of 1/2 psi, 3.4 kPa, or 14 IN WC.

NOTES:

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

PRESSURE TESTING SUPPLY PIPING

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

Gas Supply Piping

⚠ DANGER ⚠

- **All components of a gas supply system must be leak tested prior to placing equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME. Failure to comply could result in personal injury, property damage, or death.**
- **Pipe joint compounds (pipe dope) shall be resistant to the action of liquefied petroleum gas or any other chemical constituents of the gas being supplied.**

- All piping must be in accordance with requirements outlined in the *National Fuel Gas Code* (ANSI/Z223.1, latest edition) or the *Natural Gas and Propane Installation Code* (CSA B149.1).
- Gas supply piping installation shall conform with good practice and with local codes.
- Duct furnaces are orificed for operation with natural gas having a heating value of 1,000 (±50) BTU per cubic foot or with propane gas having a heating value of 2,500 (±100) BTU per cubic foot. Sizing of gas supply lines depends on piping capacity and is based on cubic feet per hour based on a 0.3 IN WC pressure drop, a 0.6 specific gravity for natural gas at 1,000 BTU per cubic feet, and a 1.6 specific gravity for propane at 2,550 BTU per cubic feet. If the gas at the installation does not meet this specification, consult the factory for proper orificing.
- Variables for sizing gas supply lines are listed in **Table 14**. When sizing supply lines, consider the possibility of future expansion and increased requirements. Refer to the *National Fuel Gas Code* for additional information on line sizing.

Piping Connections—Continued

Gas Supply Piping—Continued

Table 14. Gas Supply Line Sizes

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

Supply Piping Connections

- Install a ground joint union and manual shutoff valve upstream of the unit control system, as shown in **Figure 17**.
- The 1/8-inch plugged tapping in the manual shutoff valve in **Figure 17** provides connection for a supply line pressure test gauge.
- The *National Fuel Gas Code* requires the installation of a trap with a minimum 3-inch drip leg (see **Figure 17**). Local codes may require a drip leg longer than 3 inches (typically 6 inches).
- 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.
- Gas connection sizes are listed in **Table 15**.

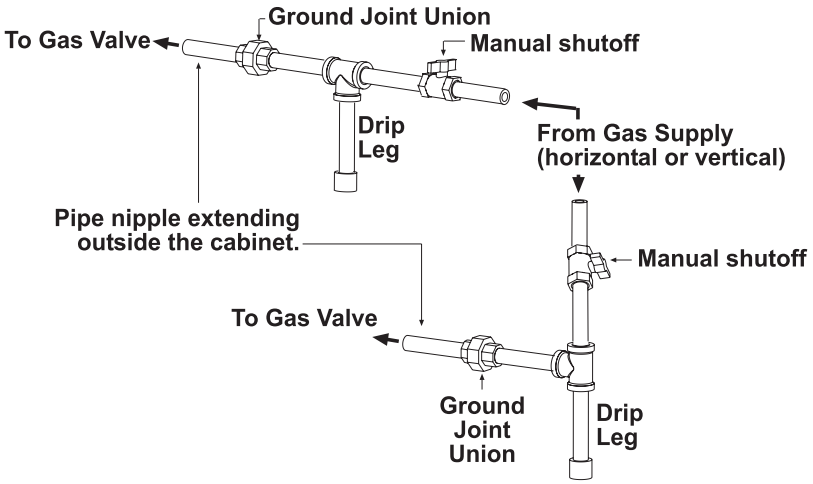


Figure 17. Supply Piping Connections

Table 15. Gas Connection Sizes		
Unit Size (MBTUh)	Natural Gas	Propane
	Connection (Inches)*	
75–250	1/2	1/2
300–400	3/4	1/2
*Connection size to single-stage valve (not gas supply line size).		

Electrical Connections

⚠ WARNING ⚠

- **If you turn OFF the electrical power supply, turn OFF the gas.**
- **All electrical wiring and connections, including electrical grounding, MUST be completed in accordance with local, state, and national codes and regulations and with the *National Electric Code* (ANSI/NFPA 70) or in Canada with the *Canadian Electrical Code* (Part 1, C.S.A. C.22.1).**
- **The installer should be aware of any local ordinances or gas company requirements that might apply.**

⚠ CAUTION ⚠

If any of the unit's original wire must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C, except for limit switch, energy cutoff, and sensor lead wires, which must be 150°C.

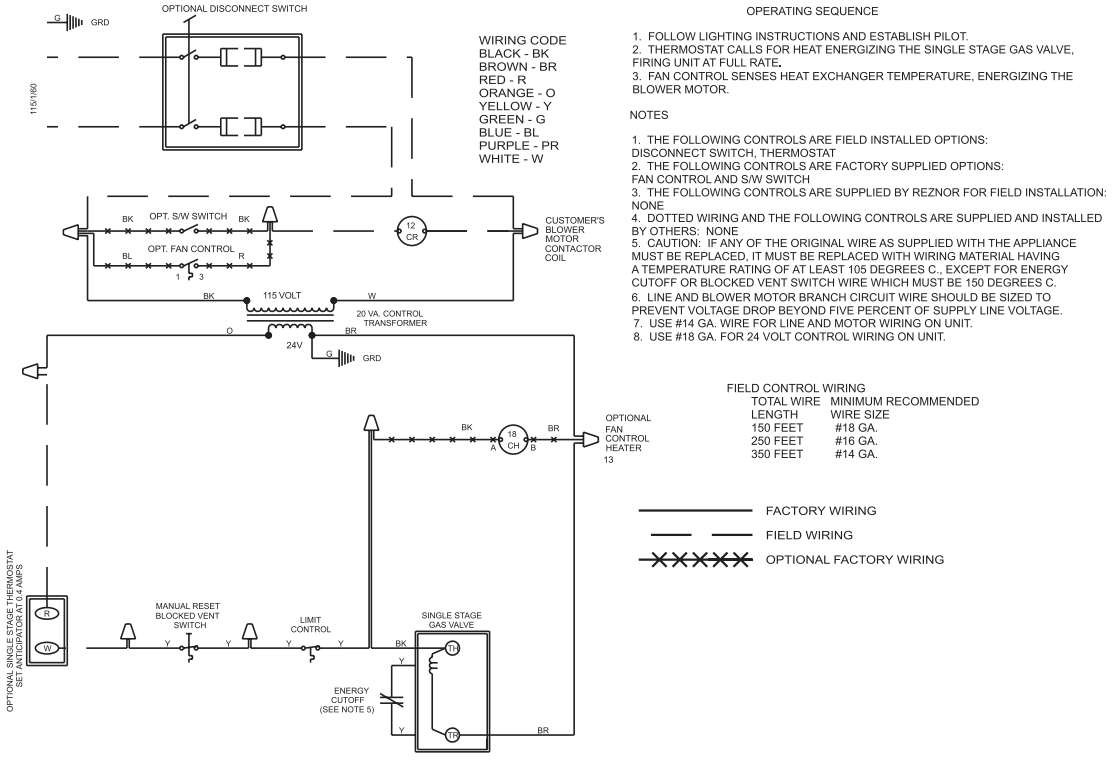
NOTES:

- **Specific wiring diagrams that include standard and factory-installed options are provided with the unit. Ensure that all wiring is in accordance with these wiring diagrams.**
- **Wiring diagrams for units manufactured *before* OCT 2003 are shown in Figure 18.**

- 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.
- The 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 sized according to 1.25 × maximum total input amps.
- When installing the disconnect switch, ensure that the conduit and switch housing are clear of furnace panels and inspection plates. Allow at least 4 feet (1.2 meters) of service room between the switch and removable panels.
- All external wiring must be within approved conduit and have a minimum temperature rise rating of 60°C. Conduit from the disconnect switch must be run so as not to interfere with the service panels of the furnace.
- Electrical connection locations are shown in **Figure 19**.

Electrical Connections—Continued

UNITS WITH SINGLE-STAGE GAS VALVE



OPERATING SEQUENCE

1. FOLLOW LIGHTING INSTRUCTIONS AND ESTABLISH PILOT.
2. THERMOSTAT CALLS FOR HEAT ENERGIZING THE SINGLE STAGE GAS VALVE, FIRING UNIT AT FULL RATE.
3. FAN CONTROL SENSES HEAT EXCHANGER TEMPERATURE, ENERGIZING THE BLOWER MOTOR.

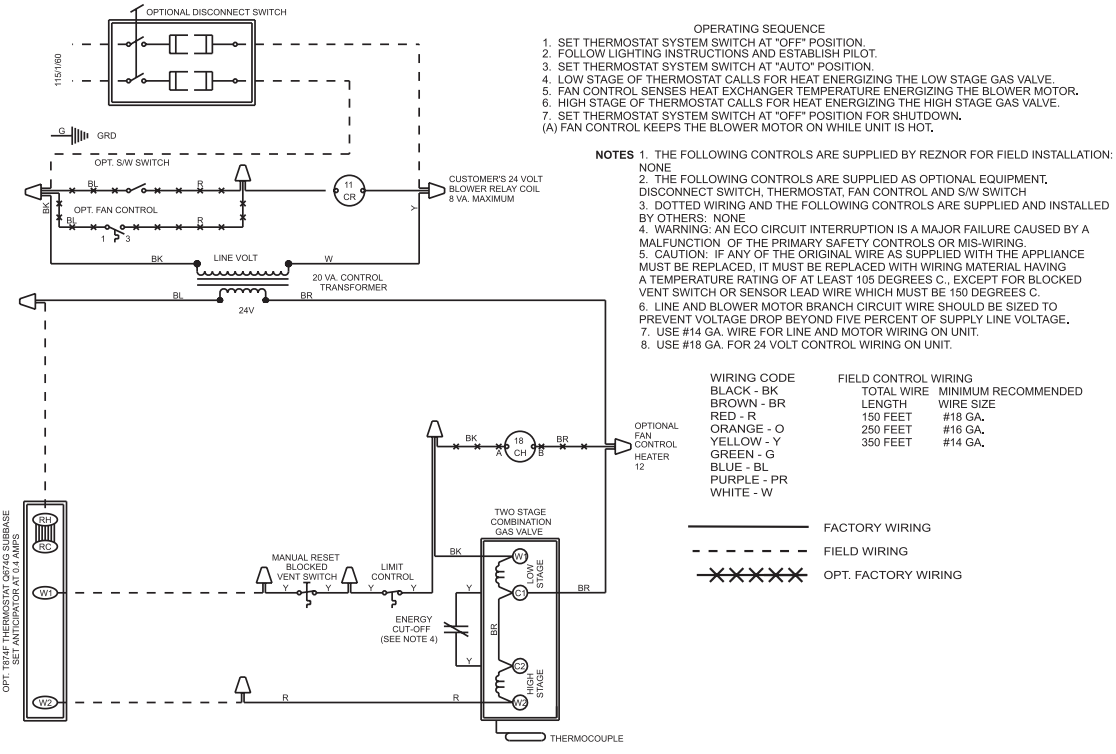
NOTES

1. THE FOLLOWING CONTROLS ARE FIELD INSTALLED OPTIONS: DISCONNECT SWITCH, THERMOSTAT
2. THE FOLLOWING CONTROLS ARE FACTORY SUPPLIED OPTIONS: FAN CONTROL AND S/W SWITCH
3. THE FOLLOWING CONTROLS ARE SUPPLIED BY REZNOR FOR FIELD INSTALLATION: NONE
4. DOTTED WIRING AND THE FOLLOWING CONTROLS ARE SUPPLIED AND INSTALLED BY OTHERS: NONE
5. 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 BLOCKED VENT SWITCH WIRE WHICH MUST BE 150 DEGREES C.
6. LINE AND BLOWER MOTOR BRANCH CIRCUIT WIRE SHOULD BE SIZED TO PREVENT VOLTAGE DROP BEYOND FIVE PERCENT OF SUPPLY LINE VOLTAGE.
7. USE #14 GA. WIRE FOR LINE AND MOTOR WIRING ON UNIT.
8. USE #18 GA. FOR 24 VOLT CONTROL WIRING ON UNIT.

FIELD CONTROL WIRING

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

UNITS WITH OPTIONAL TWO-STAGE GAS VALVE



OPERATING SEQUENCE

1. SET THERMOSTAT SYSTEM SWITCH AT "OFF" POSITION.
2. FOLLOW LIGHTING INSTRUCTIONS AND ESTABLISH PILOT.
3. SET THERMOSTAT SYSTEM SWITCH AT "AUTO" POSITION.
4. LOW STAGE OF THERMOSTAT CALLS FOR HEAT ENERGIZING THE LOW STAGE GAS VALVE.
5. FAN CONTROL SENSES HEAT EXCHANGER TEMPERATURE ENERGIZING THE BLOWER MOTOR.
6. HIGH STAGE OF THERMOSTAT CALLS FOR HEAT ENERGIZING THE HIGH STAGE GAS VALVE.
7. SET THERMOSTAT SYSTEM SWITCH AT "OFF" POSITION FOR SHUTDOWN.

(A) FAN CONTROL KEEPS THE BLOWER MOTOR ON WHILE UNIT IS HOT.

NOTES

1. THE FOLLOWING CONTROLS ARE SUPPLIED BY REZNOR FOR FIELD INSTALLATION: NONE
2. THE FOLLOWING CONTROLS ARE SUPPLIED AS OPTIONAL EQUIPMENT. DISCONNECT SWITCH, THERMOSTAT, FAN CONTROL AND S/W SWITCH
3. DOTTED WIRING AND THE FOLLOWING CONTROLS ARE SUPPLIED AND INSTALLED BY OTHERS: NONE
4. WARNING: AN ECO CIRCUIT INTERRUPTION IS A MAJOR FAILURE CAUSED BY A MALFUNCTION OF THE PRIMARY SAFETY CONTROLS OR MIS-WIRING.
5. 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 BLOCKED VENT SWITCH OR SENSOR LEAD WIRE WHICH MUST BE 150 DEGREES C.
6. LINE AND BLOWER MOTOR BRANCH CIRCUIT WIRE SHOULD BE SIZED TO PREVENT VOLTAGE DROP BEYOND FIVE PERCENT OF SUPPLY LINE VOLTAGE.
7. USE #14 GA. WIRE FOR LINE AND MOTOR WIRING ON UNIT.
8. USE #18 GA. FOR 24 VOLT CONTROL WIRING ON UNIT.

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.

Figure 18. Wiring Diagrams for Standard Match-Lit Pilot Models (Discontinued OCT 2003)

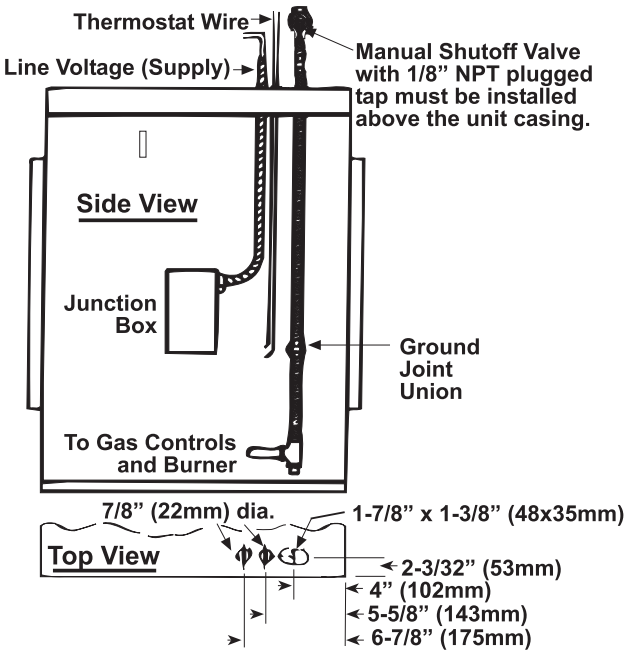


Figure 19. Electrical Connection Locations

Electrical Connections for Field-Installed Options

⚠ WARNING ⚠

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

Refer to the instruction sheet and wiring diagram provided in the option package for field-installed options that require electrical connections.

Thermostat Installation

⚠ CAUTION ⚠

If applicable, ensure that the thermostat has an adequate VA rating for the total requirements. Add the coil ratings of all relays and match the thermostat rating.

- 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 24V thermostat must be used to actuate low voltage gas controls. If line voltage from the thermostat to the unit is desired, consult the factory representative.
- 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 5 feet (1.5 meters) above the floor on an inside wall—not in the path of warm or cold air currents and not in corners where air may be pocketed.
- Do NOT install 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.
- If using a low voltage (24V) thermostat with a heat anticipator, set the anticipator at full load control amps. Refer to **Table 16**, which lists the maximum amps for 24V controls.

Electrical Connections—Continued

Thermostat Installation—Continued

Table 16. Maximum Amps for 24V Controls

Control	Maximum Amps	Control	Maximum Amps
Single-stage gas valve	0.7A	Heater fan control	0.12A
Two-stage gas valve	0.33A	Heater time delay relay	0.1A
Maxitrol system	0.5A		
Spark ignition	0.1A	Relay coil	0.12A
NOTE: The 24V transformer has a 20VA capacity.			

CONTROLS

Unit controls are described in the following paragraphs.

Limit Switch

The heater is equipped with a non-adjustable high limit switch that shuts OFF the gas in the event of motor failure, lack of air due to dirty filters, or restrictions at the inlet or outlet of the unit. Refer to the **Post-Startup Checklist** section for checking the limit switch.

Blocked Vent Switch

⚠ DANGER ⚠

If a blocked vent sensor causes the heater to shut off, determine and correct the cause. Failure to do so could result in personal injury or death.

- The blocked vent switch is a heat-activated, manually-reset, safety device that interrupts the electric supply to the gas valve when the vent is 100% blocked.
- The sensor is located near the relief opening of the draft hood. The reset button is located inside the control compartment by the draft hood side.
- If the sensor detects heated flue gases in the draft hood relief opening area, the blocked vent safety device activates to shut down the furnace. The cause of the shutdown must be determined and corrected.
- The blocked vent switch is designed to activate when the vent is blocked it but may also be affected by a negative building pressure or an inadequate vent system.
- After the problem has been corrected, remove the furnace control compartment panel and push the manual reset button on the blocked vent switch to restart the heater. Replace the panel.

Fan Control

⚠ CAUTION ⚠

To ensure that the blower can continue to operate, the power supply to the furnace MUST NOT be interrupted except for when servicing the unit.

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

- The 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 and **b)** blower operation continues after the thermostat is satisfied, as determined by the fan time delay.
- For proper operation, ensure that fan control wiring is in accordance with the **Electrical Connections for Field-Installed Options** section.
- If the heater is to be turned 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 turned off in the same manner.

Combination Gas Valve

⚠ WARNING ⚠

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

All furnaces are equipped with a 24V combination gas valve that includes an automatic electric ON-OFF valve controlled by the room thermostat, a pressure regulator, and a manual shutoff valve. The standard combination gas valve allows for single-stage control from a single-stage, 24V thermostat.

Optional Two-Stage Control (Heating Only Application)

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

Optional Two-Stage Control (Makeup Air Application)

- Two-stage makeup air units are equipped with a two-stage gas valve, but instead of control from a two-stage room thermostat, the outlet air temperature is monitored and controlled by a two-stage ductstat. When 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 maintain discharge air temperature between 65°F and 75°F. In all applications, the allowable temperature rise of the furnace in the installation dictates the limits of the ductstat temperature setting.
- Depending on the option selection, the sensor is either field-connected by capillary tubing to the unit-mounted ductstat (option AG3) or electrically-connected to a remote electronic remote temperature selector (option AG15).

Ductstat with Capillary Tubing (Option AG3)

- See **Figure 20**, DETAIL A.
- The control is set to 70°F and has an adjustable range of 0–100°F with a fixed differential of 3°F.
- Due to different CFM settings and outside air temperatures, the average downstream outlet air temperature may not match the ductstat exactly. After the installation is complete, adjust the ductstat's setpoint to achieve the desired average discharge air temperature.

Ductstat with Electronic Remote Setpoint Module (Option AG15)

- See **Figure 20**, DETAIL B.
- The remote modules are shipped separately for field-installation. There will be one module for selecting temperature and one-stage adder module.
- The sensing probe is field-wired to a remote temperature selector. Follow the wiring diagram provided with the unit and the manufacturer's instructions for wiring and installation.
- The temperature selector has an operating range to 120°F. For proper function, ensure that the switch is set to the **Heat** position.

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

Ductstat with Electronic Remote Setpoint Module (Option AG15)—Continued

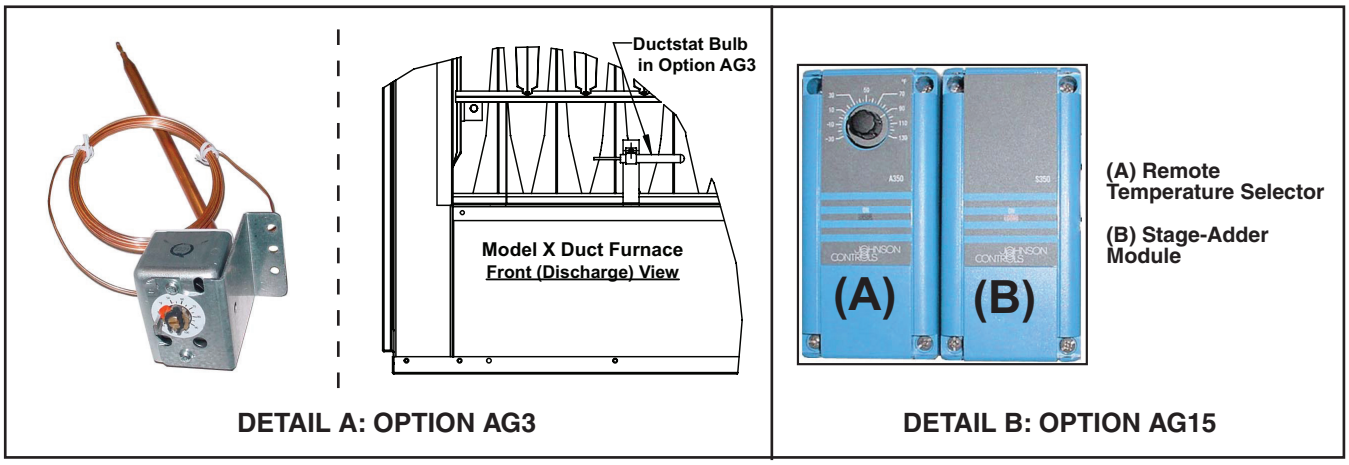


Figure 20. Ductstat Options

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 number printed on the heater rating plate. AG7 is identified as MV-1, AG8 is identified as MV-3, AG9 is identified as MV-4, and AG21 is identified as MV-A.
- Refer to the wiring diagram supplied with the furnace for proper wiring connections.

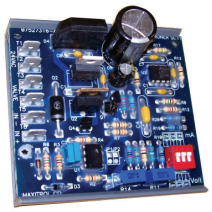
Electronic Modulation Between 50% and 100% Firing Rate (Options AG7, AG8, and AG9)

- See **Figure 21**, DETAIL A.
- 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) that 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 IN WC pressure to the main operating valve.
- Electronic modulation for heating controlled by a specially-designed room thermostat (60–85°F) is identified as option AG7.
- Electronic modulation control systems for makeup air applications controlled by a duct sensor and temperature selector (55–90°F) are identified as either option AG8 or 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)

- See **Figure 21**, DETAIL B.
- With this option the furnace is equipped with a Maxitrol signal conditioner that 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 0–20 volt DC current required to control the modulating valve.

DETAIL A: OPTIONS AG7, AG8, AND AG9



DETAIL B: OPTION AG21

Figure 21. Electronic Modulation Options

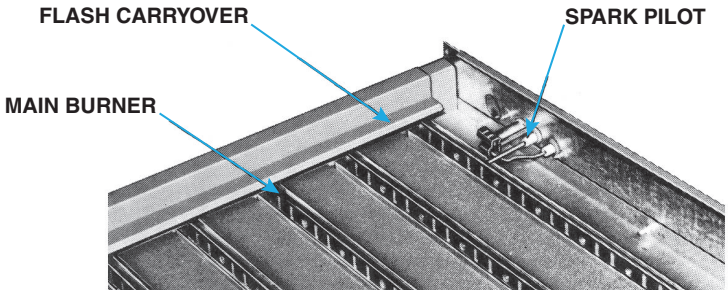
Pilot and Ignition Systems

- **Intermittent spark pilot system:**

NOTE: Units manufactured *before* OCT 2003 may have a match-lit standing pilot (see Figure 18).

a. 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 (see **Figure 22**).

b. Pilot gas pressure should be the same as supply line pressure (refer to **Gas Supply Pressure** section). If required, adjust the pilot adjustment screw in the control valve body so that pilot flame length is approximately 1-1/4 inches.



BURNER RACK WITH SPARK PILOT

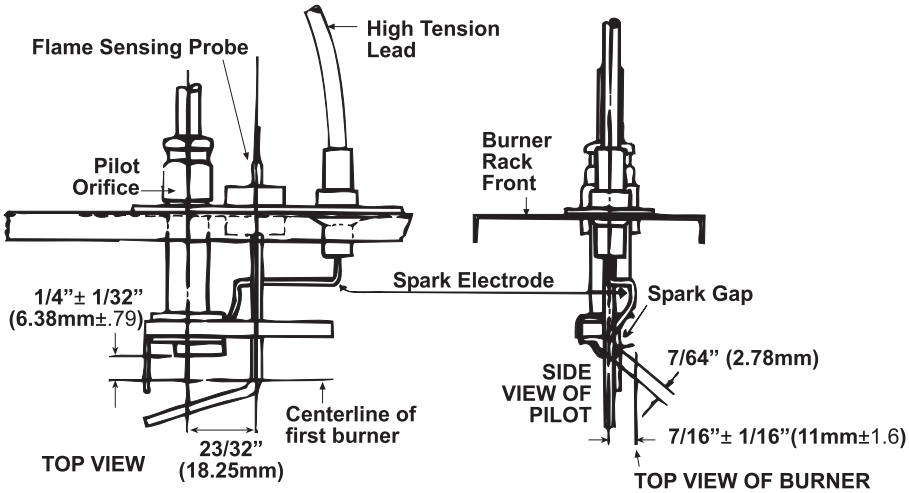


Figure 22. Spark Pilot

Pilot and Ignition Systems—Continued

- **Spark ignition safety pilot system:**
  a. Natural gas units are equipped with a spark ignited intermittent safety pilot system that shuts off the pilot gas flow between heat cycles.
  b. Propane units (or as an option on natural gas units) require a lockout device. The lockout device stops the gas flow to the pilot if the pilot fails to light in 120 seconds.
  c. The lockout feature has a 1-hour retry or requires manual reset by interruption of the control circuit.
  d. Refer to the wiring diagram supplied with the unit for pilot system identification and proper wiring.
  e. Pilot with lockout is option AH3. Spark pilot without lockout is option AH2.
- **Ignition Controller:**
  a. 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.
  b. After ignition of the pilot gas, the ignition controller electronically senses the pilot flame.
  c. 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.
  d. The pilot flame acts as a conduction path to ground that completes the DC circuit and proving pilot flame. With pilot flame proven, the ignition controller energizes the main gas valve.
  e. Proper operation of the electronic spark ignition system requires a minimum flame signal of 0.2 microamps as measured by a microampmeter.
  f. Ignition controller with lockout for option AH3 gas control (UTEC #1003-514, PN 257010) is shown in **Figure 23**, DETAIL A.
  g. Recycling ignition controller for option AH2 gas control (UTEC #1003-638A, PN 257009) is shown in **Figure 23,** DETAIL B.

DETAIL A

DETAIL B

Figure 23. Ignition Controllers

⚠ WARNING ⚠

Do not touch pilot spark wire and pilot electrode when energized due to high voltage.

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 no spark, check the following:**
  a. Voltage between terminals TH and 7 should be at least 20V and no higher than 32V. Refer to **TROUBLESHOOTING** section 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 inch.
  d. 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. If voltage between black and brown leads on the main gas valve is 20–32VAC and there is no main gas flow with the built-in manual valve in FULL OPEN position, the main gas valve is defective.
  b. If there is no voltage between black and brown leads on the main gas valve, check for a disconnected or shorted flame sensor lead or flame sensor probe.
  c. When the above conditions are normal and the main gas flow is still OFF, the ignition controller is probably defective.

NOTES:

- **If replacing an earlier style of ignition controller, order replacement kit PN 257472 for a unit with recycling gas control option AH2 or PN 257473 for option AH3 gas control with lockout. Option codes are listed on the unit wiring diagram.**
- **Use of an optional vent damper requires an ignition controller with lockout.**

OPERATION

⚠ 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 that vents all flue products to the outside atmosphere. FAILURE TO PROVIDE PROPER VENTING WILL RESULT IN A HEALTH HAZARD THAT COULD CAUSE SERIOUS PERSONAL INJURY OR DEATH.**
- **Always comply with the combustion air requirements in the installation codes and in the Combustion Air Requirements section. Combustion air at the burner should be regulated only by manufacturer-provided equipment. NEVER RESTRICT OR OTHERWISE ALTER THE SUPPLY OF COMBUSTION AIR TO ANY HEATER. Indoor units installed in a confined space must be supplied with air for combustion as required by code and in the Combustion Air Requirements section. MAINTAIN THE VENT SYSTEM IN A STRUCTURALLY-SOUND AND PROPERLY-OPERATING CONDITION.**

Pre-Startup Checklist

- ❑ Check suspension—unit must be secure and level.
- ❑ Ensure that electrical supply matches voltage rating of furnace as listed on unit rating plate.
- ❑ Ensure that all field wiring is in accordance with wiring diagram.
- ❑ Ensure that wire gauges are as required for electrical load.
- ❑ Ensure that that fuses or circuit breakers are in place and are sized correctly.
- ❑ Ensure that clearances from combustibles are in accordance with **Clearances** section.
- ❑ If installed in confined space, ensure that furnace has adequate combustion air supply (refer to **Combustion Air Requirements** section).
- ❑ Ensure that vent system is installed in accordance with **Vent Connections** section.
- ❑ Ensure that flue discharge openings are free from obstructions.

Pre-Startup Checklist—Continued

- ❑ Check piping for for proper gas line pressure and for leaks as follows:
  a. Turn manual shutoff valve OFF.
  b. Turn gas supply ON.
  c. Observe gas meter for movement or attach pressure gauge (readable to 0.1 IN WC) and, after turning gas ON for 10 seconds, turn gas supply OFF. No change in pressure should occur over a 3-minute period.
  d. If leak is indicated, locate leak by brushing leak-detecting solution on all fittings. Bubbles will appear at leak. Repair and repeat test.
- ❑ Bleed gas lines of trapped air (refer to **Supply Piping Connections** section).

Startup

⚠ WARNING ⚠

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

Turn ON the electric and gas supply to the furnace. Adjust the thermostat or ductstat so that a call for heat exists. Observe operating sequence listed in **Table 17** for complete sequencing of ipilot and ignition.

NOTE: Units manufactured *before* AUG 2008 may have an intermittent spark system without lock-out (option AH2). Check the wiring diagram on the furnace.

Table 17. Operating Sequence for Intermittent Spark Pilot System

Operation	Result
1. Set thermostat to lowest setting	
2. Follow lighting instructions	
3. Set thermostat to desired setting	Thermostat calls for heat, which energizes ignition controller and pilot gas valve
	Pilot flame ignites
	Sensing probe proves presence of pilot flame
	Ignitor deenergizes and gas valve energizes
	Blower motor operates from fan time delay
	If pilot flame is extinguished during main burner operation, safety switch closes main valve and spark gap recycles
	If pilot is not established within 120 seconds (approximately), unit locks out and, at 60-minute intervals, controller attempts to re-establish pilot—pilot may be reset at any time by interrupting power to control circuit
4. Return thermostat to lowest setting for shutdown	Blower motor remains ON as determined by fan time delay

Post-Startup Checklist

- ❑ With unit in operation, measure manifold gas pressure—pressure for natural gas should be 3.5 IN WC and 10 IN WC for propane gas (refer to **Manifold Gas Pressure Measurement and Adjustment** section).
- ❑ Turn unit OFF and ON, pausing 2 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 inches in height with blue coloring.
- ❑ Propane gas flame at full fire should be about 1-1/2 inches in height with blue coloring. Yellow tipping may appear on propane gas. If yellow extends beyond 1/2 to 3/4 inch, adjust air shutters (refer to **Burner Air Adjustment (Propane Units Only)** section).
- ❑ Place owner's envelope that contains Limited Warranty Card, this manual, and any optional information in accessible location near heater—follow instructions on envelope.

ADJUSTMENTS

The adjustments described in the following paragraphs can be accomplished only after the heater is in operation.

Manifold Gas Pressure Measurement and Adjustment

NOTE: Consult the valve manufacturer's literature provided with the furnace for more detailed information.

⚠ WARNING ⚠

Manifold gas pressure must never exceed 3.5 IN WC for natural gas or 10 IN WC for propane gas.

Normally, adjustment to the factory-preset regulator should not be necessary. Before attempting to measure or adjust manifold gas pressure, the inlet (supply) pressure must be within the specified range for the gas being used, both when the heater is in operation and when on standby. Incorrect inlet pressure could cause excessive manifold gas pressure immediately or at some future time. Measure and adjust the manifold gas pressure as follows:

NOTE: A manometer (fluid-filled gauge) with an inches water column scale is recommended for gas pressure measurement rather than a spring-type gauge due to the difficulty of maintaining the calibration of a spring-type gauge.

1. With manual valve on combination valve positioned to prevent flow to main burners, connect manometer to 1/8-inch outlet pressure tap (see **Figure 24**) on valve.

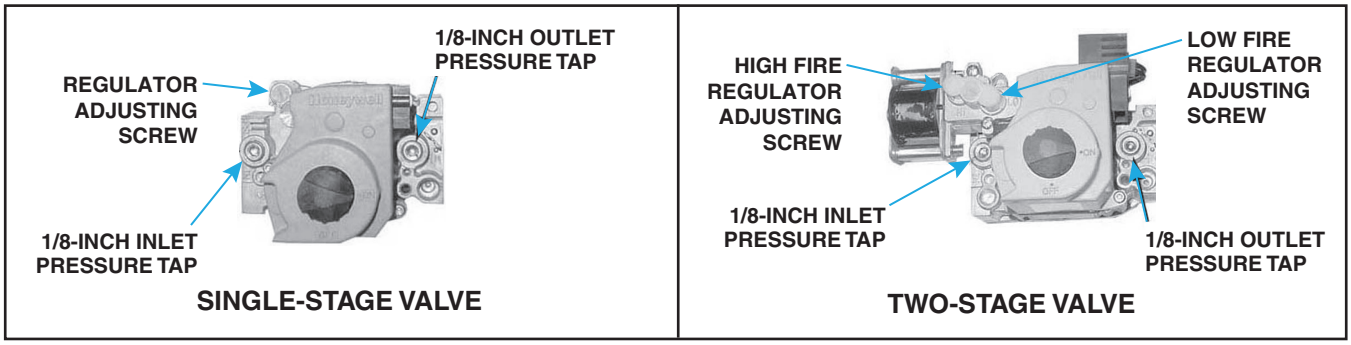


Figure 24. Combination Gas Valve Pressure Taps

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

NOTES:

- **Natural gas units leave the factory with the combination valve set so that the outlet gas pressure of a single-stage valve or high fire of a two-stage valve is regulated to 3.5 IN WC. Low fire on a two-stage valve is set to 1.8 IN WC. Inlet supply pressure to the valve must be a minimum of 5 IN WC or as noted on the rating plate and must be a maximum of 14 IN WC. Always check the rating plate for the minimum gas supply pressure. Minimum supply pressure requirements vary based on the size of the burner and the gas control option. Most units require a minimum of 5 IN WC, but unit size 350 and 400 models with electronic modulation require a minimum of 6 IN WC and unit size 350 and 400 models with mechanical modulation require a minimum of 7 IN WC.**
- **Propane units leave the factory with the combination valve set so that the outlet gas pressure of a single-stage valve or high fire of a two-stage valve is 10 IN WC. Low fire on a two-stage valve is set to 5 IN WC. Inlet pressure to the valve must be a minimum of 11 IN WC and a maximum of 14 IN WC.**

Manifold Gas Pressure Measurement and Adjustment—Continued

⚠ CAUTION ⚠

Do not bottom out the gas valve regulator adjusting screw. This can result in unregulated manifold pressure, which may cause overfire and heat exchanger failure.

4. Adjust pressure as necessary to required setting by turning regulator adjusting screw (see **Figure 24**)—IN (clockwise) to increase pressure or OUT (counterclockwise) to decrease pressure.
5. If wire from HI terminal on valve was disconnected in step 2, reconnect wire.

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

NOTES:

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

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

1. Determine model number and rated input (BTUh) from unit's rating plate.
2. Determine appropriate orifice replacement (refer to **Table 18**) for installation elevation.
3. Unthread existing gas orifices from gas manifold.

⚠ DANGER ⚠

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

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

⚠ DANGER ⚠

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

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

Table 18. High Elevation Burner Orifices						
Installation Elevation (Feet (Meters))	Installation Location	Unit Size	Natural Gas		Propane	
			PN	Orifice Size	PN	Orifice Size
2001–3000 (611–915)	US	75	16590	#46	39658	#56
		100, 125, 175, 225, 300, 350, 400	84437	#42	11834	#54
		150, 200, 250	11833	#44	11830	#55
2001–4500 (611–1373)	Canada	75	84853	#47	63922	1.15 mm
		100, 125, 175, 225, 300, 350, 400	84437	#42	11834	#54
		150, 200	11833	#44	11830	#55
		250	38678	#45	11830	#55
3001–4000 (916–1220)	US	75	84853	#47	63922	1.15 mm
		100, 125, 175, 225, 300, 350, 400	84437	#42	11834	#54
		150, 200	11833	#44	11830	#55
		250	38678	#45	11830	#55
4001–5000 (1221–1525)	US	75	84853	#47	63922	1.15 mm
		100, 125, 175, 225, 300, 350, 400	84437	#42	11834	#54
		150, 200	11833	#44	11830	#55
		250	38678	#45	11830	#55
5001–6000 (1526–1830)	US	75	84853	#47	63922	1.15 mm
		100, 125, 175, 225, 300, 350, 400	11828	#43	97360	1.35 mm
		150, 200, 250	38678	#45	39658	#56
6001–7000 (1831–2135)	US	75	40414	#48	40416	#57
		100, 125, 175, 225, 300, 350, 400	11828	#43	97360	1.35 mm
		150, 200	38678	#45	39658	#56
		250	16590	#46	39658	#56
7001–8000 (2136–2440)	US	75	40414	#48	40416	#57
		100, 125, 175, 225, 300, 350, 400	11833	#44	11830	#55
		150, 200	16590	#46	39658	#56
		250	84853	#47	39658	#56
8001–9000 (2441–2745)	US	75	39651	#49	40416	#57
		100, 125, 175, 225, 300, 350, 400	11833	#44	11830	#55
		150, 200	84853	#47	39658	#56
		250	39651	#49	39659	#58
9001–10,000 (2746–3048)	US	75	38678	#45	11830	#55
		100, 125, 175, 225, 300, 350, 400	84853	#47	39658	#56
		150, 200	40414	#48	39658	#56
		250	40414	#48	39658	#56

Conversion to LP (Propane)

⚠ DANGER ⚠

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

If LP (propane) conversion is required, convert the unit in accordance with form ***OPT-GC*** listed in **Table 1**. When conversion is complete, verify that the input rate is correct.

ADJUSTMENTS—CONTINUED

Burner Air Adjustment (Propane Units Only)

⚠ DANGER ⚠

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

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

This duct furnace has individually-formed steel burners with accurately die-formed ports to provide controlled flame stability with either natural gas or propane without lifting or flashback. The burners are lightweight and are factory-mounted in an assembly that permits them to be removed as a unit for inspection or service. All natural gas burners are equipped with two flash carryover systems that receive a supply of gas simultaneously with the main burner. All propane gas burners are equipped with one flash carryover and a regulated gas lighter tube system. Burner air shutters are not normally required on natural gas furnaces. Air shutters are supplied on propane gas units and may require adjustment as follows:

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

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

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

NOTE: A limited amount of yellow-tipping is permissible for propane gas. Other fuels should not display any yellow-tipping.

3. Open air shutters until yellow disappears.

MAINTENANCE

⚠ WARNING ⚠

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

NOTE: Use only factory-authorized replacement parts.

The unit is designed to operate with a minimum of maintenance. However, to ensure long life and satisfactory performance, routine service is recommended. When servicing, follow standard safety procedures and those specific instructions and warnings in this manual.

Service Checklist

⚠ CAUTION ⚠

Eye protection is recommended when cleaning unit.

- ❑ Under normal conditions, inspect furnaces at beginning of each heating season and once every 4 months. If furnace is located where an unusual amount of dust, soot, or other impurities are contained in the air, more frequent inspection is recommended.
- ❑ Clean heat exchanger inside and out (annually at minimum).
- ❑ Clean all dirt and grease from combustion air openings (annually at minimum).
- ❑ Check combination gas valve to ensure that gas flow is being shut off completely (annually at minimum).
- ❑ Check pilot burner and main burners for scale, dust, or lint accumulation and clean as necessary (annually at minimum).
- ❑ Check soundness of vent system and replace parts as necessary (annually at minimum).
- ❑ Check wiring for damage and replace as necessary (annually at minimum).

Maintenance Procedures

Combination Gas Valve Maintenance

⚠ WARNING ⚠

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

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

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

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

2. Connect manometer to 1/8-inch inlet pressure tap on combination gas valve (see **Figure 24**).
3. Observe manometer for 2 to 3 minutes—no gas pressure should be indicated.
   a. If manometer indicates any gas pressure, manual shutoff valve must be replaced or repaired before combination gas valve can be checked.
   b. If manometer does not indicate gas pressure, slowly open manual shutoff valve.
4. Close manual shutoff valve and observe manometer— no loss of gas pressure should be indicated. If loss of pressure is indicated, replace combination gas valve before furnace is restored to operation.

Maintenance Procedures—Continued

Burner Rack and Pilot Maintenance

1. Remove burner rack assembly:
   a. Turn OFF gas supply.
   b. Turn OFF electric supply.
   c. Remove control access side panel.
   d. Disconnect pilot tubing and thermocouple or flame sensor lead.
   e. Disconnect valve's electric leads and mark for correct reconnection.
   f. Uncouple gas supply union.
   g. Remove two sheet metal screws in top corners of burner rack assembly and pull drawer-type burner rack out of furnace.
2. Disassemble burner rack:
   a. For natural gas units, remove flash carryover system from manifold end of burner rack. For propane units, remove flash carryover system by breaking lighter tube connection at regulator, removing lighter tube orifice supply tubing, removing retaining screws in drip shield, removing drip shield, removing retaining screws, and sliding out lighter tube.
   b. Pull main burners away—horizontally—from injection opening and lift out.
   c. Remove manifold bracket screws and remove manifold.
   d. Remove main burner orifices.
   e. Remove screws and lift out pilot burner.
3. Clean pilot:

⚠ CAUTION ⚠

- **Do not ream the orifice.**
- **If pilot flame is short and/or yellow, check pilot orifice for blockage caused by lint or dust accumulation.**

   a. Remove the pilot orifice and clean with air pressure.
   b. Check and clean aeration slot in pilot burner.
   c. Clean metal sensing probe and pilot hood with emery cloth and wipe off ceramic insulator.
   d. Check spark gap and ensure that gap is maintained to be 7/64 inch as shown in **Figure 22**.
   e. After pilot is cleaned, blow away any dirt using compressed air.
4. Clean main burners as necessary:
   a. Using air pressure, blow out scale and dust accumulation from burner ports.
   b. Blow air pressure through burner ports and venturi.
   c. Use fine wire to dislodge any stubborn particles. Do not use anything that might change orifice port size.
5. Clean burner rack flash carryover systems using air pressure.
6. Reassemble burner rack and replace burner rack assembly by reversing steps 2 and 1, being careful not to create any unsafe conditions.

NOTES:

- **If the heater has been converted to high CFM in accordance with High CFM Conversion section, the baffles will have already been removed.**
- **For cleaning the inner surfaces of the heat exchanger, an air hose, a long (18- to 24-inch) stiff brush of 1/2-inch diameter or heavy wire with steel wool securely attached, a flashlight, and a mirror are needed.**
- **The furnace has V-shaped baffles in the top of each heat exchanger tube. Units manufactured *before* MAR 1995 may not have heat exchanger V-baffles.**

1. Clean heat exchanger outer surfaces (circulating air side):
   a. Gain access by removing inspection panels in ductwork or remove ductwork.
   b. Remove baffles between heat exchanger tubes in accordance with **Reverse Airflow Conversion** section.
   c. Remove accumulated dust and grease deposits from heat exchanger tubes and baffles using brush and/or air hose.
   d. Re-install baffles in accordance with **Reverse Airflow Conversion** section.
   e. Secure ductwork as necessary.
2. Clean heat exchanger inner surfaces (combustion gas side):
   a. Remove burner rack assembly in accordance with **Burner Rack and Pilot Maintenance** section.
   b. Remove heat exchanger V-baffles (see **Figure 25**):
      (1) Remove screws (number varies depending on unit size) along bottom of front baffle and three on each end.
      (2) Slide front baffle out of furnace.
      (3) Remove screws that secure tube baffle hold-down plate to rear flue baffle.
      (4) Pull V-baffles out of heat exchanger.
   c. Clean inner surfaces using furnace brush or piece of heavy wire to which piece of steel wool is attached. Scrub tube walls to remove any accumulated dust, rust, and/or soot.
   d. Clean V-tubes and reassemble heat exchanger.
   e. Install burner rack assembly in accordance with **Burner Rack and Pilot Maintenance** section.
3. Check furnace for proper operation.

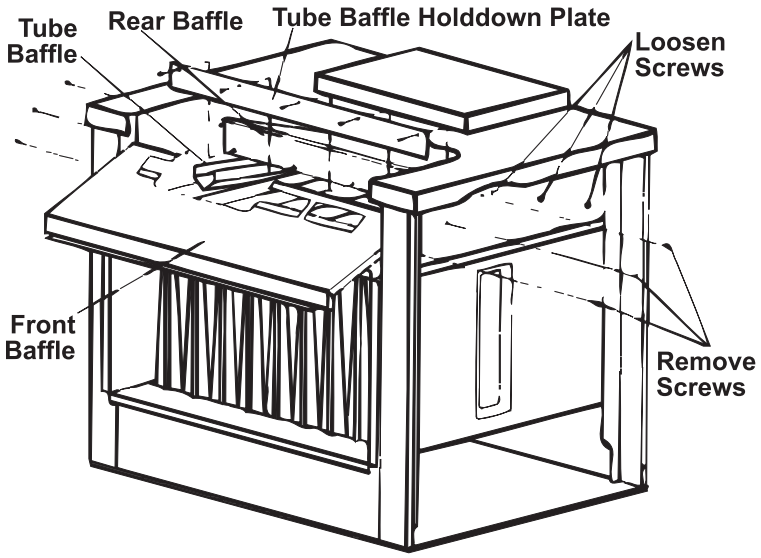


Figure 25. Heat Exchanger V-Baffles Removal

TROUBLESHOOTING

Table 19. General Troubleshooting

Symptom	Probable Cause	Remedy
A. Pilot will not light (spark ignition system)	1. Manual valve not open	Open manual valve
	2. Air in gas line	Bleed gas line
	3. Dirt in pilot orifice	Remove and clean with compressed air or solvent (do not ream)
	4. Gas pressure too high or too low	Adjust supply pressure (refer to **Manifold Gas Pressure Measurement and Adjustment** section)
	5. Kinked pilot tubing	Replace tubing
	6. Pilot valve does not open	If 24V is available at valve, replace valve
	7. No spark	
	a. Loose wire connections	Check and tighten all wiring connections as necessary
	b. Transformer failure	Ensure that 24V is available
	c. Incorrect spark gap	Maintain spark gap at 7/64 inch
	d. Spark cable shorted to ground	Replace worn or grounded spark cable
	e. Spark electrode shorted to ground	Replace pilot if ceramic spark is electrode is cracked or grounded
	f. Drafts affecting pilot	Ensure that all panels are in place and tightly secured to prevent drafts at pilot
	g. Ignition control not grounded	Ensure that ignition control is grounded to furnace chassis
	h. Faulty ignition controller	If 24V 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	Reset lockout by interrupting control at thermostat
	9. Faulty combustion air proving switch	Replace combustion air proving switch
B. Pilot lights, main valve will not open (spark Ignition system)	1. Manual valve not open	Open manual valve
	2. Main valve not operating	
	a. Defective valve	If 24V is measured at valve connections and valve remains closed, replace valve
	b. Loose wire connections	Check and tighten all wiring connections as necessary
	3. Ignition control does not power main valve	
	a. Loose wire connections	Check and tighten all wiring connections as necessary
	b. Flame sensor grounded while pilot lights and spark continues	Ensure that flame sensor lead is not grounded or insulation or ceramic is not cracked; replace as necessary
	c. Gas pressure incorrect	Adjust supply pressure (refer to **Manifold Gas Pressure Measurement and Adjustment** section)
	d. Cracked ceramic at sensor	Replace sensor
	e. Faulty ignition controller	If all checks indicate no other cause, replace ignition controller
		Do not attempt to repair ignition controller, which has no field-replaceable components
C. Pilot will not light (match-lit system)*	1. Manual valve not open	Open manual valve
	2. Air in gas line	Bleed gas line
	3. Dirt in pilot orifice	Remove and clean with compressed air or solvent (do not ream)
	4. Gas pressure too high or too low	Adjust supply pressure (refer to **Manifold Gas Pressure Measurement and Adjustment** section)
	5. Bent or kinked pilot tubing	Replace tubing
	6. Failed ECO device	Replace ECO device

*Units manufactured ***before*** OCT 2003.

Table 19. General Troubleshooting—Continued		
Symptom	**Probable Cause**	**Remedy**
D. Pilot lights, main valve will not open (match-lit system)*	1. Manual valve not open	Open manual valve
	2. Power not turned on or thermostat not calling for heat	Turn on power
		Check fuses
		Turn on thermostat
	3. Circuit to valve open	Check wiring and connections at transformer and thermostat
	4. Faulty transformer	Replace transformer
	5. Component failure	
	a. Faulty or dirty thermocouple	Clean and test with millivolt member; replace as necessary
	b. Faulty or dirty safety pilot switch	
	c. Failed ECO device	
	6. Faulty thermostat	Replace thermostat in accordance with manufacturer's instructions
	7. Faulty valve	Replace valve or magnetic head
	8. High gas pressure	Adjust supply pressure (refer to **Manifold Gas Pressure Measurement and Adjustment** section)
	9. Activated blocked vent switch	Correct venting problem and reset switch
E. No heat (heater operating)	1. Dirty filter(s) in blower system	Clean or replace filter(s)
	2. Incorrect manifold pressure or orifices	Check manifold pressure (refer to **Manifold Gas Pressure Measurement and Adjustment** section)
	3. Cycling on limit control	Check air throughput (refer to **Duct Furnace Airflow** section)
	4. Improper thermostat location or adjustment	See thermostat manufacturer's instructions
	5. Belt slipping on blower	Adjust belt tension
F. Cold air delivered at startup or during operation	1. Fan control improperly wired	Ensure that all wiring connections are in accordance with wiring diagram provided with unit
	2. Defective fan control	Replace fan control
	3. Incorrect manifold pressure	Check manifold pressure (refer to **Manifold Gas Pressure Measurement and Adjustment** section)
	4. Blower set for too low temperature rise	Slow down blower or increase static pressure
*Units manufactured ***before*** OCT 2003.		

INSTALLATION RECORD (TO BE COMPLETED BY INSTALLER)

For service or repair, contact the Installer. For additional assistance, contact the Distributor. For more information, contact your Factory Representative.

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

For more information on Reznor HVAC products:

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

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