



Model FT Gas-Fired, Power-Vented Unit Heaters

REZNOR *Thomas & Betts*

INSTALLATION FORM RZ 433 (Version G)
Obsoletes Form RGM 433 (Version F)

APPLIES TO: Installation/Operation/Service

Models FT 30, 45, and 60 are certified for residential and commercial/industrial installations.
Models FT 75-300 are certified for commercial/industrial installations.

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REFERENCE: Replacement Parts, Form RZ 728
Gas Conversion Form, RZ 432/433-GC

FOR YOUR SAFETY

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.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call your fire department.

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

FOR YOUR SAFETY

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

HAZARD INTENSITY LEVELS

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

General

Installation should be done by a qualified agency in accordance with the instructions in this manual and in compliance with all codes and requirements of authorities having jurisdiction. The instructions in this manual apply to the unit heater model shown below.



Model	Type	Fuel	Vent	Air Delivery
FT	Indoor, Suspended Unit Heater	Gas-Fired	Power	Propeller Fan

IMPORTANT: If your heater Model No. has a suffix -LN or -CV, do not use the venting instructions in this manual. Follow the instructions in Form RZ-433-CV/LN to install a Model FT30-CV, FT45-CV, or FT45-LN heater.

General (Cont'd)

Model FT heaters are design-certified by the Canadian Standards Association (CSA) to ANSI Z83.8a and CGA 2.6a for industrial/commercial installations in the United States and Canada. Models FT 30, 45 and 60 are approved by the Canadian Standards Association to IAS 10-96 for residential installations in both the United States and Canada. All heaters are available for use with either natural or propane gas. The type of gas, the firing rate, and the electrical characteristics are on the unit rating plate.

WARNING: Gas-fired appliances are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, in atmospheres containing chlorinated or halogenated hydrocarbons, or in applications with airborne silicone substances. See Hazard Levels, Page 1.

WARNING: Should overheating occur, or the gas supply fail to shut off, shut off the manual gas valve to the appliance before shutting off the electrical supply.

WARNING: Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and replace any gas control which has been under water.

1. Installation Codes

These units must be installed in accordance with local building codes. In the absence of local codes, in the United States, the unit must be installed in accordance with the National Fuel Gas Code (latest edition). A Canadian installation must be in accordance with the CAN/CGA B149.1 and B149.2 Installation Code for Gas Burning Appliances and Equipment. These codes are available from CSA Information Services, 1-800-463-6727. Local authorities having jurisdiction should be consulted before installation is made to verify local codes and installation procedure requirements.

Special Commercial Installations (Aircraft Hangars/Repair Garages/Parking Garages)

Installations in aircraft hangars should be in accordance with ANSI/NFPA No. 409 (latest edition), Standard for Aircraft Hangars; in public garages in accordance with ANSI/NFPA No. 88A (latest edition), Standard for Parking Structures; and for repair garages in accordance with ANSI/NFPA No. 88B (latest edition), Standard for Repair Garages. ANSI/NFPA-88 (latest edition) specifies overhead heaters must be installed at least eight 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 CAN/CGA B149 codes.

ANSI/NFPA 409 (latest edition) specifies a clearance of ten feet to the bottom of the heater from the highest surface of the top of the wing or engine enclosure of whatever aircraft would be the highest to be housed in the hangar, and a minimum clearance of eight feet from the floor in other sections of aircraft hangars, such as the offices, and shops which communicate with areas used for servicing or storage. The heaters must be located so as to be protected from damage by aircraft or other objects such as cranes and movable scaffolding. In addition, the heaters must be located so as to be accessible for servicing, adjustment, etc.

2. Warranty

Refer to the limited warranty information on the Warranty Card in the "Owner's Envelope".

Warranty is void if ...

- Wiring is not in accordance with the diagram furnished with the heater.
 - The unit is installed without proper clearance to combustible materials.
 - The heater is connected to a duct system or if the air delivery system is modified.
-

3. Uncrating and Preparation

This unit was test operated and inspected at the factory prior to crating and was in operating condition. If the heater has incurred any damage in shipment, file a claim with the transporting agency.

Check the rating plate for the gas specifications and electrical characteristics of the heater to be sure that they are compatible with the gas and electric supplies at the installation site.

Read this booklet and become familiar with the installation requirements of your particular heater. If you do not have knowledge of local requirements, check with the local gas company or any other local agencies who might have requirements concerning this installation.

Before beginning, make preparations for necessary supplies, tools, and manpower. If the installation includes optional vertical louvers or a downturn nozzle, install these options before the heater is suspended. Follow the instructions included in the option package; option packages are shipped separately.

4. High Altitude Operation

If the heater is being installed in an altitude above 2000 ft (610M), check the rating plate to determine what must be done to prepare the heater for high altitude operation.

NOTE: A heater equipped with a two-stage valve must be factory-built for high altitude installation.

Check the rating plate, determine which circumstance below applies, and follow the instructions.

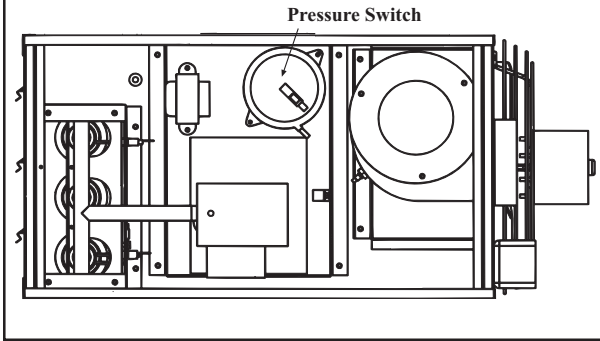
- If the altitude range on the rating plate **agrees with the altitude at the site**, no further action is required. Proceed with the installation.
- If the altitude range on the rating plate **reads "Sea Level" and the altitude at the site is between 2000 ft and 6000 ft (610M to 1830M) and the heater has a single-stage gas valve**, install the heater and follow the instructions in Paragraph 12 to derate by manifold gas pressure adjustment.
- If the altitude range on the rating plate **reads "Sea Level" and the altitude at the site is above 6000 ft (1830M) and the heater has a single-stage gas valve**, in addition to adjusting the manifold pressure, it will be necessary to replace the combustion air pressure switch. Order the appropriate switch from the list below and replace the switch before suspending the heater.

After the heater is installed, follow the instructions in Paragraph 12 to derate by adjusting the manifold gas pressure.

High Altitude Combustion Air Pressure Switches

FT	P/N	Description
30	164674	Blue Label, -.10", #PPS10027-2733
45-60	164675	Brown Label, -.17", #PPS10027-2734
75-200	149879	Orange Label, -.50", #PPS10027-2355
250-300	151372	White Label, -.74", #PPS10027-2406

Figure 1 - Pressure Switch Location (above 6000 ft, replace with a pressure switch set for high altitude operation)



5. Clearances and Combustion Air

Units must be installed so that the clearances in the table are provided for combustion air space, inspection and service, and for proper spacing from combustible construction.

Required Clearances - inches and millimeters						
Model Sizes	30, 45, 60, 75		100, 125, 150, 200		250, 300	
	inches	mm	inches	mm	inches	mm
Top	1	25	6	152	6	152
Flue Connector	6	152	6	152	6	152
Access Panel	18	457	24	610	24	610
Non-Access Side	1	25	6	152	6	152
Bottom	1	25	1	25	1	25
Rear	18	457	18	457	24	610

This fuel-burning heater must be supplied with the air that enters into the combustion process and is then vented to the outdoors. Sufficient air must enter the equipment location to replace that exhausted through the heater vent system. In the past, the infiltration of outside air assumed in heat loss calculations (one air change per hour) was assumed to be sufficient. However, current construction methods using more insulation, vapor barriers, tighter fitting and gasketed doors and windows, weather-stripping, and/or mechanical exhaust fans may now require the introduction of outside air through wall openings or ducts.

The requirements for combustion and ventilation air depend upon whether the unit is located in a confined or unconfined space. An "unconfined space" is defined as a space whose volume is not less than 50 cubic feet per 1000 BTUH of the installed appliance. **Under all conditions**, enough air must be provided to ensure there will not be a negative pressure condition within the equipment room or space. For specific requirements for confined space installation, see Paragraph 6.

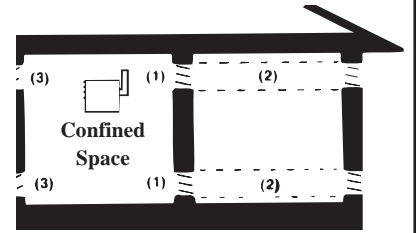
WARNING: These power-vented unit heaters are designed to take combustion air from the space in which the unit is installed and are not designed for connection to outside combustion air intake ducts. Connecting outside air ducts voids the warranty and could cause hazardous operation. See Hazard Levels, Page 1.

6. Combustion Air Requirements for a Heater Located in a Confined Space

Do not install a unit in a confined space without providing wall openings leading to and from the space. Provide openings near the floor and ceiling for ventilation and air for combustion as shown in Figure 2, depending on the combustion air source as noted in Items 1, 2, and 3 below.

Add total BTUH of all appliances in the confined space and divide by figures below for square inch free area size of each (top and bottom) opening.

Figure 2 - Confined Space: A space whose volume is less than 50 cubic feet per 1000 BTUH of the installed appliance input rating



1. Air from inside the building -- openings 1 square inch free area per 1000 BTUH. Never less than 100 square inches free area for each opening. See (1) in Figure 2.

2. Air from outside through duct -- openings 1 square inch free area per 2000 BTUH. See (2) in Figure 2.

3. Air direct from outside -- openings 1 square inch free area per 4000 BTUH. See (3) in Figure 2.

NOTE: For further details on supplying combustion air to a confined space, see the National Fuel Gas Code ANSI Z223.1a (latest edition).

7. Unit Heater Location

Suspend the heater so that it is a minimum of five feet (1.5M) above the floor. Other clearances are listed in Paragraph 5.

WARNING: If touched, the vent pipe and certain internal heater surfaces that are accessible from outside the heater will cause burns. Suspend the heater a minimum of 5' (1.5M) above the floor.

For best results, the heater should be placed with certain rules in mind. In general, a unit should be located from 8 to 12 feet (2.4-3.7M) above the floor. Units should always be arranged to blow toward or along exposed wall surfaces, if possible. Where two or more units are installed in the same room, a general scheme of air circulation should be maintained for best results.

Suspended heaters are most effective when located as close to the working zone as possible, and this fact should be kept in mind when determining the mounting heights to be used. However, care should be exercised to avoid directing the discharged air directly on the room occupants.

Partitions, columns, counters, or other obstructions should be taken into consideration when locating the unit heater so that a minimum quantity of airflow will be deflected by such obstacles.

When units are located in the center of the space to be heated, the air should be discharged toward the exposed walls. In large areas, units should be located to discharge air along exposed walls with extra units provided to discharge air in toward the center of the area.

At those points where infiltration of cold air is excessive, such as at entrance doors and shipping doors, it is desirable to locate the unit so that it will discharge directly toward the source of cold air from a distance of 15 to 20 feet (4.6-6.1M).

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

8. Left Side Controls

All units are factory built with controls on the right side (as viewed when facing the heater discharge). If the installation location requires that the controls be on the left side, follow the steps below to change the control side.

- 1. Turn the heater over (180°).** Turn so that the sides are opposite but the front and rear remain the same. (Notice that the "bottom" panel, which is now on the top of the heater, has four suspension holes.)
- 2. Reverse the Louver Position** -- Remove the screws holding the louver frame. Turn the louver assembly (180°). Reinstall the assembly so that the louvers will direct the air downward with the heater in its new position.
- 3. Sizes 60, 75, 100, 125, 150, 200, 250 and 300; Move the Ignitor** -- Remove the control access panel. On the side of the burner rack, remove the screws holding the spark ignitor and the flame sensor. Interchange the locations of the ignitor and the flame sensor so that the ignitor will be toward the bottom of the burner rack. **IMPORTANT: The brown ground wire must stay with the spark ignitor.**
- 4.** Turn the access panel so that the labels are in an upright position. Re-attach the panel (NOTE: Illustrations of the control section, except for the location of the ignitor and the flame sensor on Sizes 60-300, will appear to be upside down.)

9. Suspending the Heater

Before suspending the heater, check the supporting structure to be used to verify that it has sufficient load-carrying capacity to support the weight of the unit.

Net Weight										
Size	30	45	60	75	100	125	150	200	250	300
lbs	60	66	84	90	140	145	205	215	258	280
kg	27	30	38	41	64	66	93	98	117	127

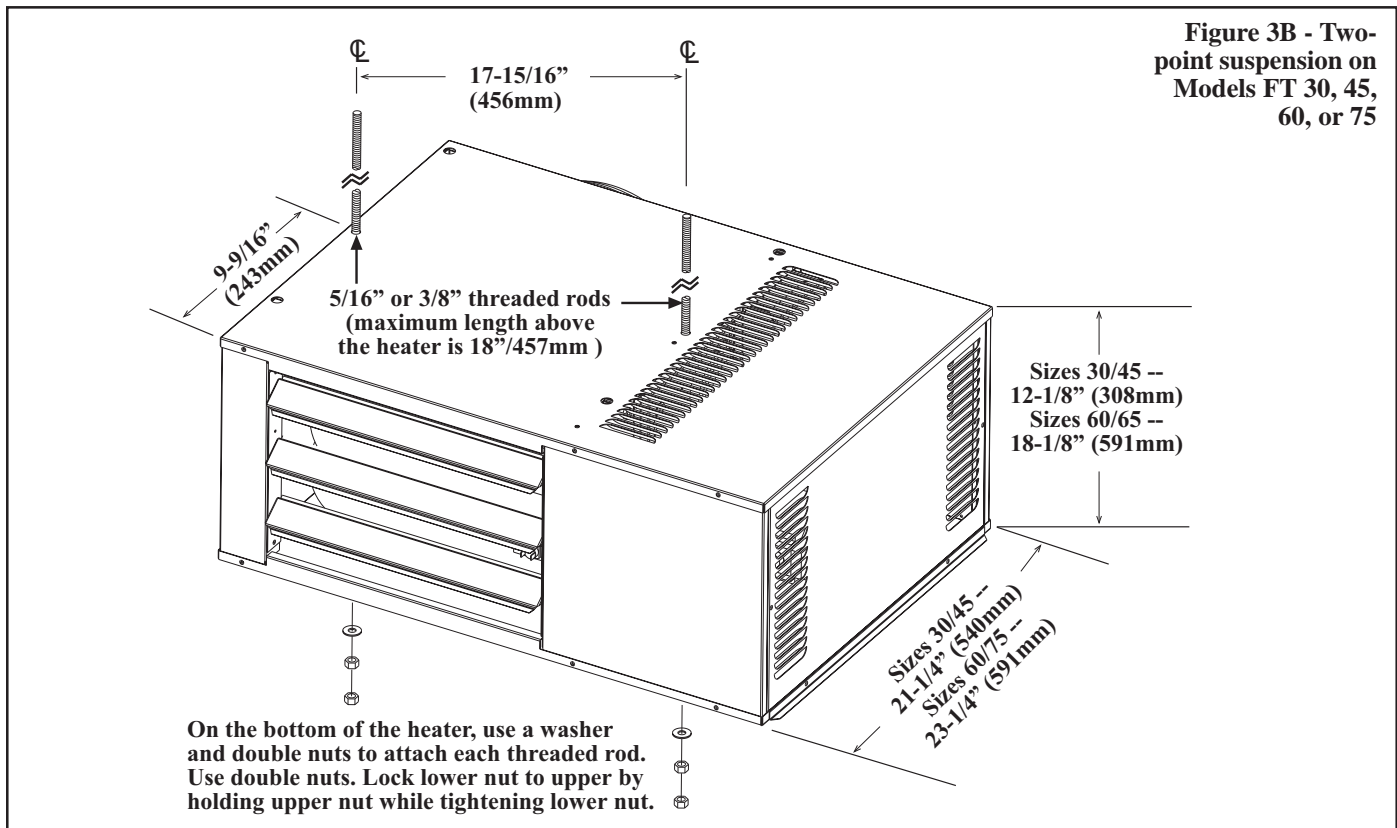
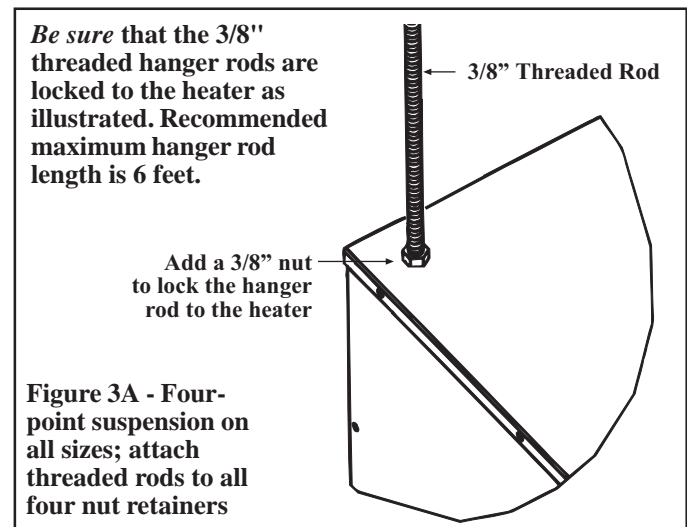
When the heater is lifted for suspension, support the bottom of the heater with plywood or other appropriately placed material. If the bottom is not supported, damage could occur.

The heater is equipped with four-point suspension. Two 3/8"-16 threaded nut retainers are located on each side of the heater. See Dimensions in Paragraph 8 and illustration in Figure 4.

Sizes 30, 45, 60 and 75 may be installed using two-point suspension. Follow the illustrated instructions in Figure 3B.

WARNING: Suspend the heater only from the threaded nut retainers. Do not suspend from the heater cabinet panels.

WARNING: Unit must be level for proper operation. Do not place or add additional weight to the suspended heater. Hazard Levels, page 1.

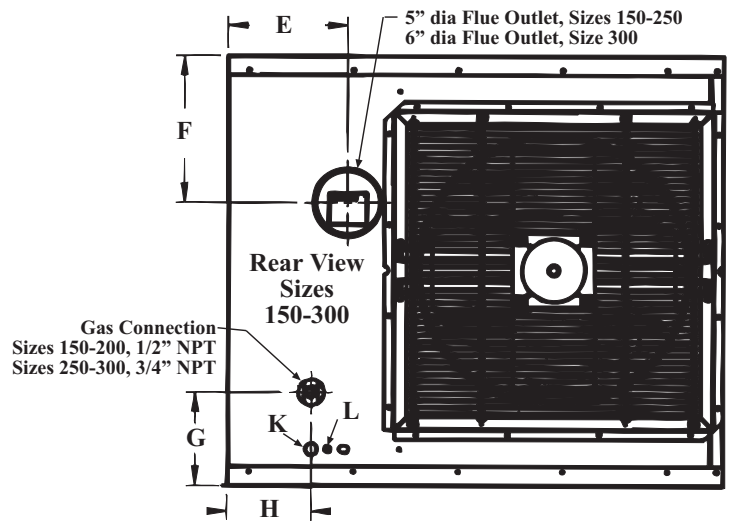
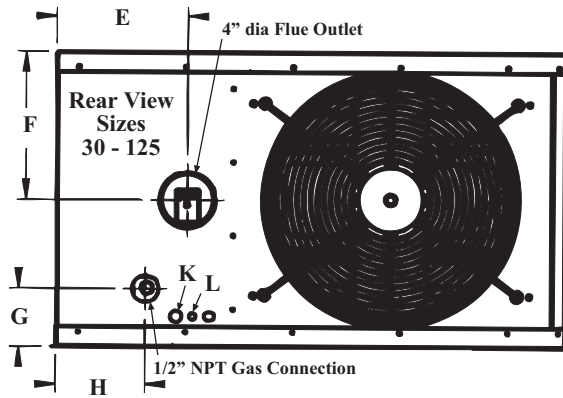
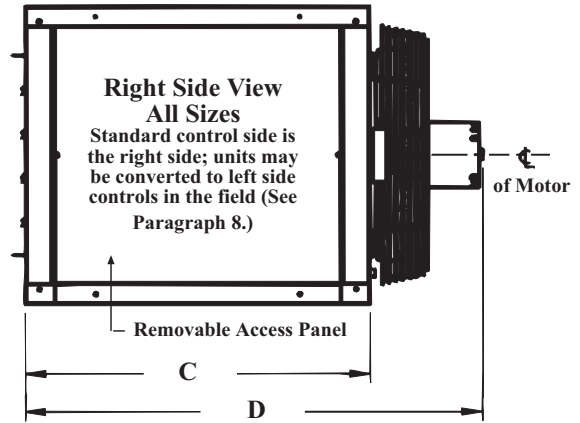
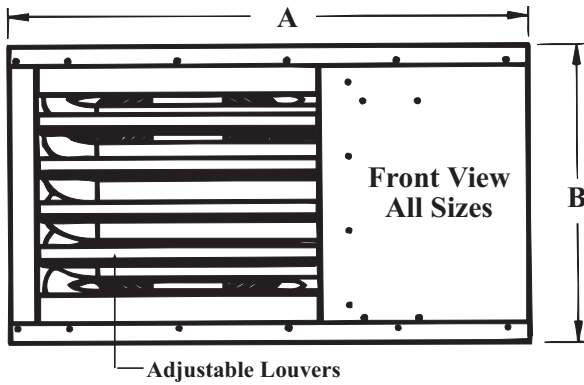


10. Dimensions

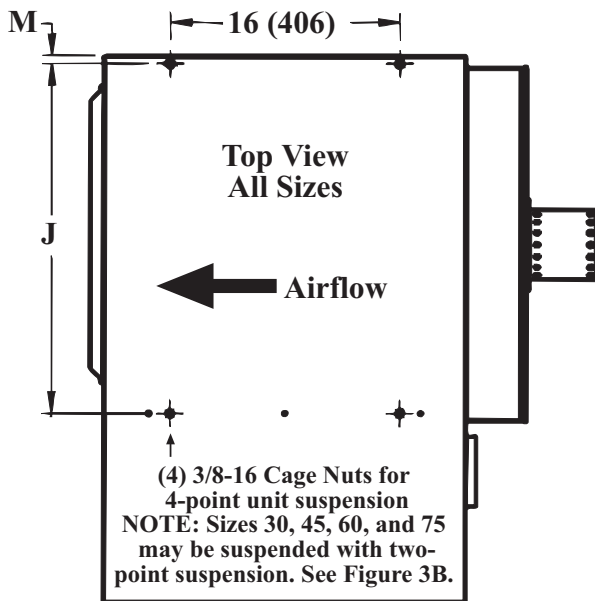
Model FT Dimensions (inches and mm)

Figure 4

NOTE: Composite drawings are not proportional for all sizes.



Field Wiring	K = 115V/60Hz/1Ph
Connections	L = Thermostat Wires (24V)



Dimensions (inches)

Size	30	45	60,75	100,125	150,200	250,300
A	28-5/8	28-5/8	28-5/8	38	38	50-1/8
B	12-1/8	12-1/8	18-1/8	22-1/16	33-1/16	33-1/16
C	21-1/4	21-1/4	23-1/4	25-5/16	25-5/16	25-5/16
D	25-9/16	26-3/16	31-3/8	33-9/16	34	35-3/8
E	6-9/16	6-9/16	6-9/16	9-3/4	6-3/16	8-3/16
F	5-13/16	5-13/16	8-3/4	11-1/8	11-3/8	11-3/8
G	4	4	4-1/4	4-3/8	7-1/8	7-1/8
H	3-1/16	3-1/16	3-1/16	6-11/16	6-1/2	4-15/16
J	17-15/16	17-15/16	17-15/16	24-1/4	24-1/4	29-3/8
M	9/16	9/16	9/16	9/16	9/16	8-1/2

Dimensions (mm)

Size	30	45	60,75	100,125	150,200	250,300
A	727	727	727	965	965	1273
B	308	308	460	560	840	840
C	540	540	591	643	643	643
D	649	665	797	852	864	899
E	167	167	167	248	233	208
F	148	148	222	283	289	289
G	102	102	108	111	181	181
H	78	78	78	170	165	125
J	456	456	456	616	616	746
M	14	14	14	14	14	216

11. Venting

DANGER: Check the Model No. on the rating plate. If there is a suffix -LN or -CV, DO NOT USE these venting instructions. Model FT heaters with either of these suffixes have special venting requirements; follow the instructions in Form RZ 433-CV/LN.

WARNING: Units installed in multiples require individual vent pipe runs and vent caps. Manifolding of vent runs is not permitted due to possible recirculation of combustion products into the building and possible back pressure effects on the combustion air proving switch.

Venting must be in accordance with the National Fuel Gas Code Z223.1 or CAN/CGA B149.1 and B149.2, Installation Code for Gas Burning Appliances and Equipment, and all local codes. Local requirements supersede national requirements.

These power-vented unit heaters are designed to operate safely and efficiently with either a horizontal or vertical vent. (Horizontal vent run is recommended for maximum fuel savings.) Comply with the specific requirements and instructions in the following paragraphs.

If this heater is replacing an existing heater, be sure that the vent is sized properly for the heater being installed. A properly sized vent system is required for safe operation of the heater. An improperly sized vent system can cause unsafe conditions and/or create condensation. Do not vent into an existing gravity vent or chimney.

Specific Venting Requirements (read all before installing)

1. Vent Pipe - The type of vent pipe required depends on the size of heater, the type of installation, and the vent configuration. Determine the vent pipe type from the table below.

Vent pipe diameters are listed in the Maximum Permissible Vent Length Table in No. 3. Select the vent pipe type and one of the flue pipe diameter(s) listed in the Table for the heater size being installed. If the vent being installed is a residential horizontal with Category I pipe, special vent pipe diameter and length requirements apply.

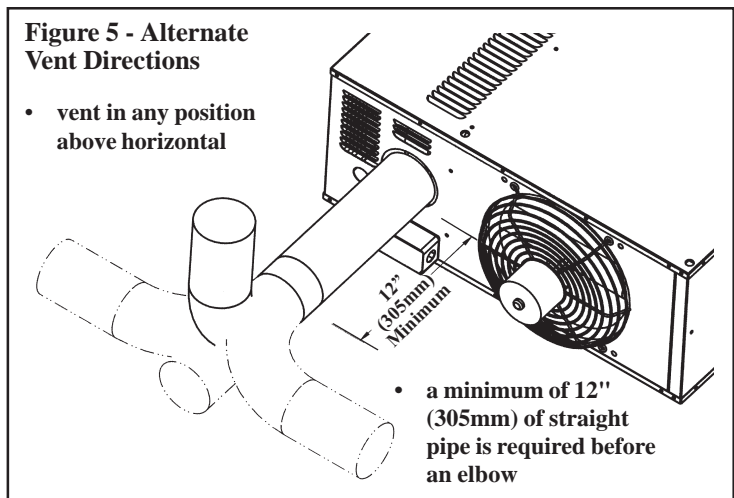
Type of Installation	Vent Configuration	Type of VENT Pipe Required
COMMERCIAL/ INDUSTRIAL (ANSI Z83.8 and CAN/C.G.A. 2.6) - Applies to all Sizes	Horizontal Vent	Use either vent pipe approved for a Category III appliance OR appropriately sealed 26-gauge galvanized steel or equivalent single-wall pipe. If local code requires, the terminal section may be double-wall pipe with a single-wall vent run.
	At least 1/2 of the equivalent vent length is Vertical	Vent pipe listed above for a horizontal power-vented system may be used, OR vent pipe approved for a Category I heater may be used. Single-wall pipe or double-wall (Type B) vent pipe are suitable for use with a Category I heater. If local code requires, the terminal section may be double-wall pipe with a single-wall vent run.
RESIDENTIAL (IAS Requirement 10-96) - Applies only to Sizes 30, 45 and 60	Horizontal or Vertical Vent	Use either vent pipe approved for a Category III appliance OR vent pipe approved for a Category I heater. Single-wall pipe or double-wall (Type B) vent pipe are suitable for use with a Category I heater. (Special vent pipe size and vent length requirements apply to a residential horizontal vent with Category I pipe.) If local code requires, the terminal section may be double-wall pipe with a single-wall vent run.

2. Venter (Flue) Outlet

Venter Outlet:	Model Size	30-125	150-250	300
	Outlet Diameter	4"	5"	6"

Venter Outlet Attachment Requirements:

- A 4" to 3" vent reducer is required whenever 3" diameter vent pipe is used on Sizes 30, 45, 60, or 75. See the Vent Length Table in Paragraph No. 3.
- A 4" to 5" vent increaser collar is required whenever 5" diameter vent pipe is used on Sizes 45 and 60. See the special venting requirements for a horizontal residential Category I vent in Paragraph No. 3.
- A minimum of 12" of straight pipe is required at the venter outlet before installing an elbow in the vent system. An elbow should never be attached directly to the venter. An elbow attached to the straight pipe can be in any position at or above horizontal. See Figure 5.



3. Vent Pipe Diameter and Vent Length

Comply with all requirements that apply. Use only one diameter of vent pipe on an installation. Minimum vent length is 5 feet.

Maximum Permissible Vent Lengths				
FT	Vent Pipe Diameter	Maximum Vent Length	Equivalent Straight Length*	
			90° Elbows	45° Elbows
(see NOTES and special requirements in the right column)				
30	3" or 4"	30 ft	5 ft	2.5 ft
		9 M	1.5M	.75M
45	3" or 4"	30 ft	5 ft	2.5 ft
		9 M	1.5M	.75M
60	3"	30 ft	5 ft	2.5 ft
		9 M	1.5M	.75M
	4"	40 ft	5 ft	2.5 ft
		12 M	1.5M	.75M
75	3"	30 ft	5 ft	2.5 ft
		9 M	1.5M	.75M
	4"	40 ft	5 ft	2.5 ft
		12 M	1.5M	.75M
100	4"	50 ft	5 ft	2.5 ft
		15 M	1.5M	.75M
125	4"	50 ft	5 ft	2.5 ft
		15 M	1.5M	.75M
150	5"	50 ft	5 ft	2.5 ft
		15 M	1.5M	.75M
200	5"	50 ft	5 ft	2.5 ft
		15 M	1.5M	.75M
250	5"	50 ft	5 ft	2.5 ft
		15 M	1.5M	.75M
300	6"	50 ft	5 ft	2.5 ft
		15 M	1.5M	.75M

*Reduce the maximum vent length by the amount indicated for each elbow used.

IMPORTANT Vent Length NOTES:

1) If the system contains all vertical pipe or a combination of horizontal and vertical vent pipe, the Maximum Permissible Vent Length in the Table may be increased one foot for each foot of vertical rise up to a maximum increase of ten feet.

2) If using vent pipe approved for a Category I appliance to install a horizontal vent on a residential application, the maximum horizontal length is five feet (1.5M). Do not include the elbow used to connect the horizontal section to the vertical section in the 5-foot limit. The vertical portion must be a minimum of 8". See Special Requirements below and Figure 6.

Special Vent Pipe Requirements for Residential Horizontal Vent System Using Category I Pipe (See Figure 6)

When installing pipe approved for a Category I heater in a residential horizontal vent system, it is necessary to use 4" pipe only on a Size 30 and 5" pipe only on Sizes 45 and 60. Sizes 45 and 60 will require an increaser collar at the venter outlet. The maximum horizontal vent length for a residential Category I vent is 5 ft (1.5M); see Figure 6.

Model FT Size	Vent Pipe Diameter	Venter Outlet Diameter	Field-supplied "increaser" collar required to connect pipe to venter outlet
30	4"	4"	No
45	5"	4"	Yes
60	5"	4"	Yes

Figure 6 - Horizontal Vent on a Residential Installation using Category I Vent Pipe

- Size 30 requires 4" diameter vent pipe
- Size 45 requires 5" diameter vent pipe
- Size 60 requires 5" diameter vent pipe
- Maximum horizontal vent length is 5' (1.5M)
- Minimum vertical vent length is 8" (203mm)
- Comply with clearances
- Drill the elbow as illustrated (single-wall pipe only)

Pitch horizontal pipe 1/4" per foot toward outlet for water drainage.

11. Venting Requirements (cont'd)

4. Vent System Joints - Vent system joints depend on the type of pipe being used (See "Vent Pipe" requirements, No.1).

- If using single wall, 26-gauge or heavier galvanized pipe, secure slip-fit connections using sheetmetal screws or rivets. Seal pipe joints either with tape suitable for 550°F (such as Option FA1, P/N 98266) or high-temperature silicone sealant.

If using single-wall pipe to install a horizontal vent on a residential application (Figure 6), make the elbow rigid by adding a light bead of silicone sealant to the full circumference of *all* elbow section joints.

- If using Category III vent pipe, follow the pipe manufacturer's instructions for joining pipe sections. When attaching Category III pipe to the venter outlet or the vent cap, make secure, sealed joints following a procedure that best suits the style of Category III pipe being used.

- If using double-wall (Type B) vent pipe, follow the pipe manufacturer's instructions for joining pipe sections.

For joining double-wall pipe to the venter outlet collar, increaser collar, single-wall pipe, and/or the vent cap, follow the "boxed" instructions below:

Instructions for attaching double-wall (Type B) vent pipe to the venter outlet, a single-wall pipe run, or to the vent cap (use these instructions for either full length double-wall or terminal only):

Hardware and Sealant Required: 3/4" long sheetmetal screws; and a tube of silicone sealant

1) Look for the "flow" arrow on the vent pipe; attach according to the arrow. Slide the pipe so that the venter outlet, the single-wall pipe, or the vent cap is inside the double-wall pipe.

2) Drill a hole through the pipe into the outlet collar, the single-wall pipe, or the vent cap. (Hole should be slightly smaller than the sheetmetal screw being used.) Using a 3/4" long sheetmetal screw, attach the pipe. Do not overtighten. Repeat, drilling and inserting two additional screws evenly spaced (120° apart) around the pipe.

3) Use sealant to seal any gaps. If there is an annular opening, run a large bead of sealant in the opening. The bead of sealant must be large enough to seal the opening, but it is not necessary to fill the full volume of the annular area.

5. Vent System Support - Lateral runs should be supported every six feet using a non-combustible material, such as strap steel or chain. Do not rely on the heater for support of either horizontal or vertical vent pipe.

6. Condensation - On Model Sizes 30 and 45 only, if a single-wall vent pipe run exceeds 15 feet (4.6 M) of straight length, it is recommended that the pipe be insulated along its entire length with a minimum of 1/2" foil-faced fiberglass, 1-1/2# density insulation rated for 250°F.

On all Model Sizes, any length of single-wall vent pipe exposed to cold air or run through an unheated area or an area with an ambient temperature of 45°F or less must be insulated along its entire length with a minimum of 1/2" foil-faced fiberglass, 1-1/2# density insulation. Model Sizes 30 and 45 require insulation rated for 250°F; Model Sizes 60-300 require insulation rated for 400°F.

Where extreme conditions are anticipated, install a means of condensate disposal.

7. Vent Terminal (Pipe and Vent Cap) - The vent system must be terminated with the type of vent cap approved for use with this heater. The vent cap must be the same size as the vent pipe (vent pipe is either 3", 4", 5" or 6" diameter). Heaters must be equipped with the heater manufacturer's vent cap, a Type L Breidert *Air-x-hauster*® vent cap, or equivalent. Use of a vent cap supplied by the pipe manufacturer is not permitted; the vent cap must be the type approved for use with this heater. A different style vent cap could cause nuisance problems or unsafe conditions.

See the illustrations in Figures 7A and 7B for requirements of vertical and horizontal vent termination. The vent terminal pipe may be either single-wall or double-wall (Type B). If double-wall pipe is used in the vent terminal with a single-wall vent run, follow the instructions in "Vent System Joints" (in the left column) to attach the vent cap and to connect the double-wall pipe to the single-wall vent pipe run.

Figure 7A - Vertical Vent Terminals

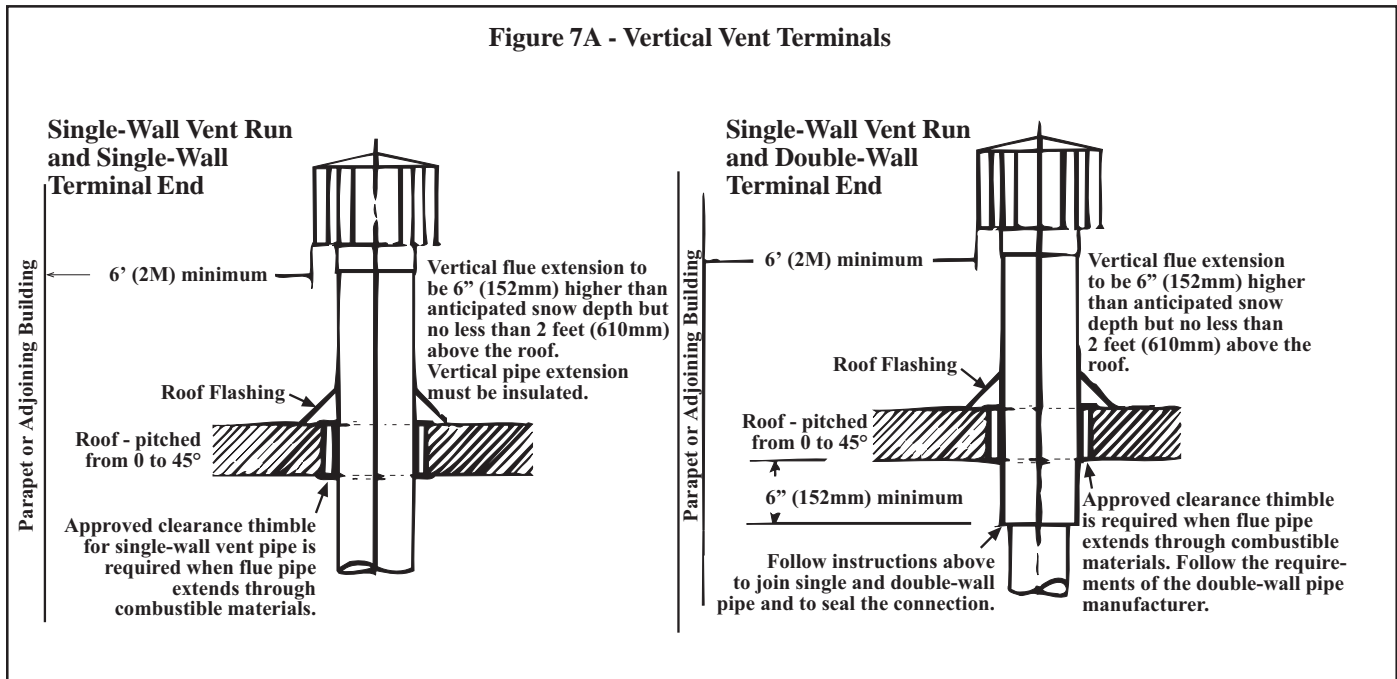
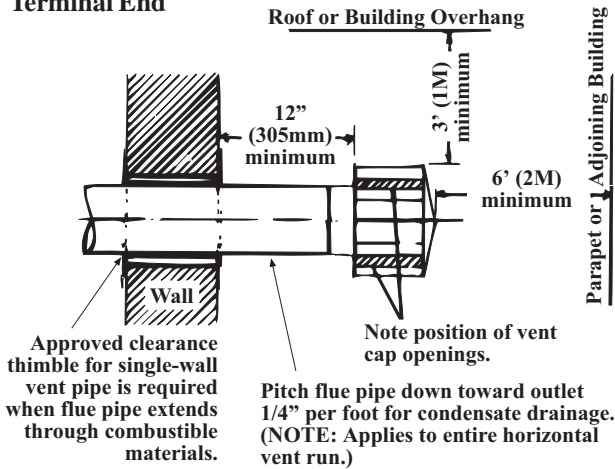
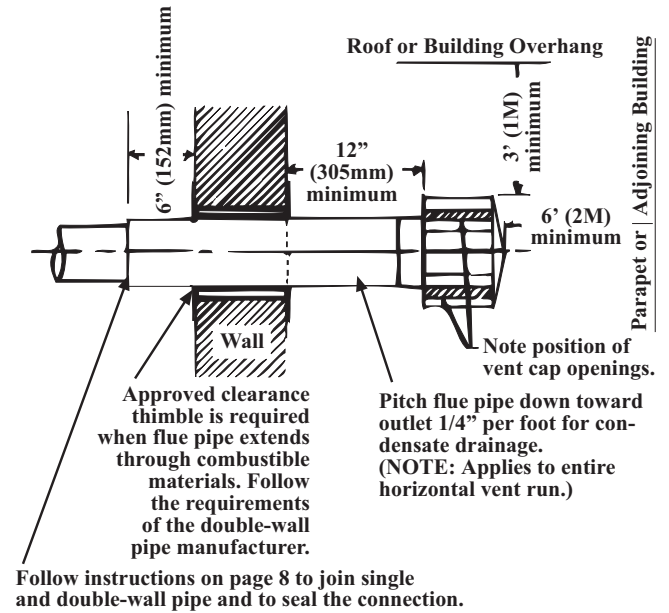


Figure 7B - Horizontal Vent Terminals

Single-Wall Vent Run and Single-Wall Terminal End



Single-Wall Vent Run and Double-Wall Terminal End



Horizontal Vent Terminal Clearances

A vent cap is required. Maintain a clearance of 12" (305mm) from the wall to the vent terminal cap for stability under wind conditions.

Products of combustion can cause discoloration of some building finishes and deterioration of masonry materials. Applying a clear silicone sealant that is normally used to protect concrete driveways can protect masonry materials. If discoloration is an esthetic problem, relocate the vent or install a vertical vent.

Structure	Minimum Clearances for Vent Termination Location (all directions unless specified)
Forced air inlet within 10 ft (3.1m)	3 ft (0.9m) above
Combustion air inlet of another appliance	6 ft (1.8m)
Door, window, or gravity air inlet (any building opening)	4 ft (1.2m) horizontally 4 ft (1.2m) below 1 ft (30cm) above
Electric meter, gas meter * and relief equipment	4 ft (1.2m) horizontally
Gas regulator *	3 ft (0.9m)
Adjoining building or parapet	6 ft (1.8m)
Adjacent public walkways	7 ft (2.1m) above
Grade (ground level)	7 ft (2.1m) above

*Do not terminate the vent directly above a gas meter or service regulator.

12. Gas Piping and Pressures

WARNING: This appliance is equipped for a maximum gas supply pressure of 1/2 pound, 8 ounces, or 14 inches water column. Supply pressure higher than 1/2 pound requires installation of an additional lockup-type service regulator external to the unit.

PRESSURE TESTING SUPPLY PIPING

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

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

All piping must be in accordance with requirements outlined in the National Fuel Gas Code ANSI/Z223.1a (latest edition) or CAN/CGA-B149.1 and B149.2 (See Paragraph 1). Gas supply piping installation should conform with good practice and with local codes. Support gas piping with pipe hangers, metal strapping, or other suitable material; do not rely on the heater to support the gas pipe.

Unit heaters are orificed for operation with natural gas having a heating value of 1000 (± 50) BTUH per cubic ft or propane gas with a heating value of 2550 BTUH per cubic ft. If the gas at the installation does not meet these specifications, consult the factory for proper orificing.

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

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

Gas connection is 1/2" for Sizes 30-200 and 3/4" for Sizes 250-300. Leak-test all connections by brushing on a leak-detecting solution.

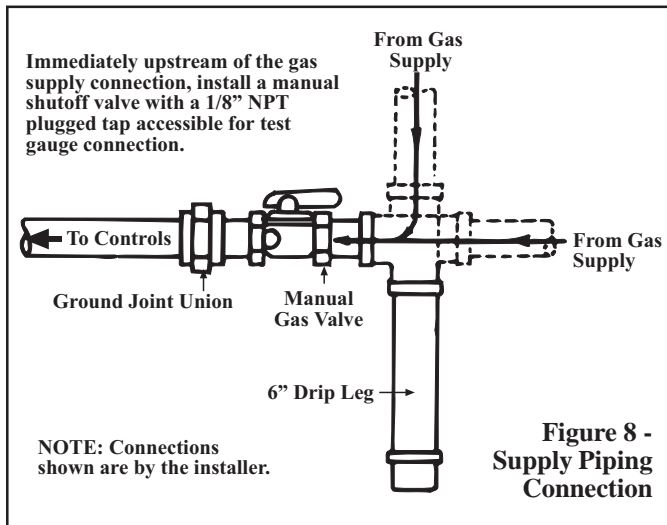
WARNING: All components of a gas supply system must be leak tested prior to placing equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME. Failure to comply could result in personal injury, property damage or death.

12. Gas Pressures (cont'd)

Sizing a Gas Supply Line

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

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



Manifold or Orifice Pressure Settings

Measuring manifold gas pressure cannot be done until the heater is in operation. It is included in the steps of the "Check-Test-Start" procedure in Paragraph 21. The following warnings and instructions apply.

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

For Natural Gas: When the heater leaves the factory, the combination gas valve is set so that the manifold gas pressure is regulated to 3.5" w.c. Inlet supply pressure to the valve for natural gas must be a minimum of 5" w.c. or as noted on the rating plate and a maximum of 14" w.c.

For Propane Gas: When the heater leaves the factory, the combination gas valve is set so that the manifold gas pressure is regulated to 10" w.c. Inlet supply pressure to the valve for propane gas must be a minimum of 11" w.c. and a maximum of 14" w.c.

Before attempting to measure or adjust manifold gas pressure, the inlet supply pressure *must* be within the specified range both when the heater is in operation and on standby. Incorrect inlet pressure could cause excessive manifold gas pressure immediately or at some future time. If natural gas supply pressure is too high, install a regulator in the supply line before it reaches the heater. If natural gas supply pressure is too low, contact your gas supplier.

Instructions on How to Check Manifold Pressure (can only be done after heater is installed):

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

2) Open the valve and operate the heater. Measure the gas pressure to the manifold. Normally adjustments should not be necessary to the factory preset regulator.

If adjustment is necessary, set pressure to correct settings by turning the regulator screw IN (clockwise) to increase pressure. Turn regulator screw OUT (counterclockwise) to decrease pressure.

Derating by Manifold Pressure Adjustment for High Altitude Operation

If the heater is being installed above 2000 ft (610M) and it was determined in Paragraph 4 that derating by manifold pressure adjustment is permissible, follow the instructions below.

Instructions for Derating a Heater by Adjusting Manifold Pressure (The heater *must* have a single-stage gas valve and *must* be factory-equipped for sea level operation.)

1. Check the rating plate to be certain that the heater is equipped for sea level operation. *Do not attempt to derate by manifold gas pressure adjustment if the heater is factory equipped for high altitude. Do not attempt to adjust manifold pressure on heaters equipped with two stage gas valves.*

2. Determine the required manifold pressure for the elevation where the heater will be operating. If unsure of the elevation, contact the local gas supplier.

Manifold Pressure Settings by Elevation

Altitude		Natural Gas	Propane Gas
Feet	Meters	(inches W.C.)	(inches W.C.)
0- 2000	1-610	3.5	10.0
2001-3000	911-915	2.8	7.7
3001-4000	916-1220	2.5	7.1
4001-5000	1221-1525	2.3	6.4
5001-6000	1526-1830	2.1	5.8
6001-7000	1831-2135	1.9	5.2
7001-8000	2136-2440	1.7	4.6
8001-9000	2441-2745	1.5	4.1

- With the manual valve positioned to prevent flow to the main burners, connect a manometer to the 1/8" pipe outlet pressure tap in the valve. Use a water column manometer that is readable to the nearest tenth of an inch.
- Remove the cap from the pressure adjusting screw and adjust the manifold pressure to the pressure setting selected from the table. Cycle the main burners once or twice to properly seat the adjustment spring in the valve.

Re-check the pressure. If necessary, re-adjust the pressure. When the pressure is correct, remove the manometer and replace the cap. Check for leaks at the pressure tap fitting.

- With the heater operating determine that the inlet pressure to the heater for natural gas is between 5 and 13.5 in. w.c. and for propane between 10 and 13.5 in. w.c. Take this reading as close as possible to heater (Most heaters are now equipped with gas valves that have an inlet pressure tap.) *If the inlet pressure is not within the specified range, the inlet pressure must be corrected and Steps 3 and 4 repeated.*
- If altitude is above 6000 ft (1830M), verify that the pressure switch has been changed.

High Altitude Combustion Air Pressure Switches

FT	P/N	Description
30	164674	Blue Label, -.10", #PPS10027-2733
45-60	164675	Brown Label, -.17", #PPS10027-2734
75-200	149879	Orange Label, -.50", #PPS10027-2355
250-300	151372	White Label, -.74", #PPS10027-2406

- Find the Manifold Pressure Adjustment label in the plastic bag that contained these instructions. Using a permanent marker, fill-in the pressure setting. Adhere the label on the heater near the gas valve so that it is conspicuous to someone servicing the valve.

13. Electrical Supply and Connections

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

Check the rating plate on the heater for the supply voltage and current requirements. A dedicated line voltage supply with fused disconnect switch should be run directly from the main electrical panel to the heater. All external wiring must be within approved conduit and have a minimum temperature rise of 60°C. Conduit from the disconnect switch must be run so as not to interfere with the service panels of the heater. The electrical supply and control wiring enter at the rear of the heater and connect to the integrated circuit board. The 115 volt supply wiring connects to pigtails on the lower portion of the circuit board. The terminal strip for 24 volt thermostat connections is located on the upper portion of the circuit board. See Figure 9.

CAUTION: Route the wires so that they do not contact the flue wrapper or venter housing.

Consult the wiring diagram supplied with your heater. A typical wiring diagram is on page 12.

CAUTION: If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C, except for limit control and sensor lead wires which must be 150°C. See Hazard Levels, page 1.

14. Thermostat and Connections

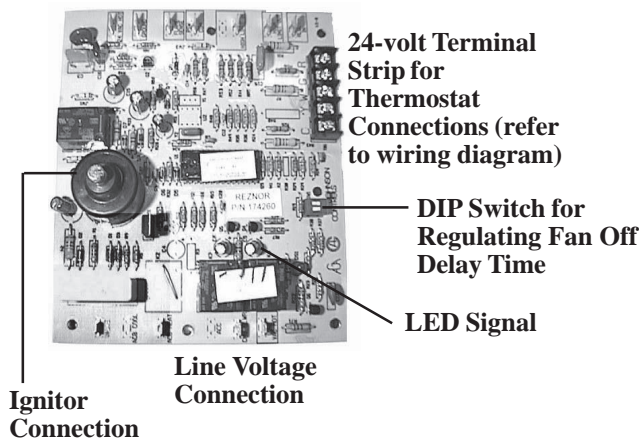
A thermostat is not standard equipment but is an installation requirement. Use either an optional thermostat available with the heater or a field-supplied 24-volt thermostat. Install according to the thermostat manufacturer's instructions, paying particular attention to the requirements regarding the location of the thermostat.

Make sure that the heat anticipator setting on the thermostat is 0.6 amps (or in accordance with the amperage value noted on the wiring diagram of your heater).

15. Fan Motor

The fan motor is equipped with thermal overload protection of the automatic reset type. Should the motor refuse to run, it may be because of improper current characteristics. Make certain that the correct voltage is available at the motor.

Figure 9 - Electrical Connections, DIP Switch Settings, and LED Signal Codes on the Integrated Circuit Board in the Control Compartment



DIP Switch Settings		
SW1		Fan Delay to Off
1	2	
OFF	OFF	90 seconds
OFF*	ON*	120 seconds*
ON	OFF	180 seconds
ON	ON	240 seconds

*Standard factory setting.

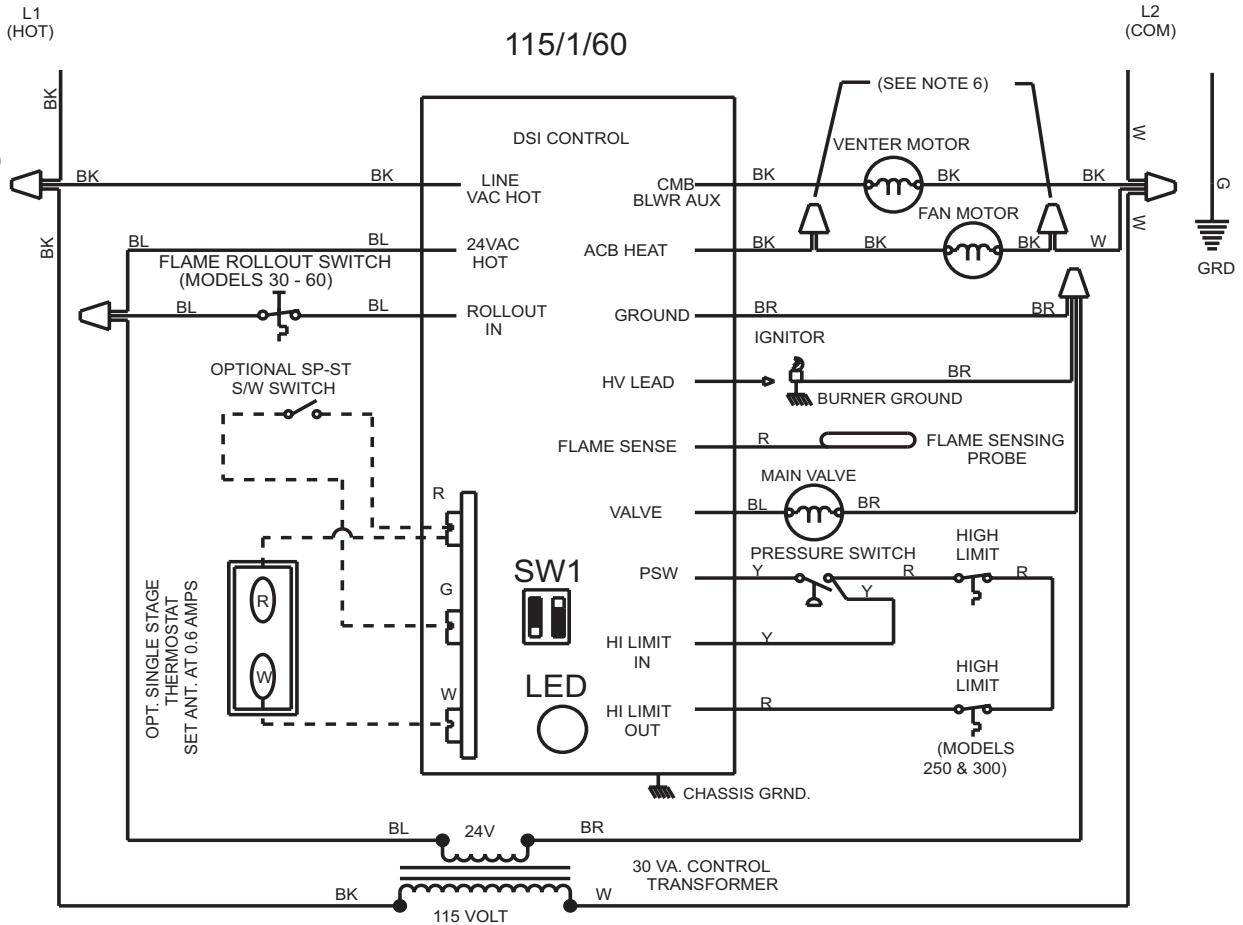
Circuit Board LED Flash Codes

- Slow Flash** Normal Operation, No Call for Heat
- Fast Flash** Normal Operation, Call for Heat
- 2 Flashes** System Lockout, Failed to Detect or Sustain Flame
- 3 Flashes** Pressure Switch Open or Closed
- 4 Flashes** High Limit or Flame Rollout Switch Open
- 5 Flashes** Flame Sensed and Gas Valve Not Energized
- Steady On** Internal Failure - Replace the Circuit Board

TYPICAL WIRING DIAGRAM

Fan-Type, Power-Vented Model with Direct Spark Ignition, Single-Stage Heating, Natural or Propane Gas

Figure 10 -
Wiring
Diagram
#147203 for
Model FT,
Sizes 30 - 300



OPERATING SEQUENCE

1. SET THERMOSTAT AT LOWEST SETTING.
2. TURN ON MANUAL GAS VALVE.
3. TURN ON POWER TO UNIT.
4. SET THERMOSTAT AT DESIRED SETTING.
5. THERMOSTAT CALLS FOR HEAT, ENERGIZING THE VENTER MOTOR.
6. VENTER PRESSURE SWITCH CLOSSES, FIRING UNIT.
7. BURNER FLAME IS SENSED, AND IN 30 SECONDS THE FAN MOTOR IS ENERGIZED.
8. IF THE FLAME IS EXTINGUISHED DURING MAIN BURNER OPERATION, THE INTEGRATED CONTROL SYSTEM CLOSSES THE MAIN VALVE AND MUST BE RESET BY INTERRUPTING POWER TO THE CONTROL CIRCUIT (SEE LIGHTING INSTRUCTIONS).

WIRING CODE

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

NOTES

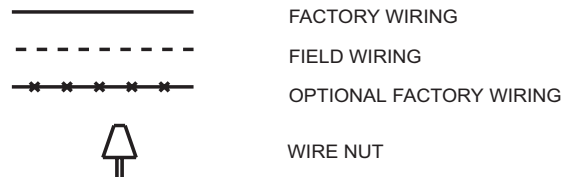
1. THE FOLLOWING CONTROLS ARE FIELD INSTALLED OPTIONS: THERMOSTAT
2. DOTTED WIRING INSTALLED BY OTHERS.
3. CAUTION: IF ANY OF THE ORIGINAL WIRING AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRING MATERIAL HAVING A TEMPERATURE RATING OF AT LEAST 105°C. EXCEPT FOR SENSOR LEAD WIRE AND LIMIT WIRING WHICH MUST BE 150°C.
4. USE 18 GA. WIRE FOR ALL WIRING ON THE UNIT.
5. LINE AND FAN MOTOR BRANCH WIRE SIZES SHOULD BE OF A SIZE TO PREVENT VOLTAGE DROPS BEYOND 5% OF SUPPLY LINE VOLTAGE.
6. THESE WIRE NUTS ARE NOT USED ON ALL MODELS.

DIP SWITCH SETTINGS

SW1		FAN DELAY TO OFF
1	2	
OFF	OFF	90 SECONDS
OFF	ON	120 SECONDS (FACTORY SETTING)
ON	OFF	180 SECONDS
ON	ON	240 SECONDS

LED CODES

- SLOW FLASH NORMAL OPERATION - NO CALL FOR HEAT
- FAST FLASH NORMAL OPERATION - CALL FOR HEAT
- 2 FLASHES SYSTEM LOCKOUT - FAILED TO DETECT OR SUSTAIN FLAME
- 3 FLASHES PRESSURE SWITCH OPEN OR CLOSED
- 4 FLASHES OPEN CIRCUIT TO HIGH LIMIT OR FLAME ROLLOUT TERMINAL
- 5 FLASHES FLAME SENSED AND GAS VALVE NOT ENERGIZED
- STEADY ON INTERNAL FAILURE (MICRO-CONTROLLER FAILURE: SELF CHECK)



FIELD CONTROL WIRING

TOTAL WIRE LENGTH	DISTANCE FROM UNIT TO CONTROL	MIN. RECOMMENDED WIRE GAUGE
150'	75'	#18 GA. WIRE
250'	125'	#16 GA. WIRE
350'	175'	#14 GA. WIRE

REZNOR
FT SERIES

W.D. 147203 REV. #6

16. Combustion Air Proving Switch

The combustion air proving switch is a pressure sensitive switch that monitors air pressure to ensure that proper combustion air flow is available. The switch is a single pole - normally open - device which closes when a decreasing pressure is sensed in the venter housing.

On start-up when the heater is cold, the sensing pressure is at the most negative level, and as the heater and flue system warm up, the sensing pressure becomes less negative. After the system has reached equilibrium (about 20 minutes), the sensing pressure levels off.

If a restriction or excessive flue length or turns cause the sensing pressure to be outside the switch setpoint, the pressure switch will function to shut off the main burners. The main burners will remain off until the system has cooled and/or the flue system resistance is reduced. The Table below lists the approximate water column negative pressure readings and switch setpoints for sea level operating conditions.

Model Sizes		Start-Up Cold	Equilibrium	Set Point "OFF"	Set Point "ON"
30	Units mfgd prior to 11/97	-1.2	-0.70	-0.55	-0.65
45	(verify on rating plate; 11/97	-1.2	-0.70	-0.55	-0.65
60	is Serial No. Date Code AWK)	-1.2	-0.75	-0.55	-0.65
30	Units mfgd beginning 11/97	-0.9	-0.60	-0.42	-0.52
45	(verify on rating plate; 11/97	-1.1	-0.67	-0.55	-0.65
60	is Serial No. Date Code AWK)	-1.1	-0.66	-0.50	-0.60
30	Units mfgd beginning 8/98	-1.4	-0.60	-0.15	-0.25
45	(verify on rating plate; 8/98	-1.1	-0.60	-0.22	-0.32
60	is Serial No. Date Code AXH)	-1.1	-0.63	-0.22	-0.32
75, 100, 125, 150, 200		-1.3	-0.78	-0.55	-0.65
250, 300		-1.4	-1.25	-0.80	-0.90

DANGER: Safe operation of this unit requires proper venting flow. NEVER bypass combustion air proving switch or attempt to operate the unit without the venter running and the proper flow in the vent system. Hazardous conditions could result. See Hazard Levels, page 1.

17. Gas Valve

The main operating gas valve is powered by the 24-volt control circuit through the thermostat and safety controls. The main control valve is of the diaphragm type providing regulated gas flow preset at the factory.

WARNING: The operating valve is the prime safety shutoff. All gas supply lines must be free of dirt or scale before connecting the unit to ensure positive closure. See Hazard Levels, page 1.

18. Ignition System

This heater is equipped with a direct spark integrated control system. The system monitors the safety devices and controls the operation of the fan and venter motors and the gas valve between heat cycles.

Ignition System Operating Sequence -- On a call for heat from the thermostat, the system energizes the venter motor and goes through a 10-second prepurge. The system verifies that both the pressure switch and the high limit are in the closed state. The gas valve is then energized and the ignition system provides the high voltage spark to the electrode to ignite the main burner gas. Burner flame is electronically sensed by the control upon carryover of all burners. (A separate solid metal probe is used as the flame sensing function. A low voltage electrical signal is imposed on the metal probe which is electrically isolated from ground. When the flame impinges on the flame sensing probe, the flame acts as a conduction path to ground. The flame rectifies and completes the DC circuit, and the ignition system acknowledges the flame.) The fan motor is energized by the system after 30 seconds of flame sensing.

After the thermostat has been satisfied, the system de-energizes the gas valve, the venter motor goes through a 45-second post-purge, and the fan motor remains energized for an additional 180 seconds.

NOTE: This is a three trial system, should the unit not sense burner flame, the unit will lockout for one hour before initiating another trial for ignition. To initiate another trial for ignition before the one hour, requires that either the thermostat be reset or the power to the unit be interrupted for 30 seconds.

19. Burners

This unit heater has inshot burners designed to provide controlled flame stability without lifting or flashback with either natural or propane gas. The burners are lightweight and factory mounted in an assembly which permits them to be removed as a unit for inspection or service.

20. Burner Air Restrictor

Sizes 250 and 300 burning propane gas are equipped with a two-piece burner air restrictor. The air restrictor is attached to the burner assembly and is not field adjustable.

21. Check Installation & Start-up

Check the installation prior to start-up:

- Check suspension. Unit must be secure and level.
- Check clearances from combustibles. Requirements are shown in Paragraph 6.
- Check vent system to be sure that it is installed according to the instructions in Paragraph 11.
- Check piping for leaks and proper gas line pressure. Bleed gas lines of trapped air. See Paragraph 12.
- Check electrical wiring. Be sure all wire gauges are as recommended. A service disconnect switch should be used. Verify that fusing or circuit breakers are adequate for the load use.

Heater Start-Up:

WARNINGS: For your safety, read before operating. If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

- This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

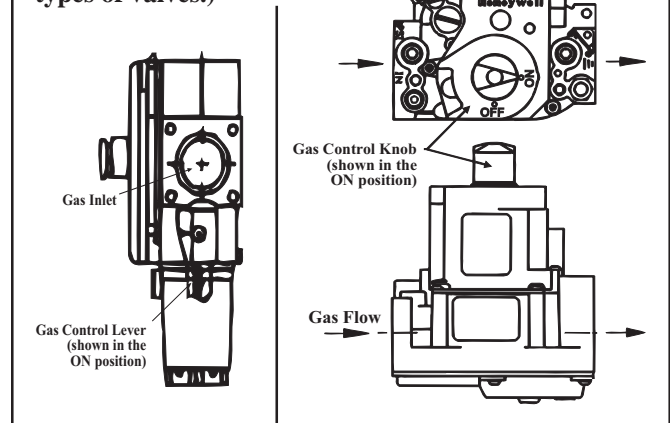
WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call your fire department.
- Use only your hand to turn the gas control ON/OFF knob or lever on the gas valve. Never use tools. If the valve ON/OFF knob or lever will not turn by hand, do not try to repair it. Call a qualified service technician. Force or attempted repair may result in a fire or explosion.
 - Should overheating occur, or the gas supply fail to shut off, turn off the manual gas valve to the appliance before shutting off the electrical supply.
 - Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

Operating Instructions and Operating Sequence

1. Set thermostat at lowest setting.
2. Turn off all electric power to the appliance.
3. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand. Open the access door and locate the gas control (ON/OFF) knob or lever on the gas valve. (See Figure 11.)
4. Turn the gas control knob or lever clockwise to "OFF".
5. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. **If you smell gas, STOP!** and follow the steps in the **WARNINGS** printed on the left or on the Operating Label on the heater. If you do not smell gas, proceed to the next step.

Figure 11 - Gas Valve (Depending on the size and date of manufacture, the heater could have either of these types of valves.)



6. Turn the gas control knob or lever counterclockwise to "ON".
 7. Close the access door.
 8. Turn on the electric power to the heater.
 9. Set the thermostat to the desired setting.
- NOTE:** If the appliance does not operate, follow the instructions "To Turn Off Gas to Appliance" printed below (and on the Operating Label on the heater) and call your service technician.
10. Thermostat calls for heat, energizing the venter motor.
 11. Venter pressure switch closes, firing the unit.
 12. Burner flame is sensed and in 30 seconds, the fan motor is energized.
 13. If the flame is extinguished during the main burner operation, the integrated control system closes the main valve and must be reset by interrupting power to the control circuit. (See lighting instructions on the heater.)

TO TURN OFF GAS TO THE APPLIANCE

- 1) Set thermostat to lowest setting
- 2) If service is to be performed, turn off all electric power to the appliance.
- 3) Open the access door.
- 4) Turn the gas control knob or lever clockwise to "OFF". Do not force.
- 5) Close the access door.

Check installation after start-up:

Vent System Testing Procedure

1. Seal any unused openings in the venting system.
 2. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, ANSI Z223.1 or CAN/CGA B149.1 and B149.2, Installation Code for Gas Burning Appliances and Equipment, and this manual. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
 3. In so far as practical, close all building doors and windows and all doors between the space where the heater is and other spaces of the building. Turn on clothes dryers and exhaust fans, such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
 4. Light the heater following the lighting instructions. Adjust the thermostat for continued operation. Verify that combustion products are venting properly. After determining that the heater vents properly, return doors, windows, exhaust fans, and fireplace dampers to their previous conditions. If improper venting is observed, the venting system must be corrected.
- With the unit in operation, measure manifold gas pressure. See Paragraph 12.
- Turn the unit off and on, pausing two minutes between each cycle. Observe for smooth ignition.
- Place the "Owner's Envelope" containing the Limited Warranty, this booklet, and any control or optional information in an accessible location near the heater. Follow the instructions on the envelope.

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

Always comply with the combustion air requirements in the installation codes and in Paragraphs 6 and 7. 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 Paragraph 7 of this heater installation manual. MAINTAIN THE VENT SYSTEM IN STRUCTURALLY SOUND AND PROPERLY OPERATING CONDITION.

MAINTENANCE AND SERVICE

WARNING: If you turn off the power supply, turn off the gas. See Hazard Levels, page 1.

The material contained in the MAINTENANCE AND SERVICE Section of this manual is designed to aid a qualified service person in maintaining and servicing this equipment. This unit will operate with a minimum of maintenance. To ensure long life and satisfactory performance, a heater that is operated under normal conditions should be inspected and cleaned at the start of each heating season. If the heater is operating in an area where an unusual amount of dust or soot or other impurities are present in the air, more frequent maintenance is recommended.

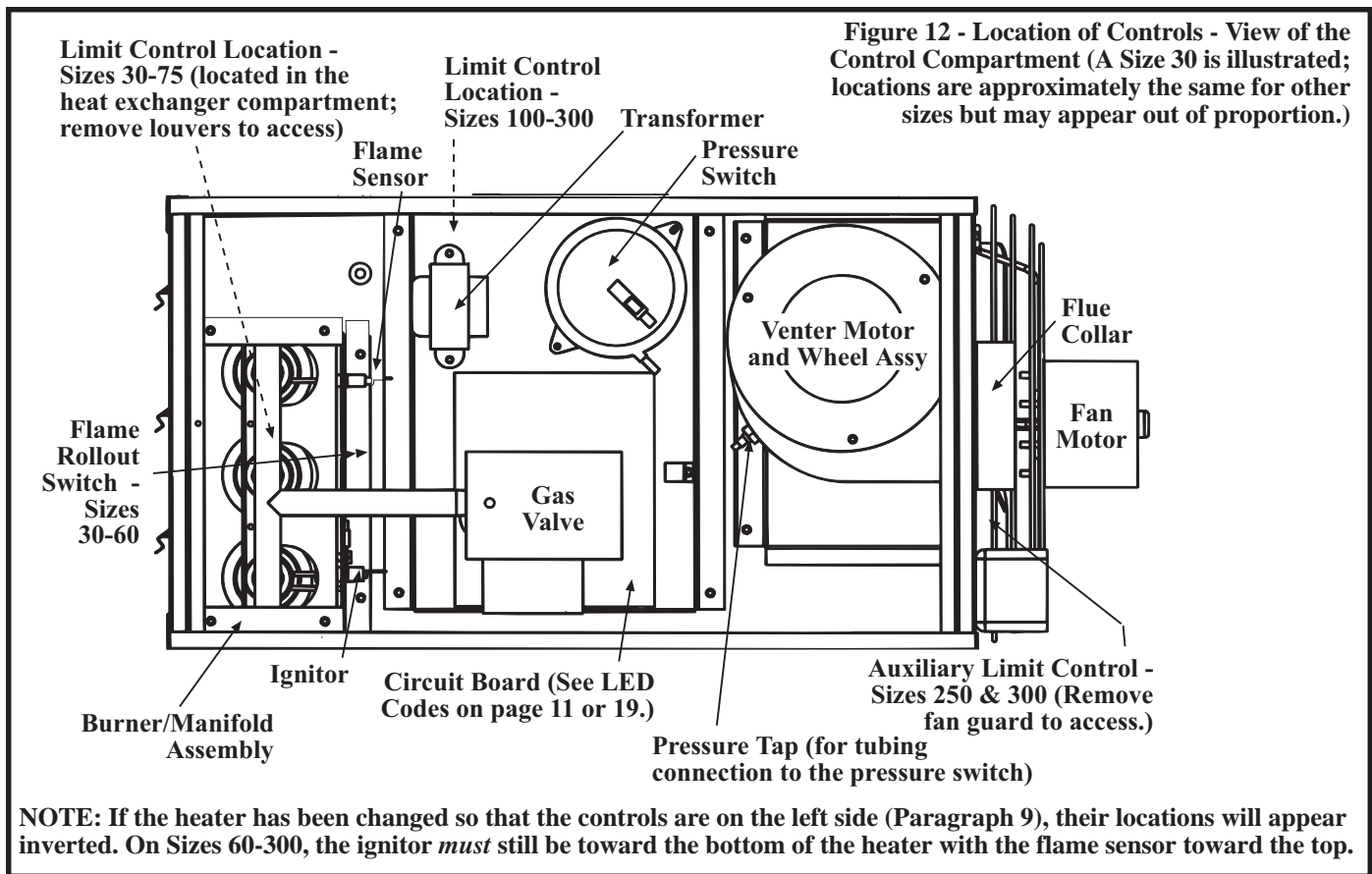
When any service is completed, be careful to reassemble correctly to ensure that no unsafe conditions are created. When re-lighting, always follow the lighting instructions on the heater.

WARNING: Excessive dirt buildup on and inside the burner ports could cause fuel gas to spill out of the back of the burner tube causing gas odor inside the building. If uncorrected, fuel spilling out of the back of the burner tube could cause a fire or explosion. To prevent fuel gas from spilling from the back of the burners, clean the burner ports at least annually.

Maintenance Schedule - The following procedures should be carried out at least annually (See Figure 12 and Paragraphs 22-32.):

- Clean all dirt and grease from the primary and secondary combustion air openings (vents in cabinet panels).
- Clean the fan blade, fan guard, and motor.
- Clean the heat exchanger both internally and externally.
- Check the burners for scale, dust, or lint accumulation.
- Check the vent system for soundness. Replace any parts that do not appear sound.
- Check the wiring for any damaged wire. Replace damaged wiring. (See Paragraph 13 for replacement wiring requirements.)

NOTE: Use only factory-authorized replacement parts.



22. Burner Removal

Instructions for Burner Removal (See Figure 12)

1. Shut the gas supply off ahead of the combination valve.
2. Turn off electric supply.
3. Remove the access panel; the vertical burner assembly is visible on the left side of the heater.
4. Open the union in the gas line before the gas valve.
5. Disconnect the flame sensor wire and the ignitor wire.
6. Remove the screws that attach the burner assembly to the front panel and inner wall. Pull the manifold/burner assembly out of the heater.

Clean the Burners (requires a wire brush, cleaning cloth, and an automotive type aerosol degreaser or refrigerant coil cleaner)

CAUTION: Use of eye protection is recommended.

Excessive dirt buildup on and inside the ports on the burner could cause fuel gas to spill out of the back of the burner tube. Fuel gas spilling out of the back of the burner tube will cause gas odor inside the building, and if not corrected, could eventually cause a fire/explosion hazard. To prevent fuel gas spilling from the back of the burners, clean the burner ports at least annually. Remove any soot deposits from the burner with a wire brush. Clean the ports with an aerosol degreaser and/or compressed air. Wipe the inside of the burner tube clean. (Cleaning the burner with an aerosol degreaser is highly recommended as the degreaser will retard future buildup of dirt.)

Inspect the cleaned burner for any damage or deterioration. If the burner has any damage or signs of deterioration, replace it.

Re-assemble the heater and test for proper operation.

23. Burner Orifices

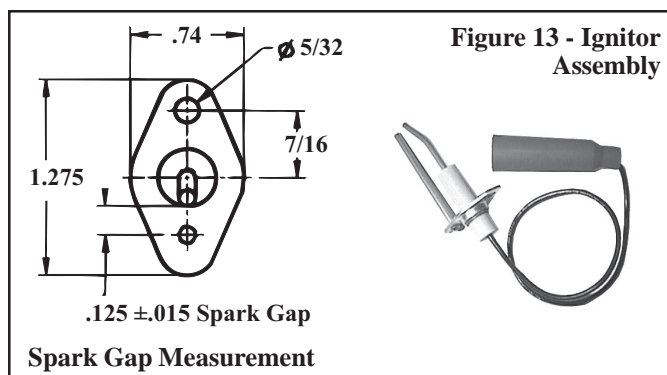
Heaters are shipped with orifices of proper size and type for gas and altitude specified on the order. When ordering replacement orifices, give BTUH content, specific gravity of gas, and altitude, as well as the model and serial number of the heater.

24. Ignition System

To access the ignition system, follow Steps 1-3 in Paragraph 22.

Ignitor - Refer to Figure 12 and locate the ignitor (on the side of the burner rack). Disconnect the wire; remove the screw and the ignitor. Clean the ignitor assembly with an emery cloth.

Spark gap must be maintained to 1/8". See Figure 13.



IMPORTANT: When re-assembling, the brown ground wire must remain attached to the ignitor.

CAUTION: Due to high voltage on the spark wire and electrode, do not touch when energized. See Hazard Levels, page 1.

Flame Sensor - Refer to Figure 12 and locate the flame sensor. Disconnect the wire; remove the screw and the flame sensor. Clean with an emery cloth.

Ignition Control - The integrated circuit board monitors the operation of the heater including ignition. Do not attempt to disassemble the circuit board. However, each heating season the lead wires should be checked for insulation deterioration and good connections.

Proper operation of the direct spark ignition system requires a minimum flame signal of 1.0 microamps as measured by a microammeter.

For further information and check out procedure on the direct spark ignition system, refer to the manufacturer's control operating instructions supplied with the heater.

25. Heat Exchanger

The outside of the tubular heat exchanger can be cleaned from the front of the heater with an air hose and/or a brush. Remove all accumulated dust and grease deposits.

CAUTION: Eye protection is recommended.

The inner surfaces of the heat exchanger can be reached for cleaning with the burner and venter assemblies removed (See Figure 12 and Paragraph 21). Clean with a long furnace brush or a heavy wire to which steel wool has been attached. Brush inside each heat exchanger tube until all foreign material is removed. A flashlight is helpful in examining the inside of the tubes.

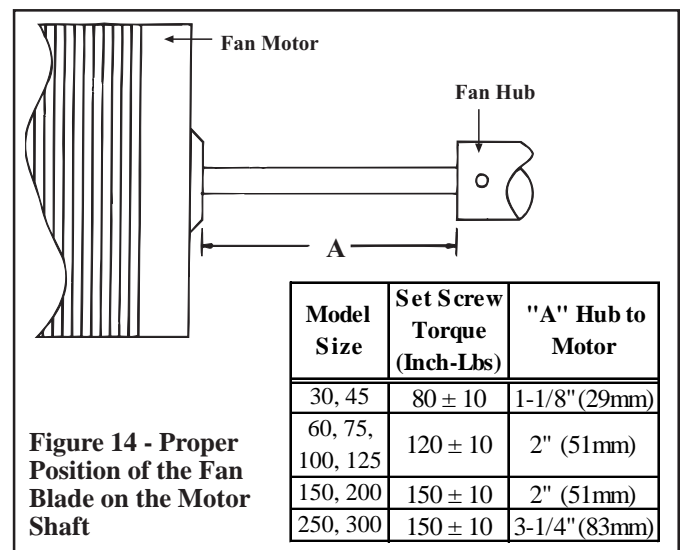
26. Fan

Remove dirt and grease from the motor. Remove dirt and grease from the fan guard and blades. Use care when cleaning the fan blades to prevent causing misalignment or imbalance. Check that the hub of the fan blades is secure to the shaft.

Follow these instructions for replacement of the fan guard, fan motor and/or fan blades.

1. If the heater is installed, turn off the gas and disconnect the electric power.
2. Remove the access panel or 2x4 junction box cover. Disconnect the fan motor wires.
3. Remove the assembled parts (the fan guard, the motor and the fan blade).
4. Disassemble and replace whatever parts are needed and reassemble using whatever part(s) are being replaced and the original parts. If the fan guard is being replaced, it is **important** that the same hardware be used for attaching the motor to the fan guard as was used with the original guard. These screws are especially made to cut through the coating on the fan guard to provide adequate grounding for the motor.

Be sure the fan blade is in the proper position on the shaft; refer to the illustration and table in Figure 14.



Position the assembly on the heater. Attach the fan guard. (**IMPORTANT:** If replacing the fan guard, use the screws that held the original fan guard. These specially designed screws will cut through the coating on the fan guard to provide a ground for the fan motor.)

Rotate the fan blade to check for adequate clearance. If adjustment is required, loosen the mounting screws, re-position the fan guard, and tighten the screws. Rotate the fan blade and re-check for adequate clearance. Repeat this procedure until the assembly is positioned properly.

5. Reconnect the fan motor wires and replace the access panel.
6. Restore power to the heater and turn on the gas. Light, following the instructions on the lighting instruction plate. Check for proper operation.

27. Venter Motor

Remove dirt and grease from the motor housing. Power venter motor is permanently lubricated.

The integrated circuit board controls and monitors operation of the venter motor. If the contacts fail to close the venter motor will not run. If the contacts fail to open, the venter motor will not shut off, preventing the combustion air pressure switch from opening.

28. Operating Gas Valve

The gas valve requires no field maintenance except careful removal of external dirt accumulation and checking of wiring connections. Instructions for testing pressure settings are in Paragraph 12.

WARNING: The operating valve is the prime safety shutoff. All gas supply lines must be free of dirt or scale before connecting to the unit to ensure positive closure. See Hazard Levels, page 1.

29. Limit Control

If it is determined that the limit control needs replacing, use only a factory-authorized replacement part that is designed for the size of heater. To access the limit control on Sizes 30-75, remove the louver assembly from the front of the heater. On Sizes 100-300, the limit control is accessible in the control compartment.

Sizes 250 and 300 have an auxiliary limit control. To access the additional limit on Size 250 and 300 heaters, remove the fan guard.

For approximate limit locations, see Figure 12, page 15.

30. Combustion Air Pressure Switch

See Figure 12, page 15, for location. If it is determined that the pressure switch needs replacing, use only the factory-authorized replacement part that is designed for the size of heater being serviced.

31. Flame Rollout Switch

Models FT 30, 45 and 60 are equipped with a flame rollout safety switch. The flame rollout switch is a temperature activated manually reset, limit switch. The switch is mounted on the side of the burner box in a location that senses temperature in a central horizontal location at the rear of the burner assembly.

If the flame rollout switch activates to shutdown the heater, the cause must be corrected.

If it is determined that the flame rollout switch needs replacing, use only the factory-authorized replacement part that is designed for use on this heater.

32. Vent System

Check the vent system at least once a year. Inspection should include all joints, seams, and the vent cap. Replace any defective parts.

33. Troubleshooting

Check the Circuit Board - The integrated circuit board monitors the operation of the heater and includes an LED signal that indicates normal operation and various abnormal conditions. If the heater fails to operate properly, check this signal to determine the cause and/or to eliminate certain causes.

Do not attempt to repair the integrated circuit board; it does not have any field replaceable components.

Circuit Board LED Codes

- Slow Flash Normal Operation, No call for heat
- Fast Flash Normal Operation, Call for heat
- 2 Flashes System Lockout, Failed to detect or sustain flame
- 3 Flashes Pressure Switch Open or Closed
- 4 Flashes High Limit or Flame Rollout Switch Open
- 5 Flashes Flame Sensed and Gas Valve not energized
- Steady On Internal Failure - Replace the circuit board

PROBLEM	PROBABLE CAUSE	REMEDY
Venter motor will not start	<ol style="list-style-type: none"> 1. No power to unit. 2. No 24 volt power to venter relay. 3. Integrated circuit board defective. 4. Defective motor. 	<ol style="list-style-type: none"> 1. Turn on power, check supply fuses or circuit breaker. 2. Turn up thermostat; check control transformer output. 3. Replace integrated circuit board. 4. Replace motor.
Burners will not light	<ol style="list-style-type: none"> 1. Manual valve not open. 2. Air in the gas line. 3. Gas pressure too high or too low. 4. No Spark: <ol style="list-style-type: none"> a) Loose wire connections b) Transformer failure c) Incorrect spark gap. d) Spark cable shorted to ground. e) Spark electrode shorted to ground f) Burners not grounded g) Circuit board not grounded. h) Faulty integrated circuit board 5. Lockout device interrupting control circuit by above causes. 6. Faulty combustion air proving switch. 7. Main valve not operating. <ol style="list-style-type: none"> a) Defective valve b) Loose wire connections 8. Integrated circuit board does not power main valve. <ol style="list-style-type: none"> a) Loose wire connections b) Flame sensor grounded c) Incorrect gas pressure d) Cracked ceramic at sensor 	<ol style="list-style-type: none"> 1. Open manual valve. 2. Bleed gas line. 3. Correct supply pressure is 5" - 14" w.c. for natural gas or 11" - 14" w.c. for propane gas. 4. <ol style="list-style-type: none"> a) Be certain all wire connections are solid. b) Be sure 24 volts is available. c) Maintain spark gap at 1/8". d) Replace worn or grounded spark cable. e) Replace if ceramic spark electrode is cracked or grounded. f) Make certain integrated circuit board is grounded to ignitor. g) Make certain integrated circuit board is grounded to furnace chassis. h) If 24 volt is available to the integrated circuit board and all other causes have been eliminated, replace board. 5. Reset lockout by interrupting control at the thermostat or main power. 6. Replace combustion air proving switch. 7. <ol style="list-style-type: none"> a) If 24 volt is measured at the valve connections and valve remains closed, replace valve. b) Check and tighten all wiring connections. 8. <ol style="list-style-type: none"> a) Check and tighten all wiring connections. b) Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required. c) Correct supply pressure is 5" - 14" w.c. for natural gas or 11" - 14" w.c. for propane gas. d) Replace sensor
Burners cycle on and off	<ol style="list-style-type: none"> 1. Gas pressure too high or too low. 2. Burners not grounded 3. Circuit board not grounded. 4. Faulty integrated circuit board 5. Faulty combustion air proving switch. 6. Flame sensor grounded 7. Cracked ceramic at sensor 	<ol style="list-style-type: none"> 1. Correct supply pressure is 5" - 14" w.c. for natural gas or 11" - 14" w.c. for propane gas. 2. Make certain integrated circuit board is grounded to ignitor. 3. Make certain integrated circuit board is grounded to furnace chassis. 4. If 24 volt is available to the integrated circuit board and all other causes have been eliminated, replace board. 5. Replace combustion air proving switch. 6. Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required. 7. Replace sensor

33. Troubleshooting (cont'd)

PROBLEM	PROBABLE CAUSE	REMEDY
No heat (Heater Operating)	<ol style="list-style-type: none"> 1. Incorrect manifold pressure or orifices. 2. Cycling on limit control. 3. Improper thermostat location or adjustment. 	<ol style="list-style-type: none"> 1. Check manifold pressure (See Paragraph 12). 2. Check air throughput. 3. See thermostat manufacturer's instructions.
Cold air delivered	<ol style="list-style-type: none"> 1. Incorrect manifold pressure. 	<ol style="list-style-type: none"> 1. Check manifold pressure (See Paragraph 12).
Motor will not run	<ol style="list-style-type: none"> 1. Circuit open. 2. Defective integrated circuit board. 3. Defective motor. 	<ol style="list-style-type: none"> 1. Check wiring and connections. 2. Replace board. 3. Replace motor.
Motor turns on & off while burner is operating (See below)	<ol style="list-style-type: none"> 1. Motor overload device cycling on and off. 	<ol style="list-style-type: none"> 1. Check motor load against motor rating plate. Replace motor if needed.
Fan motor cuts out on overload	<ol style="list-style-type: none"> 1. Low or high voltage supply . 2. Defective motor. 3. Poor air flow. 4. Defective bearing or lubrication. 	<ol style="list-style-type: none"> 1. Correct electric supply . 2. Replace motor. 3. Clean motor, fan and fan guard. 4. Lubricate bearings or replace motor.

FOR SERVICE OR REPAIR, FOLLOW THESE STEPS IN ORDER:

FIRST: **Contact the Installer**

Name _____

Address _____

Phone _____

SECOND: **Contact the nearest distributor** (See Yellow Pages). If no listing, contact Authorized Factory Representative, 1-800-695-1901 (Press 1).

THIRD: **Contact** REZNOR®/ Thomas & Betts Corporation
 150 McKinley Avenue
 Mercer, PA 16137
 Phone: (724) 662-4400

Model No. _____

Unit Serial No. _____

Date of Installation _____

