



REZNOR *Thomas & Betts*

Model FT30-CV and FT45-CV Gas-Fired, Fan-Assisted, Unit Heaters with Option AV6 (common venting) and Model FT45-LN with Option AL2B (classroom unit)

INSTALLATION FORM RGM 433-CV/LN (Version A)
Obsoletes RGM 433-CV/LN

APPLIES TO: Installation/Operation/Service

Models FT 30-CV, FT45-CV, and FT45-LN are certified for residential and commercial/industrial installations. These instructions apply *only* to Models FT30-CV and FT45-CV designed for common venting and Model FT45-LN designed for classroom application.

WARNING: DO NOT use these instructions when installing standardly equipped Model FT unit heaters. Check the Model No. on the rating plate to verify the -CV or -LN suffix.

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REFERENCES: Replacement Parts, Form RGM 728
Gas Conversion, Form RGM 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 *only* to the unit heater models *with the factory-installed options* shown below. **If the heater is not equipped with one of these options, do not use these instructions.**

Model	Equipped With	Type	Fuel	Vent	Air Delivery
FT 30-CV	Option AV6	Indoor, Suspended Unit Heater	Gas- Fired	Fan Assisted	Propeller Fan
FT 45-CV	Option AV6				
FT 45-LN	Option AL2B				

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 (2.4M) 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 (3.0M) 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 (2.4M) 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, install them before the heater is suspended. Follow the instructions included in the option package; option package is shipped separately.

4. High Altitude Operation

If the heater is being installed at an altitude between 2000 and 5000 ft (610 to 1525M), check the rating plate to determine what must be done to prepare the heater for high altitude operation.

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 5000 ft (610M to 1525M)**, install the heater and follow the instructions in Paragraph 12 to derate by manifold gas pressure adjustment.

NOTE: This heater is not designed for installation at an elevation above 5000 ft (1525M).

5. 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 7.

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 ft (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.

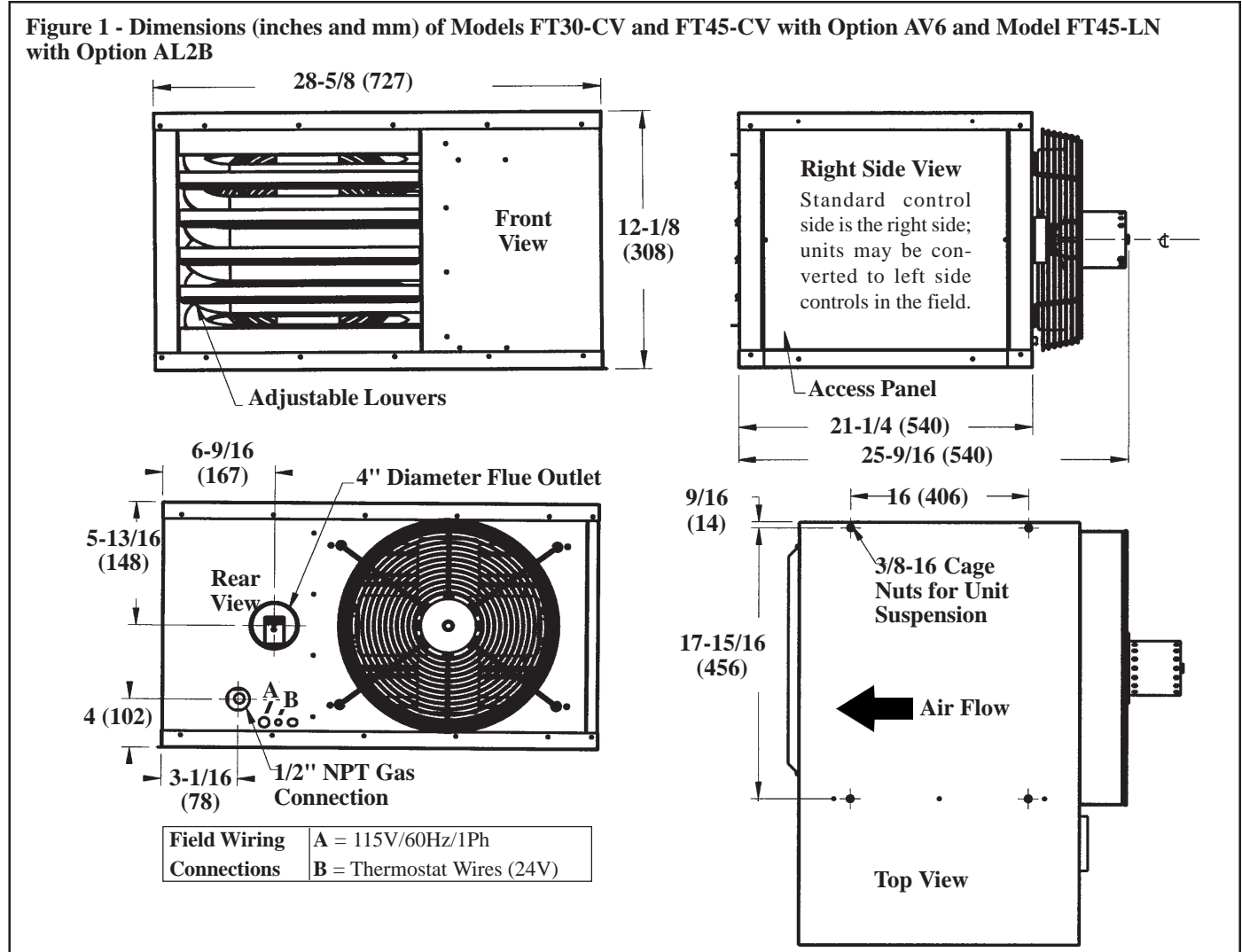
Partitions, columns, counters, or other obstructions should be taken into consideration when locating the unit heater so that a minimum quantity of airflow will be deflected by such obstacles.

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.

6. Dimensions



7. 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.

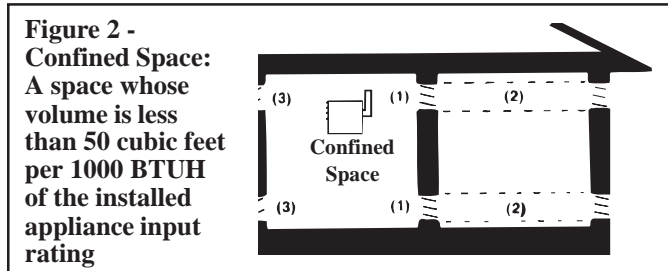
This fuel-burning heater must be supplied with the air that enters into the combustion process and is then vented to the outdoors. Sufficient air must enter the equipment location to replace that exhausted through the heater vent system. In the past, the infiltration of outside air assumed in heat loss 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 8.

WARNING: These fan-assisted 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.

8. 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.

- 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).

9. 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.
- Turn the access panel so that the labels are in an upright position. Re-attach the panel.

10. 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	lbs	kg
30	60	27
45	66	30

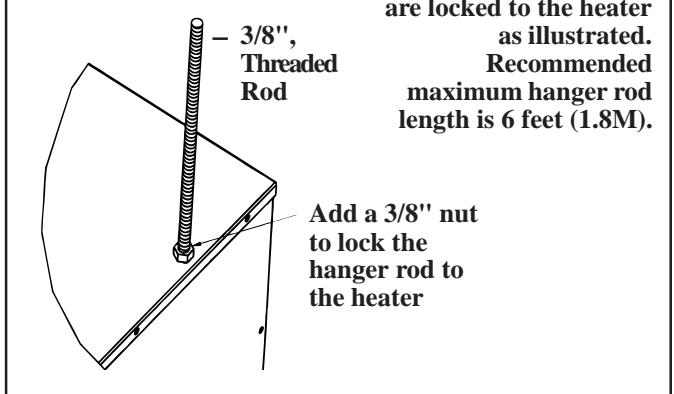
When the heater is lifted for suspension, support the bottom of the heater with plywood or other appropriately placed material. If the bottom is not supported, damage could occur.

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 6 and illustration in Figure 3.

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.

Figure 3 - Suspension



11. Venting

Venting must be in accordance with these instructions or 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.

Model FT30-**CV** and Model FT45-**CV** heaters and Model FT45-**LN** heater **require** a vertical vent. Common vertical venting is permitted when installed according to the instructions in Section 11B. Venting instructions are divided into two sections - Section 11A covers venting a heater as a single Category I appliance; Section 11B covers common venting with another Category I appliance. Select and follow the instructions in the section that apply to the application.

WARNING: Use only the venting instruction section that applies to the installation. Do not combine any requirements. Use these venting instructions only with Model FT heaters with -LN or -CV in the Model No.

11A. Requirements and Instructions when Venting as a Single Category I Appliance

A vertical vent is required; vent as a Category I appliance.

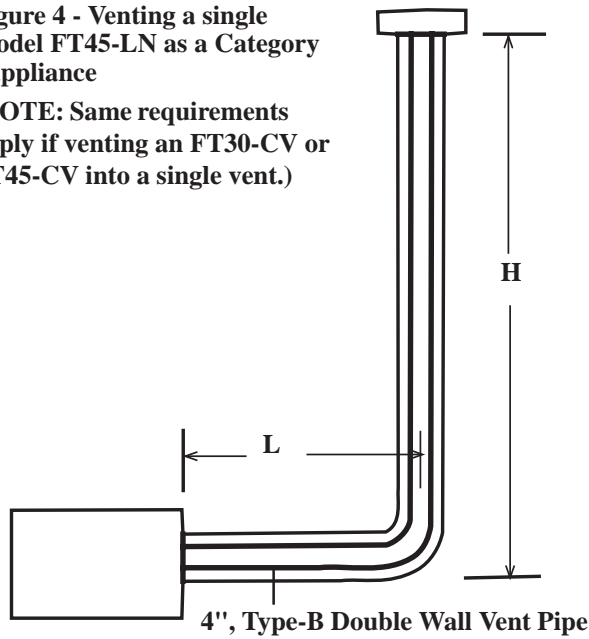
- Vent Pipe** - Use 4" Type-B double-wall vent pipe in the entire vent system.
- Vent Pipe Length/Height (See Figure 4)**

Model FT Size	Vertical Height (H)	Horizontal Vent Connector Length (L)
30 or 45	6 ft (1.8M)	0 - 6 ft (0 - 1.8M)
30 or 45	8 ft (2.4M)	0 - 8 ft (0 - 2.4M)
30 or 45	10 ft (3M)	0 - 10 ft (0 - 3M)
30	15 ft (4.6M)	0 - 5 ft (0 - 1.5M)
45	15 ft (4.6M)	0 - 15 ft (0 - 4.6M)
45	20 ft (6.1M)	0 - 10 ft (0 - 3M)
45	25 ft (7.6M)	0 - 5 ft (0 - 1.5M)

NOTE: The information in the table above is used by permission (1001-99-5) of the copyright holder, American Gas Association, all rights reserved.

Figure 4 - Venting a single Model FT45-LN as a Category I appliance

(NOTE: Same requirements apply if venting an FT30-CV or FT45-CV into a single vent.)



• Vent System Joints

Follow the pipe manufacturer's instructions for joining Type B double-wall vent pipe sections.

For joining the double-wall pipe to the heater outlet collar and the vent cap, follow the instructions below:

Instructions for attaching double-wall (Type B) vent pipe to the heater outlet

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 heater outlet is inside the double-wall pipe.
- 2) Drill a hole through the pipe into the outlet collar. (Hole should be slightly smaller than the sheet metal screw being used.) Using a 3/4" long sheet metal screw, attach the pipe. Do not overtighten. Repeat, drilling and inserting two additional screws evenly spaced (120° apart) around the pipe.
- 3) Use silicone 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.

• 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.

• Vent Terminal

The vent terminal should be a minimum of six feet (1.8M) from adjoining buildings. The vent terminal should be six inches higher than the anticipated snow depth but no less than two feet above the roof. Where the vent extends through the roof, a clearance thimble is required when the flue pipe extends through combustible materials; follow the requirements of the double-wall pipe manufacturer.

Terminate with a vent cap that meets the requirements of the double-wall pipe manufacturer.

11B. Requirements and Instructions for Common Venting (Refer to Figures 5A and 5B and Common Vent Tables 1-4)

DANGER: This heater is designed for a Category I common venting application. Common venting meaning when two or more Category I appliances are vented into a single vertical vent. The installer must comply with the venting requirements listed in this section. **DO NOT** install this heater with a horizontal vent. Verify that any appliances being commonly vented with this heater are designed for Category I common venting.

Common Venting Terms and Requirements

Common vents must be vertical. The common vertical portion may be either a Type B double-wall vent, a masonry chimney lined with a Type-B or listed liner, or an interior clay-tile-lined masonry chimney. These tables are for chimneys and vents not exposed to the outdoors below the roof line (a Type B vent or listed chimney lining system passing through an unused masonry chimney is not considered to be exposed to the outdoors). If using a clay-tile-lined exterior chimney, consult the National Fuel Gas Code (latest edition) for specific requirements.

The vent system may include combinations of vent connectors of different pipe sizes and either single-wall or double-wall metal pipe provided all of the appropriate tables permit all of the selected sizes and types of pipe. If both single-wall and double-wall pipe are used in vent connectors in the system, use the single-wall table to size the common vent. **Model FT heaters require double-wall pipe connectors.**

NOTE: The Common Vent Tables in this section are used by permission (1001-99-5) of the copyright holder, American Gas Association, all rights reserved. For larger vent sizes or information not provided here, consult the National Fuel Gas Code (latest edition).

■ Vent Connector

Definition - The individual length of vent pipe from the heater and other appliance (example: water heater) to the common vent

■ Vent Connector Rise

Definition - Vertical distance measurement from the heater or appliance outlet to the centerline where the vent gas streams come together (See Figures 7A and 7B).

Model FT-CV or -LN Vent Connector and Vent Connector Rise Requirements-

Pipe - Use 4" diameter, Type B double-wall pipe.

Length - Maximum horizontal length is 6 ft (1.8M).

Because Model FT requires a 4" double-wall vent connector, use the 4" Diameter/Fan Assist column in Table 1A if venting into a double-wall common vent or Table 3A if venting into a masonry chimney to determine permissible vent connector rise and vent length. (NOTE: The table for 4" double-wall vent connector does not show 30,000 BTU input for the shorter vent heights. For the Model FT30, use the "smallest" BTU listed, allowing for a maximum 1-ft connector rise.)

Other Category I Appliance(s) Vent Connector and Vent Connector Rise Requirements

- Select the table that matches the installation and determine the allowable vent connector size and rise. The maximum vent connector horizontal length in feet is 18" times the diameter in inches of the vent connector pipe, as follows:

11. Venting (cont'd)

11B. Requirements and Instructions for Common Venting (Refer to Figures 5A and 5B and Common Vent Tables 1-4) (cont'd)

■ Vent Connector Rise (cont'd)

Maximum Length of the Vent Connector of Other Category I Appliance

Connector Diameter	Maximum Horizontal Length
3"	4-1/2 ft (1.4M)
4"	6 ft (1.8M)
5"	7-1/2 ft (2.3M)
6"	9 ft (2.7M)
7"	10-1/2 ft (3.2M)
8"	12 ft (3.7M)
9"	13-1/2 ft (4.1M)
10"	15 ft (4.6M)

■ Common Vent

Definition - The vertical portion of a Type B double-wall vent or tile-lined masonry chimney into which two or more vent connectors attach

■ Common Vent Height

Definition - Vertical distance measurement from the highest draft-hood outlet or flue collar to the vent cap or chimney outlet of the common vent (See Figures 5A and 5B).

Add the BTUH's of the appliances and use the Common Vent Capacity Tables to determine permissible common vent size and height combination. If either of the connector vents in the system are single-wall vent pipe, use a single-wall vent pipe table.

Model FT-CV or FT-LN Common Vent Height Requirements

NOTE: Because Model FT-CV and -LN is fan assisted, the column Nat/Nat does not apply. Depending on the other appliance, use either Fan+Nat or Fan+Fan.

Type B Double-Wall Pipe - Depending on the type of vent connector, use Table 1B or Table 2B

Masonry Chimney lined with Type B or a Listed Liner (see note under table) - Depending on the type of vent connector, use Table 1B or Table 2B

Interior Tile-lined Masonry Chimney - Depending on the type of vent connector, use Table 3B or Table 4B

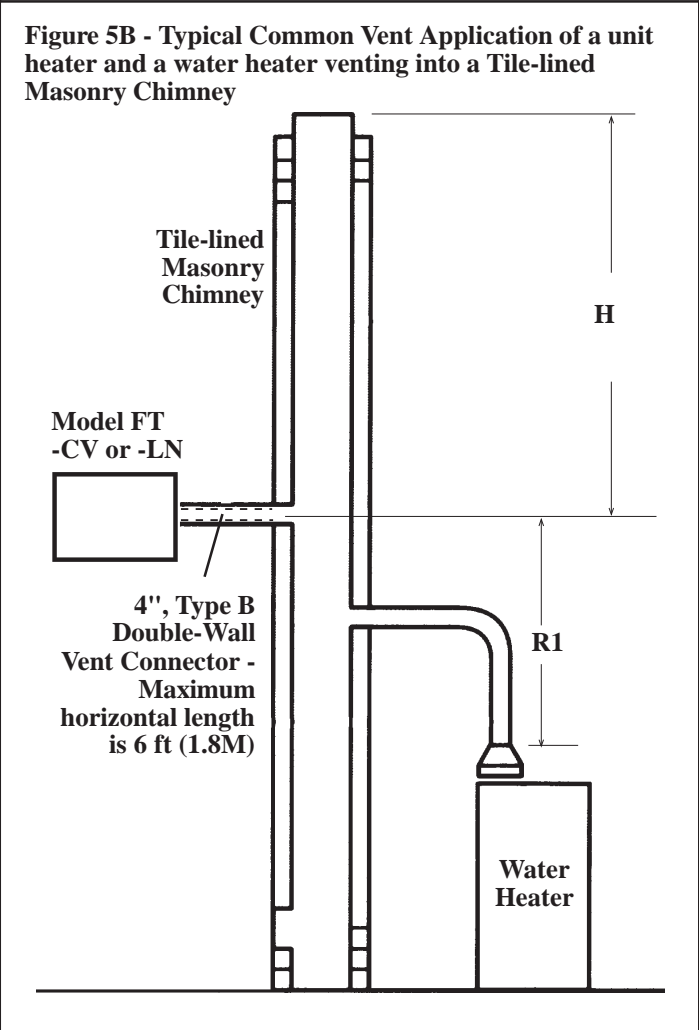
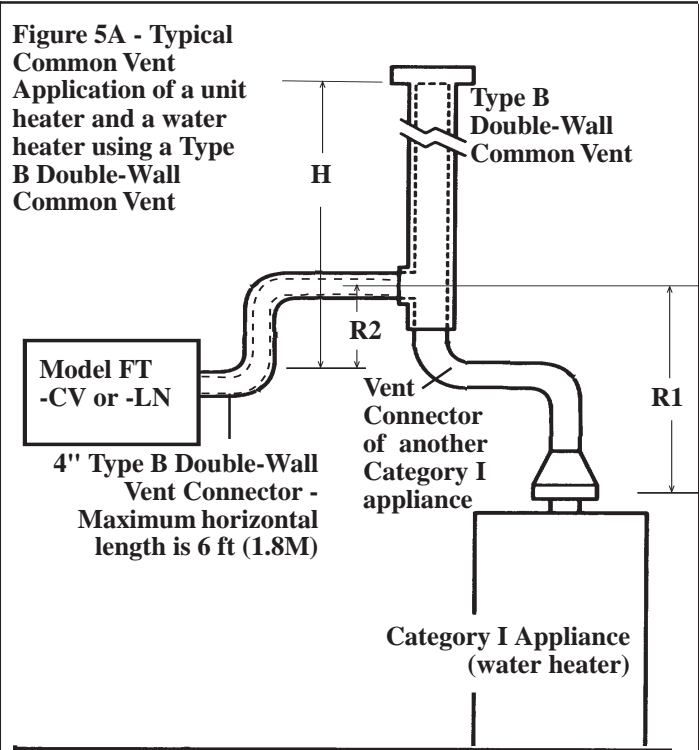
Key to Figures 5A and 5B AND/OR Tables (pages 7-10)

H (appears in illustrations and tables) = **Common Vent Height**
Definition - The common vent height is the vertical distance measurement from the highest draft-hood outlet or flue collar to the vent cap or chimney outlet of the common vent.

R (appears in tables only) = **Vent Connector Rise**
Definition - The vent connector rise is the vertical distance measurement from each heater or appliance outlet to the centerline where the vent gas streams come together.

R1 (appears in illustrations only) = **Vent Connector Rise (R above) of the Category I Appliance in Figures 5A and 5B** **IMPORTANT:** Be certain that the appliance being vented with the heater is one that is permissible for common Category I venting.

R2 (appears in illustrations only) = **Vent Connector Rise (R above) of Model FT30-CV, FT45-CV, or FT45-LN in Figures 5A and 5B** (NOTE: In Figure 5B, there is no R2 because the vent connector rise is zero.)



Common Venting Tables 1 and 2 Apply to Vertical Common Vents of Type B Double-Wall Pipe or a Masonry Chimney Lined with a Type B or Listed Liner (see Note)

NOTE: If a masonry chimney is lined with a listed *corrugated* metallic chimney liner system, size by using Table 1 or 2 for Type B vents with the maximum capacity reduced by 20% (.80 x maximum capacity) and the minimum capacity as listed.

Common Vent Tables 1A and 1B - Capacity of Type B Double-Wall Vents with Type B Double-Wall Connectors Serving Two or More Category I Appliances

NOTE: Category I appliance can be either Category I draft hood-equipped or fan-assisted type but must be approved for common venting.

Table 1A - Vent Connector Capacity

H - Vent Height (ft)	R - Vent Connector Rise (ft)	Type B Double Wall Vent and Connector																							
		3" Diameter		4" Diameter		5" Diameter		6" Diameter		7" Diameter		8" Diameter		9" Diameter		10" Diameter									
		Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat						
		Input Rating Limits in Thousands of BTUH																							
		Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max
6	1	22	37	26	35	66	46	46	106	72	58	164	104	77	225	142	92	296	185	109	376	237	128	466	289
	2	23	41	31	37	75	55	48	121	86	60	183	124	79	253	168	95	333	220	112	424	282	131	526	345
	3	24	44	35	38	81	62	49	132	96	62	199	139	82	275	189	97	363	248	114	463	317	134	575	386
8	1	22	40	27	35	72	48	49	114	76	64	176	109	84	243	148	100	320	194	118	408	248	138	507	303
	2	23	44	32	36	80	57	51	128	90	66	195	129	86	269	175	103	356	230	121	454	294	141	564	358
	3	24	47	36	37	87	64	53	139	101	67	210	145	88	290	198	105	384	258	123	492	330	143	612	402
10	1	22	43	28	34	78	50	49	123	78	65	189	113	89	257	154	106	341	200	125	436	257	146	542	314
	2	23	47	33	36	86	59	51	136	93	67	206	134	91	282	182	109	374	238	128	479	305	149	596	372
	3	24	50	37	37	92	67	52	146	104	69	220	150	94	303	205	111	402	268	131	515	342	152	642	417
15	1	21	50	30	33	89	53	47	142	83	64	220	120	88	298	163	110	389	214	134	493	273	162	609	333
	2	22	53	35	35	96	63	49	153	99	66	235	142	91	320	193	112	419	253	137	532	323	165	658	394
	3	24	55	40	36	102	71	51	163	111	68	248	160	93	339	218	115	445	286	140	565	365	167	700	444
20	1	21	54	31	33	99	56	46	157	87	62	246	125	86	334	171	107	436	224	131	552	285	158	681	347
	2	22	57	37	34	105	66	48	167	104	64	259	149	89	354	202	110	463	265	134	587	339	161	725	414
	3	23	60	42	35	110	74	50	176	116	66	271	168	91	371	228	113	486	300	137	618	383	164	764	466
30	1	20	62	33	31	113	59	45	181	93	60	288	134	83	391	182	103	512	238	125	649	365	151	802	372
	2	21	64	39	33	118	70	47	190	110	62	299	158	85	408	215	105	535	282	129	679	360	155	840	439
	3	22	66	44	34	123	79	48	198	124	64	309	178	88	423	242	108	555	317	132	706	405	158	874	494
50	1	19	71	36	30	133	64	43	216	101	57	349	145	78	477	197	97	627	257	120	797	330	144	984	403
	2	21	73	43	32	137	76	45	223	119	59	358	172	81	490	234	100	645	306	123	820	392	148	1014	478
	3	22	75	48	33	141	86	46	229	134	61	366	194	83	502	263	103	661	343	126	842	441	151	1043	538
100	1	18	82	37	28	158	66	40	262	104	53	442	150	73	611	204	91	810	266	112	1038	341	135	1285	417
	2	19	83	44	30	161	79	42	267	123	55	447	178	75	619	242	94	822	316	115	1054	405	139	1306	494
	3	20	84	50	31	163	89	44	272	138	57	452	200	78	627	272	97	834	355	118	1069	455	142	1327	555

Table 1B - Common Vent Capacity

H - Vent Height (ft)	4" Diameter Common Vent			5" Diameter Common Vent			6" Diameter Common Vent			7" Diameter Common Vent			8" Diameter Common Vent			9" Diameter Common Vent			10" Diameter Common Vent		
	Combined Input Rating of the Appliances in Thousands of BTUH																				
	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat
6	92	81	65	140	116	103	204	161	147	309	248	200	404	314	260	547	434	335	672	520	410
8	101	90	73	155	129	114	224	178	163	339	275	223	444	348	290	602	480	378	740	577	465
10	110	97	79	169	141	124	243	194	178	367	299	242	477	377	315	649	522	405	800	627	495
15	125	112	91	195	164	144	283	228	206	427	352	280	556	444	365	753	612	465	924	733	565
20	136	123	102	215	183	160	314	255	229	475	394	310	621	499	405	842	688	523	1035	826	640
30	152	138	118	244	210	185	361	297	266	547	459	360	720	585	470	979	808	605	1209	975	740
50	167	153	134	279	244	214	421	353	310	641	547	423	854	706	550	1164	977	705	1451	1188	860
100	175	163	N/A	311	277	N/A	489	421	N/A	751	658	479	1025	873	625	1408	1215	800	1784	1502	975

11. Venting (cont'd)

11B. Requirements and Instructions for Common Venting (cont'd)

IMPORTANT: Do not use Table 2 for Model FT heater. It is published here only for determining the vent connector length, vent height, and vent capacity of a Category I appliance that may use a single-wall vent connector.

Common Vent Tables 2A and 2B - Capacity of Type B Double-Wall Vents with Single-Wall Connectors Serving Two or More Category I Appliances

NOTE: Category I appliance can be either Category I draft hood-equipped or fan-assisted type but must be approved for common venting.

Table 2A - Vent Connector Capacity

H - Vent Height (ft)	R - Vent Connector Rise (ft)	Single-Wall Vent Connector																							
		3" Diameter		4" Diameter		5" Diameter		6" Diameter		7" Diameter		8" Diameter		9" Diameter		10" Diameter									
		Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat								
		Input Rating Limits in Thousands of BTUH																							
		Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max
6	1	N/A	N/A	26	N/A	N/A	46	N/A	N/A	71	N/A	N/A	102	207	223	140	262	293	183	325	373	234	447	463	280
	2	N/A	N/A	31	N/A	N/A	55	N/A	N/A	85	168	182	123	215	251	167	271	331	219	334	422	281	458	524	344
	3	N/A	N/A	34	N/A	N/A	62	121	131	95	175	198	138	222	273	188	279	361	247	344	462	316	468	574	385
8	1	N/A	N/A	27	N/A	N/A	48	N/A	N/A	75	N/A	N/A	106	226	240	145	285	316	191	352	403	244	481	502	299
	2	N/A	N/A	32	N/A	N/A	57	125	126	89	184	193	127	234	266	173	293	353	228	360	450	292	492	560	355
	3	N/A	N/A	35	N/A	N/A	64	130	138	100	191	208	144	241	287	197	302	381	256	370	489	328	501	609	400
10	1	N/A	N/A	28	N/A	N/A	50	119	121	77	182	186	110	240	253	150	302	335	196	372	429	252	506	534	308
	2	N/A	N/A	33	84	85	59	124	134	91	189	203	132	248	278	183	311	369	235	381	473	302	517	589	368
	3	N/A	N/A	36	89	91	67	129	144	102	197	217	148	257	299	203	320	398	265	391	511	339	528	637	413
15	1	N/A	N/A	29	79	87	52	116	138	81	177	214	116	238	291	158	312	380	208	397	482	266	556	596	324
	2	N/A	N/A	34	83	94	62	121	150	97	185	230	138	246	314	189	321	411	248	407	522	317	568	646	387
	3	N/A	N/A	39	87	100	70	127	160	109	193	243	157	255	333	215	331	438	281	418	557	360	579	690	437
20	1	49	56	30	78	97	54	115	152	84	175	238	120	233	325	165	306	425	217	390	538	276	546	664	336
	2	52	59	36	82	103	64	120	163	101	182	252	144	243	346	197	317	453	259	400	574	331	558	709	403
	3	55	62	40	87	107	72	125	172	113	190	264	164	252	363	223	326	476	294	412	607	375	570	750	457
30	1	47	60	31	77	110	57	112	175	89	169	278	129	226	380	175	296	497	230	378	630	294	528	779	358
	2	51	62	37	81	115	67	117	185	106	177	290	152	236	397	208	307	521	274	389	662	349	541	819	425
	3	54	64	42	85	119	76	122	193	120	185	300	172	244	412	235	316	542	309	400	690	394	555	855	482
50	1	46	69	34	75	128	60	109	207	96	162	336	137	217	460	188	284	604	245	364	768	314	507	951	384
	2	49	71	40	79	132	72	114	215	113	170	345	164	226	473	223	294	623	293	376	793	375	520	983	458
	3	52	72	45	83	136	82	119	221	123	178	353	186	235	486	252	304	640	331	387	816	423	535	1013	518
100	1	45	79	34	71	150	61	104	249	98	153	424	140	205	585	192	269	774	249	345	993	321	476	1236	393
	2	48	80	41	75	153	73	110	255	115	160	428	167	212	593	228	279	788	299	358	1011	383	490	1259	469
	3	51	81	46	79	157	85	114	260	129	168	433	190	222	603	256	289	801	339	368	1027	431	506	1280	527

Table 2B - Common Vent Capacity

H - Vent Height (ft)	4" Diameter Common Vent		5" Diameter Common Vent			6" Diameter Common Vent			7" Diameter Common Vent			8" Diameter Common Vent			9" Diameter Common Vent			10" Diameter Common Vent			
	Combined Input Rating of the Appliances in Thousands of BTUH																				
	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat
6	N/A	78	64	N/A	113	99	200	158	144	304	244	196	398	310	257	541	429	332	665	515	407
8	N/A	87	71	N/A	126	111	218	173	159	331	269	218	436	342	285	592	473	373	730	569	460
10	N/A	94	76	163	137	120	237	189	174	357	292	236	467	369	309	638	512	398	787	617	487
15	121	108	88	189	159	140	275	221	200	416	343	274	544	434	357	738	599	456	905	718	553
20	131	118	98	208	177	156	305	247	223	463	383	302	606	487	395	824	673	512	1013	808	626
30	145	132	113	236	202	180	350	286	257	533	446	349	703	570	459	958	790	593	1183	952	723
50	159	145	128	268	233	208	406	337	296	622	529	410	833	686	535	1139	954	689	1418	1157	838
100	166	153	N/A	297	263	N/A	469	398	N/A	726	633	464	999	846	606	1378	1185	780	1741	1459	948

Common Venting Tables 3 and 4 Apply to Vertical Common Venting into an Interior, Tile-Lined Masonry Chimney

Do not vent into an exterior tile-lined masonry chimney.

Before connecting a vent connector to a chimney, inspect the chimney passageway to be sure that it is clear and free of obstructions. Clean the chimney if it was previously used for venting solid or liquid fuel-burning appliances or fireplaces. Install the vent connector above the extreme bottom of the chimney. Use a thimble or slip joint to facilitate removal. Attach the connector securely to the thimble. Do not insert the vent connector into the chimney beyond the chimney wall.

Masonry Chimney Liner Dimensions with Circular Equivalents

Nominal Liner Size (inches)	Inside Dimensions of Liner (inches)	Inside Diameter or Equivalent Diameter (inches)	Equivalent Area (inches ²)
4 x 8	2-1/2 x 6-1/2	4	12.2
		5	19.6
		6	28.3
		7	38.3
8 x 8	6-3/4 x 6-3/4	7.4	42.7
		8	50.3
8 x 12	6-1/2 x 10-1/2	9	63.6
		10	78.5

Common Vent Tables 3A and 3B - Capacity of an Interior Tile-Lined Masonry Chimney with Type B Double-Wall Connectors Serving Two or More Category I Appliances

NOTE: Category I appliance can be either Category I draft hood-equipped or fan-assisted type but must be approved for common venting.

Table 3A - Vent Connector Capacity

H - Vent Height (ft)	R - Vent Connector Rise (ft)	Type B Double Wall Vent and Connector																							
		3" Diameter			4" Diameter			5" Diameter			6" Diameter			7" Diameter			8" Diameter			9" Diameter			10" Diameter		
		Fan Assist		Nat	Fan Assist		Nat	Fan Assist		Nat	Fan Assist		Nat	Fan Assist		Nat	Fan Assist		Nat	Fan Assist		Nat	Fan Assist		Nat
		Input Rating Limits in Thousands of BTUH																							
		Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max
6	1	24	33	21	39	62	40	52	106	67	65	194	101	87	274	141	104	370	201	124	479	253	145	599	319
	2	26	43	28	41	79	52	53	133	85	67	230	124	89	324	173	107	436	232	127	562	300	148	694	378
	3	27	49	34	42	92	61	55	155	97	69	262	143	91	369	203	109	491	270	129	633	349	151	795	439
8	1	24	39	22	39	72	41	55	117	69	71	213	105	94	304	148	113	414	210	134	539	267	156	682	335
	2	26	47	29	40	87	53	57	140	86	73	246	127	97	350	179	116	473	240	137	615	311	160	776	394
	3	27	52	34	42	97	62	59	159	98	75	269	145	99	383	206	119	517	276	139	672	358	163	848	452
10	1	24	42	22	38	80	42	55	130	71	74	232	108	101	324	153	120	444	216	142	582	277	165	739	348
	2	26	50	29	40	93	54	57	153	87	76	261	129	103	366	184	123	498	247	145	652	321	168	825	407
	3	27	55	35	41	105	63	58	170	100	78	284	148	106	397	209	126	540	281	147	705	366	171	893	463
15	1	24	48	23	38	93	44	54	154	74	72	277	114	100	384	164	125	511	229	153	658	297	184	824	375
	2	25	55	31	39	105	55	56	174	89	74	299	134	103	419	192	128	558	260	156	718	339	187	900	432
	3	26	59	35	41	115	64	57	189	102	76	319	153	105	448	215	131	597	292	159	760	382	190	960	486
20	1	24	52	24	37	102	46	53	172	77	71	313	119	98	437	173	123	584	239	150	752	312	180	943	397
	2	25	58	31	39	114	56	55	190	91	73	335	138	101	467	199	126	625	270	153	805	354	184	1011	452
	3	26	63	35	40	123	65	57	204	104	75	353	157	104	493	222	129	661	301	156	851	396	187	1067	505
30	1	24	54	25	37	111	48	52	192	82	69	357	127	96	504	187	119	680	255	145	883	337	175	1115	432
	2	25	60	32	38	122	58	54	208	95	72	376	145	99	531	209	122	715	287	149	928	378	179	1171	484
	3	26	64	36	40	131	66	56	221	107	74	392	163	101	554	233	125	746	317	152	968	418	182	1220	535
50	1	23	51	25	36	116	51	51	209	89	67	405	143	92	582	213	115	798	294	140	1049	392	168	1334	506
	2	24	59	32	37	127	61	53	225	102	70	421	161	95	604	235	118	827	326	143	1085	433	172	1379	558
	3	26	64	36	39	135	69	55	237	115	72	435	180	98	624	260	121	854	357	147	1118	474	176	1421	611
100	1	23	46	24	35	108	50	49	208	92	65	428	155	88	640	237	109	907	334	134	1222	454	161	1589	596
	2	24	53	31	37	120	60	51	224	105	67	444	174	92	660	260	113	933	368	138	1253	497	165	1626	651
	3	25	59	35	38	130	68	53	237	118	69	458	193	94	679	285	116	956	399	141	1282	540	169	1661	705

Table 3B - Common Vent Capacity

H - Vent Height (ft)	Minimum Internal Area of Masonry Chimney Flue (in ²)																								
	12			19			28			38			50			63			75			113			
	Combined Input Rating of the Appliances in Thousands of BTUH																								
	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	Fan + Fan	Fan + Nat	Nat + Nat	
6	N/A	74	25	N/A	119	46	N/A	178	71	N/A	257	103	N/A	351	143	N/A	458	188	N/A	582	246	1041	853	N/A	
8	N/A	80	28	N/A	130	53	N/A	193	82	N/A	279	119	N/A	384	163	N/A	501	218	724	636	278	1144	937	408	
10	N/A	84	31	N/A	138	56	N/A	207	90	N/A	299	131	N/A	409	177	606	538	236	776	686	302	1226	1010	454	
15	N/A	N/A	36	N/A	152	67	N/A	233	106	N/A	334	152	523	467	212	682	611	283	874	781	365	1374	1156	546	
20	N/A	N/A	41	N/A	164	75	N/A	250	122	N/A	367	172	565	508	243	742	668	325	955	858	419	1513	1286	648	
30	N/A	N/A	N/A	N/A	N/A	N/A	N/A	270	137	N/A	404	198	615	564	278	816	747	381	1062	969	496	1702	1473	749	
50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	620	328	879	831	461	1165	1089	606	1905	1692	922
100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	348	N/A	N/A	499	N/A	N/A	669	2053	1921	1058	

11. Venting (cont'd)

11B. Requirements and Instructions for Common Venting (cont'd)

IMPORTANT: Do not use Table 4 for Model FT heater. It is published here only for determining the vent connector length, vent height, and vent capacity of a Category I appliance that may use a single-wall vent connector.

Common Vent Tables 4A and 4B - Capacity of an Interior, Tile-Lined Masonry Chimney with Single-Wall Connectors Serving Two or More Category I Appliances

NOTE: Category I appliance can be either Category I draft hood-equipped or fan-assisted type but must be approved for common venting.

Table 4A - Vent Connector Capacity

H - Vent Height (ft)	R - Vent Connector Rise (ft)	Single-Wall Vent Connector																							
		3" Diameter		4" Diameter		5" Diameter		6" Diameter		7" Diameter		8" Diameter		9" Diameter		10" Diameter									
		Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat	Fan Assist	Nat								
		Input Rating Limits in Thousands of BTUH																							
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
6	1	N/A	N/A	21	N/A	N/A	39	N/A	N/A	66	179	191	100	231	271	140	292	366	200	362	474	252	499	594	316
	2	N/A	N/A	28	N/A	N/A	52	N/A	N/A	84	186	227	123	239	321	172	301	432	231	373	557	299	509	696	376
	3	N/A	N/A	34	N/A	N/A	61	134	153	97	193	258	142	247	365	202	309	491	269	381	634	348	519	793	437
8	1	N/A	N/A	21	N/A	N/A	40	N/A	N/A	68	195	208	103	250	298	146	313	407	207	387	560	263	529	672	331
	2	N/A	N/A	28	N/A	N/A	52	137	139	85	202	240	125	258	343	177	323	465	238	397	607	309	540	766	391
	3	N/A	N/A	34	N/A	N/A	62	143	156	98	210	264	145	266	376	205	332	509	274	407	663	356	551	838	450
10	1	N/A	N/A	22	N/A	N/A	41	130	151	70	202	225	106	267	316	151	333	434	213	410	571	273	558	727	343
	2	N/A	N/A	29	N/A	N/A	53	136	150	86	210	255	128	276	358	181	343	489	244	420	640	317	569	813	403
	3	N/A	N/A	34	97	102	62	143	166	99	217	277	147	284	389	207	352	530	279	430	694	363	580	880	459
15	1	N/A	N/A	23	N/A	N/A	43	129	151	73	199	271	112	268	376	161	349	502	225	445	646	291	623	808	366
	2	N/A	N/A	30	92	103	54	135	170	88	207	295	132	277	411	189	359	548	256	456	706	334	634	884	424
	3	N/A	N/A	34	96	112	63	141	185	101	215	315	151	286	439	213	368	586	289	466	755	378	646	945	479
20	1	N/A	N/A	23	87	99	45	128	167	76	197	303	117	265	425	169	345	569	235	439	734	306	614	921	387
	2	N/A	N/A	30	91	111	55	134	185	90	205	325	136	274	455	195	355	610	266	450	787	348	627	986	443
	3	N/A	N/A	35	96	119	64	140	199	103	213	343	154	282	481	219	365	644	298	461	831	391	639	1042	496
30	1	N/A	N/A	24	86	108	47	126	187	80	193	347	124	259	492	183	338	665	250	430	864	330	600	1089	421
	2	N/A	N/A	31	91	119	57	132	203	93	201	366	142	269	518	205	348	699	282	442	908	372	613	1145	473
	3	N/A	N/A	35	95	127	65	138	216	105	209	381	160	277	540	229	358	729	312	452	946	412	626	1193	524
50	1	N/A	N/A	24	85	113	50	124	204	87	188	392	139	252	567	208	328	778	287	417	1022	383	582	1302	492
	2	N/A	N/A	31	89	123	60	130	218	100	196	408	158	262	588	230	339	806	320	429	1058	425	596	1346	545
	3	N/A	N/A	35	94	131	68	136	231	112	205	422	176	271	607	255	349	831	351	440	1090	466	610	1386	597
100	1	N/A	N/A	23	84	104	49	122	200	89	182	410	151	243	617	232	315	875	328	402	1181	444	560	1537	580
	2	N/A	N/A	30	88	115	59	127	215	102	190	425	169	253	636	254	326	899	361	415	1210	488	575	1570	634
	3	N/A	N/A	34	93	124	67	133	228	115	199	438	188	262	654	279	337	921	392	427	1238	529	589	1604	687

Table 4B - Common Vent Capacity

H - Vent Height (ft)	Minimum Internal Area of Masonry Chimney Flue (in ²)																															
	12				19				28				38				50				63				75				113			
	Combined Input Rating of the Appliances in Thousands of BTUH																															
Fan + Fan		Fan + Nat		Nat + Nat		Fan + Fan		Fan + Nat		Nat + Nat		Fan + Fan		Fan + Nat		Nat + Nat		Fan + Fan		Fan + Nat		Nat + Nat		Fan + Fan		Fan + Nat		Nat + Nat				
6	N/A	N/A	25	N/A	118	45	N/A	176	71	N/A	255	102	N/A	348	142	N/A	455	187	N/A	579	245	N/A	846	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
8	N/A	N/A	28	N/A	128	52	N/A	190	81	N/A	276	118	N/A	380	162	N/A	497	217	N/A	633	277	1136	928	405	N/A	N/A	N/A	N/A	N/A	N/A		
10	N/A	N/A	31	N/A	136	56	N/A	205	89	N/A	295	129	N/A	405	175	N/A	532	234	771	680	300	1216	1000	450	N/A	N/A	N/A	N/A	N/A	N/A		
15	N/A	N/A	36	N/A	N/A	66	N/A	230	105	N/A	335	150	N/A	400	210	677	602	280	866	772	360	1359	1139	540	N/A	N/A	N/A	N/A	N/A	N/A		
20	N/A	N/A	N/A	N/A	N/A	74	N/A	247	120	N/A	362	170	N/A	503	240	765	661	321	947	849	415	1495	1264	640	N/A	N/A	N/A	N/A	N/A	N/A		
30	N/A	N/A	N/A	N/A	N/A	N/A	N/A	135	N/A	398	195	N/A	558	275	808	739	377	1052	957	490	1682	1447	740	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	612	325	N/A	821	456	1152	1076	600	1879	1672	910	N/A	N/A	N/A	N/A	N/A	N/A		
100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	494	N/A	N/A	663	2006	1885	1046	N/A	N/A	N/A	N/A	N/A	N/A	

■ Vent System Joints

- Follow the pipe manufacturer's instructions for joining Type B double-wall vent pipe sections.

For joining double-wall pipe to the heater outlet collar or single-wall pipe, follow the "boxed" instructions below:

Instructions for attaching double-wall (Type B) vent pipe to the heater outlet or single-wall pipe run

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 heater outlet or the single-wall pipe is inside the double-wall pipe.

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

3) Use silicone 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.

- If using single-wall, 26-gauge or heavier galvanized pipe in the vent connector of an appliance, secure slip-fit connections using sheet metal screws or rivets. Seal pipe joints with high-temperature tape or sealant. **NOTE: The Model FT requires double-wall vent connector pipe.**
- When attaching a vent connector to a masonry chimney, use a thimble or slip joint to facilitate removal. Fasten vent connector securely being sure that it does not extend into the chimney.

■ 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.

■ Vent Terminal

The vent terminal should be a minimum of six feet from adjoining buildings. The vent terminal should be six inches higher than the anticipated snow depth but no less than two feet above the roof. Where the vent extends through the roof, a clearance thimble is required when the flue pipe extends through combustible materials; follow the requirements of the double-wall pipe manufacturer.

If using a Type B double-wall vent, terminate with a vent cap that meets the requirements of the double-wall pipe manufacturer.

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), published by the American Gas Association or CAN/CGA-B149.1 and B149.2, published by the Canadian Gas Association (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.

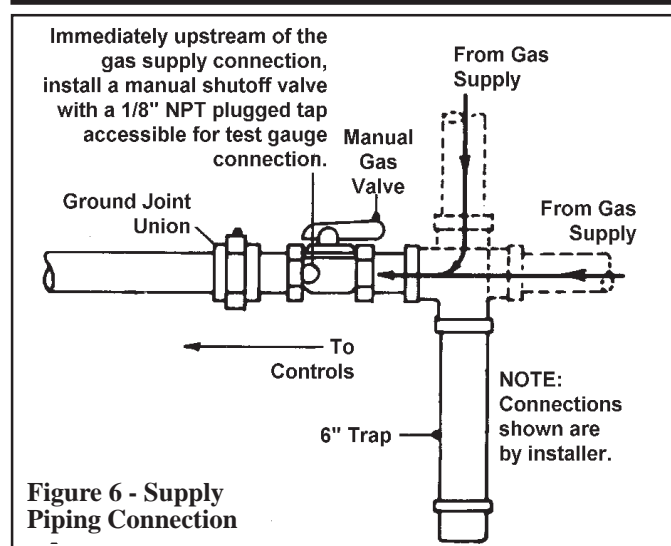
Unit heaters are orificed for operation with natural gas having a heating value of 1000 (± 50) BTUH per cubic ft or propane gas with a heating value of 2550 BTUH per cubic ft. If the gas at the installation does not meet these specifications, consult the factory for proper orificing.

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 6. 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 supply connection is 1/2". 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.



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 19. 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

12. Gas Piping and 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 (cont'd)

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 between 2000 and 5000 ft (610 to 1525M) 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

1. 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

2. 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 fluid-filled manometer that is readable to the nearest tenth of an inch w.c.

3. 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.

4. With the heater operating, determine that the inlet pressure to the heater for natural gas is between 5 and 14 inches w.c. and for propane between 10 and 14 inches w.c. Take this reading as close as possible to the 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.***

5. 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 and/or heater.

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.

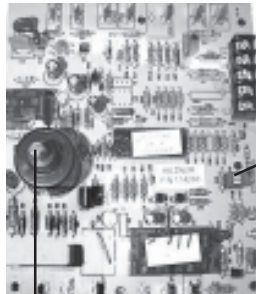
Check the rating plate on the heater for the supply voltage and current requirements. A dedicated line voltage supply with fused disconnect switch should be run directly from the main electrical panel to the heater. All external wiring must be within approved conduit and have a minimum temperature rise 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 7.

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

Consult the wiring diagram supplied with your heater. Typical wiring diagram is on page 14.

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.

Figure 7 - Electrical Connections, DIP Switch Settings, and LED Signal Codes on the Integrated Circuit Board in the Control Compartment



24-volt Terminal Strip for Thermostat Connections (refer to wiring diagram)

DIP Switch for Regulating Fan Off Delay Time
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.

Line Voltage Connection
 Ignitor Connection

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

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).

14. 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.

15. 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	Start-Up Cold	Equilibrium	Set Point "OFF"	Set Point "ON"
FT30-CV	-0.43	-0.20	-0.15	-0.20
FT45-CV or LN	-0.43	-0.205	-0.15	-0.20

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.

16. 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.

17. 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.

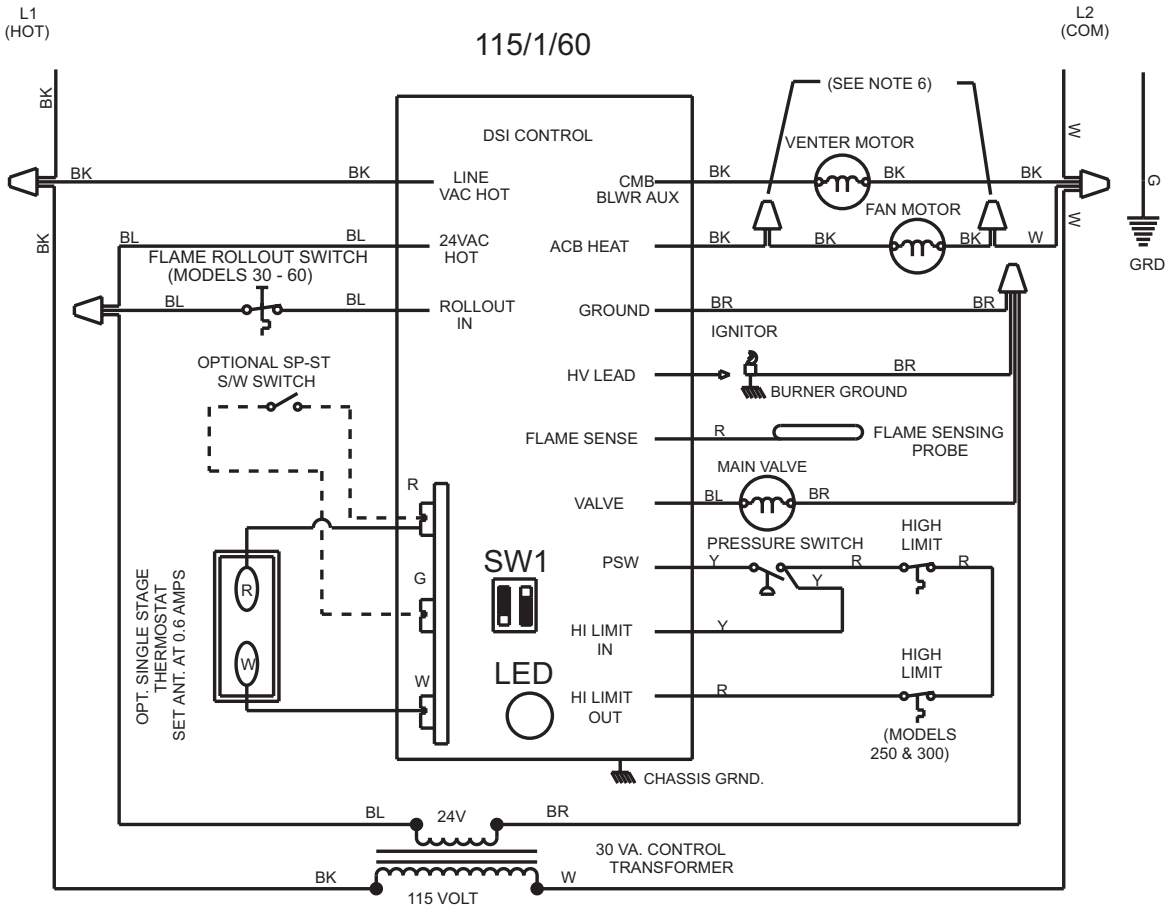
After the thermostat has been satisfied, the system de-energizes the gas valve, the venter motor goes through a 45-second post-purge, and the fan motor remains energized for an additional 180 seconds.

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.

TYPICAL WIRING DIAGRAM

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

Figure 8 -
Wiring
Diagram
#147203 for
Model FT,
Sizes 30 - 45



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).

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.

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

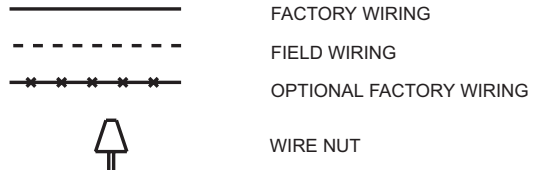
TOTAL WIRE LENGTH	DISTANCE FROM UNIT TO CONTROL	MIN. RECOMMENDED WIRE GAUGE
150'	75'	#18 GA. WIRE
250'	125'	#16 GA. WIRE
350'	175'	#14 GA. WIRE

WIRING CODE

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

DIP SWITCH SETTINGS

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



REZNOR
FT SERIES

W.D. 147203 REV. #6

18. 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.

19. 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 7.
- 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.

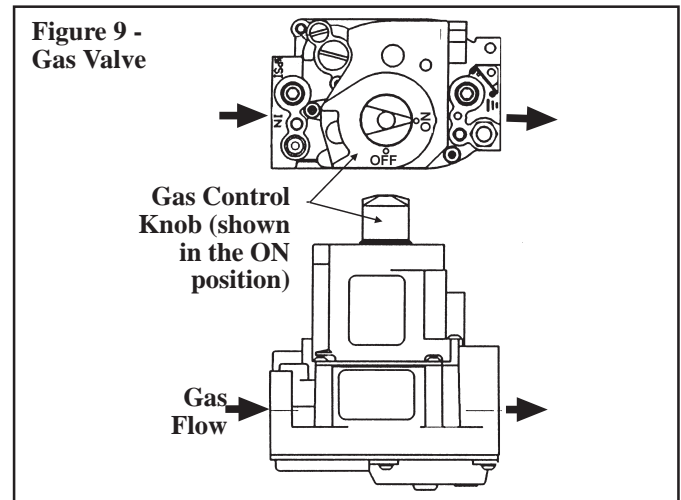
WHAT TO DO IF YOU SMELL GAS

- 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 on the gas valve. Never use tools. If the valve ON/OFF knob 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 ser-

vice 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 on the gas valve. (See Figure 9.)



4. Turn the gas control knob clockwise **C** 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.
 6. Turn the gas control knob counterclockwise **D** 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 clockwise **C** 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/

19. Check Installation & Start-up (cont'd)

Check the installation after start-up (cont'd):

- 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.
- 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.
 - 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 7 and 8. 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 8 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.

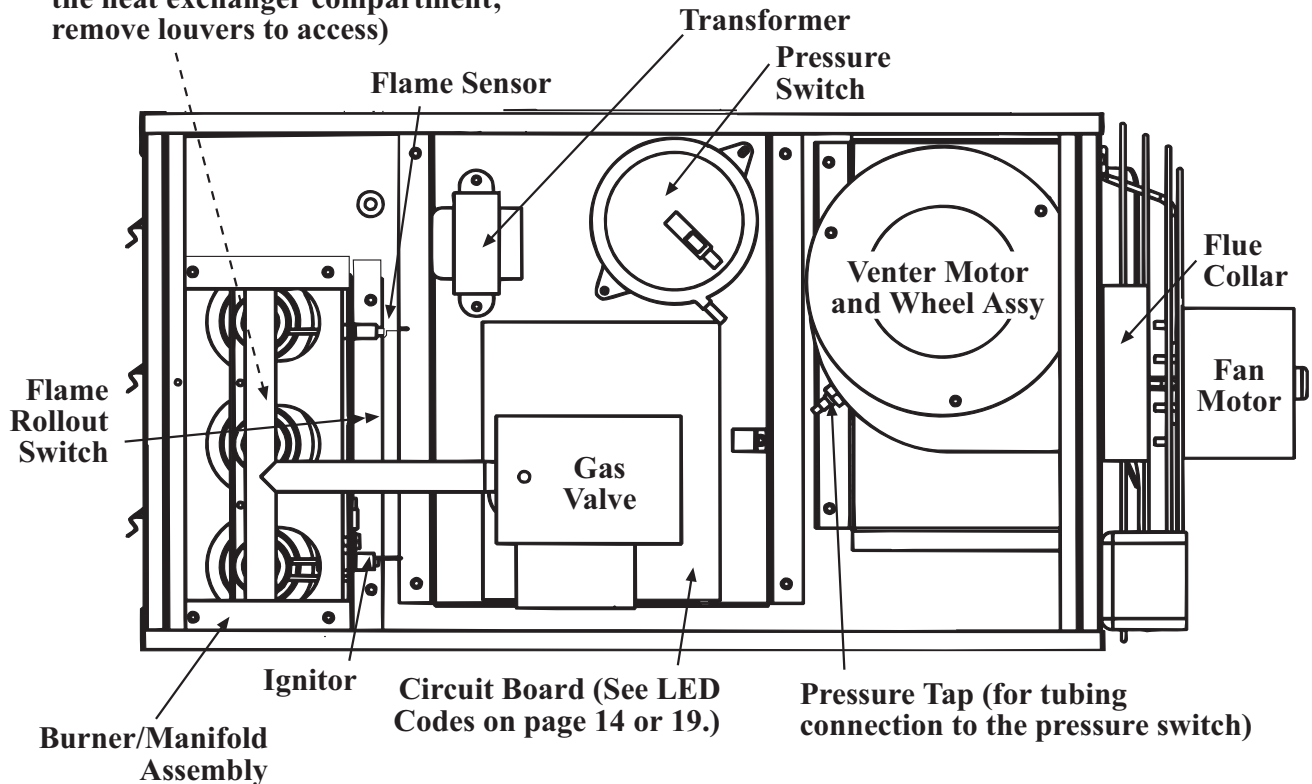
Maintenance Schedule - The following procedures should be carried out at least annually (See Figure 11 and Paragraphs 20-30.):

- 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.

Limit Control Location (located in the heat exchanger compartment; remove louvers to access)

Figure 10 - Location of Controls - View of the Control Compartment



NOTE: If the heater has been changed so that the controls are on the left side (Paragraph 9), their locations will appear inverted.

20. Burner Removal and Cleaning

Instructions for Burner Removal (See Figure 10)

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.

21. Burner Orifices

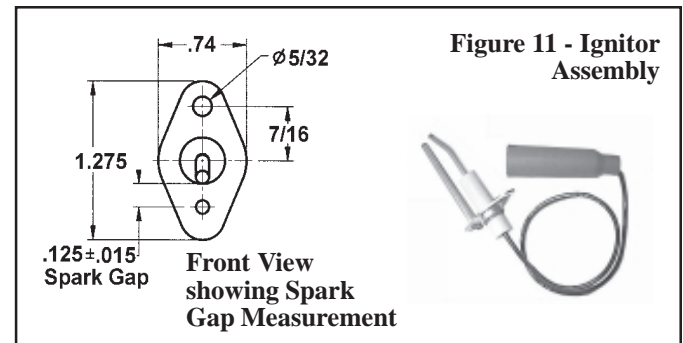
Heaters are shipped with orifices of proper size and type for gas and altitude specified on the order. When ordering replacement orifices, give BTUH content, specific gravity of gas, and altitude, as well as the model and serial number of the heater.

22. Ignition System

To access the ignition system, follow Steps 1-3 in Paragraph 20.

Ignitor - Refer to Figure 10 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 11.



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.

22. Ignition System (cont'd)

Flame Sensor - Refer to Figure 10 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 microampmeter.

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.

23. 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 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.

24. 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 12.

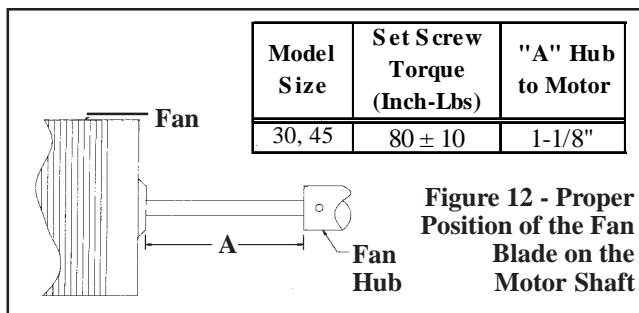


Figure 12 - Proper Position of the Fan Blade on the Motor Shaft

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.

25. Venter Motor

Remove dirt and grease from the motor housing. 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.

26. 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.

27. 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, remove the louver assembly from the front of the heater.

For approximate limit location, see Figure 11.

28. Combustion Air Pressure Switch

See Figure 12 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.

29. Flame Rollout Switch

Models FT 30 and 45 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.

30. 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.

31. 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"> No power to unit. No 24 volt power to venter relay. Integrated circuit board defective. Defective motor. 	<ol style="list-style-type: none"> Turn on power, check supply fuses or circuit breaker. Turn up thermostat; check control transformer output. Replace integrated circuit board. Replace motor.
Burners will not light	<ol style="list-style-type: none"> Manual valve not open. Air in the gas line. Gas pressure too high or too low. No Spark: <ol style="list-style-type: none"> Loose wire connections Transformer failure Incorrect spark gap. Spark cable shorted to ground. Spark electrode shorted to ground Burners not grounded Circuit board not grounded. Faulty integrated circuit board Lockout device interrupting control circuit by above causes. Faulty combustion air proving switch. Main valve not operating <ol style="list-style-type: none"> Defective valve Loose wire connections Integrated circuit board does not power main valve. <ol style="list-style-type: none"> Loose wire connections Flame sensor grounded Incorrect gas pressure Cracked ceramic at sensor 	<ol style="list-style-type: none"> Open manual valve. Bleed gas line. Supply pressure should be 5 - 14" w.c. for natural gas or 11 - 14" w.c. for propane gas. <ol style="list-style-type: none"> Be certain all wire connections are solid. Be sure 24 volts is available. Maintain spark gap at 1/8". Replace worn or grounded spark cable. Replace if ceramic spark electrode is cracked or grounded. Make certain integrated circuit board is grounded to ignitor. Make certain integrated circuit board is grounded to furnace chassis. If 24 volt is available to the integrated circuit board and all other causes have been eliminated, replace board. Reset lockout by interrupting control at the thermostat or main power. Replace combustion air proving switch. <ol style="list-style-type: none"> If 24 volt is measured at the valve connections and valve remains closed, replace valve. Check and tighten all wiring connections. <ol style="list-style-type: none"> Check and tighten all wiring connections. Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required. Supply pressure should be 5 - 14" w.c. for natural gas or 11 - 14" w.c. for propane gas. Replace sensor
Burners cycle on and off	<ol style="list-style-type: none"> Gas pressure too high or too low. Burners not grounded Circuit board not grounded. Faulty integrated circuit board Faulty combustion air proving switch. Flame sensor grounded Cracked ceramic at sensor 	<ol style="list-style-type: none"> Supply pressure should be 5 - 14" w.c. for natural gas or 11 - 14" w.c. for propane gas. Make certain integrated circuit board is grounded to ignitor. Make certain integrated circuit board is grounded to furnace chassis. If 24 volt is available to the integrated circuit board and all other causes have been eliminated, replace board. Replace combustion air proving switch. Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required. Replace sensor
No heat (Heater Operating)	<ol style="list-style-type: none"> Incorrect manifold pressure or orifices. Cycling on limit control. Improper thermostat location or adjustment. 	<ol style="list-style-type: none"> Check manifold pressure (See Paragraph 10). Check air throughput. See thermostat manufacturer's instructions.
Cold air delivered	<ol style="list-style-type: none"> Incorrect manifold pressure. 	<ol style="list-style-type: none"> Check manifold pressure (See Paragraph 10).
Motor will not run	<ol style="list-style-type: none"> Circuit open. Defective integrated circuit board. Defective motor. 	<ol style="list-style-type: none"> Check wiring and connections. Replace board. Replace motor.
Motor turns on & off while burner is operating (See below)	<ol style="list-style-type: none"> Motor overload device cycling on and off. 	<ol style="list-style-type: none"> Check motor load against motor rating plate. Replace motor if needed.
Fan motor cuts out on overload	<ol style="list-style-type: none"> Low or high voltage supply . Defective motor. Poor air flow. Defective bearing or lubrication. 	<ol style="list-style-type: none"> Correct electric supply . Replace motor. Clean motor, fan and fan guard. 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 _____

Thomas & Betts
