Revision: ACiQ-IOM (01-26) 2000661-0
Supersedes: — (Original Version)

GAS-FIRED UNIT HEATER INSTALLATION, OPERATION, AND MAINTENANCE

MODELS ACiQ-UH-30-NG, ACiQ-UH-60-NG, AND ACiQ-UH-125-NG

⚠ DANGER ⚠

FIRE OR EXPLOSION HAZARD

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

WHAT TO DO IF YOU SMELL GAS

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

RISQUE D'INCENDIE OU D'EXPLOSION

- **Le non respect des mises en garde pourrait entraîner des blessures graves, la mort ou des pertes matérielles.**
- **Une installation, un réglage, une modification, une réparation ou un entretien inapproprié peut entraîner des blessures graves, la mort ou des pertes matérielles.**
- **L'installation et les réparations doivent être confiées à un installateur qualifié ou au fournisseur de gaz.**
- **Prendre soin de lire et de comprendre les instructions d'installation, de fonctionnement et d'entretien contenues dans ce guide.**
- **Ne pas entreposer ni utiliser d'essence ou autre vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.**

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ

- **Ne tentez pas d'allumer un appareil.**
- **Ne touchez pas à un interrupteur ; n'utilisez pas de téléphone dans l'édifice où vous vous trouvez.**
- **Sortez de l'édifice immédiatement.**
- **Appelez immédiatement le fournisseur de gaz à partir d'un téléphone à l'extérieur de l'édifice. Suivez les instructions du fournisseur de gaz.**
- **Si vous ne pouvez joindre le fournisseur de gaz, appelez les pompiers.**

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

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GENERAL INFORMATION

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

Features

- 115/1/60 voltage/phase/Hz
- 80% thermal efficiency
- 50–60°F temperature rise
- Natural gas standard (propane conversion kit available)
- Integrated circuit board with seven-segment display
- Aluminized-steel heat exchanger
- Multi-point suspension

Important Safety Information

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

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

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

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

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

⚠ DANGER ⚠

- **Gas-fired appliances are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, in atmospheres containing chlorinated or halogenated hydrocarbons, or in applications with airborne silicone substances. *Les appareils au gaz ne sont pas conçus pour être utilisés dans les environnements dangereux qui renferment des vapeurs inflammables ou de la poussière combustible, dans des environnements contenant des hydrocarbures chlorés ou halogénés ni dans les applications où des substances à base de silicone sont en suspension dans l'air.***
- **Should overheating occur, or the gas supply control system fail to shut off the flow of gas, shut off the manual gas valve to the unit before shutting off the electrical supply. *En cas de surchauffe ou si le système de contrôle de l'alimentation de gaz omet de couper la circulation de gaz, fermez la vanne de gaz manuelle sur l'appareil avant de couper l'alimentation électrique.***
- **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 that has been under water. *N'utilisez pas cet appareil si une partie quelconque a été immergée dans de l'eau. Appelez immédiatement un technicien de service qualifié afin qu'il inspecte l'appareil et qu'il remplace toute commande de gaz ayant été submergée.***
- **Installation should be done by a qualified agency in accordance with these instructions. The qualified service agency installing this heater is responsible for the installation. *L'installation doit être effectuée par un organisme qualifié en chauffage et climatisation ou par un électricien agréé. L'agence de service qualifiée qui installe ce système à combustion séparée à haute efficacité est responsable de l'installation.***

⚠ WARNING ⚠

- **This appliance is not intended for use by persons with reduced physical, sensory, or mental capabilities or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.**
- **Children should be supervised to ensure that they do not play with the appliance.**

⚠ CAUTION ⚠

To prevent damage to the unit or to its internal components, it is recommended that two wrenches be used when loosening or tightening nuts. Do not overtighten!

Certification

These unit heaters are listed by Intertek for use in the United States and Canada in industrial and commercial installations and as utility heaters for use in non-living spaces that are attached to, adjacent to, or part of a structure that contains space for family living quarters.

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* (ANSI Z223.1, latest edition). A Canadian installation must be in accordance with the *Natural Gas and Propane Installation Code* (CSA B149, latest edition). This code is available from CSA Information Services, 1-800-463-6727. Local authorities having jurisdiction should be consulted before installation is made to verify local codes and installation procedure requirements.
- Installations in aircraft hangars should be in accordance with the *Standard for Aircraft Hangars* (ANSI/NFPA 409, latest edition). Installations in public garages should be in accordance with the *Standard for Parking Structures* (ANSI/NFPA 88A, latest edition). Installations in repair garages should be in accordance with the *Standard for Repair Garages* (NFPA 88B), which has been incorporated into the *Code for Motor Fuel Dispensing Facilities and Repair Garages* (NFPA 30A, latest edition). In Canada, installations in aircraft hangars and public garages should be in accordance with CSA B149.
- If the heater is being installed in the Commonwealth of Massachusetts, installation must be performed by a licensed plumber or licensed gas fitter.

Clearances

Units must be installed so that the clearances listed in **Table 1** are provided for with regards to combustion air space, inspection, and service and for proper spacing from combustible construction. Clearance to combustibles is defined as the minimum distance from the heater to a surface or object for which it is necessary to ensure that a surface temperature of 90°F (50°C) above the surrounding ambient temperature is not exceeded.

Table 1. Clearances

Heater Surface	Minimum Clearance (Inches (mm))
Top	1 (25)
Flue connector	6 (152)
Access panel	18 (457)
Non-access side	1 (25)
Bottom*	1 (25)
Rear**	18 (457)
Front	Refer to values for variable X (distance from heater to start of floor coverage) in **Heater Throw** section

*Suspend the heater so that the bottom is a minimum of 5 feet (1.5 meters) above the floor.

**Measure rear clearance from the fan motor.

Heater Throw

Figure 1 shows throw patterns and **Table 2** lists throw distances for heaters suspended at varying mounting heights.

H = the distance from the bottom of the heater to the floor
X = the distance from the heater to the start of floor coverage
Y = the distance from the heater to the end of floor coverage
Z = the distance at which air velocity drops below 50 feet (15.2 meters) per minute

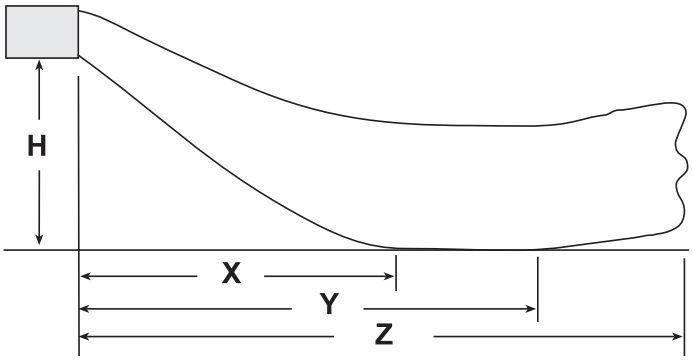


Figure 1. Heater Throw Patterns (Refer to Table 2)

Table 2. Heater Throw Distances

H* (Feet (Meters))	Dmension*/ Louver Angle**	Unit Size (MBTUh)		
		30	60	125
		Feet (Meters)		
5 (1.5)	X	6 (1.8)	8 (2.4)	10 (3.0)
	Y	14 (4.3)	18 (5.5)	22 (6.7)
	Z	30 (9.1)	45 (13.8)	65 (19.9)
	Angle	21°	16°	14°
8 (2.4)	X	7 (2.1)	10 (3.0)	12 (3.7)
	Y	13 (4.0)	18 (5.5)	23 (7.0)
	Z	26 (7.9)	42 (12.8)	63 (19.2)
	Angle	39°	29°	24°
10 (3.0)	X	6 (1.8)	10 (3.0)	13 (4.0)
	Y	11 (3.4)	17 (5.2)	24 (7.3)
	Z	22 (6.7)	39 (11.9)	60 (18.3)
	Angle	52°	37°	30°
12 (3.7)	X	—	10 (3.0)	14 (4.3)
	Y		16 (4.9)	23 (7.0)
	Z		34 (10.4)	57 (17.4)
	Angle		46°	36°
14 (4.3)	X	—	9 (2.7)	14 (4.3)
	Y		14 (4.3)	22 (6.7)
	Z		29 (8.8)	53 (16.1)
	Angle		56°	43°
16 (4.9)	X	—		13 (4.0)
	Y			20 (6.1)
	Z			47 (14.3)
	Angle			50°
18 (5.5)	X	—		11 (3.4)
	Y			17 (5.2)
	Z			40 (12.2)
	Angle			57°

*See **Figure 1**.

**From bottom of heater.

Heater Location

⚠ CAUTION ⚠

- **Unit heaters should not be used in an application where the heated space temperature is below 40°F (4°C). Operating under low ambient conditions may cause condensation to form in the heat exchanger.**
- **Do not locate the heater where it may be exposed to water spray, rain, or dripping water.**

Halogenated Hydrocarbons

Halogenated hydrocarbons are a family of chemical compounds characterized by the presence of halogen elements (fluorine, chlorine, bromine, etc.). These compounds are used in refrigerants, cleaning agents, and solvents and are heavier than air, a fact that should be kept in mind when determining the installation location of heaters and building exhaust systems.

⚠ CAUTION ⚠

CORROSION HAZARD: Halogenated hydrocarbons, when exposed to flame, precipitate with any condensation present in the heater to form hydrochloric acid, which readily attacks all metals. Care should be taken to separate these vapors from the combustion process. An outside air supply MUST BE provided to the burner whenever the presence of these compounds is suspected.

Mounting Height Requirements

⚠ WARNING ⚠

If touched, the vent pipe and internal heater surfaces that are accessible from outside the heater will cause burns. Suspend the heater a minimum of 5 feet (1.5 meters) above the floor. *Le tuyau d'évent et les surfaces internes de l'appareil de chauffage qui sont accessibles depuis l'extérieur causent des brûlures au toucher. Suspendez l'appareil de chauffage à au moins 5 pieds (1.5 mètres) du sol.*

In general, a unit should be located 8 to 12 feet (2.4 to 3.7 meters) above the floor. 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 to 6.1 meters).

Vent Requirements

Requirements and instructions vary depending on whether the installation is residential or commercial/industrial and whether the vent is dedicated or common. Select and follow the venting instructions (refer to **Vent Connections** section) that apply to the installation only.

⚠ CAUTION ⚠

- **When an existing appliance is removed or replaced in a venting system, verify that the venting system is properly sized to vent the new appliance. An improperly sized venting system may result in the formation of condensate, leakage, and/or spillage.**
- **Do not intermix different vent system parts from different manufacturers in the same venting system.**
- **Do not vent into an existing gravity vent or chimney.**

NOTE: Venting must be in accordance with local codes and with the *National Fuel Gas Code* (ANSI Z223.1) or the *Installation Code for Gas Burning Appliances and Equipment* (CSA B149.1). Local requirements supersede national requirements.

Dimensions

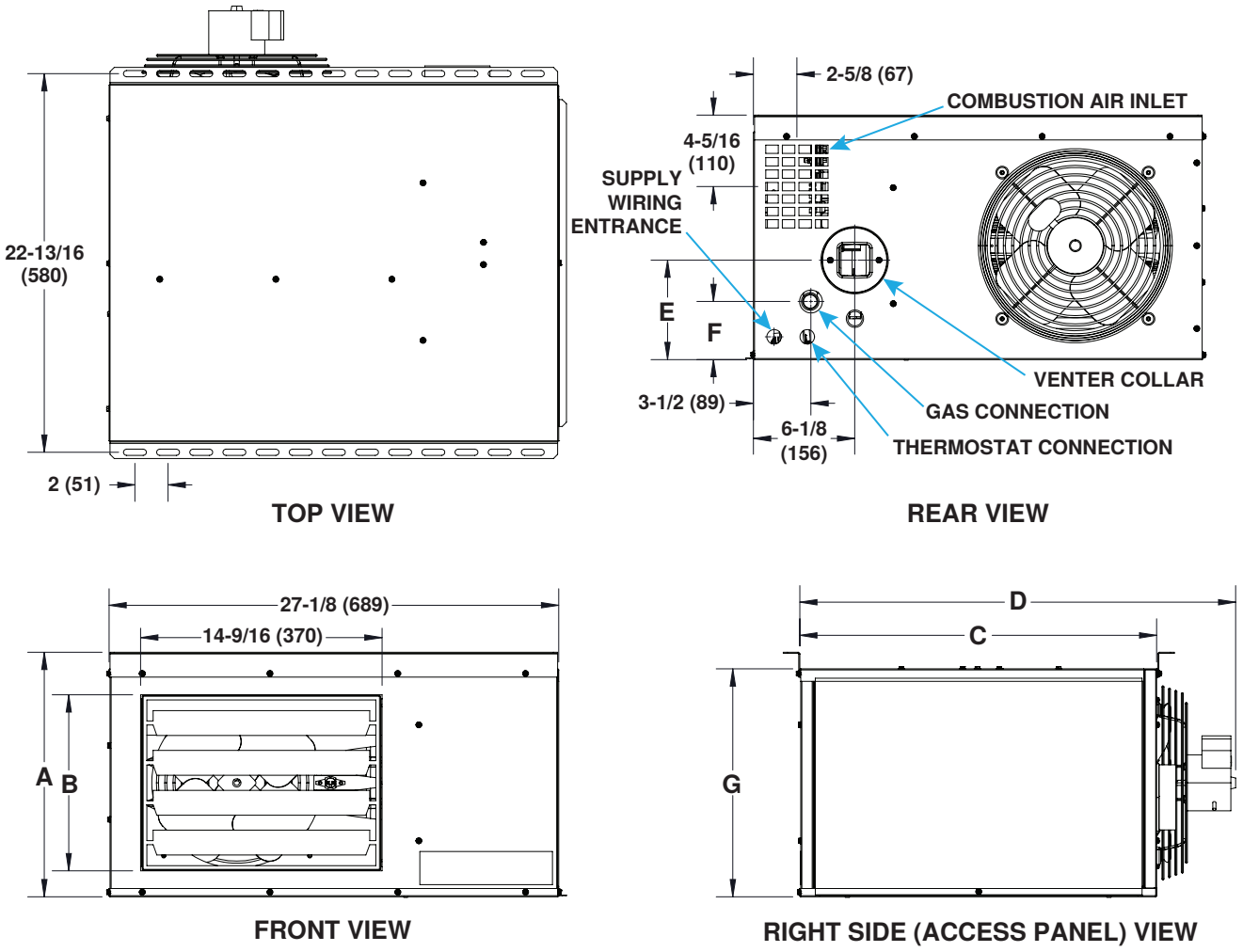


Figure 2. Dimensions (Refer to Table 3)

Table 3. Dimensions

Unit Size (MBTUh)	Dimension (See Figure 2)						
	A	B	C	D	E	F	G
	Inches (mm)						
30	14-3/4 (375)	10-5/8 (270)	26-9/32 (668)	21-17/32 (547)	6 (152)	3-1/2 (89)	13-3/4 (349)
60	17-3/4 (451)	13-5/8 (346)	21-9/16 (548)	23-9/16 (599)	8-11/16 (220)	6-5/16 (160)	16-3/4 (425)
125	25-3/4 (654)	21-5/8 (549)	21-19/32 (548)	30-21/32 (778)	5-1/4 (387)	9-17/32 (242)	24-3/4 (629)

Weights

Table 4. Weights

Unit Size (MBTUh)	Pounds (kg)
30	60 (28)
60	77 (35)
125	122 (56)

Combustion Air Requirements

⚠ WARNING ⚠

- **Connecting the unit to outside combustion air intake ducts voids the warranty and could cause hazardous operation. Le raccordement de unité aux conduits d'admission d'air de combustion extérieurs annule la garantie et peut entraîner un fonctionnement dangereux.**

Units 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. Units 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 which is exhausted through the heater vent system. Under all conditions, enough air must be provided to ensure that there will not be a negative pressure condition within the equipment room or space. Requirements for combustion ventilation air depend upon whether the unit is located in a confined or unconfined space. A ***confined*** space is defined as a space whose volume is <50 cubic feet per 1,000 BTUh of the installed appliance input rating. An ***unconfined*** space is defined as a space whose volume is ≥50 cubic feet per 1,000 BTUh of the installed appliance input rating. For confined space installation of standard units, provide openings (depending on the combustion air source) near the floor and ceiling for ventilation and air for combustion, as shown in **Figure 3** and as listed in **Table 5**.

NOTE: For further details on supplying combustion air to a confined space, refer to the *National Fuel Gas Code* (ANSI Z223.1/NFPA 54, latest edition).

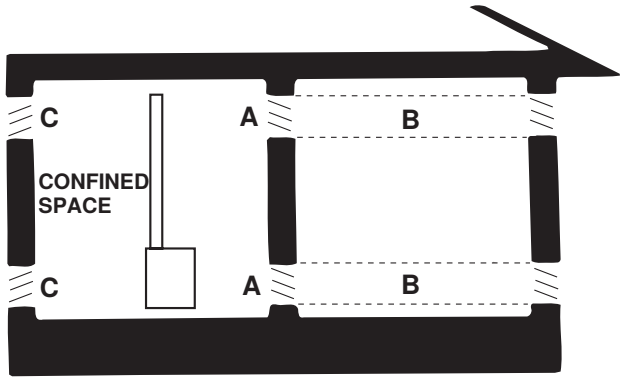


Figure 3. Confined Space Combustion Air Openings (Refer to Table 5)

Table 5. Determining Confined Space Combustion Air Requirements

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

*See **Figure 3**.

Technical Data

Table 6. Technical Data

Parameter	Unit of Measure	Unit Size (MBTUh)		
		30	60	125
Thermal efficiency	%	80		
Input heating capacity	BTUh	30,000	60,000	120,000
	kW	8.8	17.6	35.2
Output heating capacity (ETL ratings for elevations up to 2000 feet)	BTUh	24,000	48,000	96,000
	kW	7.0	14.1	28.1
Gas connection size (to single-stage gas valve—not supply line size)	inch	1/2		
Vent connection diameter		4*		
Control amps, 24V	amp	1.0		
Full load amps (FLA)		1.9	2.4	5.6
Maximum overcurrent protection (MCOP), 115V		15**		
Normal power consumption	watt	109	155	354
Discharge air temperature rise	°F	50	60	
	°C	27.8	33.3	33.3
Air volume	CFM	456	769	1537
	meter^3/minute	12.9	21.8	45.9
Discharge air opening area	foot^2	0.96	1.25	2.01
	meter^2	0.09	0.12	0.19
Output velocity	FPM	475	616	763
	meter/minute	145	188	233
Fan motor power	HP	0.02	0.03	1/20
Fan motor speed	RPM	1550		1050
Fan diameter	inch	10	12	16
Sound level @ 15 feet	dBa	40	40	55

*Smaller and/or larger vent pipe diameters may be permissible.

**MOCP = 2.25 × (largest motor FLA) + smallest motor FLA. Value is rounded to the next lower standard circuit breaker size.

INSTALLATION

Unpacking and Inspection

NOTE: The unit was test-operated and inspected at the factory prior to packaging and was in operating condition.

Unpack the unit and remove the screws used to secure the heat exchanger tube support that prevents the heat exchanger tubes from shifting during shipment. Remove the support and replace the screws in the unit.

Pre-Installation Checklist

- ❑ Check the rating plate for the gas specifications and electrical characteristics of the heater to ensure that they are compatible with the gas and electric supplies at the installation site.
- ❑ Read this manual and become familiar with the installation requirements of your particular 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.

Heater Suspension

⚠ WARNING ⚠

- **Multi-point suspension is required. *Suspension multipoint est requise.***
- **Before suspending the heater, check the supporting structure to be used to verify that it has sufficient load-carrying capacity to support the weight (refer to Weights section) of the unit. *Avant de suspendre l'appareil de chauffage, assurez-vous que la structure de montage choisie a une capacité de charge suffisante pour supporter le poids de l'appareil (reportez-vous à la section Weights).***
- **The heater must be level for proper operation. DO NOT place or add additional weight to a suspended heater. *Cet appareil de chauffage doit être de niveau pour fonctionner correctement. NE placez et n'ajoutez PAS de poids supplémentaire sur un appareil de chauffage suspendu.***

⚠ CAUTION ⚠

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.

NOTE: The mounting brackets provided with the heater allow the heater to be installed 1 inch from the ceiling. Alternatively, the heater may be suspended from field-supplied 3/8-inch threaded rods—the recommended maximum rod length is 6 feet (1.8 meters).

1. Secure mounting brackets provided with heater to four mounting holes in top front and top rear of heater using hardware provided.
2. Secure mounting brackets to supporting structure using field-supplied hardware.

Piping Connections

Gas Supply Pressure

- The unit is equipped for a maximum gas supply pressure of 1/2 psi, 3.5 kPa, or 14 IN WC for natural gas or propane. The minimum supply pressure, as measured while the unit is operating at full fire, is 5 IN WC for natural gas or 11 IN WC for propane.
- Supply pressure higher than 1/2 psi requires the installation of an additional service regulator external to the unit.
- **Pressure testing supply piping:** For test pressures ***above*** 1/2 psi, disconnect the heater and manual valve from the gas supply line to be tested and cap or plug the supply line. For test pressures ***below*** 1/2 psi, before testing, close the manual valve on the heater.

Gas Supply Piping

⚠ DANGER ⚠

- **All piping must be in accordance with requirements outlined in the *National Fuel Gas Code* (ANSI Z223.1, latest edition) or the *Natural Gas and Propane Installation Code* (CSA B149.1, latest edition). *Tous les tuyaux doivent être conformes aux exigences du National Fuel Gas Code (ANSI/ Z223.1, dernière édition) ou Natural Gas and Propane Installation (CSA B149.1, dernière édition).***
- **Gas supply piping installation shall conform with good practice and with local codes. *L'installation des tuyaux d'alimentation de gaz doit être conforme aux bonnes pratiques et aux codes locaux.***
- **Support gas piping with pipe hangers, metal strapping, or other suitable material. Do not rely on the heater to support the gas pipe. *Supportez les tuyaux de gaz avec des supports de tuyaux, des bandes métalliques ou un autre matériau approprié. Ne vous fiez pas à l'appareil de chauffage pour supporter le tuyau de gaz.***

Piping Connections—Continued

Gas Supply Piping—Continued

⚠ DANGER ⚠

- **All components of a gas supply system must be leak tested prior to placing equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME. Failure to comply could result in personal injury, property damage, or death. *Un essai d'étanchéité doit être effectué sur tous les composants du système d'approvisionnement en gaz avant la mise en service de l'équipement. N'EFFECTUEZ JAMAIS D'ESSAI D'ÉTANCHÉITÉ DES GAZ AVEC UNE FLAMME NUE. Le non-respect de cette règle cause des blessures ou des dommages matériels ou la mort.***
- **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. *Toute pâte à joint de tuyau (enduit à tuyau) doit résister à l'action du gaz de pétrole liquéfié ou à toute autre composant chimique contenu dans le gaz d'alimentation.***

- The heater is orificed for operation with natural gas having a heating value of 1,050 (±50) BTU per cubic foot or with propane gas having a heating value of 2,550 (±100) BTU per cubic foot. Sizing of gas supply lines depends on piping capacity and is based on cubic feet per hour based on a 0.3 IN WC pressure drop, a 0.6 specific gravity for natural gas at 1,050 BTU per cubic feet, and a 1.6 specific gravity for propane at 2,550 BTU per cubic feet. If the gas at the installation does not meet this specification, consult the factory for proper orificing.
- When sizing supply lines, consider the possibility of future expansion and increased requirements (refer to the *National Fuel Gas Code* for additional information).

Supply Piping Connections

NOTE: The *National Fuel Gas Code* requires the installation of a minimum 3-inch sediment trap with a drip leg. Local codes may require a sediment trap longer than 3 inches (typically 6 inches). To permit burner removal, this sediment trap must extend beyond the edge of the heater.

Connect the gas supply piping as follows (see **Figure 4**):

1. Make 1/2-inch gas connection at pipe nipple that extends outside cabinet using ground joint union.
2. Install manual shutoff valve upstream of unit control system. Manual shutoff valve's 1/8-inch plugged tapping provides connection for supply line pressure test gauge.
3. Install minimum 3-inch sediment trap (typically 6 inches).
4. Bleed trapped air from gas lines as needed.
5. Leak test all connections using leak detecting solution.

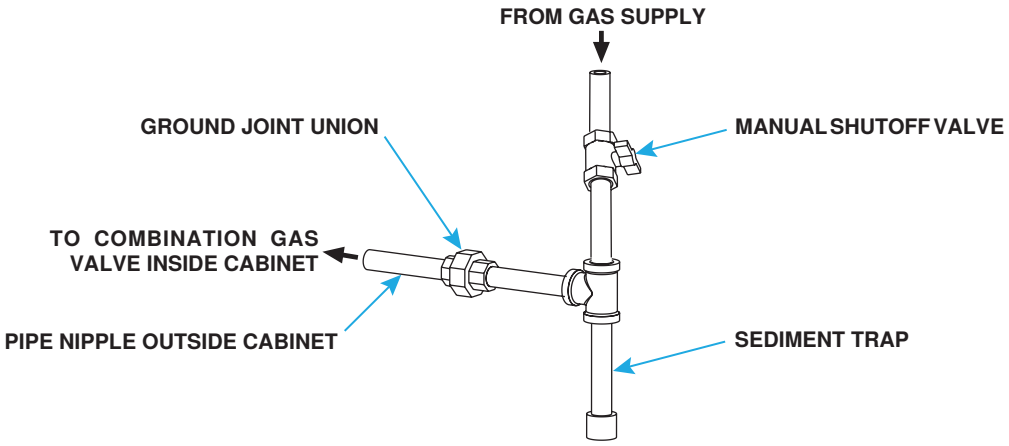


Figure 4. Gas Connections

⚠ CAUTION ⚠

- **Ensure that all wiring is in accordance with the wiring diagram provided with the unit.**
- **Check the rating plate on the heater for the supply voltage and current requirements.**
- **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 Electric Code* (Part 1, CSA C.22.1). In addition, the installer should be aware of any local ordinances or gas company requirements that might apply.**
- **A dedicated line voltage supply with a disconnect switch MUST 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 rating of 140°F (60°C). Conduit MUST BE run so as not to interfere with the heater access panel.**
- **If any of the original wire supplied with the appliance must be replaced, it MUST BE replaced with wiring material having a temperature rating of at least 220°F (105°C).**

The supply wiring enters at the rear of the heater as shown in **Figure 2** and connects to the green, white, and black wire leads inside the control compartment. Install a strain relief bushing in the supply wiring entrance.

Circuit Board Connection

The circuit board (see **Figure 5**) is located inside on the bottom of the control compartment. The circuit board is polarity sensitive. The circuit board is factory-wired, but it is advisable to check to ensure that the black wire is the hot wire connected to terminal L1 and that the white wire is the neutral wire.

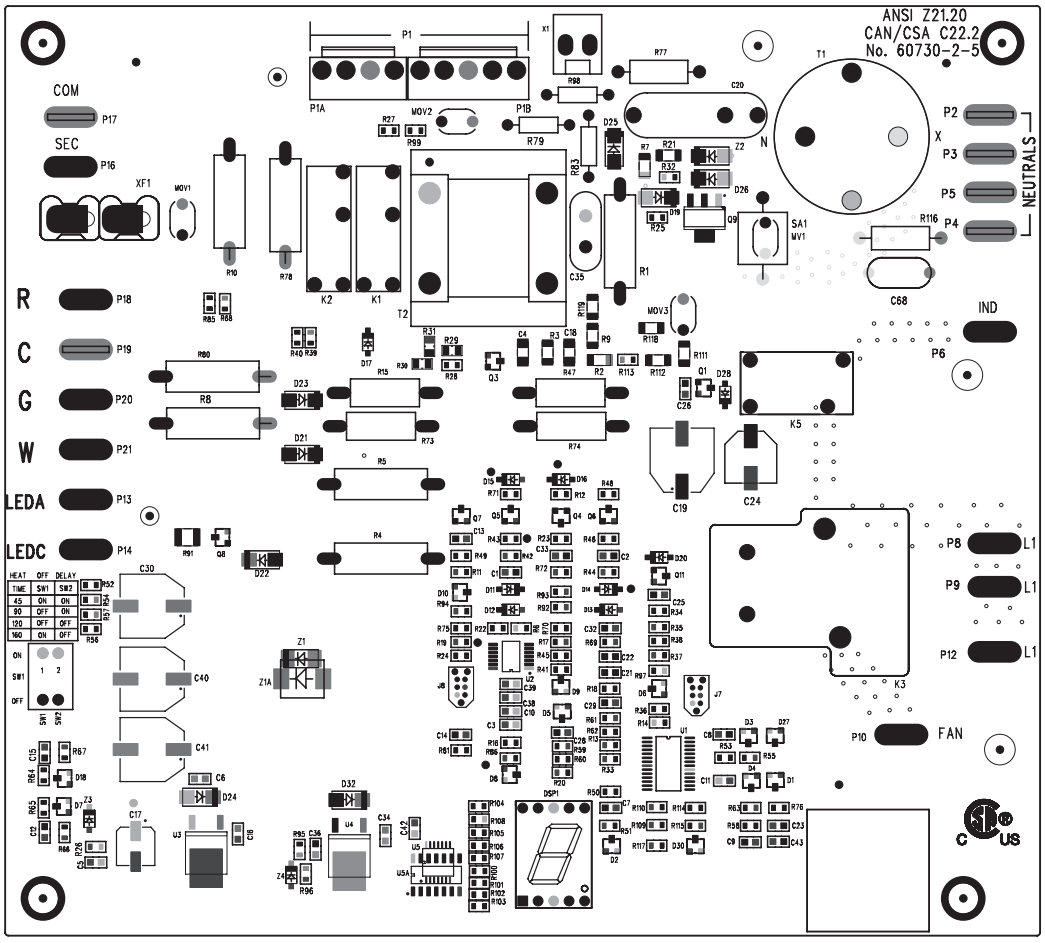


Figure 5. Circuit Board (DSI Control Module)

Electrical Connections—Continued

Vent Connections

⚠ CAUTION ⚠

- **When an existing appliance is removed or replaced in a venting system, verify that the venting system is properly sized to vent the new appliance. An improperly sized venting system may result in the formation of condensate, leakage, and/or spillage.**
- **DO NOT vent into an existing gravity vent or chimney.**
- **DO NOT intermix different vent system parts from different manufacturers in the same venting system.**
- **Venting must be in accordance with local codes and with the *National Fuel Gas Code* (ANSI Z223.1) or the *Installation Code for Gas Burning Appliances and Equipment* (CSA B149.1). Local requirements supersede national requirements.**

NOTE: Residential installations of unit sizes 30 and 60 with a vertical common vent may use a Category I vent but Category III is recommended—Category III is required for unit size 125.

The method of venting varies depending on the installation type: Category III venting for most installations or Category I, commercial/industrial or residential locations, and vent configuration—common or not. Category I venting is used for unit sizes 30 and 60 with either a dedicated vent or a common (with another appliance) vent. Category III venting may be used for all unit sizes. Refer to **Table 7** for a list of Category III vent manufacturers.

Table 7. Category III Vent Manufacturers

Manufacturer	Model(s)	Diameter (Inches)
CaptiveAire Systems	2V-Type BH	—
Cheminee Lining E Inc.	IPP, HEP, HEPL, HEPLA, HEPL1, and HEPL2	6–48
Cleaver-Brooks Inc.	CBH, CBHL, CBHL2, CBHLA, and CBHL1	
DuraVent Inc.	FasNSeal fixed blade damper assembly	4–18 (ID)
	FasNseal special gas vent assembly	—
	FasNSeal W2 special gas vent system	
	FasNSmooth chimney liner system for use in masonry chimneys only	
	FasNSeal CVS special gas vent system and direct vented pellet system	
	S-Vent and PVP	4 and 5
ENERVEX Inc.	EPS and EPS-1	4–48
ECCO Manufacturing Division of ECCO Heating Products Ltd.	SGDW series	3–6
ICC Industrial Chimney Co.	VIC	4–24
Industrial Combustion LLC	ICH, ICHL, ICHLA, ICHL1, and ICHL2	4–48
Jeremias Inc.	DWKL, SWKL, DWFL, and SWFL	4–36
	DWGV double-wall, air-insulated, 1 inch between inner and outer pipe diameter	—
	DWGV1 double-wall, fiber-insulated, 1 inch between inner and outer pipe diameter	
	DWGV2 double-wall, fiber-insulated, 2 inches between inner and outer pipe diameter	
	SWGV single-wall	4–12
Lifetime Chimney Supply LLC	Xi1, Xi2, and Xi4	5
METAL-FAB Inc.	CGSW, FCSSW, CG, FCS, FCG-1, and FCS-1	6–24 (ID)
	FCGSW, FCG, FCG-1, FCS-3 CORR/GUARD, and FCS-2 CORR/GUARD	6–36 (ID)
	CGSW, CG, FCG, 3CGSWHVK, and 4CGSWHVK	4 and 5
Noritz America Corporation	N-Vent	4 and 5
Rheem Sales Co. Inc.	RTG	3
Security Chimneys International Ltd.	Secure Seal Flex chimney lining system	3–12

Table 7. Category III Vent Manufacturers—Continued		
Manufacturer	**Model(s)**	**Diameter (Inches)**
Selkirk Corporation	Saf-T-CI and Saf-T C1	4, 5, and 6
	Saf-T-Vent	3–6 and 8
	EZ Seal	3–6
	SGV	3, 4, and 5
	CI Plus	6 and 8
	SC, DGV, EZ Seal Quick Kit, Sel-Vent, and Sel-Vent II	4
	IPS316, PS316, and G316	5 and 6
SFL Flue & Chimney	DEVON EPS and EPS-1	4–6
The Schebler Co.	SSD, ESW, eVent, and eVent PLUS	2 and 4–6
	eVent SD	4–6
Sunair Products	SADW-2V and SADW-V	4
Tokyo Gas Renovation Co. Ltd.	KP and KC	4 and 5
	N-Vent	3, 4, and 5
Van-Packer Co. Inc.	MW, CS, and CSplus	4–6 (ID)
Z-FLEX US Inc.	SVE and SVEII	3 and 4
	SVEIII	2, 3, and 4
	SVEIV single-wall and SVEIV double-wall	4, 5, and 6
	NovaVent single-wall and NovaVent double-wall	
	Z-VentBlu single-wall and Z-VentBlu double-wall	3, 4, and 5

Venter (Flue) Outlet Diameter

Depending on the size of vent pipe, either attach the vent pipe directly to the 4-inch (102-mm) venter (flue) outlet collar or to a taper-type connector. If using 3-inch Category III vent pipe, attach a 4-inch appliance adapter (available from the Category III pipe manufacturer) directly to the collar and then use a reducer.

Vent Pipe Size Requirements

Table 8 lists size requirements for horizontal and vertical vent pipe.

Table 8. Vent Pipe Size for Horizontal and Vertical Vents					
Unit Size (MBTUh)	**Vent Pipe Diameter (Inches (mm))**	**Maximum Vent Length**	**Equivalent Straight Length***		**Venter Outlet Connection****
			90-Degree Elbow	**45-Degree Elbow**	
		Feet (Meters)			
30	3 (76)	20 (6.1)	3 (0.9)	1.5 (0.5)	4- to 3-inch (102- to 76-mm) reducer
	4 (102)	10 (3)	2 (0.6)	1 (0.3)	—
60	3 (76)	30 (9.1)	4 (1.2)	2 (0.6)	4- to 3-inch (102- to 76-mm) reducer
	4 (102)	15 (4.6)	2 (0.6)	1 (0.3)	—
125	4 (102)	40 (12.2)	5 (1.5)	2.5 (0.8)	
*Add all straight sections and equivalent lengths for elbows—the total combined length must not exceed the maximum vent length.					
**Field-supplied taper-type connection required at the venter outlet.					

Vent System Sealing Requirements

Vent system joints depend on the type of pipe being used:

- **Category III pipe:** follow manufacturer's instructions for joining pipe sections—connect venter outlet or the vent cap using secure, sealed joints that follow a procedure best suited to the style of Category III pipe being used.
- **Single-wall galvanized pipe (26-gauge or heavier):** secure slip-fit connections using sheet metal screws or rivets—seal all joints and seams using aluminum tape or silicone sealant.
- **For Category I vents:** when connecting Type B double-wall pipe to single-wall pipe or to the vent collar, use an adapter made by the Type B double-wall pipe manufacturer for that purpose and follow the Type B double-wall pipe manufacturer's instructions.
- **Double-wall Type B vent pipe:** join pipe sections in accordance with the pipe manufacturer's requirements.

Vent Connections—Continued

Vent System Support Requirements

⚠ CAUTION ⚠

DO NOT rely on the heater to support either horizontal or vertical vent pipe. Use non-combustible supports on vent pipe.

- Support horizontal runs every 6 feet (1.8 meters).
- Support vertical runs in accordance with the pipe manufacturer's requirements.
- Support single-wall pipe in accordance with accepted industry practice.

Vent Terminal Requirements

⚠ DANGER ⚠

- **DO NOT enclose the vent pipe or place it closer than 6 inches (152 mm) to combustible material. *N'enfermez PAS le tuyau de ventilation et ne le placez pas à moins de 6 pouces (152 mm) d'un matériau combustible.***
- **To prevent combustion products from entering the occupied space, all vent terminations MUST BE positioned or located away from fresh air intakes, doors, and windows. Failure to comply could result in severe personal injury or death and/or property damage. *Tous les terminaux d'évacuation DOIVENT ÊTRE éloignés des entrées d'air, des portes et des fenêtres afin d'éviter l'entrée de produits de combustion. Le non-respect de cette règle peut causer des blessures graves ou la mort et/ou des dommages matériels.***
- **Consider local snow depth conditions. The vent MUST BE at least 6 inches (152 mm) above the anticipated snow depth. *Tenez compte des précipitations de neige locales. L'évent DOIT ÊTRE se trouver au moins 6 pouces (152 mm) au-dessus de la profondeur de neige prévue.***

⚠ WARNING ⚠

- **A different style vent cap could cause nuisance problems or unsafe conditions. The vent cap MUST BE the same size as the vent pipe. *Un capuchon d'évent de style différent pourrait causer des problèmes de nuisance ou des conditions dangereuses. Le capuchon d'évent DOIT ÊTRE de la même taille que le tuyau d'évent.***
- **DO NOT locate a vent termination where it may cause hazardous frost or ice accumulations on adjacent property surfaces. *NE PAS installer le terminal de ventilation à un endroit où elle pourrait provoquer des accumulations dangereuses de gel ou de glace sur les surfaces adjacentes.***
- **Maintain the required clearance from the wall to the vent terminal cap for stability under wind conditions and to protect the building. *Respectez le dégagement minimum entre le mur et le chapeau du terminal d'évacuation afin d'assurer une résistance suffisante aux vents et de protéger le bâtiment.***

⚠ CAUTION ⚠

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.

- For Category I vents:
  a. 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.
  b. Maintain a 6-inch (152-mm) clearance between a single-wall vent pipe and combustibles.
  c. For Type B double-wall vent pipe, follow the pipe manufacturer's recommendations for clearance to combustibles.
- Vertical vents must terminate a minimum horizontal and vertical distance from roof lines and adjacent walls or obstructions. For vertical vents with double wall vent pipe and a vent cap size of ≤12 inches (≤305 mm):
  a. **Vent is >8 feet (>2.44 meters) horizontally from any vertical wall or obstruction:** terminate the vent at least 2 feet (0.61 meters) above the highest point where it passes through a roof or any part of a building.
  b. **Vent is <8 feet (<2.44 meters) horizontally from any vertical wall or obstruction:** terminate the vent in accordance with **Figure 6** and **Table 9**.

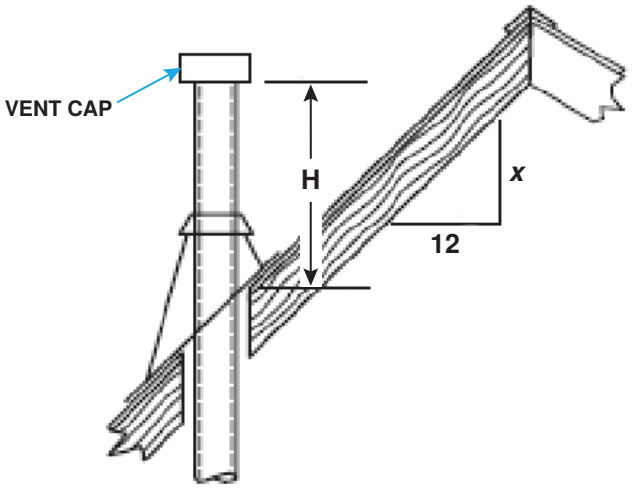


Figure 6. Double-Wall Vertical Vent Height Based on Roof Pitch

Table 9. Double-Wall Vertical Vent Height

Variable *x* (See Figure 6) = Roof Pitch Numerator (Inches)*											
≤6	>6–7	>7–8	>8–9	>9–10	>10–11	>11–12	>12–14	>14–16	>16–18	>18–20	>20–21
Dimension H (See Figure 6) = Minimum Height to Lowest Discharge Opening (Feet (Meters))											
1.0 (0.30)	1.25 (0.38)	1.5 (0.46)	2.0 (0.61)	2.5 (0.76)	3.25 (0.99)	4.0 (1.22)	5.0 (1.52)	6.0 (1.83)	7.0 (2.13)	7.5 (2.27)	8.0 (2.44)
*Roof pitch = *x*/12 inches.											
NOTE: The values above apply to vents <8 feet (<2.44 meters) horizontally from any vertical wall or obstruction.											

- For Category III vents, refer to **Table 10** for horizontal vent terminal clearances.

Table 10. Minimum Clearance Requirements for Category III Horizontal Vent Terminal

Component/Structure	Minimum Clearance, All Directions Unless Specified (Feet (Meters))
Forced air inlet within 10 feet (3.1 meters)*	3 (0.9) above
Combustion air inlet of another appliance	6 (1.8)
Mechanical air supply inlet to any building	Canada: 6 (1.8)
Any building opening (door, window, or gravity air inlet)	4 (1.2) horizontal and below
	1 (0.3) above
Gas meter,** electric meter, and relief equipment	US: 4 (1.2) horizontal
	Canada: 6 (1.8) horizontal
Gas regulator**	US: 3 (0.9) horizontal
	Canada: 6 (1.8) horizontal
Adjoining building or parapet	6 (1.8)
Adjacent public walkway	7 (2.1) above
Grade (ground level)	3 (0.9) above
*Does not apply to the inlet of a direct vent appliance.	
**Do not terminate the vent directly above a gas meter or service regulator.	

Vent Connections—Continued

Condensation Mitigation Requirements

⚠ CAUTION ⚠

- **Failure to pitch the vent run properly may damage the heater due to condensate running back into the unit.**
- **Exceeding vent pipe diameter and length requirements may result in condensate forming in the vent pipe.**

- For units with long vent runs—over 50% of maximum vent length allowed—or installed in low ambient conditions (below 50°F (10°C), it is recommended that vent pipes be fitted at the low point of the vent system with a tee, a drip leg, and a cleanout cap to prevent any moisture in the vent pipe from entering the unit. The drip leg should be inspected and cleaned out periodically during the heating season.
- 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 50°F (10°C) or less, must be insulated along its entire length with a minimum of 1/2-inch foil-faced fiberglass, 1-1/2# density insulation.
- For horizontal vent runs, the flue pipe must be pitched down toward the terminal end—1/4-inch per foot for condensate drainage—for the entire length of the horizontal vent run.

Category I Residential Installations with Vertical Dedicated Vent (Unit Sizes 30 and 60)

Residential installations of unit sizes 30 and 60 may use a Category I dedicated vent. Install the vent as follows:

NOTE: Unit size 60 may use a single- or double-wall vent connector.

1. Select vent pipe and vent connector for Category I vent (see **Figure 7**).
2. Determine vent pipe diameter and length in accordance with **Table 11**.
3. Make all vent pipe joint connections in accordance with **Vent System Sealing Requirements** section.
4. Properly support all vent pipe runs in accordance with **Vent System Support Requirements** section.
5. Take appropriate steps to mitigate condensation in accordance with **Vent Pipe Size Requirements** section.
6. Terminate vent with suitable vent cap. Ensure that vent terminal is installed in accordance with **Vent Terminal Requirements** section.

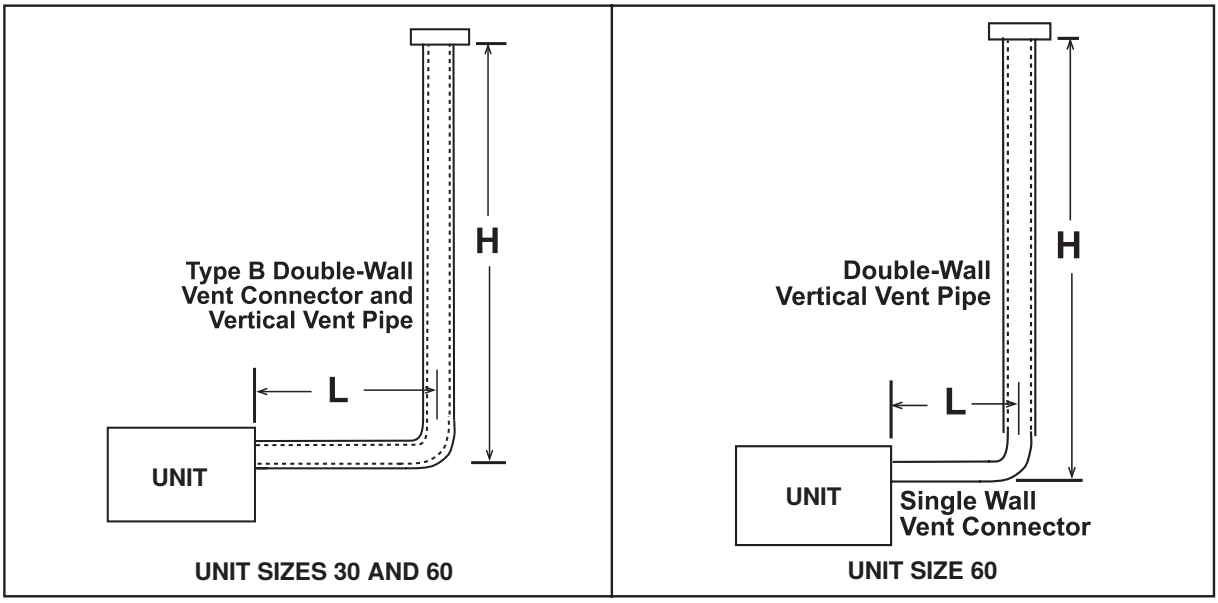


Figure 7. Typical Category I Dedicated Vent (Refer to Table 11)

Table 11. Category I Vent Pipe Diameters and Lengths		
Connector	Unit Size (MBTUh)	
	30	60
	H × L (See Figure 7) Dimension (Feet (Meters))	
Double-Wall	6 (1.8) × 4 (1.2)	6 (1.8) × 6 (1.8)
	10 (3.0) × 2 (0.6)	8 (2.4) × 8 (2.4)
	15 (4.6) × 5 (1.5)	10 (3.0) × 10 (3.0)
	20 (6.1) × 5 (1.5)	15 (4.6) × 15 (4.6)
		20 (6.1) × 20 (6.1)
Single-Wall	—	6 (1.8) × 2 (0.6)
		8 (2.4) × 2 (0.6)
		10 (3.0) × 2 (0.6)
		15 (4.6) × 2 (0.6)
		20 (6.1) × 2 (0.6)

Category I Commercial/Industrial/Residential Installations with Vertical Dedicated Vent (Unit Sizes 30 and 60)

Commercial/Industrial installations or residential installations of unit sizes 30 and 60 may use a Category I vertical dedicated vent. To permit this, at least 75% of the equivalent length of the vent run must be vertical and the vent must terminate at least 5 feet above the vent outlet of the heater. All vertically vented heaters that are Category I must be connected to a chimney or vent complying with a recognized standard or a lined masonry (or concrete) chimney with a material acceptable to the authority having jurisdiction. Venting into an unlined masonry chimney is not permitted. Install the vent as follows:

1. Select type of pipe for standard vertical (Category I) vent. Double-wall vent pipe is recommended. Use single-wall vent pipe if requirements of the *National Fuel Gas Code* are followed.
2. Determine 4-inch (102-mm) vent pipe length.
3. Make all vent pipe joint connections in accordance with **Vent System Sealing Requirements** section.
4. Properly support all vent pipe runs in accordance with **Vent System Support Requirements** section.
5. Take appropriate steps to mitigate condensation in accordance with **Vent Pipe Size Requirements** section.
6. Terminate vent as follows:
   a. Install UL listed Category I terminal vent pipe and terminate vent with suitable vent cap.
   b. Ensure that vent terminal is installed in accordance with **Vent Terminal Requirements** section.

Category I Residential Installations with Common Vent (Unit Sizes 30 and 60)

⚠ DANGER ⚠

The installer must comply with the venting requirements listed in this section, with the instructions provided for other appliances that are to be commonly vented with the unit, and with applicable local codes. Verify that any appliances being commonly vented with the unit are designed for Category I common venting. Failure to comply may result in severe injury, death, and/or property damage. ***L'installateur doit se conformer aux exigences de ventilation répertoriées dans cette section, aux instructions fournies pour les autres appareils qui doivent être communément ventilés avec l'unité et aux codes locaux applicables. Vérifiez que tous les appareils communément ventilés avec l'unité sont conçus pour une ventilation commune de catégorie I. Le non-respect peut entraîner des blessures graves, la mort et/ou des dommages matériels.***

Residential installations of unit sizes 30 and 60 may use a Category I common vent. Common venting is when two or more Category I appliances are vented into a single vertical vent. Install the vent as follows:

1. Select vent pipe and vent connector for Category I vent (see **Figure 8**).
2. Determine vertical height of vent based on vent capacity in accordance with **Table 12**.

NOTE: Table 12 applies to Type B double-wall common vents including lined masonry chimneys. If a conflict in capacity occurs with other instructions, the more conservative capacity must be chosen.

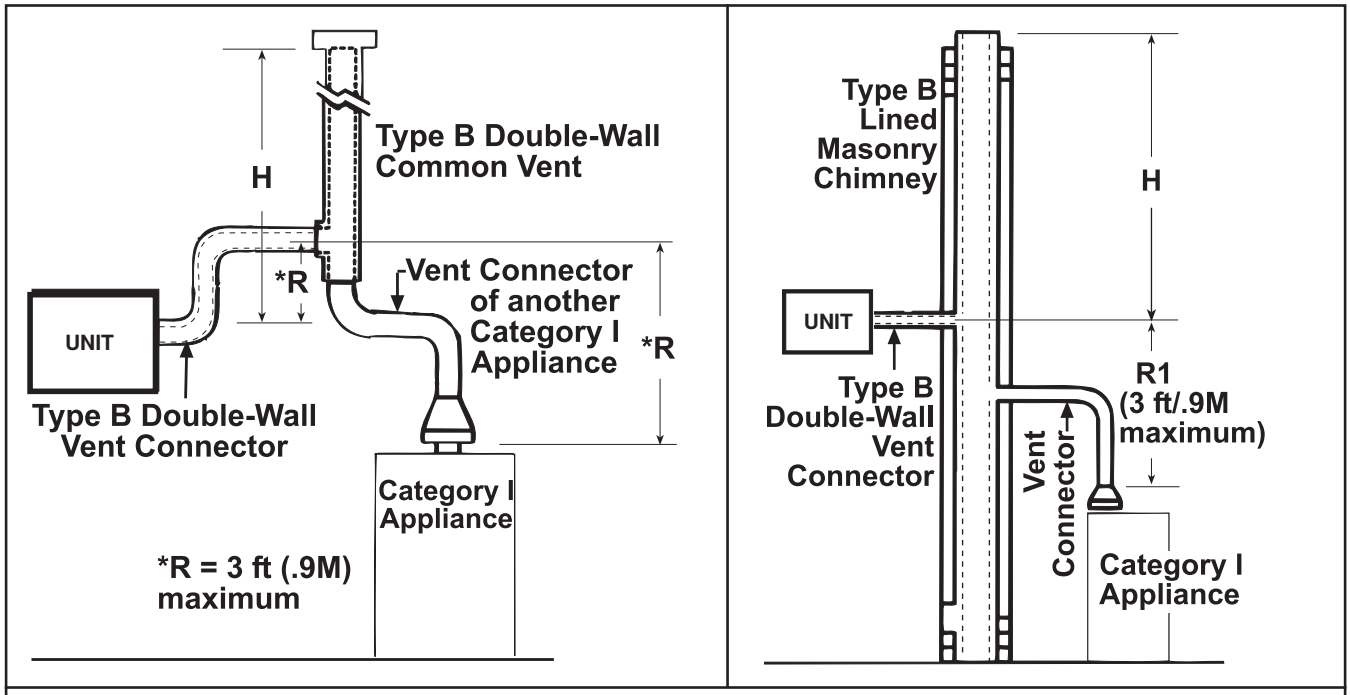
Vent Connections—Continued

Category I Residential Installations with Common Vent (Unit Sizes 30 and 60)—Continued

3. Determine maximum length of horizontal connector pipe in accordance with **Table 13**.

NOTE: When two or more vent connectors enter a common vent, the smaller connector shall enter at the highest level consistent with available headroom or clearances to combustible material.

4. Make all vent pipe joint connections in accordance with **Vent System Sealing Requirements** section.
5. Properly support all vent pipe runs in accordance with **Vent System Support Requirements** section.
6. Take appropriate steps to mitigate condensation in accordance with **Vent Pipe Size Requirements** section.
7. Terminate vent with suitable vent cap. Ensure that vent terminal is installed in accordance with **Vent Terminal Requirements** section.



H = COMMON VENT HEIGHT = VERTICAL DISTANCE FROM HIGHEST DRAFT HOOD OUTLET OR FLUE COLLAR TO VENT CAP OR CHIMNEY OUTLET OF COMMON VENT

R = VENT CONNECTOR RISE = VERTICAL DISTANCE FROM EACH HEATER OR APPLIANCE OUTLET TO CENTER LINE WHERE VENT GAS STREAMS COME TOGETHER (3 FEET (0.9 METER) MAXIMUM)

VENT CONNECTOR = HORIZONTAL LENGTH OF VENT PIPE BETWEEN EACH APPLIANCE AND VERTICAL COMMON VENT

Figure 8. Typical Category I Common Vertical Vent

Table 12. Category I Common Vertical Vent Capacity

Appliance Types Sharing Common Vertical Vent	Vent Diameter (Inches (mm))*	Vent Height (Feet (Meters))						
		6 (1.8)	7 (2.1)	8 (2.4)	10 (3.0)	15 (4.6)	20 (6.1)	30 (9.1)
		Maximum Combined Input Rating of Appliances (MBTUh)						
Two fan-assisted appliances	5 (127)	—		147	170	187	212	241
	6 (152)	180	188	196	213	248	275	315
	7 (178)	274	286	298	321	374	417	480
One fan-assisted appliance and one non-fan-assisted appliance**	5 (127)	102	108	113	123	143	159	182
	6 (152)	142	149	156	170	199	222	257
	7 (178)	220	231	242	263	309	345	401

*Type B double-wall vent pipe.

**Non-fan-assisted appliances rely solely on the natural buoyancy of the vent gases for venting.

Table 13. Maximum Length of Category I Horizontal Connector Pipe				
Vertical Vent Height (Feet (Meters))	With Single-Wall Connector		With Double-Wall Connector	
	Unit Size (MBTUh)			
	30	60	30	60
	Vent Connector Diameter (Inches (mm))			
	4 (102)		4 (102)	
	Pipe Length (Feet (Meters))			
6 (1.8)	0 (0)	2 (0.6)	2 (0.6)	
7 (2.1)	2 (0.6)		3 (0.9)	
8 (2.4)	3 (0.9)		4 (1.2)	
10 (3.0)	3 (0.9)	4 (1.2)	5 (1.5)	
15 (4.6)		5 (1.5)	5 (1.5)	6 (1.8)
20 (6.1)				
30 (9.1)				
NOTE: For the proper vent connector length and diameter of other appliances connected in common with the unit, refer to the appliance manufacturer's instructions or to the *National Fuel Gas Code*.				

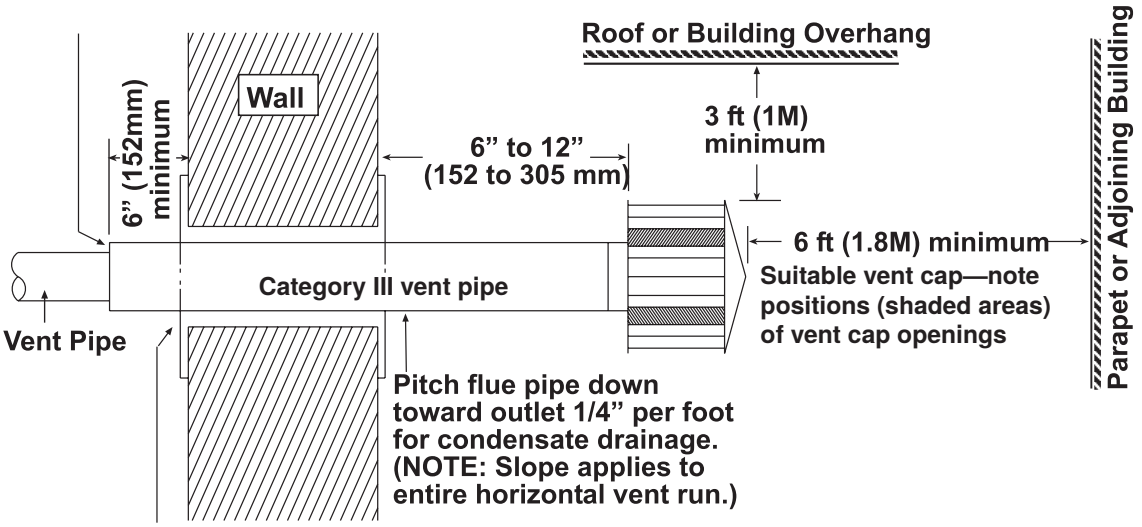
Category III Commercial/Industrial Installations

A commercial/industrial installation may have either a horizontal or a vertical vent run. Install the vent as follows:

1. Select vent pipe (refer to **Table 7**)—following types are acceptable:
   a. If at least 75% of equivalent length of vent run **IS** vertical:
      (1) Double-wall Type B vent pipe.
      (2) Vent pipe approved to UL standard 1738 for Category III appliances.
      (3) Appropriately-sealed 26-gauge (minimum) galvanized or equivalent steel single-wall pipe.
   b. If at least 75% of equivalent length of vent run **IS NOT** vertical:
      (1) Vent pipe approved to UL standard 1738 for Category III appliances.
      (2) Appropriately-sealed 26-gauge (minimum) galvanized or equivalent steel single-wall pipe.
2. If connecting double-wall pipe to heater, connect in accordance with pipe manufacturer's requirements.
3. Determine vent pipe diameter and length. Minimum vent length is 3 feet (1 meter). Use only one diameter of vent pipe for installation (refer to **Table 8**).
4. Make all vent pipe joint connections in accordance with **Vent System Sealing Requirements** section.
5. Properly support all vent pipe runs in accordance with **Vent System Support Requirements** section.
6. Take appropriate steps to mitigate condensation in accordance with **Vent Pipe Size Requirements** section.
7. Terminate vent as follows:
   a. If using single wall metal pipe or double-wall Type B vent pipe:
      (1) Install double-wall Type B terminal vent pipe (in accordance with pipe manufacturer's requirements) and terminate vent with suitable vent cap.
      (2) Refer to instructions shown in **Figure 9** to install horizontal vent terminal.
      (3) Refer to instructions shown in **Figure 10** to install vertical vent terminal.
      (4) Ensure that vent terminal is installed in accordance with **Vent Terminal Requirements** section.
   b. If using vent pipe approved to UL standard 1738 for Category III appliances, install the Category III vent system in accordance with manufacturer's instructions. Ensure that required distances shown in **Figure 9**, **Figure 10**, and **Vent Terminal Requirements** section are implemented.

Vent Connections—Continued

Category III Commercial/Industrial Installations—Continued



Approved clearance thimble is required when flue pipe extends through combustible materials. Follow the requirements of the thimble and/or the vent pipe manufacturer.

Figure 9. Horizontal Vent Terminal (Commercial/Industrial Installations)

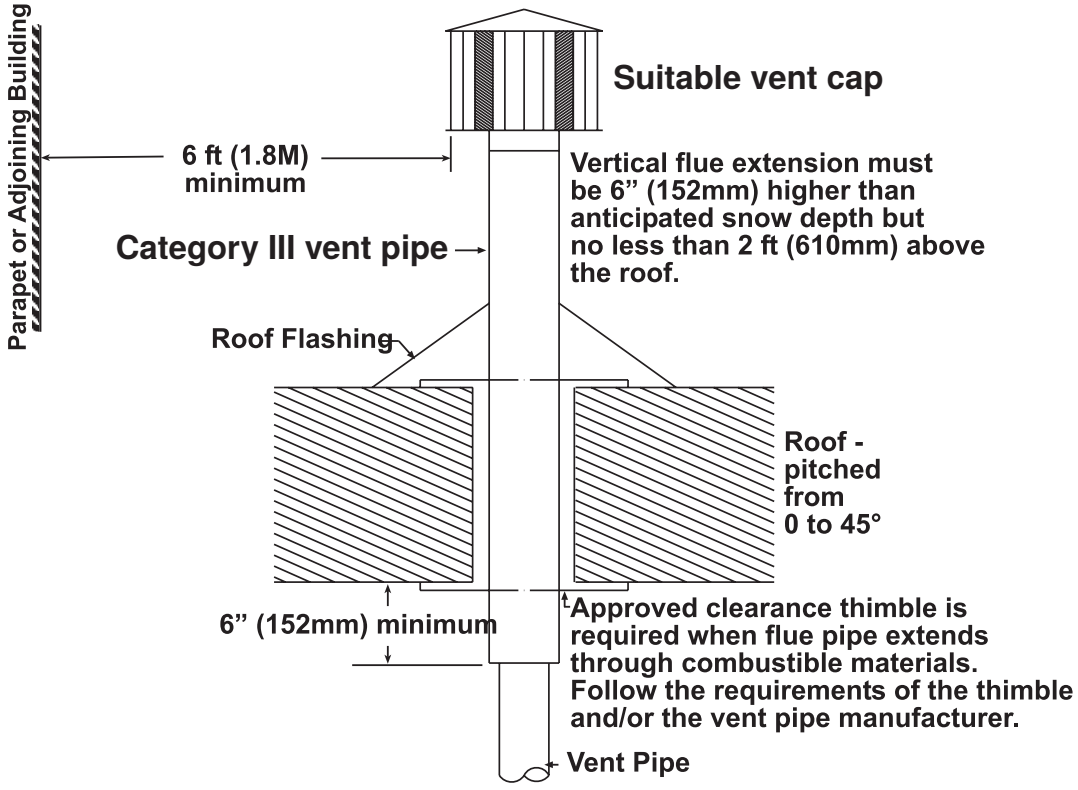
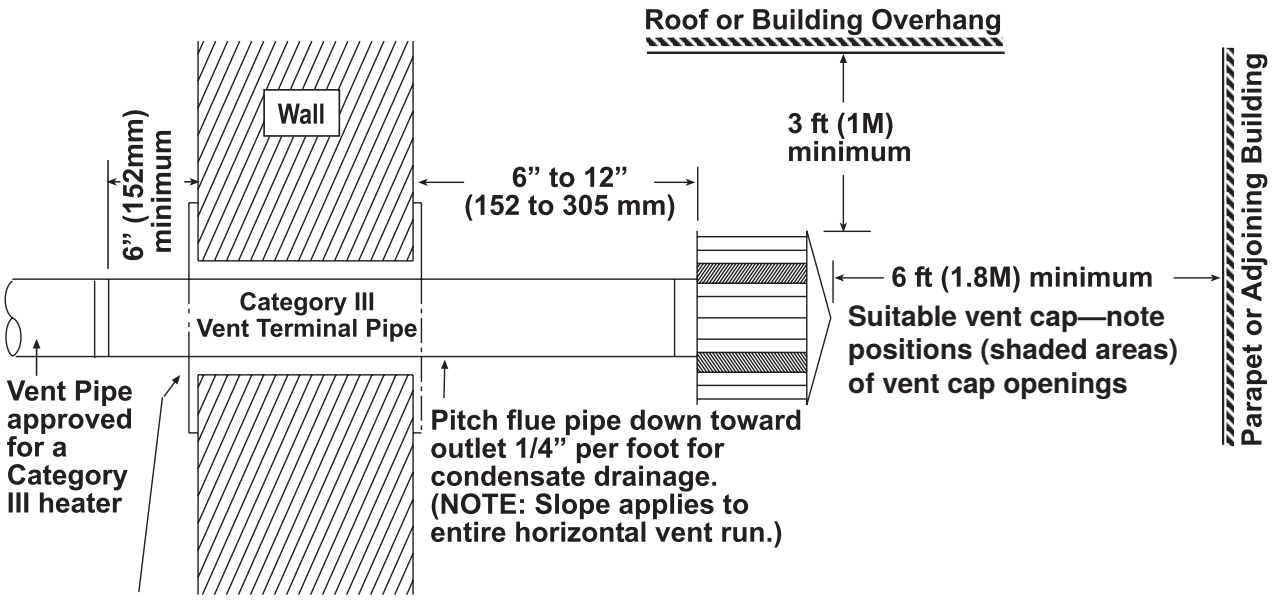


Figure 10. Vertical Vent Terminal (Commercial/Industrial Installations)

Category III Residential Installations (Unit Sizes 30 and 60)

Residential installations of unit sizes 30 and 60 may use a Category III dedicated vent as defined by the *National Fuel Gas Code* (ANSI Z223.1) or the *Installation Code for Gas Burning Appliances and Equipment* (CSA B149.1). Some venting requirements will vary depending on whether the vent is horizontal or vertical. Install the vent as follows:

1. Select vent pipe (refer to **Table 7**) approved to UL standard 1738 for Category III appliance for either horizontal or vertical vent run.
2. Determine vent pipe diameter and length. Minimum vent length is 3 feet (1 meter). Use only one diameter of vent pipe for installation (refer to **Table 8**).
3. Make all vent pipe joint connections in accordance with **Vent System Sealing Requirements** section.
4. Properly support all vent pipe runs in accordance with **Vent System Support Requirements** section.
5. Take appropriate steps to mitigate condensation in accordance with **Vent Pipe Size Requirements** section.
6. Terminate vent as follows:
   a. Install UL standard 1738 approved Category III vent pipe and terminate vent with suitable vent cap.
   b. Refer to instructions shown in **Figure 11** and to **Table 10** to install horizontal vent terminal.
   c. Refer to instructions shown in **Figure 12** to install vertical vent terminal.
   d. Ensure that vent terminal is installed in accordance with **Vent Terminal Requirements** section.



Approved clearance thimble is required when the flue pipe extends through combustible materials. Follow the requirements of the thimble and/or Category III vent pipe manufacturer.

Figure 11. Horizontal Vent Terminal (Residential Installations)

Vent Connections—Continued

Category III Residential Installations (Unit Sizes 30 and 60)—Continued

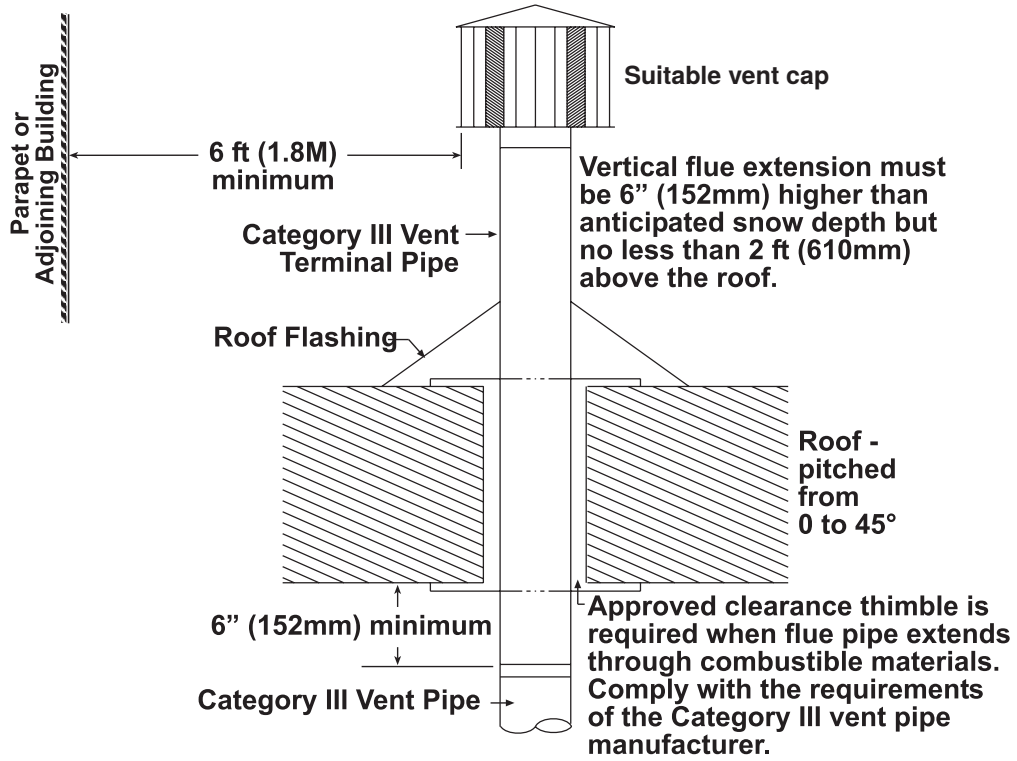


Figure 12. Vertical Vent Terminal (Residential Installations)

CONTROLS

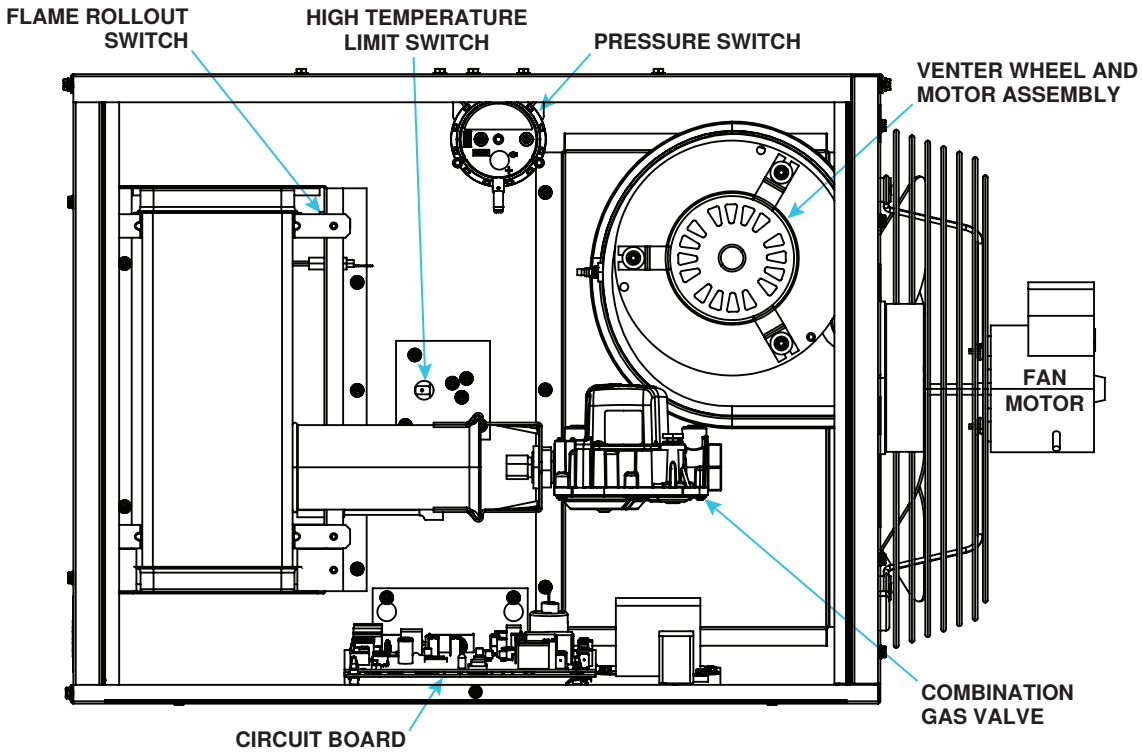


Figure 13. Control Locations (Typical)

Pressure Switch

⚠ DANGER ⚠

Safe operation of this unit requires proper venting flow. NEVER bypass the pressure switch or attempt to operate the unit without the venter running and the proper flow in the vent system. Hazardous conditions could result. ***Le fonctionnement sécuritaire de cet appareil requiert une circulation d'air appropriée. Ne contournez JAMAIS le pressostat ni ne tentez d'utiliser l'appareil sans l'aérateur ni une circulation adéquate dans le système de ventilation. Des conditions dangereuses pourraient en résulter.***

- The pressure (combustion air proving) switch (see **Figure 13**) is a pressure-sensitive switch that monitors air pressure to ensure that proper combustion airflow is available.
- The pressure switch is a single-pole/normally-open device that closes when a negative pressure (refer to **Table 14**) is sensed in the venter housing.
- At startup 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/turns cause the sensing pressure to be outside the pressure switch setpoint, the switch will function to shut off the main burner. The main burner will remain off until the system has cooled and/or the flue system resistance is reduced.

Table 14. Pressure Switch Settings

Unit Size (MBTUh)	Startup Cold	Equilibrium Hot	Setpoint OFF	Setpoint ON
	Negative Pressure (IN WC)			
30	1.25	0.95	0.35	0.50
60	1.30			
125	1.40	1.00	0.70	0.85

High Temperature Limit Switch

⚠ WARNING ⚠

The automatic-reset high temperature limit switch will continue to shut down the heater until the cause is corrected. Never bypass this switch as hazardous conditions could result. ***Le limiteur de température haute à réinitialisation automatique garde l'appareil de chauffage à l'arrêt tant que la cause n'est pas corrigée. Ne contournez jamais ce dispositif, car cela pourrait donner lieu à des conditions dangereuses.***

All units are equipped with a temperature-activated, automatic-reset high temperature limit switch (see **Figure 13**). The switch is factory-set and is non-adjustable. If the setpoint is reached, the switch interrupts the electric supply to the combination gas valve. This safety device provides protection in the case of motor failure or lack of airflow due to a restriction at the inlet or outlet.

Venter Wheel and Motor Assembly

The venter motor is assembled to the venter wheel (see **Figure 13**) and operates to provide combustion airflow. Operation is controlled by the circuit board (refer to **Circuit Board (DSI Control Module)** section).

Combination Gas Valve

⚠ WARNING ⚠

The combination gas valve is the prime safety shutoff. All gas supply lines must be free of dirt or scale before connecting them to the unit to ensure positive closure. ***La vanne de gaz combiné est le principal sectionneur de sûreté. Tous les conduits d'alimentation de gaz doivent être exempts de saleté et de dépôts avant d'être branchés à l'appareil pour assurer la fermeture de la vanne.***

The combination gas valve (see **Figure 13**) is powered by the 24V control circuit through the thermostat and safety controls. The diaphragm-type valve is pre-set at the factory and provides regulated gas flow.

Fan Motor

The fan motor (see **Figure 13**) is equipped with automatic-reset thermal overload protection. If the motor does not run, the cause may be due to improper current. Ensure that the correct voltage is available at the motor.

NOTE: If the unit is equipped with an optional, totally-enclosed motor or optional voltage, the motor's horsepower may be greater than the standard motor. Refer to the motor's nameplate to verify its horsepower.

Thermostat

NOTE: IMPORTANT: all units MUST be operated by a field-supplied 24V thermostat.

The field-supplied 24V thermostat must be field-installed in accordance with the thermostat manufacturer's instructions. Pay particular attention to the requirements regarding the location of the thermostat.

Circuit Board (DSI Control Module)

The heater's ignition system is controlled by a circuit board (see **Figure 13**), a Direct-Spark Integrated (DSI) control module (see **Figure 5**), that monitors the safety devices and controls the operation of the fan and venter motors and the combination gas valve between heat cycles. The module's Seven-Segment Display (SSD) is visible through a viewport on the access door panel. In addition, there is a status LED on the bottom of the heater. Its status indications are **off** (heater is not powered or control board fault), **steady on** (heater is on with no faults), or **flashing** (heater is on with fault(s)). Additional status indications appear on the display at the bottom of the control module (labeled as DSP1, see **Figure 5**). The display's codes are listed and described in the **Unit Troubleshooting Using DSI Control Module** section.

OPERATION

⚠ DANGER ⚠

- **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. *Pour votre sécurité, veuillez lire ce qui suit avant l'utilisation. Si ces directives ne sont pas respectées à la lettre, un incendie ou une explosion pourrait survenir et causer des dommages matériels, des blessures ou des pertes de vie.***
- **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. *Cet appareil n'est pas doté d'une veilleused'allumage. Il est pourvu d'un dispositif d'allumage qui allume automatiquement le brûleur. N'essayez pas d'allumer le brûleur de façon manuelle.***
- **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. *Avant de faire fonctionner l'appareil, sentez tout autour de l'appareil pour déceler toute odeur de gaz. Sentez à proximité du sol, car certains gaz sont plus lourds que l'air et se déposent sur le sol.***
- **WHAT TO DO IF YOU SMELL GAS: *QUE FAIRE S'IL Y A UNE ODEUR DE GAZ :***
  - **a. Do not try to light any appliance. *N'essayez d'allumer aucun appareil.***
  - **b. Do not touch any electrical switch; do not use any phone in your building. *Ne touchez à aucun interrupteur électrique; n'utilisez aucun téléphone dans le bâtiment.***
  - **c. Leave the building immediately. *Évacuez l'immeuble immédiatement.***
  - **d. Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions. *Appelez immédiatement le fournisseur de gaz en employant le téléphone isolé de la fondation de l'édifice. Respectez les directives du fournisseur de gaz.***
  - **e. If you cannot reach your gas supplier, call your fire department. *Si personne ne répond, appelez le service des incendies.***

⚠ DANGER ⚠

- **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.** ***Utilisez seulement la main pour ouvrir et fermer le bouton ON/OFF sur la vanne de gaz. N'utilisez jamais d'outils. Si le bouton ON/OFF ne tourne pas avec la main, ne tentez pas de le réparer. Communiquez avec un technicien de service qualifié. Si vous forcez l'interrupteur ou tentez de le réparer, cela pourrait causer un incendie ou une explosion.***
- **Should overheating occur, or the gas supply control system fail to shut off the flow of gas, turn off the manual gas valve to the appliance before shutting off the electrical supply.** ***En cas de surchauffe ou si le système de contrôle de l'alimentation de gaz omet de couper la circulation de gaz, fermez la vanne de gaz manuelle sur l'appareil avant de couper l'alimentation électrique.***
- **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.** ***N'utilisez pas cet appareil si une partie quelconque a été immergée dans de l'eau. Appelez immédiatement un technicien qualifié pour inspecter l'appareil et remplacer toute pièce du système de commande ou toute commande de gaz qui a été immergée dans de l'eau.***
- **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.** ***Un essai d'étanchéité doit être effectué sur tous les composants du système d'approvisionnement en gaz avant la mise en service de l'équipement. N'EFFECTUEZ JAMAIS D'ESSAI D'ÉTANCHÉITÉ DES GAZ AVEC UNE FLAMME NUE. Le non-respect de cette règle cause des blessures ou des dommages matériels ou la mort.***

Pre-Startup Checklist

Check the following ***before*** startup:

- ❑ Check to ensure that all screws used to secure shipping brackets have been re-installed in heater cabinet.
- ❑ Check suspension—unit must be secure and level.
- ❑ Check to ensure that clearances from combustibles are in accordance with **Table 1**.
- ❑ Check vent system to ensure that it is installed in accordance with venting instructions.
- ❑ Check piping for leaks and proper gas line pressure and bleed trapped air from gas lines (refer to **Supply Piping Connections** section).
- ❑ Check electrical wiring—ensure that all wire gauges are as recommended—service disconnect switch should be used—verify that fusing or circuit breakers are adequate for load use.
- ❑ Check polarity—verify that line voltage exists between black L1 wire and earth ground.
- ❑ If installation elevation is >6,000 feet (>1,830 meters), replace pressure switch in accordance with **Pressure Switch Replacement** section.

Startup

Start up the heater as follows:

1. Set thermostat at lowest setting.
2. Turn OFF all electric power to appliance.

NOTE: This appliance is equipped with an ignition device that automatically lights the burner. Do not try to light the burner by hand.

Startup—Continued

3. Open access door and locate gas control ON/OFF knob or switch on gas valve (see **Figure 14**).

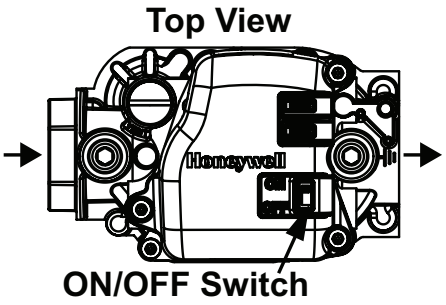


Figure 14. Gas Valve ON/OFF Control

4. Turn gas control switch to OFF or turn knob clockwise to OFF.
5. Wait 5 minutes to clear out any gas and then smell for gas (including near floor).
   a. If you smell gas, STOP! and follow steps in DANGER message listed above or on heater operating label.
   b. If you do not smell gas, proceed to step 6.
6. Turn gas control switch to ON or turn knob counterclockwise to ON.
7. Close access door.
8. Turn ON electric power to heater.
9. Set thermostat to desired setting.
   a. If heater does not operate, follow instructions in step 13 or on heater operating label and call your service technician.
   b. If heater operates, thermostat calls for heat, which energizes venter motor.
10. Pressure switch closes, which fires unit.
11. Burner flame is sensed and in 30 seconds after combination gas valve is energized, fan motor is energized.
12. If flame is extinguished during main burner operation, integrated control system closes main valve and must be reset by interrupting power to control circuit (refer to lighting instructions provided with heater).
13. TO TURN OFF GAS TO APPLIANCE:
   a. Set thermostat to lowest setting.
   b. If service is to be performed, turn off all electric power to appliance.
   c. Open the access door.
   d. Turn gas control switch to OFF or turn knob clockwise to OFF (do not force).
   e. Close access door.

Operating Sequences

The following tables list the heater's operating sequence. Refer to **Unit Troubleshooting Using DSI Control Module** section for LED indications.

Table 15. Operating Sequence (Normal Heat Cycle)		
Step	**Condition**	**Action**
1. Call for heat	Terminal W is energized	Thermostat calls for heat by energizing terminal W
		Control determines whether limit switch is open or closed and if pressure switch is open
	Limit switch is open	Control deenergizes gas valve, turns fan/blower motor onto heat speed, and runs venter motor
		SSD displays “5”
		Control is in soft lockout “L” before returning to normal operation
	Pressure switch is closed	SSD displays “4”
		Control waits indefinitely for pressure switch to open
	Pressure switch is open	Control proceeds to step 2
2. Prepurge	Venter motor is energized	Control waits for pressure switch to close
	Pressure switch not closed within 30 seconds of venter motor energizing	SSD displays “3”
		Control maintains venter motor energized indefinitely as long as call for heat remains and pressure switch is open
	Pressure switch is proven closed	Control begins prepurge
	Flame is present at any time during prepurge	Prepurge is restarted
	Flame is present long enough to cause lockout	Control runs venter motor and runs fan/blower motor on heat speed
		When flame is no longer sensed, venter motor runs through post-purge and fan/blower motor runs through selected delay OFF time
		Control proceeds to soft lockout but still responds to open limit and flame
		SSD displays “6” when lockout is due to undesired flame
	Venter motor runs for 20-second prepurge time	Control proceeds to step 3
3. Ignition trial period	Spark and main gas valve are energized	Venter remains energized
	Flame is sensed during first 16 seconds	Control deenergizes spark and proceeds to heat fan/blower on delay
	Flame is not sensed during first 16 seconds	Control deenergizes spark and maintains gas valve energized for additional 1-second flame-proving period
	Flame is not present after flame-proving period	Control deenergizes gas valve and proceeds with ignition retries as specified in **Table 16**: abnormal function ***Ignition Retry***
	Flame is present after flame-proving period	Control proceeds to step 4
4. Fan/blower ON delay	30 seconds after gas valve has opened	Control energizes fan/blower motor
	Gas valve and venter motor remain energized	Control proceeds to step 5
5. Steady heat	Limit switch is closed	Control continuously monitors inputs
	Pressure switch is closed	
	Flame is established	
	Thermostat call for heat remains	
	Thermostat call for heat is removed	Control deenergizes gas valve and proceeds to steps 6 and 7
6. Post-purge	Thermostat is satisfied	Venter motor remains on for 45-second post-purge period
7. Fan/blower OFF delay		Fan/blower motor is deenergized after selected fan/blower OFF delay

Operating Sequences—Continued

Table 16. Operating Sequence (Abnormal Heat Cycle)

Abnormal Function	Condition	Action
Interrupted thermostat call for heat	Thermostat demand for heat is removed before flame is recognized	Control runs venter motor for post-purge period
		All outputs are deenergized
	Thermostat demand for heat is removed after successful ignition	Control deenergizes gas valve
		Control runs venter motor through post-purge period
		Control runs fan/blower motor on heat speed for selected delay OFF time
Ignition retry	Flame is not established on first trial for ignition period	Control deenergizes gas valve
		Venter motor remains energized for 10-second inter-purge period
		Spark and gas valve are re-energized
		Control initiates another trial for ignition
	Flame is not established on second trial for ignition	Control deenergizes gas valve
		Control runs fan/blower motor on heat speed
		Venter motor remains energized
		Fan/blower motor deenergizes after selected delay OFF period and spark and gas valve are re-energized
		Control initiates another trial for ignition (this fan delay is self-healing feature for open auxiliary limit switch)
	Flame is not established on third trial for ignition	Control deenergizes gas valve
		Venter motor remains energized for 10-second inter-purge period
		Spark and gas valve are re-energized
		Control initiates another trial for ignition
	Flame is not established on fourth trial for ignition (initial try plus three re-tries)	Control deenergizes gas valve and proceeds to lockout
		SSD displays “L” to indicate ignition failure lockout
Limit switch operation	Limit switch is open and call for heat is present (switch is ignored unless call for heat (terminal W energized) is present)	Control deenergizes gas valve
		Control runs venter motor and runs fan/blower motor on heat speed
		Control is in soft lockout (SSD displays “L”) before returning to normal operation
	Limit switch re-closes or call for heat is not present	Control runs venter motor through post-purge period
		Control runs fan/blower motor on heat speed through selected delay OFF period
Pressure switch operation	Pressure switch opens before trial for ignition period	Venter motor runs through 2-second pressure switch recognition delay
		Control deenergizes gas valve
		Control runs venter motor through post-purge period
		Control restarts heat cycle at pressure switch proving state if call for heat still exists
	Pressure switch opens for less than 2 seconds during trial for ignition period (shall not interrupt heat cycle)	Control deenergizes gas valve while pressure switch is open
	Pressure switch opens after successful ignition	Control deenergizes gas valve
	Flame is lost before end of 2-second pressure switch recognition delay	Control responds to loss of flame
	Pressure switch remains open for 2 seconds and flame remains	Control deenergizes gas valve
		Control runs venter motor through post-purge period
		Control runs fan/blower motor on heat speed through selected delay OFF period
		When fan OFF delay ends, fan/blower motor is deenergized, and heat cycle begins if call for heat still exists
Continuous fan operation	Thermostat calls for continuous fan (G) without call for heat	Fan motor is energized after 0.25-second delay (this brief ON delay allows terminal G to energize slightly before terminal Y and allows external changeover relay to switch from terminal G to terminal W without causing momentary glitches in fan/blower output
		Fan remains energized as long as call for fan remains without call for heat
	Thermostat calls for heat (W) during continuous fan operation	Fan/blower is deenergized
		Call for fan is ignored during lockout

Table 17. Fault Modes		
Fault Mode	**Condition**	**Action**
Undesired flame	Flame is sensed longer than 20 seconds while gas valve is deenergized	Control runs venter motor and runs fan/blower motor on heat speed
		When flame is no longer sensed, venter motor runs through post-purge and fan/ blower motor runs through selected delay OFF time
		Control proceeds to soft lockout but still responds to open limit and flame
		SSD displays “6” when lockout is due to undesired flame
Gas valve relay fault	Control senses that gas valve is energized for more than 1 second when control is not attempting to energize gas valve or control senses that gas valve is not energized when it is supposed to be energized	Control proceeds to lockout (SSD is blank)
		Control assumes either that contacts of relay driving gas valve have welded shut or that sensing circuit has failed
		Venter motor is forced OFF to open pressure switch to stop gas flow unless flame is present
	Control senses that gas valve is closed when it should be open (has not deenergized after venter motor has been shut off for 15 seconds	Venter motor is re-energized to vent unburned gas
Soft lockout	Control does not initiate call for heat or call for continuous fan operation while in lockout	Control still responds to open limit and undesired flame
		Lockout is automatically reset after 1 hour
		Lockout may be manually reset by removing power from control for more than 1 second or by removing thermostat call for heat for more than 1 but less than 20 seconds
Hard lockout	Control detects fault on control board	SSD is blank or displays “L” (fault dependent)
		Control remains in lockout as long as fault remains
		Hard lockout automatically resets when hardware fault clears
Power interruption	Momentary interruption or voltage level is below minimum operating voltage (line voltage or low voltage)	System self-recovers without lockout when voltage returns to operating range
	Interruption <80 milliseconds	Control does not change operating state
	Interruption >80 milliseconds	Control may interrupt current operating cycle to restart

Vent System Testing

For each heater or utility heater connected to the venting system and placed in operation while any other appliance(s) connected to the venting system(s) is not in operation, test the vent system as follows:

1. Seal unused openings(s) in vent system.
2. Inspect vent system for proper size and horizontal pitch as required in *National Flue Gas Code* (ANSI Z223.1/ NFPA 54) or *Natural Gas and Propane Installation Code* (CSA B149.1) and in venting instructions.
3. Verify that there is no blockage or restriction, leakage, corrosion, and/or other deficiencies that could cause any unsafe condition.
4. In so far as is practical, close all doors, windows, and other open spaces within building and all doors between space in which appliance(s) is connected and space where vent system is located.
5. Close any fireplace dampers.
6. Turn on clothes dryers and any exhaust fans (such as range hoods and bathroom exhausts) so that they operate at maximum speed. Do not operate a summer exhaust fan.
7. Following lighting instructions provided with heater, place heater being inspected in operation. Adjust thermostat so that heater will operate continuously.
8. After it has been determined that each heater connected to vent system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous condition of use.
9. If improper venting is observed during above tests, vent system must be corrected.

Post-Startup Checklist

Check the following ***after*** startup:

- ❑ Ensure that vent system has been tested in accordance with **Vent System Testing** section.
- ❑ With unit in operation, measure manifold (outlet) gas pressure in accordance with **Measure and Adjust Manifold (Outlet) Gas Pressure** section.
- ❑ Turn unit OFF and ON, pausing 2 minutes between each cycle; observe for smooth ignition.
- ❑ Keep this manual and any control or optional information in accessible location near heater.

⚠ DANGER ⚠

- **The gas burner in this gas-fired equipment is designed and equipped to provide safe controlled complete combustion. However, if the installation does not permit the burner to receive the proper supply of combustion air, complete combustion may not occur. The result is incomplete combustion, which produces carbon monoxide, a poisonous gas that can cause death. Safe operation of indirect-fired gas burning equipment requires a properly operating vent system that vents all flue products to the outside atmosphere. FAILURE TO PROVIDE PROPER VENTING WILL RESULT IN A HEALTH HAZARD THAT COULD CAUSE SERIOUS PERSONAL INJURY OR DEATH.** ***Le brûleur à gaz contenu dans cet équipement à gaz est conçu et fourni de manière à assurer la combustion sécuritaire et complète, sans gaspillage. Toutefois, si l'installation ne permet pas au brûleur de recevoir un approvisionnement suffisant d'air de combustion, la combustion peut ne pas être complète. Le résultat est alors une combustion incomplète qui émet du monoxyde de carbone, un gaz nocif qui peut causer la mort. L'utilisation sécuritaire de l'équipement à gaz à chauffage indirect requiert un système de ventilation fonctionnel qui évacue tous les produits de la cheminée vers l'environnement extérieur. L'ABSENCE DE VENTILATION APPROPRIÉE PRÉSENTE UN RISQUE POUR LA SANTÉ QUI PEUT ENTRAÎNER DES BLESSURES GRAVES OU LA MORT.***
- **Always comply with the combustion air requirements listed in the installation codes and in this manual. NEVER RESTRICT OR OTHERWISE ALTER THE SUPPLY OF COMBUSTION AIR TO ANY HEATER. Heaters installed in a confined space must be supplied with air for combustion as required by code and by the requirements listed in this manual. MAINTAIN THE VENT IN STRUCTURALLY SOUND AND PROPER OPERATING CONDITION.** ***Respectez toujours les exigences pour l'air de combustion stipulées dans les codes d'installation et dans ce manuel. L'air de combustion au brûleur doit être contrôlé uniquement par l'équipement fourni par le fabricant. NE RESTREIGNEZ ET NE MODIFIEZ JAMAIS L'APPROVISIONNEMENT EN AIR DE COMBUSTION DE TOUT APPAREIL DE CHAUFFAGE. Les appareils de chauffage installés dans un espace clos requièrent un apport d'air de combustion tel que stipulé dans le code et les exigences contenues dans le présent manuel. GARDEZ LE SYSTÈME DE VENTILATION STRUCTURELLEMENT SOLIDE ET EN ÉTAT DE MARCHE.***

ADJUSTMENTS

NOTE: A gas conversion kit (PN 2000752) may be ordered separately for changing from natural gas to propane. Conversion instructions are included with the kit. This factory-authorized conversion kit MUST BE used.

After startup, the combination gas valve outlet pressure must be measured and adjusted if necessary in accordance with the **Measure and Adjust Manifold (Outlet) Gas Pressure** section. If the heater is being installed at an elevation of >6,000 feet (>1,830 meters), the pressure switch must be replaced in accordance with the **Pressure Switch Replacement** section before the gas pressure is adjusted.

Measure and Adjust Manifold (Outlet) Gas Pressure

When the heater leaves the factory, the combination gas valve is set so that the valve outlet gas pressure is regulated to 3.5 IN WC. Inlet supply pressure to the valve for natural gas must be a minimum of 5 IN WC or as noted on the rating plate and a maximum of 14 IN WC. During normal operation at sea level, adjustment to the factory-setting should not be necessary. Measuring outlet pressure cannot be done until the heater is in operation. Measure and adjust the manifold (outlet) gas pressure as follows:

⚠ WARNING ⚠

Valve outlet gas pressure must never exceed 3.5 IN WC for natural gas or 10 IN WC for propane. The maximum inlet supply pressure for natural gas or propane is 14 IN WC. Maximum gas pressure can never be exceeded either during operation or when unit is static (with lock-up regulator). ***La pression de gaz à la sortie de la vanne ne doit jamais dépasser 3.5 PO CE pour le gaz naturel ou 10 PO CE pour le propane. La pression d'alimentation maximum à l'entrée est de 14 PO CE pour le gaz naturel ou le propane. La pression de gaz maximum ne doit jamais être dépassée pendant le fonctionnement ni lorsque l'appareil est en mode statique (avec régulateur de verrouillage).***

⚠ CAUTION ⚠

Before attempting to measure or adjust valve outlet gas pressure, the inlet supply pressure must be within the specified range, both when the heater is in operation and when it is on standby. Incorrect inlet pressure could cause excessive valve outlet 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.

NOTE: The inputs and capacity of the heater varies depending on elevation. For installation at elevations above 2,000 feet (610 meters), the heater shall be derated 4% for each 1,000 feet (305 meters) of elevation above sea level. If unsure of elevation, contact local gas supplier.

1. If installation is at elevation >6,000 feet (>1,830 meters), replace pressure switch in accordance with **Pressure Switch Replacement** section.
2. Determine correct outlet pressure (refer to **Table 18**) for elevation of installation. If installation is at elevation >2,000 feet (>610 meters), derate the heater 4% for each 1,000 feet (305 meters) of elevation above sea level.

Table 18. Required Manifold (Outlet) Gas Pressure

Installation Location	Elevation (Feet (Meters))	Natural Gas	Propane
		Manifold Pressure (IN WC)	
US, Canada	0–2000 (0–610)	3.5	10.0
US	2001–3000 (611–915)	3.1	8.8
Canada	2001–4500 (611–1373)	2.8	8.1
US	3001–4000 (916–1220)	3.0	8.5
	4001- 5000 (1221–1525)	2.8	8.1
	5001–6000 (1526–1830)	2.7	7.7
	6001–7000 (1831–2135)	2.6	7.4
	7001–8000 (2136–2440)	2.5	7.1
	8001–9000 (2441–2745)	2.4	6.7
	9001–10,000 (2746–3045)	2.2	6.4

3. Turn ON/OFF knob or switch on valve to OFF to prevent flow to gas valve.

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

4. Connect manometer to output pressure tap on valve (see **Figure 15**).

ADJUSTMENTS—CONTINUED

Measure and Adjust Manifold (Outlet) Gas Pressure—Continued

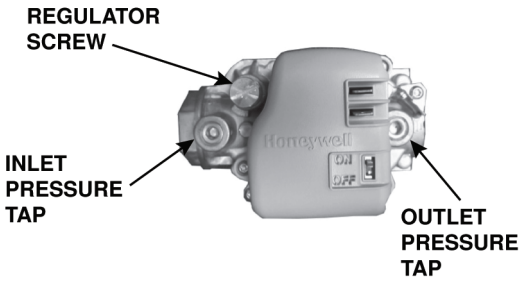


Figure 15. Combination Gas Valve

5. Turn ON/OFF knob or switch on valve to ON.

⚠ CAUTION ⚠

DO NOT bottom out the gas valve regulator screw. This can result in excessive overfire and heat exchanger failure due to unregulated manifold pressure.

6. Remove cap from regulator screw (see **Figure 15**) and adjust pressure in accordance with **Table 18** by turning regulator screw IN (clockwise) to increase pressure or OUT (counterclockwise) to decrease pressure.
7. Turn up thermostat and cycle burner once or twice to properly seat adjustment spring in valve and recheck outlet pressure. When pressure corresponds to **Table 18**, disconnect manometer and install cap on regulator screw.
8. Check for leakage at outlet pressure tap fitting. Correct as necessary.
9. Connect manometer to inlet pressure tap (see **Figure 15**). While heater is operating, measure inlet pressure, which should be between 5 and 14 IN WC for natural gas or between 11 and 14 IN WC for propane.
10. If inlet pressure is not between 5 and 14 IN WC for natural gas or between 11 and 14 IN WC for propane, inlet pressure must be corrected by adjusting manifold (outlet) pressure in accordance with steps 3 through 6.
11. Use permanent marker to fill in appropriate input and capacity values on high-elevation adjustment label provided with unit. Select location for label on outside of heater access panel that will be conspicuous to anyone operating or servicing unit. Ensure that surface is clean and dry and affix label.
12. Observe heater operation for at least one complete cycle to check for safe and proper operation.

Pressure Switch Replacement

NOTE: For installations at elevations >6,000 feet (>1,830 meters), the pressure switch must always be replaced before the heater is operated. Contact your distributer to order a replacement switch.

1. Locate pressure switch in control compartment (see **Figure 13**) and mark and disconnect two switch wires.
2. Mark and disconnect sensing tube(s) from pressure switch.
3. Remove two screws that secure mounting bracket and remove bracket and pressure switch. Save bracket and screws for reuse.
4. Install replacement pressure switch using mounting bracket and two screws. Reconnect sensing tube(s) and wires.

MAINTENANCE

⚠ WARNING ⚠

- **If you turn OFF the electrical power supply, turn OFF the gas. *Si vous coupez l'alimentation électrique, coupez également le gaz.***
- **Eye protection is recommended when cleaning unit. *Il est recommandé de porter des lunettes de protection pendant le nettoyage de l'appareil.***

⚠ CAUTION ⚠

- **When re-lighting, always follow the lighting instructions on the heater.**
- **If any of the original wire supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 220°F (105°C), except for limit control, flame rollout, and sensor lead wires, which must be rated at 302°F (150°C).**

NOTE: 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.

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

Service Checklist

At a minimum, perform the following annually (see **Figure 13** for component locations):

- ❑ Inspect burner/control compartment annually to determine if cleaning is necessary.
- ❑ Clean all dirt, lint, and grease from combustion air opening and venter assembly.
- ❑ Clean all dirt, lint, and grease from fan blade, fan guard, and motor.
- ❑ Check heat exchanger both internally and externally.
- ❑ Check burner for scale, dust, or lint accumulation and clean if needed.
- ❑ Check gas valve to ensure that gas flow is being shut off completely.
- ❑ Check vent or vent/combustion air system for soundness and clean openings.
- ❑ Replace any parts that do not appear sound.
- ❑ Check for any damaged wiring and replace as necessary.

Maintenance Procedures

⚠ CAUTION ⚠

- **When any service is completed, ensure that the unit is reassembled correctly so that no unsafe conditions are created.**
- **If replacement parts are required, use only factory-authorized parts.**

NOTE: Keep all hardware removed to be used in reassembling and installing the replacement parts.

Burner Maintenance

Visually inspect the burner compartment (see **Figure 16**). If there is an accumulation of dirt, dust, and/or lint, clean the compartment and remove and clean the burner as follows:

1. Remove gas and electric supply:
   a. Shut OFF gas supply ahead of union at manual shutoff valve outside cabinet.
   b. Turn OFF electric supply.
   c. Disconnect gas supply at union outside of cabinet.

Maintenance Procedures—Continued

Burner Maintenance—Continued

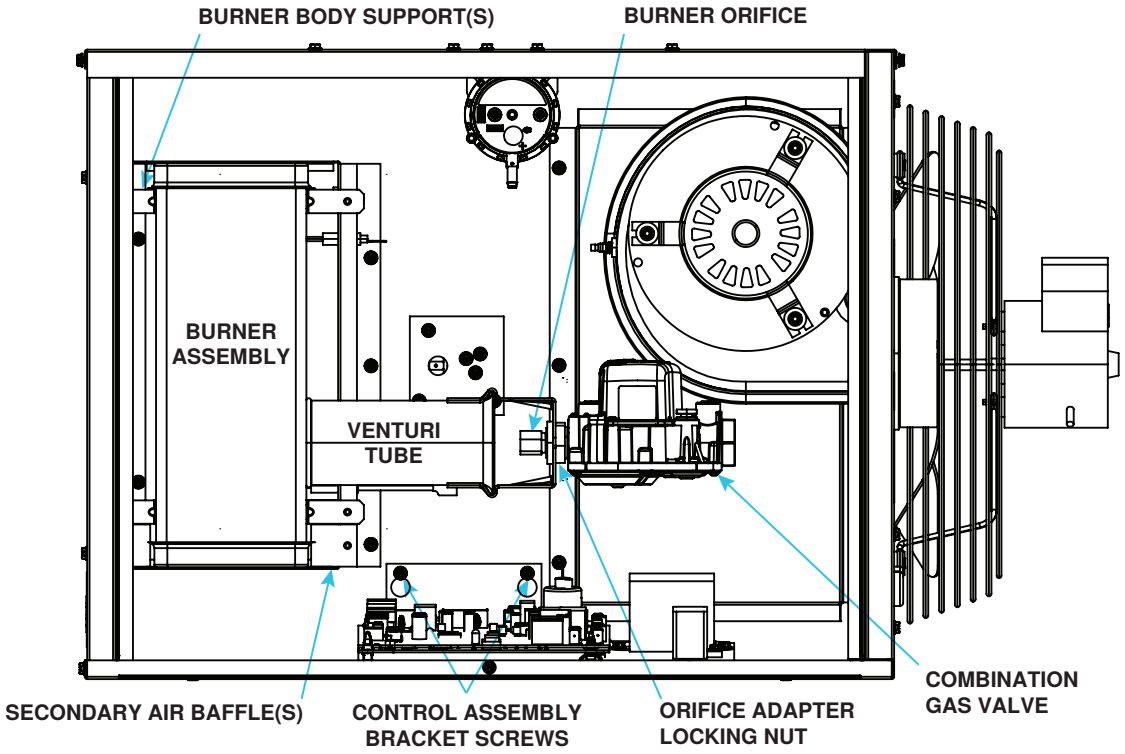


Figure 16. Burner Compartment (Typical)

⚠ CAUTION ⚠

Take care not to damage the ignitor while removing or cleaning the burner assembly.

2. Remove burner assembly (see **Figure 16**):
   a. Remove access panel.
   b. Disconnect gas train:
      (1) Mark and disconnect wires at combination gas valve.
      (2) Carefully remove burner orifice and orifice adapter locking nut.
      (3) Slide orifice adapter out through bracket on venturi tube while pushing gas train to right. This will move gas train out of way.
   c. Detach control assembly:
      (1) Remove two screws that secure control assembly bracket.
      (2) Being careful not to disconnect any wires, slide control assembly to right.
   d. For unit sizes 60 and 125, remove secondary air baffle(s):
      (1) Locate flat plate(s) identified as secondary air baffle(s)—vertical along right side of burner. Quantity of baffles could be one to four depending on heater size. Each baffle is held in place by one screw.
      (2) For correct re-assembly on secondary air shield, mark location (top and bottom) of each baffle.
      (3) Remove screw(s) and remove baffle(s) (all).
   e. Locate burner body supports—depending on size, burner will have two or more supports. At each support, remove one screw that secures support to secondary air shield.
   f. While holding venturi tube, slide entire burner assembly slightly to right to disengage burner from supports on left.
   g. Rotate open end of venturi tube inward toward heater and carefully pull burner assembly out of cabinet.

3. Inspect and clean burner:

NOTE: If, upon inspection, any of the burner components are damaged or deteriorated, replace the burner assembly.

   a. With burner assembly removed, shine flashlight on burner ribbons. Look for carbon buildup, scale, dust, lint, and/or anything that might restrict flow through spaces between burner ribbons.
   b. While holding burner assembly so that any foreign material will fall away from burner, use stiff bristle brush to loosen and remove any foreign material(s).
   c. If burner is excessively dirty, remove one burner end cap:
      (1) Remove four screws that secure end cap to burner housing.
      (2) Lightly tap end cap to remove it.
   d. Clean all foreign material from burner and venturi.
   e. When burner is thoroughly clean, replace end cap, ensuring that it is tight against burner housing.
4. Inspect lower part of heat exchanger:
   a. With burner assembly removed, shine bright light into each heat exchanger section at burner flame entrance of each tube.
   b. With light shining into heat exchanger, observe outside for visible light. Repeat for each heat exchanger section.
   c. If any light is observed, replace heat exchanger.
5. Re-install burner assembly (see **Figure 16**):
   a. Attach burner assembly:
      (1) While holding venturi tube, slide entire burner assembly into position.
      (2) Align supports on left side with slots in burner shield and slide supports into slots.
      (3) On right, install screw that secures each burner body support to secondary air shield.
   b. For unit sizes 60 and 125, re-install secondary air baffles—install screw that secures each baffle(s)—baffles may be different sizes and each must be installed in correct location as marked.
   c. Attach control assembly:
      (1) Carefully slide control assembly into position and secure using same screws.
      (2) Check to ensure that all wire connections are secure.
   d. Reconnect gas train:
      (1) Slide gas train into position so that orifice adapter is slid through bracket on burner.
      (2) Secure gas train to bracket using locking nut.
      (3) Install gas orifice and reconnect wires to combination gas valve.
   e. Install access panel.
   f. Reconnect gas supply at union outside of cabinet.
   g. Leak test connection using leak detecting solution. If leak is detected, tighten connection. If leak cannot be stopped by tightening connection, replace part(s).
6. Turn ON electric and gas.
7. Check for proper operation.

Burner Orifice Maintenance

The burner orifice usually needs to be replaced only when installing a gas conversion kit. When ordering a replacement orifice only, provide BTUh content and specific gravity of gas as well as the model and serial number of the unit. When removing or replacing the burner orifice, take care not to damage the venturi tube and/or the bracket.

Maintenance Procedures—Continued

Heat Exchanger Maintenance

NOTE: Inspection of the lower portion of the heat exchanger is done with the burner removed. Refer to the Burner Maintenance section for information on inspecting the lower portion of the heat exchanger.

8. Remove burner in accordance with **Burner Maintenance** section.
9. Remove any external dirt or dust accumulation.
10. Visually inspect heat exchanger for cracks and holes.
11. If crack or hole is found, replace heat exchanger.
12. Install burner in accordance with **Burner Maintenance** section.

Ignition System Maintenance

- The DSI control module (circuit board, see **Figure 5**) monitors the operation of the heater including ignition. The only replaceable component is the 3-amp Type ATC or ATO fuse (color code: violet, PN 201685). If the fuse is blown, the problem is most likely an external overload. Correct the problem and replace the fuse.
- Do not attempt to disassemble the control module. However, check the lead wires each heating season for insulation deterioration and good connections.
- For the flame sensor (see **Figure 13** for location), disconnect the wire and remove the screw and the flame sensor. Clean flame sensor with an emery cloth before reinstalling.
- Proper operation of the direct spark ignition system requires a minimum flame signal of 1.0 microamps as measured by a microampmeter.

⚠ CAUTION ⚠

When reassembling, the brown ground wire must remain attached to the ignitor.

- For the ignitor (see **Figure 13** for location), disconnect the wire and remove the screw and ignitor. Clean the ignitor assembly with an emery cloth before reinstalling.

⚠ WARNING ⚠

Due to high voltage on the spark wire and electrode, do not touch when energized. *En raison de la tension élevée dans le fil d'étincelles et l'électrode, ne touchez pas lorsqu'ils sont sous tension.*

- The spark gap (see **Figure 17**) must be maintained to 1/8 inch (3.2 mm).

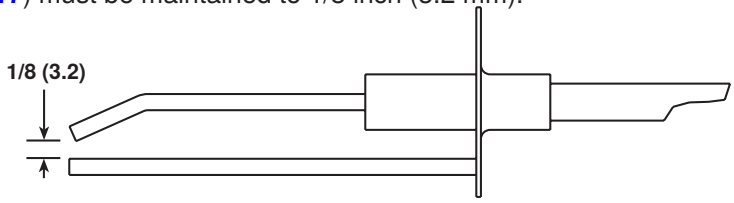


Figure 17. Ignitor Spark Gap

Fan and Motor Assembly Maintenance

Inspect and clean the motor, fan guard, and blades. Remove any dirt and grease. Take care when cleaning the fan blades to prevent causing misalignment or imbalance. Check to ensure that the hub of the fan blades is secure to the shaft. If necessary, replace the assembly as follows:

1. If heater has been installed, turn OFF gas and disconnect electric power.
2. Remove access panel and disconnect fan motor wires, capacitor wires at capacitor, and ground screw.
3. Remove assembled parts (fan guard, motor, and fan blade).

4. Disassemble and replace part(s) as needed.
5. Reassemble using replacement part(s) as needed and original parts.
6. Ensure that fan is in proper position on shaft (see **Figure 18**), that setscrew is tightened in accordance with torque listed in **Table 19**, and that nuts securing motor to fan guard are torqued to to 30 inch-pounds.

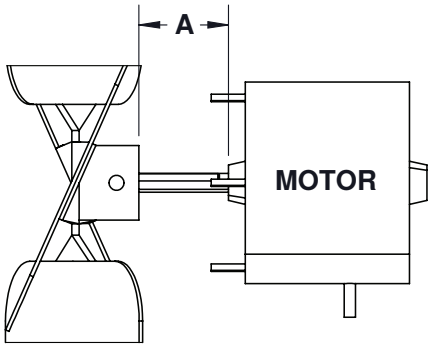


Figure 18. Fan and Motor Spacing (Refer to Table 19)

Table 19. Fan and Motor Assembly Specifications

Unit Size (MBTUh)	Dimension A* (Inches (mm))	Setscrew Torque (Inch-Pounds ±10)
30	1 (25)	80
60	1-1/2 (38)	
125	2-5/16 (59)	120

*See **Figure 18**.

7. Position assembly on heater and secure fan guard.
8. Rotate fan blade to check for adequate clearance. If adjustment is required, loosen mounting screws, reposition fan guard, and tighten screws to 30 inch-pounds. Repeat until assembly is positioned properly.
9. Reconnect fan motor wires in accordance with wiring diagram. Secure wires to fan guard leg using tie wrap(s).
10. Install access panel.
11. Restore electric power to heater and turn ON gas.
12. Follow instructions on lighting instruction plate to light heater.
13. Check for proper heater operation.

Venter Wheel and Motor Assembly Maintenance

NOTE: Venter motor bearings are permanently lubricated.

Remove dirt and grease from the motor casing, venter housing, and venter wheel. Replace the venter wheel and motor assembly as follows:

1. Turn OFF gas and disconnect electric power.
2. Remove burner/control compartment access panel.
3. Disconnect three venter motor wires at DSI control, capacitor wires at capacitor (if applicable), and ground screw (located on control panel).
4. For unit size 30, detach gas train:
   a. Disconnect gas supply at union outside of cabinet.
   b. Mark and disconnect wires at gas valve.
   c. Carefully remove burner orifice and orifice adapter locking nut.
   d. Slide orifice adapter out through bracket on burner while pushing gas train to right. This will move gas train out of way.
5. While holding venter motor, remove three or four screws that secure venter motor mounting plate to venter housing. Remove motor and wheel assembly from heater.

Maintenance Procedures—Continued

Venter Wheel and Motor Assembly Maintenance—Continued

6. Reassemble with replacement venter motor and wheel. Ensure that venter wheel is properly positioned on shaft (see **Figure 19**).

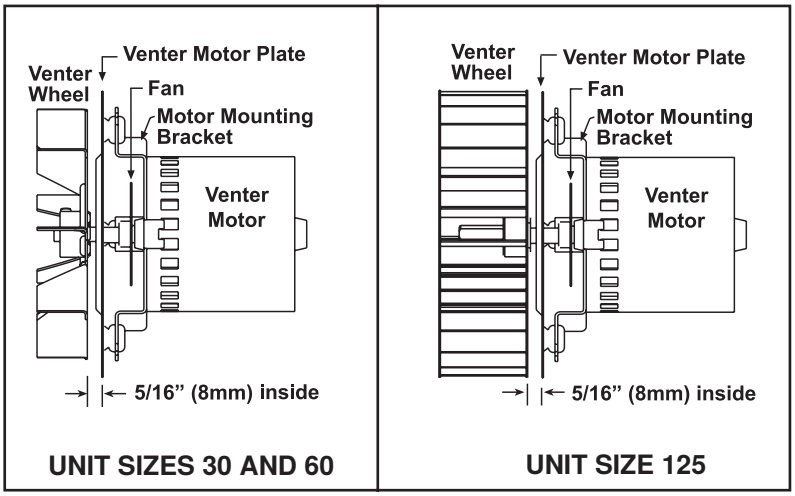


Figure 19. Venter Wheel and Motor Assembly

7. Reconnect venter wires in accordance with wiring diagram.
8. For unit size 30, reconnect gas supply at union outside of cabinet.
9. Leak test connection using leak detecting solution. If leak is detected, tighten connection. If leak cannot be stopped by tightening connection, replace part(s).
10. Install access panel.
11. Restore electric power to heater and turn ON gas.
12. Follow instructions on lighting instruction plate to light heater.
13. Check for proper heater operation.

Combination Gas Valve Maintenance

⚠ WARNING ⚠

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

Inspect the combination gas valve (see **Figure 13** for location), carefully remove any external dirt accumulation, and check wiring connections. Check the valve annually to ensure that the valve is shutting off gas flow completely as follows:

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

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

15. Connect manometer to outlet pressure tap on combination gas valve (see **Figure 15**).
16. Open manual shutoff and combination gas valves.
17. Use finger to fully block main burner orifice for several seconds.
18. Observe manometer with orifice blocked. If ***any*** pressure is indicated, combination gas valve is leaking and must be replaced before heater is restored to operation.

Pressure Switch Maintenance

If it is determined that the pressure switch needs replacing, use only the factory-authorized replacement part that is designed for the model and size of heater being serviced. Replace the switch in accordance with the **Pressure Switch Replacement** section.

NOTE: A unit operating above 6,000 feet (1,830 meters) in elevation requires a high-elevation pressure switch (refer to Pressure Switch Replacement section).

High Temperature Limit Control Maintenance

If it is determined that the high temperature limit control needs replacing, use only a factory-authorized replacement part that is designed for the size of heater. For the approximate limit control location, see **Figure 13**.

Vent System Maintenance

Check the complete system at least once a year. Inspection should include all joints, seams, and the vent terminal cap. Clean all openings and replace any defective parts.

Flame Rollout Switch Maintenance

- The cause of a flame rollout switch (see **Figure 13** for location) activating must be determined. Activation of the manually-reset flame rollout switch could be caused by one or more of the following:
  a. Restricted or plugged heat exchanger
  b. Too much building exhaust
  c. Manifold gas pressure too high
  d. Restricted combustion air inlet or exhaust outlet in combination with defective pressure switch
  e. Electrical power interruption during operation
  f. Unit being operated with line voltage disconnect (24V thermostat is required)
- If a flame rollout switch trips, inspect the burner/control compartment for signs of excessive heat and burned wiring. If there is damage to the control compartment, repairs must be made before resetting the switch.
- If the compartment appears normal, reset by depressing the red button on the switch (15–20 minutes are required for the switch to cool sufficiently before resetting). A distinct click will be felt when the switch resets. Operate the furnace. If the flame rollout switch trips again, determine and correct the cause before resetting the switch.
- If it is determined that the flame rollout switch needs replacing, use only the factory-authorized replacement part that is designed for that size of heater. The disconnect toggle switch is on the rear of the heater.

TROUBLESHOOTING

General Troubleshooting

Table 20. General Troubleshooting

Symptom	Probable Cause	Remedy
A. Venter motor will not start	1. No power to unit	Turn ON power and check supply fuses or circuit breaker
	2. No 24V power to integrated circuit board	Turn up thermostat
		Check control transformer output
	3. Integrated circuit board fuse blown	Correct cause and replace fuse (3A, type ATC or ATO, 32VDC)
	4. No power to venter motor	Tighten connections at circuit board and/or motor terminals
	5. Integrated circuit board defective	Replace integrated circuit board
	6. Defective venter motor	Replace venter motor (refer to **Venter Wheel and Motor Assembly Maintenance** section)

TROUBLESHOOTING—CONTINUED

General Troubleshooting—Continued

Table 20. General Troubleshooting—Continued

Symptom	Probable Cause	Remedy
B. Burner will not light	1. Manual valve not open	Open manual valve
	2. Air in gas line	Bleed gas line (initial startup only)
	3. Gas pressure too high or too low	Supply pressure should be 5–14 IN WC for natural gas or 11–14 IN WC for propane
	4. No spark	Perform following:
	a. Loose wire connections	Ensure that all wire connections are solid
	b. Transformer failure	Ensure that 24V power is available
	c. Incorrect spark gap	Maintain spark gap at 1/8 inch
	d. Spark cable shorted to ground	Replace worn or grounded spark cable
	e. Spark electrode shorted to ground	Replace ceramic spark electrode if it is cracked or grounded
	f. Burner not grounded	Ensure that integrated circuit board is grounded (terminals P1–9)
	g. Circuit board not grounded	Ensure that integrated circuit board is grounded to furnace chassis
	h. Unit not properly grounded	Ensure that unit is properly field grounded to earth ground and properly phased (L1 to hot lead L2 to neutral)
	i. Integrated circuit board fuse blown	Correct cause and replace fuse (3A, type ATC or ATO, 32VDC)
	j. Faulty integrated circuit board	If 24V power is available to integrated circuit board and all other causes have been eliminated, replace board
	5. Lockout device interrupting control circuit by above causes	Reset lockout by interrupting control at thermostat or main power
	6. Interlock door switch open	Close access door or replace switch
	7. Pressure switch not closing	Perform following:
		Ensure that unit is properly vented
		Remove obstruction(s) from vent
		Replace faulty tubing to pressure switch
	8. Faulty pressure switch	Replace pressure switch
	9. Main valve not operating	Perform following:
	a) Defective valve	If 24V power is measured at valve connections and valve remains closed, replace valve
	b) Loose wire connections	Check and tighten all wiring connections
	10. Integrated circuit board does not power main valve	Perform following:
	a) Loose wire connections	Ensure that all wire connections are solid
	b) Flame sensor grounded	Ensure that flame sensor lead is not grounded or that sensor insulation or ceramic is not cracked—replace as required
	c) Incorrect gas pressure	Supply pressure should be 5–14 IN WC for natural gas or 11–14 IN WC for propane
	d) Cracked ceramic at sensor	Replace sensor
C. Burner cycles ON and OFF	1. Gas pressure too high or too low	Supply pressure should be 5–14 IN WC for natural gas or 11–14 IN WC for propane
	2. Burner not grounded	Ensure that integrated circuit board is grounded (terminals P1–9)
	3. Circuit board not grounded	Ensure that integrated circuit board is grounded to furnace chassis
	4. Faulty integrated circuit board	If 24V power is available to integrated circuit board and all other causes have been eliminated, replace board
	5. Pressure switch not closing	Perform following:
		Ensure that unit is properly vented
		Remove obstruction(s) from vent
		Replace faulty tubing to pressure switch
	6. Faulty pressure switch	Replace pressure switch
	7. Flame sensor grounded	Ensure that flame sensor lead is not grounded or that sensor insulation or ceramic is not cracked—replace as required
	8. Cracked ceramic at sensor	Replace sensor
	9. Incorrect polarity	Reverse line volt leads to integrated circuit board
	10. Pin terminal loose on wire harness	Replace wire harness
D. No heat (heater operating)	1. Incorrect valve outlet pressure or orifice	Check valve outlet pressure (refer to unit rating plate for manifold pressure)
	2. Cycling on limit control	Check air throughput
	3. Improper thermostat location or adjustment	Refer to thermostat manufacturer's instructions

Table 20. General Troubleshooting		
Symptom	**Probable Cause**	**Remedy**
E. Fan or venter motor will not run	1. Circuit open	Check wiring and connections
	2. Defective integrated circuit board	Replace board
	3. Defective motor	Replace motor
F. Fan or venter motor turns ON and OFF while burner is operating	1. Motor overload device cycling ON and OFF	Check motor load against motor rating plate—replace motor if needed
G. Fan or venter motor cuts out on overload	1. Low or high voltage supply	Correct electric supply
	2. Defective motor	Replace motor
	3. Poor airflow	Clean motor, fan, and fan guard

Unit Troubleshooting Using DSI Control Module

NOTES:

- **If troubleshooting indicates that repair of the DSI control module is required, note that its only replaceable part is the fuse, which is a type ATC or ATO 3A fuse, color code violet (PN 201685).**
- **IMPORTANT: When using a multimeter to troubleshoot the 24V circuit, place the multimeter's test leads into the connectors located on the ignition control. Do not remove connectors or terminals from the electrical components. Doing so can result in misinterpreted readings caused by the control module's fault mode monitoring circuits.**
- **Remove and reapply power to the control module to view the last five fault codes stored in its memory. The most recent to least recent fault codes will be displayed.**

The Seven-Segment Diisplay (SSD) on the DSI control module (refer to **Circuit Board (DSI Control Module)** section) may be used to troubleshoot the unit. The control module monitors the operation of the heater, and the display indicates normal operation and various abnormal conditions. If the heater fails to operate properly, check this display (refer to **Table 21**) to determine the cause and/or to eliminate certain causes. Remove and reapply power to the control module to view the last five fault codes stored in its memory—the most recent to least recent fault codes will be displayed. See **Figure 20** for a flowchart for troubleshooting the unit using the DSI control module.

Table 21. Circuit Board (DSI Control Module) Display Codes		
Display Code Status	**Display Code**	**Indication**
Steady	—	Normal operation—no call for heat
	0	Ignition sequence active
	H	Normal operation—call for heat (strong flame)
Flashing	2	Normal operation—call for heat (weak flame)
	L	Lockout from failed ignition or flame loss
	3	Pressure switch is not closed within 30 seconds of venter motor energizing
	4	Pressure switch is closed before venter motor is energized
	5	Limit switch or rollout open
	6	Undesired flame
	7	Polarity reversed
Steady	Off	Internal fault/power failure

Unit Troubleshooting Using DSI Control Module—Continued

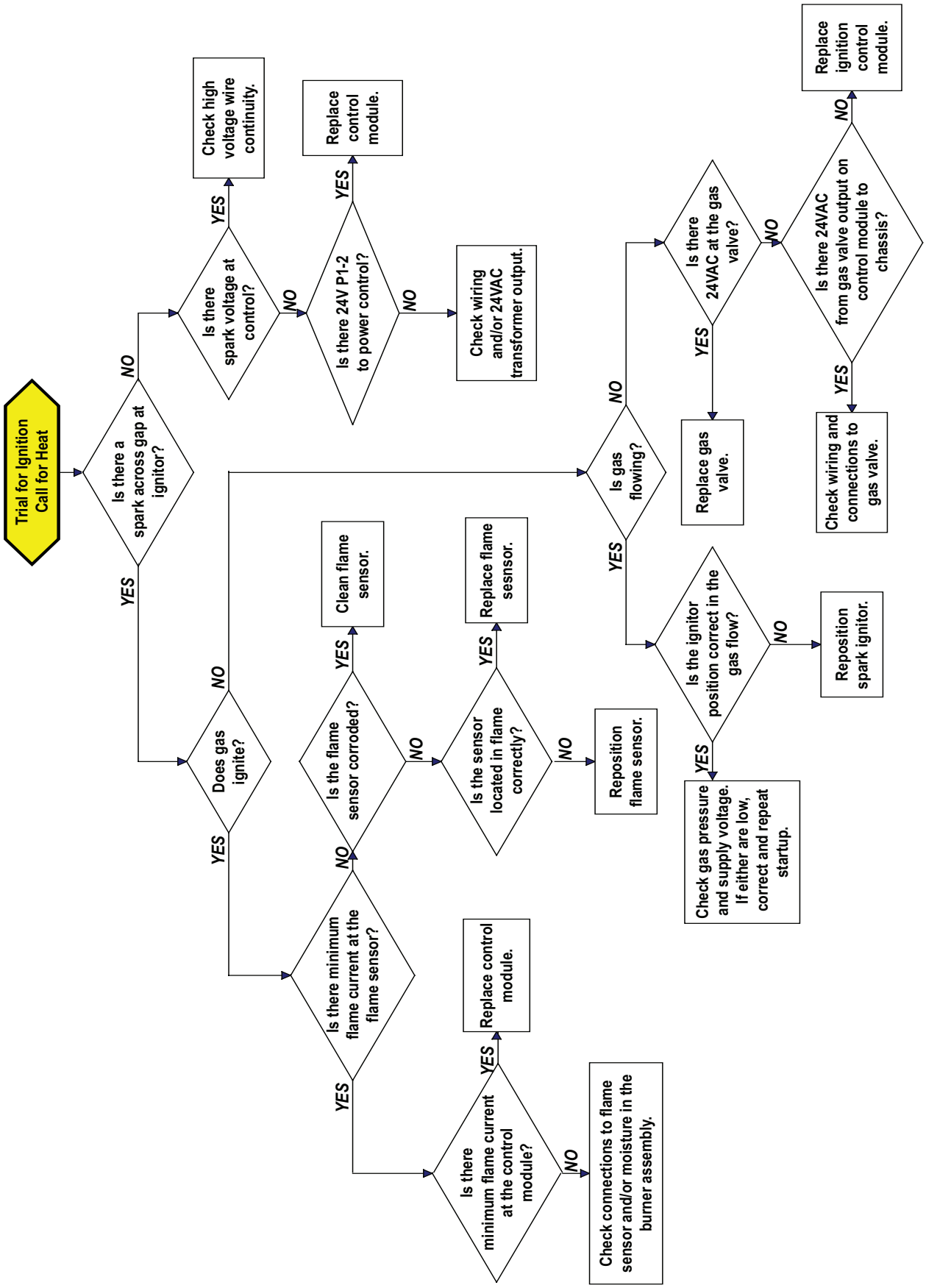


Figure 20. DSI Control Module Troubleshooting Flowchart

WARRANTY

Warranty details can be found at **https://aciq.com/aciq-product-warranties/**.

NOTES

NOTES

INSTALLATION RECORD (TO BE COMPLETED BY INSTALLER)

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

ACiQ-IOM (01-26) 2000661-0