


Installation Instructions

NTC7/GNL –Upflow/Horizontal NDC7/GDL –Downflow Series

SAFETY CONSIDERATIONS

Recognize safety information. This is the safety-alert symbol . When you see this symbol on the furnace and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal word *DANGER*, *WARNING*, or *CAUTION*. These words are used with the safety-alert symbol. *DANGER* identifies the most serious hazards **will** result in severe personal injury or death. *WARNING* signifies a hazard that **could** result in personal injury or death. *CAUTION* is used to identify unsafe practices which **would** result in minor personal injury or product and property damage.

Installing and servicing heating equipment can be hazardous due to gas and electrical components. Only trained and qualified personnel should install, repair, or service heating equipment.

Untrained service personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in the literature, on tags, and on labels attached to or shipped with the unit and other safety precautions that may apply.

Follow all safety codes. In the United States, follow all safety codes including the current edition National Fuel Gas Code (NFPA No. 54/ANSI Z223.1). In Canada, refer to the current edition of the National Standard Canada CAN/CGA-B149.1- and .2-M91 Natural Gas and Propane Installation Codes (NSCNGPIC). Wear safety glasses and work gloves. Have fire extinguisher available during start-up and adjustment procedures and service calls.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.



Manufactured by:
International Comfort Products Corporation (USA)
Lewisburg, TN USA 37091

Table of Contents

1. Installation	2	6. Gas Supply and Piping	13
2. Combustion & Ventilation Air	5	7. Electrical Wiring	15
3. Gas Vent Installation	8	8. Ductwork and Filter	16
4. Horizontal Venting	11	9. Checks and Adjustments	20
5. Masonry Chimney Venting	12	10. Furnace Maintenance	22



 **DANGER**

Electric Shock Hazard
Turn Off All Power Before Servicing.

 **WARNING**

This furnace is not designed for use in mobile homes, trailers or recreational vehicles. Such use could result in property damage, bodily injury and/or death.

1. Installation

⚠ WARNING

Installation or repairs made by unqualified persons can result in hazards to you and others. Installation **MUST** conform with local codes or, in the absence of local codes, with codes of the country having jurisdiction.

The information contained in this manual is intended for use by a qualified service technician familiar with safety procedures and equipped with the proper tools and test instruments.

Failure to carefully read and follow all instructions in this manual can result in furnace malfunction, property damage, personal injury and/or death.

NOTE: This furnace is design certified by the American Gas Association and the Canadian Gas Association for installation in the United States and Canada. Refer to the appropriate codes, along with this manual, for proper installation.

- **This furnace is NOT approved for installation in recreation vehicles or mobile home.**
- Upflow and downflow models are approved for installation in buildings constructed on site.
- Do **NOT** use this furnace as a construction heater or to heat a building under construction.
- Use only the Type of gas approved for this furnace (see **Rating Plate** on unit). Overfiring will result in failure of heat exchanger and cause dangerous operation. (Furnace can be converted to LP gas with approved kit.)
- Do **NOT** use open flame to test for gas leak.
- Ensure adequate combustion and ventilation air is provided to the furnace.
- Seal supply and return air ducts.
- The vent system **MUST** be checked to determine that it is the correct type and size.
- Install correct filter type and size.
- Unit **MUST** be installed so electrical components are protected from direct contact with water.
- It is the suggestion of this manufacturer to install fire and carbon monoxide detectors.

NOTE: It is the personal responsibility and obligation of the customer to contact a qualified installer to ensure that the installation is adequate and conforms to governing codes and ordinances.

Dual Certified Furnace

This furnace is dual certified. This means that the **INLET** pipe is optional. See **Figure 1** for identification of **INLET** and **OUTLET** pipe. Combustion air can be drawn from outside the structure or inside the structure.

Safety Rules

Your unit is built to provide many years of safe and dependable service providing it is properly installed and maintained. However, abuse and/or improper use can shorten the life of the unit and create hazards for you, the owner.

- A. The U.S. Consumer Product Safety Commission recommends that users of gas-burning appliances install carbon monoxide detectors. There can be various sources of carbon monoxide in a building or dwelling. The sources could be gas-fired clothes dryers, gas cooking stoves, water heaters, furnaces, gas-fired fireplaces, wood fireplaces, and several other items. Carbon monoxide can cause serious bodily injury and/or death. Therefore, to help alert people of potentially dangerous carbon monoxide levels, you should have carbon monoxide detectors listed by a nationally recognized agency (e.g. Underwriters Laboratories or International Approval Services) installed and maintained in the building or dwelling (see Note below).
- B. There can be numerous sources of fire or smoke in a building or dwelling. Fire or smoke can cause serious bodily injury, death, and/or property damage. Therefore, in order to alert people of potentially dangerous fire or smoke, you should have fire and smoke detectors listed by Underwriters Laboratories installed and maintained in the building or dwelling (see Note below).

Note: The manufacturer of your furnace does not test any detectors and makes no representations regarding any brand or type of detector.

- C. To ensure safe and efficient operation of your unit, you should do the the following:
 1. **Thoroughly read this manual and labels on the unit.** This will help you understand how your unit operates and the hazards involved with gas and electricity.
 2. **Do not use this unit if any part has been under water.** Immediately call a qualified service technician to inspect the unit and to replace any part of the control system and any gas control which has been under water.
 3. **Never obstruct the vent grilles, or any ducts that provide air to the unit.** Air must be provided for proper combustion and ventilation of flue gases. Carbon monoxide or "CO" is a colorless and odorless gas produced when fuel is not burned completely or when the flame does not receive sufficient oxygen.

Freezing Temperatures and Your Structure

⚠ WARNING

Freeze warning.

Turn off water system.

If your unit remains shut off during cold weather the water pipes could freeze and burst, resulting in serious water damage.

Your unit is equipped with safety devices that may keep it from operating if sensors detect abnormal conditions such as clogged exhaust flues.

If the structure will be unattended during cold weather you should take these precautions.

1. Turn off main supply water into the structure and drain the water lines if possible. Open faucets in appropriate areas.
2. Have someone check the structure frequently during cold weather to make sure it is warm enough to prevent pipes from freezing. Suggest they call qualified service agency, if required.

⚠ WARNING

Poison carbon monoxide gas hazard.

If this furnace is replacing a previously common-vented furnace, it may be necessary to resize the existing vent line and chimney to prevent oversizing problems for the other remaining appliances(s). See applicable codes and *Venting and Combustion Air Check in Gas Vent Installation* section.

Failure to properly vent this furnace or other appliances can result in property damage, personal injury and/or death.

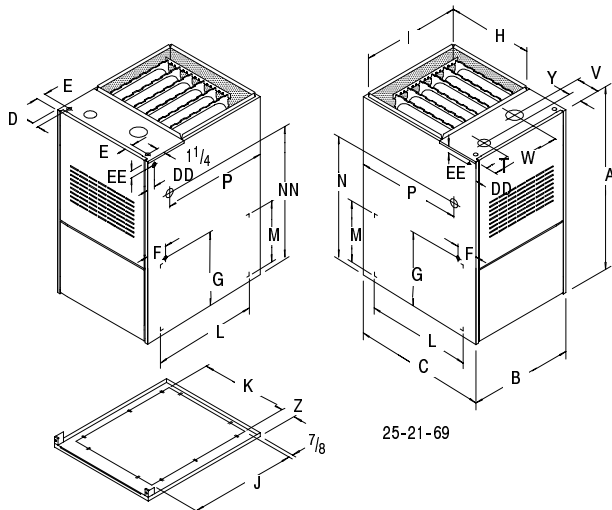
Location and Clearances

If furnace is a replacement, it is usually best to install the furnace where the old one was. Choose the location or evaluate the existing location based upon the minimum clearance and furnace dimensions (**Figure 1 & Figure 2**).

CAUTION

Do NOT operate furnace in a corrosive atmosphere containing chlorine, fluorine or any other damaging chemicals. Refer to Combustion & Ventilation Air section, Contaminated Combustion Air.

Figure 1 Dimensions and Clearances - Upflow/Horizontal Models



MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS FOR ALL UNITS	
REAR	0
FRONT	3" (75mm)*
For Service	30" (760mm)
ALL SIDES OF SUPPLY PLENUM	1" (25mm)
SIDES	0
VENT	
Single Wall Vent	6" (150mm)
Type B-1 Double Wall Vent	1" (25mm)
TOP OF FURNACE	6" (150mm)

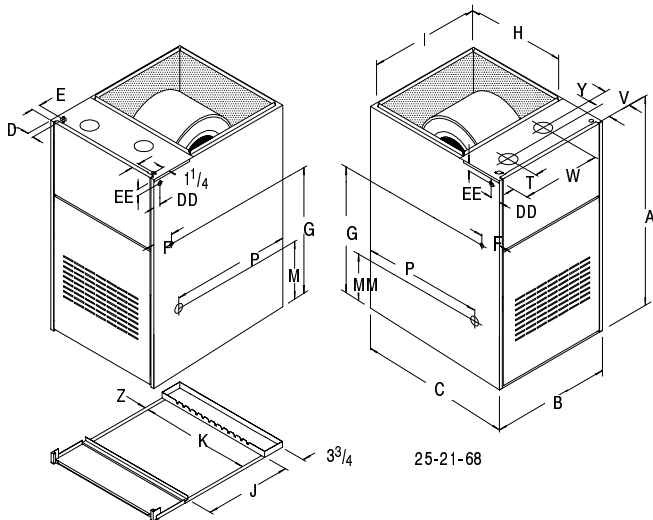
* 6" with accessory Masonry Chimney drafthood kit installed.

ALL DIMENSIONS IN INCHES (mm)

UNIT CAP.	CABINET			ELECTRICAL CONNECTIONS						SUPPLY AIR		RETURN AIR				GAS CONNECTIONS				AIR INLET		FLUE OUTLET		
				TOP		SIDE		LOW VOLT				BOTTOM		SIDE		RIGHT SD.		LEFT SD.						
	A	B	C	D	E	DD	EE	F	G	H	I	J	K	Z	L	M	NN	P	N	P	T	Y	W	V
50,000	40	19 ¹ / ₈	28 ¹ / ₂	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁵ / ₈	1 ¹ / ₂	4 ¹ / ₂	16 ⁵ / ₈	18 ¹ / ₂	17 ¹ / ₂	23 ⁵ / ₃₂	14 ³ / ₄	2 ⁵ / ₃₂	22 ⁷ / ₁₆	14 ³ / ₈	30 ⁷ / ₁₆	23	28 ³ / ₁₆	23	5 ⁵ / ₃₂	3 ¹ / ₁₆	12 ¹ / ₂	5 ⁵ / ₁₆
75,000	40	19 ¹ / ₈	28 ¹ / ₂	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁵ / ₈	1 ¹ / ₂	4 ¹ / ₂	16 ⁵ / ₈	18 ¹ / ₂	17 ¹ / ₂	23 ⁵ / ₃₂	14 ³ / ₄	2 ⁵ / ₃₂	22 ⁷ / ₁₆	14 ³ / ₈	30 ⁷ / ₁₆	23	28 ³ / ₁₆	23	5 ⁵ / ₃₂	3 ¹ / ₁₆	12 ¹ / ₂	5 ⁵ / ₁₆
100,000	40	22 ³ / ₄	28 ¹ / ₂	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁵ / ₈	1 ¹ / ₂	4 ¹ / ₂	16 ⁵ / ₈	18 ¹ / ₂	21 ¹ / ₄	23 ⁵ / ₃₂	18 ³ / ₄	1 ⁷ / ₈	22 ⁷ / ₁₆	14 ³ / ₈	30 ⁷ / ₁₆	23	28 ³ / ₁₆	23	6 ⁵ / ₈	3 ¹ / ₁₆	15 ¹ / ₈	5 ⁵ / ₁₆
125,000	40	22 ³ / ₄	28 ¹ / ₂	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁵ / ₈	1 ¹ / ₂	4 ¹ / ₂	16 ⁵ / ₈	18 ¹ / ₂	21 ¹ / ₄	23 ⁵ / ₃₂	18 ³ / ₄	1 ⁷ / ₈	22 ⁷ / ₁₆	14 ³ / ₈	30 ⁷ / ₁₆	23	28 ³ / ₁₆	23	5 ⁵ / ₃₂	3 ¹ / ₁₆	15 ¹ / ₈	5 ⁵ / ₁₆
CONVERSION TO METRIC (mm)	40 = (1016) 19 ¹ / ₈ = (486) 22 ³ / ₄ = (578) 28 ¹ / ₂ = (724)			1 ⁵ / ₈ = (41)		1 ⁵ / ₈ = (41) 1 ¹ / ₂ = (38)		4 ¹ / ₂ = (114) 16 ⁵ / ₈ = (424)		18 ¹ / ₂ = (471) 17 ¹ / ₂ = (446) 21 ¹ / ₄ = (539)		23 ⁵ / ₃₂ = (588) 14 ³ / ₄ = (375) 18 ³ / ₄ = (476)		22 ⁷ / ₁₆ = (571) 14 ³ / ₈ = (366)		30 ⁷ / ₁₆ = (773) 28 ³ / ₁₆ = (716) 23 = (584)		5 ⁵ / ₃₂ = (132) 6 ⁵ / ₈ = (169) 3 ¹ / ₁₆ = (78)		12 ¹ / ₂ = (319) 15 ¹ / ₈ = (384) 5 ⁵ / ₁₆ = (135)				

Figure 2

Dimensions and Clearances - Downflow Models



Minimum Cabinet Clearances to Combustible Materials for all Units						
TOP	BOT	RH	LH	BACK	FRNT	FLUE
6"	* 0"	0"	0"	0"	3"	6"

* Can not be installed directly on combustible flooring. Supply plenum must have 1" clearance for first 6' from furnace.

ALL DIMENSIONS IN INCHES (mm)

UNIT CAPACITY	CABINET			ELECTRICAL CONNECTIONS					RETURN AIR TOP		SUPPLY AIR BOTTOM			GAS CONNECTIONS				AIR INLET		FLUE OUTLET		
	A	B	C	D	E	DD	EE	F	G	H	I	J	K	Z	M	P	MM	P	T	Y	W	V
50,000	40	19 ¹ / ₈	28 ¹ / ₂	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁵ / ₈	1 ¹ / ₂	3 ⁷ / ₈	25 ³ / ₄	18 ¹ / ₂	17 ⁵ / ₈	16 ⁵ / ₈	17 ⁵ / ₈	5 ⁵ / ₈	12 ⁵ / ₈	24	10 ³ / ₈	24	5 ⁵ / ₃₂	3 ¹ / ₄	12 ¹ / ₂	5 ⁵ / ₁₆
75,000	40	19 ¹ / ₈	28 ¹ / ₂	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁵ / ₈	1 ¹ / ₂	3 ⁷ / ₈	25 ³ / ₄	18 ¹ / ₂	17 ⁵ / ₈	16 ⁵ / ₈	17 ⁵ / ₈	5 ⁵ / ₈	12 ⁵ / ₈	24	10 ³ / ₈	24	5 ⁵ / ₃₂	3 ¹ / ₄	12 ¹ / ₂	5 ⁵ / ₁₆
100,000	40	22 ³ / ₄	28 ¹ / ₂	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁵ / ₈	1 ¹ / ₂	3 ⁷ / ₈	25 ³ / ₄	18 ¹ / ₂	21 ¹ / ₄	16 ⁵ / ₈	21 ³ / ₈	5 ⁵ / ₈	12 ⁵ / ₈	24	10 ³ / ₈	24	6 ⁵ / ₈	3 ¹ / ₄	15 ¹ / ₈	5 ⁵ / ₁₆
125,000	40	22 ³ / ₄	28 ¹ / ₂	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁵ / ₈	1 ¹ / ₂	3 ⁷ / ₈	25 ³ / ₄	18 ¹ / ₂	21 ¹ / ₄	16 ⁵ / ₈	21 ³ / ₈	5 ⁵ / ₈	12 ⁵ / ₈	24	10 ³ / ₈	24	5 ⁵ / ₃₂	3 ¹ / ₄	15 ¹ / ₈	5 ⁵ / ₁₆
CONVERSION TO METRIC (mm)	40 = (1016) 19 ¹ / ₈ = (486) 22 ³ / ₄ = (578) 28 ¹ / ₂ = (724)			1 ⁵ / ₈ = (41)		1 ¹ / ₂ = (42)		3 ⁷ / ₈ = (99) 25 ³ / ₄ = (654)		18 ¹ / ₂ = (471) 17 ⁵ / ₈ = (448) 21 ¹ / ₄ = (540)		16 ⁵ / ₈ = (421) 17 ⁵ / ₈ = (449) 21 ³ / ₈ = (540) 5 ⁵ / ₈ = (18)			12 ⁵ / ₈ = (319) 24 = (584) 10 ³ / ₈ = (264)				5 ⁵ / ₃₂ = (131) 6 ⁵ / ₈ = (169) 3 ¹ / ₄ = (83)		12 ¹ / ₂ = (319) 15 ¹ / ₈ = (384) 5 ⁵ / ₁₆ = (135)	

Installation Requirements

1. Install furnace level.
2. This furnace is **NOT** to be used for temporary heat of buildings or structures under construction.
3. Install furnace as centralized as practical with respect to the heat distribution system.
4. Install the vent pipes as short as practical. (See *Vent and Combustion Air Piping* section).
5. For downflow installations, do **NOT** install furnace directly on combustible floors unless using a special noncombustible subbase. See *Ductwork and Filter* section later in this manual.

⚠ WARNING

Fire Hazard.

If installing horizontally, place furnace on noncombustible cement board or sheet metal.

For counterflow furnaces place furnace on noncombustible cement board or sheet metal.

Failure to install unit on noncombustible cement board or sheet metal can result in property damage, personal injury and/or death.

7. Use a raised base if the floor is damp or wet at times.
8. Residential garage installations require:
 - Burners and ignition sources installed at least 18" (457mm) above the floor.
 - Located or physically protected from possible damage by a vehicle.

Horizontal Furnace Installation

⚠ WARNING

Poison carbon monoxide gas, fire, and/or explosion hazard.

Make certain model installed is certified for use in multiple configurations.

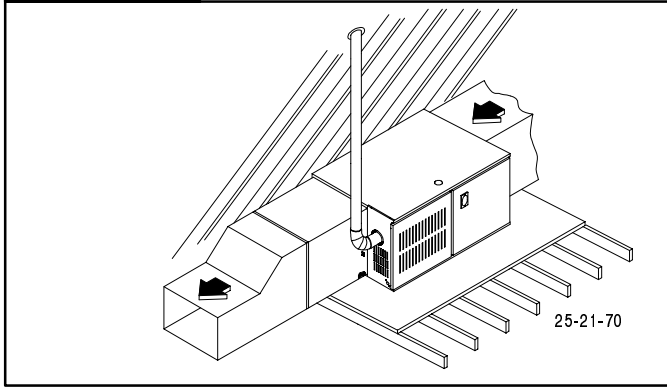
Failure to install unit in configuration for which it is certified can result in property damage, personal injury and/or death.

IMPORTANT

NOTE: Inspect unit rating plate to be certain model number begins with "NTC7" or "GNL". This identifies unit as horizontally mountable. If unit does **NOT** bear this designation, you may **NOT** mount this unit horizontally. **Horizontal furnace must not be mounted on its back.**

If you purchased a horizontally mountable furnace, it can be installed horizontally in an attic, basement, crawl space, alcove, or suspended from a ceiling in a basement or utility room in either a right-to-left or left-to-right airflow position. See **Figure 4**.

6. Maintain clearance for fire safety and servicing. A front clearance of 30" (760mm) is recommended for access to the burner, controls and filter.

Figure 3**Typical Horizontal Installation**

The following minimum clearances (**Figure 1** and **Figure 2**) to combustibles **MUST** be maintained. As shown in **Figure 3**, **ONLY** the corner of the cabinet is allowed to contact the rafters. All other clearances **MUST** be observed as shown in **Figure 1** and **Figure 2**.

If the furnace is to be suspended from the floor joists in a crawl space or the rafters in an attic, it is necessary to use steel pipe straps or an angle iron frame to attach the furnace. These straps should be attached to the furnace with sheet metal screws and to the rafters or joists with bolts. The preferred method is to use an angle iron frame bolted to the rafters or joists.

If the furnace is to be installed in a crawl space, consult local codes. A concrete pad 1" to 2" (25 to 50mm) thick is recommended for crawl space installation on the ground.

Thirty (30) inches (760mm) between the front of the furnace and adjacent construction or other appliances **MUST** be maintained for service clearance.

Keep all insulating materials clear from louvered door. Insulating materials may be combustible.

The horizontal furnaces may be installed directly on combustible wood flooring or supports for added fire protection it is recommended that cement board or sheet metal is placed between the

2. Combustion & Ventilation Air

⚠ WARNING

Poison carbon monoxide gas hazard.

Use methods described here to provide combustion and ventilation air.

Failure to provide adequate combustion and ventilation air can result in personal injury and/or death.

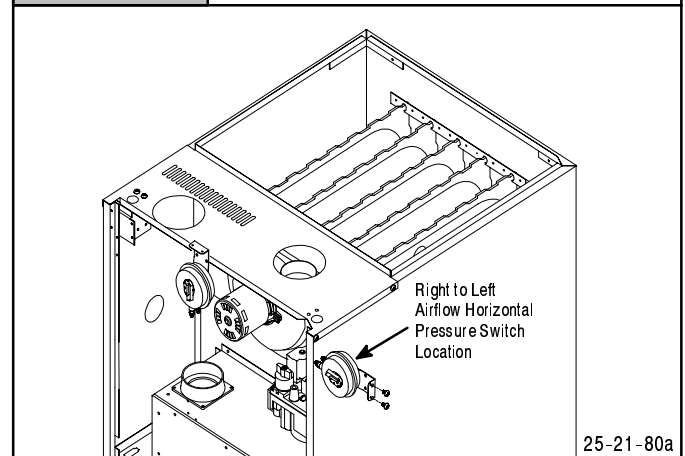
Furnaces require ventilation openings to provide sufficient air for proper combustion and ventilation of flue gases. All duct or openings for supplying combustion and ventilation air must comply with the gas codes, or in the absence of local codes, the applicable national codes.

furnace and the combustible wood floor and extend 12" (300mm) beyond the front of the furnace louver door.

This furnace **MUST NOT** be installed directly on carpeting or tile or other combustible material other than wood flooring or supports.

Pressure Switch Relocation

If the furnace is installed in a left to right airflow position (right side of furnace facing down), the pressure switch will remain in the same position as installed by the factory (see **Figure 5**). If the furnace is installed in a right to left airflow position (left side of furnace facing down), the pressure switch **MUST** be relocated to the right side of the furnace using the holes provided on the side of the furnace. Position the pressure switch in the same orientation as the original location.

Figure 4**Pressure Switch Relocation**

To reposition switch, remove the two screws that secure the pressure switch to the blower partition. Attach the pressure switch in the location shown. It may be necessary to shorten the tube length. To prevent possible kinking of the pressure switch hose, trim the hose to remove excess.

Note: Care **MUST** be taken not to cut the tube too short.

Contaminated Combustion Air

Installations in certain areas or types of structures will increase the exposure to chemicals or Halogens which may harm the furnace. These instances must use only outside air for combustion.

The following areas or types of structures may contain or have exposure to the substances listed below. The installation must be evaluated carefully as it may be necessary to provide outside air for combustion.

- Commercial buildings.
- Buildings with indoor pools.
- Furnaces installed in laundry rooms.
- Furnaces installed in hobby or craft rooms.
- Furnaces installed near chemical storage areas.

- Permanent wave solutions for hair.
- Chlorinated waxes and cleaners.
- Chlorine based swimming pool chemicals.
- Water softening chemicals.
- De-icing salts or chemicals.
- Carbon tetrachloride.
- Halogen type refrigerants.
- Cleaning solvents (such as perchloroethylene).
- Printing inks, paint removers, varnishes, etc..
- Hydrochloric acid.
- Sulfuric Acid.
- Solvent cements and glues.
- Antistatic fabric softeners for clothes dryers.
- Masonry acid washing materials.

Confined Space Installation

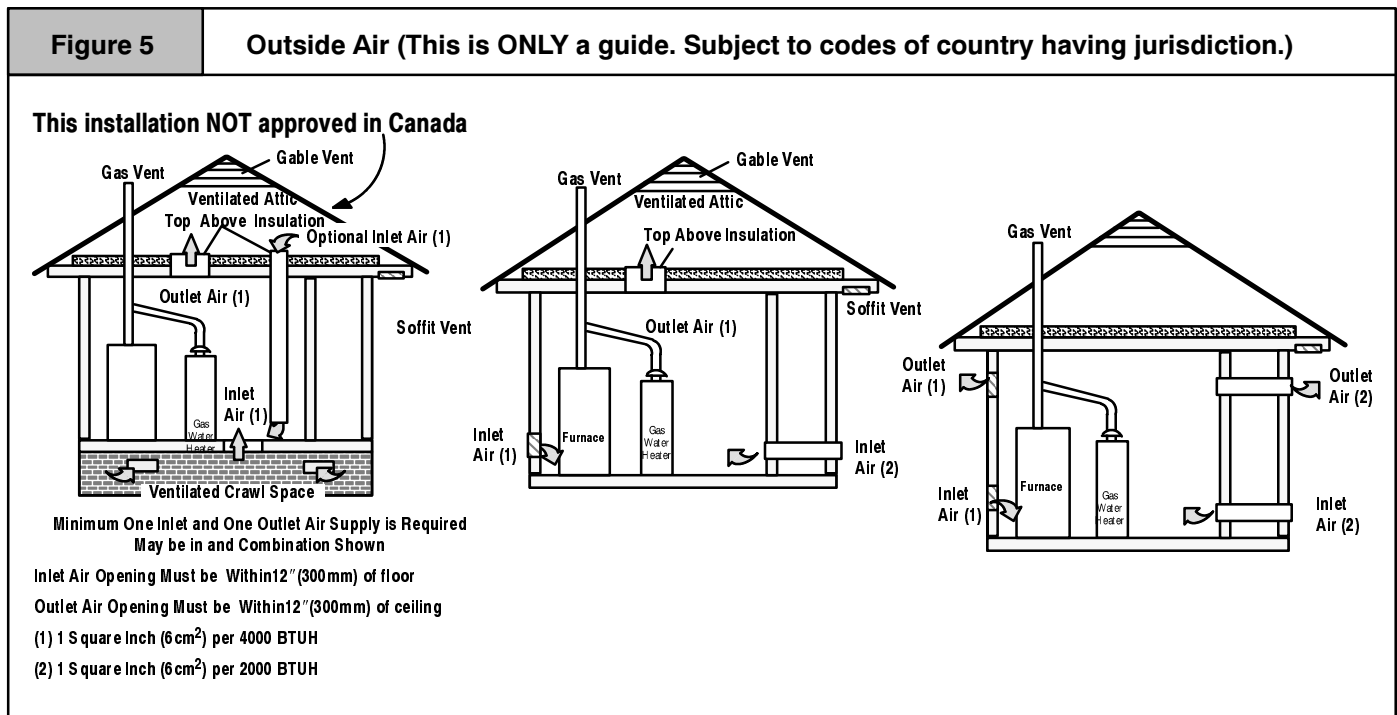
NOTE: A confined space is defined as an area with less than 50 cubic feet (1.4m³) per 1,000 BTUH input rating for all gas appliances installed in the area.

Air Openings and Connecting Ducts

1. Total input rating for all gas appliances **MUST** be considered when determining free area of openings.
2. Connect ducts or openings directly to outside.
3. When screens are used to cover openings, they **MUST** be no less than 1/4" (6mm) mesh.
4. The minimum dimension of rectangular air ducts **MUST NOT** be less than 3" (75mm).
5. When sizing grille or louver, use the free area of opening. If free area is **NOT** stamped or marked on grill or louver, assume a 20% free area for wood and 60% for metal.

Requirements

1. Provide confined space with sufficient air for proper combustion and ventilation of flue gases using horizontal or vertical ducts or openings.
2. **Figure 5** illustrates how to provide combustion and ventilation air. A minimum of two permanent openings, one inlet and one outlet, are required.



3. One opening **MUST** be within 12" (300mm) of the floor and the second opening within 12" (300mm) of the ceiling.
4. Size openings and ducts per **Table 1**.
5. Horizontal duct openings require 1 square inch (25sq. mm) of free area per 2,000 BTUH of combined input for all gas appliances in area (see **Table 1**).
6. Vertical duct openings or openings directly to outside require 1 square inch (6.5mm³) of free area per 4,000 BTUH for combined input of all gas appliances in area (see **Table 1**).

Table 1		Free Area		
BTUH Input Rating	Minimum Free Area Required for Each Opening			Round Duct (4,000 BTUH)
	Horizontal Duct (2,000 BTUH)	Vertical Duct or openings to outside (4,000 BTUH)		
50,000	161 cm ² (25 sq. in.)	81 cm ² (12.5 sq. in.)		4"
75,000	242 cm ² (35.5 sq. in.)	121 cm ² (18.75 sq. in.)		5"
100,000	323 cm ² (50 sq. in.)	161 cm ² (25 sq. in.)		6"
125,000	403 cm ² (62.5 sq. in.)	202 cm ² (31.25 sq. in.)		7"
150,000	484 cm ² (71 sq. in.)	242 cm ² (37.5 sq. in.)		7"

EXAMPLE: Determining Free Area

Furnace Water Heater Total Input
 $100,000 + 30,000 = (130,000 \div 4,000) = 210 \text{ cm}^2$
 (32.5 Sq. In.) Vertical

Furnace Water Heater Total Input
 $100,000 + 30,000 = (130,000 \div 2,000) = 210 \text{ cm}^2$
 (65 Sq. In.) Horizontal

Unconfined Space Installation

⚠ WARNING

Poison carbon monoxide gas hazard.

Most homes will require additional air.

An unconfined space or homes with tight construction may not have adequate air infiltration for proper combustion and ventilation of flue gases.

Failure to supply additional air by means of ventilation grilles or ducts could result in personal injury and/or death.

An unconfined space is defined as an area having a minimum volume of 50 cubic feet (1.4m³) per 1,000 Btuh total input rating for all gas appliances in area.

Adjoining rooms can be considered part of an unconfined area if there are no doors between rooms.

An attic or crawl space may be considered an unconfined space provided there are adequate ventilation openings directly to outdoors. Openings **MUST** remain open and **NOT** have any means of being closed off. Ventilation openings to outdoors **MUST** be at least 1 square inch (25mm²) of free area per 4,000 BTUH of total input rating for all gas appliances in area.

In unconfined spaces, infiltration should be adequate to provide air for combustion, ventilation and dilution of flue gases. However, in buildings with unusually tight construction, additional air **MUST** be provided using the methods described in section titled *Confined Space Installation*:

Unusually tight construction is defined as: Construction with

1. Walls and ceilings exposed to the outside have a continuous, sealed vapor barrier. Openings are gasketed or sealed and

2. Doors and openable windows are weather stripped and
3. Other openings are caulked or sealed. These include joints around window and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, etc.

Ventilation Air

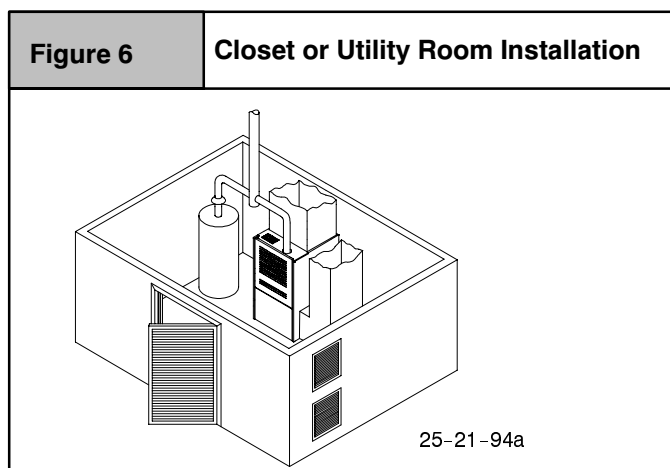
Some provincial codes and local municipalities require ventilation or make-up air be brought into the conditioned space as replacement air. Whichever method is used, the mixed return air temperature across the heat exchanger **MUST** not fall below 60°F (15° c) or flue gases will condense in the heat exchanger. This will shorten the life of the heat exchanger and possibly void your warranty.

Direct Vent Installations

Combustion air is obtained from outside the structure. Ventilation air must be obtained from the following:

In a closet or utility room installation, it will be necessary to provide ventilation air from an area of adequate air supply.

Any restricted installation requires two openings in the door or single wall of the closet or utility room. One opening should be located within 12" (305mm) of the top and the other within 12" (305mm) of the bottom of the enclosure. (see **Figure 6**).



The following minimum free area is required for these openings:

- a. Openings to interior space—Each opening to interior space must have a free area at least 1 square inch per 1,000 BTU per hour input rating, but not less than 100 square inches.
- b. Openings to outdoors—Each opening to the outdoors must have a free area at least 1 square inch per 2,000 BTU per hour input rating if horizontal air ducts are used.

Air openings in the casing front, return air grilles, and warm air registers must not be obstructed.

In all instructions provisions for adequate combustion air must be made in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z223.1-1988, or applicable provisions of the local building codes.

3. Gas Vent Installation

⚠ **WARNING**

Carbon monoxide poisoning, fire and explosion hazard.

Read and follow all instructions in this section.

Failure to properly vent this furnace can result in property damage, personal injury and/or death.

Dual Certified Furnace

This furnace is dual certified as a direct vent furnace using outside air for combustion or it can use air from inside the structure for combustion. The **INLET** air pipe is optional.

Install the vent in compliance with codes of the country having jurisdiction and the **United States National Fuel Gas Code** venting tables, local codes or ordinances and these instructions. This Category I furnace has a natural draft vent system and **MUST NOT** be connected into any portion of a mechanical draft system operating under positive pressure.

These fan assisted combustion furnaces have been classified as Category I appliances which means that they **MUST** operate with a negative vent pressure.

Venting and Combustion Air Check

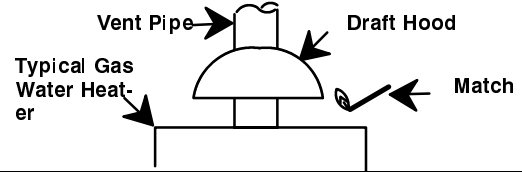
NOTE: The following information is supplied to allow the installer to make adjustments to the setup of existing appliances, **IF REQUIRED**, based on good trade practices, local codes, and good judgement of the installer. Manufacturer does **NOT** take responsibility for modifications made to existing equipment.

NOTE: If this installation removes an existing furnace from a venting system serving one or more appliances, and to make sure there is adequate combustion air for all appliances, **MAKE THE FOLLOWING CHECK.**

1. Seal any unused openings in the venting system.
2. Visually inspect the venting system for proper size and horizontal pitch to ensure there is no blockage or restriction, leakage, corrosion or other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all doors and windows and all doors between the space in which the appliance(s) remaining connected to the venting system are located and other spaces of the building.
4. Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
5. Follow the lighting instructions for each appliance being inspected. Adjust thermostat so appliance(s) will operate continuously.
6. Allow 5 minutes of main burner operation, then check for spillage at the draft hood relief opening of each appliance. Use the flame of a match or candle (**Figure 8**).

Figure 7

Vent Check



7. After it has been determined that each appliance vents properly, return doors, windows, appliances etc. to their normal condition.
8. If improper venting is observed, the cause **MUST** be corrected using the appropriate tables in code books of country having jurisdiction.

NOTE: If flame pulls towards draft hood, this indicates sufficient infiltration air.

NOTE: Non-direct vent appliances occupying same enclosed space as furnace **MUST** have enough air for proper combustion and ventilation. All duct or openings for supplying combustion and ventilation air must comply with the gas codes, in the absence of local codes, the applicable national codes.

When the installation is complete, check that all appliances have adequate combustion air and are venting properly. See *Venting And Combustion Air Check* in this manual.

Category I Safe Venting Requirements

NOTE: The following instructions comply with the United States National Fuel Gas Code.

1. If a Category I vent passes through an attic, any concealed space or floor, use **ONLY** Type B or Type L double wall vent pipe. If vent pipe passes through interior wall, use type B vent pipe with ventilated thimble **ONLY**.
2. Do **NOT** vent furnace into any chimney serving an open fireplace or solid fuel burning appliance.
3. Use the same diameter Category I connector or pipe as permitted by the **United States National Fuel Gas Code** venting tables.
4. Keep vertical Category I vent pipe or vent connector runs as short and direct as possible.
5. Vertical outdoor runs of type B or **ANY** single wall vent pipe below the roof line are **NOT** permitted.
6. Slope all horizontal runs up away from furnace a minimum of $\frac{1}{4}$ " per foot (6mm per 300mm).
7. Support all horizontal vent pipe every 6' (2m) using proper clamps and metal straps.
8. Check existing gas vent or chimney to ensure they meet clearances and local codes.
9. The furnace **MUST** be connected to a factory built chimney or vent complying with a recognized standard.
10. All Category I vent piping **MUST** be attached directly to the combustion blower flange.

Venting into a masonry or concrete chimney is only permitted as outlined in the United States National Fuel Gas Code venting tables or see *Masonry Chimney Section*.

On downflow units, Category I pipe **MUST** be attached to the factory provided 3" vent pipe where it exits the furnace. Do **NOT** remove the factory installed 3" vent pipe from vent enclosure. Inspect connection to ensure connection is tight and all screws are in place.

⚠ WARNING

Poison carbon monoxide gas hazard.

If this furnace is replacing a previously common-vented furnace, it may be necessary to resize the existing chimney liner or vent to prevent over sizing problems for the other remaining appliances(s). See codes of country having jurisdiction.

Failure to properly vent this furnace or other appliances can result in property damage, personal injury and/or death.

Venting to Existing Masonry Chimney

NOTE: The tables and notes referred to below are found in the most recent printing of the **United States National Fuel Gas Code** venting tables.

Dedicated venting of one fan assisted furnace into any masonry chimney is prohibited. The chimney must first be lined with either type B vent sized in accordance with **United States National Fuel Gas Code** or a listed single wall, metal lining system, sized in accordance with the following: (Venting as outlined with use of optional masonry chimney kit as applicable.)

Listed, corrugated metallic chimney liner systems in masonry chimneys shall be sized by using **United States National Fuel Gas Code** for dedicated venting and **United States National Fuel Gas Code** for common venting with the maximum capacity reduced by 20% (0.80 X maximum capacity) and the minimum capacity as shown in the applicable table. Corrugated metal vent systems installed with bends or offsets require additional reduction of 10% of the vent capacity for each 90° elbow.

NOTE: Two 45° elbows are equivalent to one 90° elbow.

Combined Venting into a Masonry Chimney

Venting into a masonry or concrete chimney is only permitted as outlined in the **United States National Fuel Gas Code** venting tables or as outlined with use of optional masonry chimney kit as applicable.

Note: See section "Masonry Chimney Venting".

Optional Fresh Air Inlet

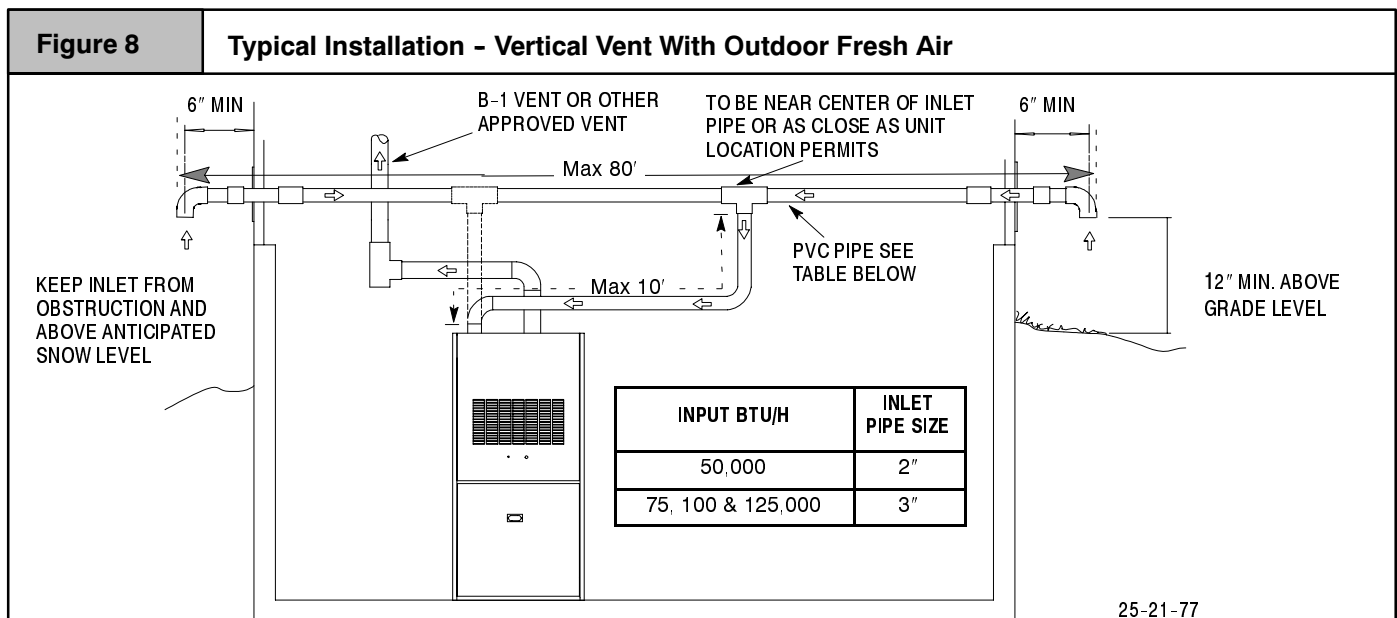
Consult local codes for any requirements for a fresh air inlet to the furnace. For additional information on the provisions of fresh air to the furnace refer to the current edition of the "National Fuel Gas Code" ANSI-Z223.1.

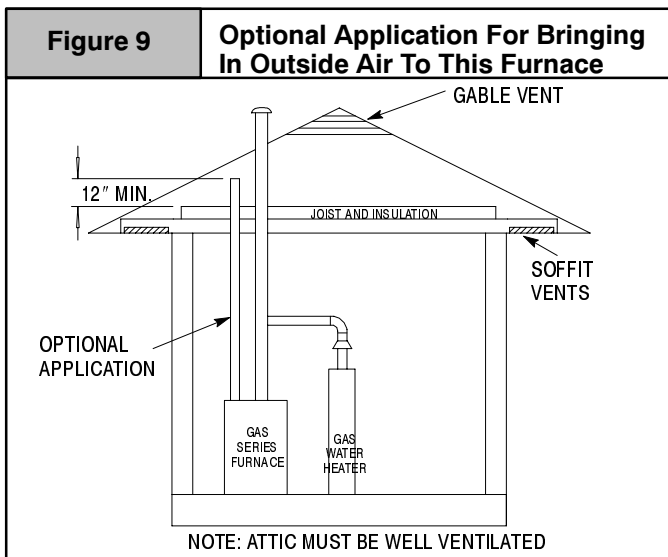
This installation, for providing fresh air to the furnace, is not considered as complying with the requirements for a Direct Vent Furnace. It is a means of supplying fresh air for combustion to those furnaces that are vented vertically. It is for those locations where a direct vent furnace cannot be installed but the surrounding air may contain products that could be harmful to the heat exchanger material.

It should be noted that adequate quantities of air must reach the furnace to provide for proper and safe operation for the furnace. Any obstruction to this air flow can cause an unsafe condition which may result in unit failure or personal injury.

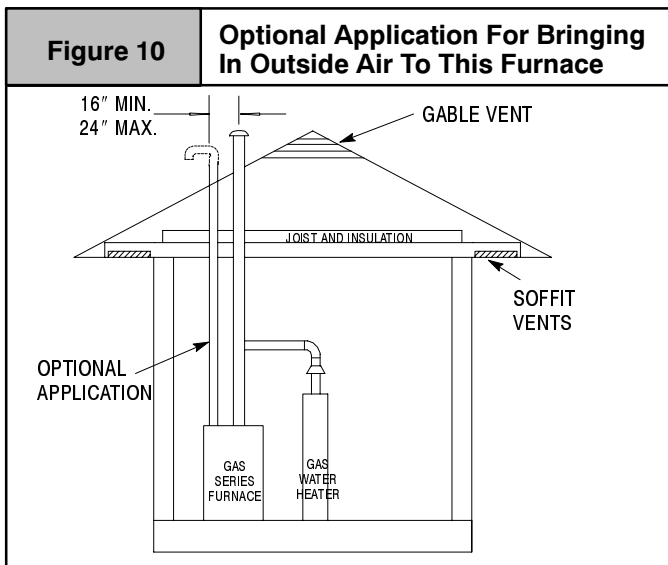
The following methods for bringing in outside air are listed below.

1. The vertically vented furnace may have outside air brought directly to it by means of 2" or 3" plastic (PVC) drain pipe, schedule 40 PVC, single wall galvanized or single wall stainless steel pipe as shown in **Figure 8**. Any one of the listed pipe materials are recommended. This configuration, for the inlet air, may require some modifications to accommodate for unit location, inlet pipe, and building structure. The two inlets that are installed, with the "Tee" near the furnace may be located on opposite sides or adjacent sides of the building. Because of the possibility of wind outage, the use of only one air inlet is not permitted. The air movement through the pipe must not be blocked or restricted, therefore, the inlet fittings must be located above any obstructions or expected snow level.
2. Outside air may be brought directly to the intake of a vertically vented furnace from a well ventilated attic as shown in **Figure 9**. The material for the intake pipe can be of 2 or 3" plastic (PVC) drain pipe, schedule 40 PVC, single wall galvanized or single wall stainless steel pipe. Any one of the listed pipe materials are recommended. The intake pipe should terminate in the attic 12" above the ceiling joist or the insulation which ever is the highest. Also the vents in the attic should be checked so proper ventilation air can be supplied. If proper ventilation is not provided, the furnace may not operate properly.





3. An additional option for bringing in outside air directly to the intake of a vertically vented furnace is also shown in **Figure 10**. The intake pipe can be run from the furnace through the roof terminating at the same height as the vent. These pipes should be installed with a minimum of 16" and a maximum of 24" apart. A 180° elbow should be installed on the intake to prevent rain water or snow from draining down the intake. Also when bringing fresh air in for combustion from the roof the actual height for terminating the intake above the roof should take into consideration snow accumulation and be terminated 12" above the highest recorded snowfall.



If the furnace, with fresh air inlet, is connected to an approved vent or the common vent, with any other appliance, the system should be checked for venting in accordance with the instructions found under **Combustion and Ventilation Air** in this booklet.

Vertical Termination

Figure 11 shows the proper installation and clearances for vertical vent termination. The vertical roof termination should be sealed with a plumbing roof boot or equivalent flashing. The inlet of the intake pipe and end of the exhaust vent must be terminated no less than 12" (300mm) above the roof or snow accumulation level, and 12" (300mm) away from a vertical wall or other protrusion.

Optional Inlet Pipe Screens

To prevent unwanted pests or foreign material from entering terminated pipes, plastic vent screens are available from distributor in 2" and 3" sizes. Use of these screens is recommended except in cold climate areas where ice is likely to form on them. Glue the screen inside the termination elbow using pipe cement. Screens should be inspected monthly for blockage and cleaned yearly prior to startup.

Horizontal Termination Shielding (external power venter)

Under certain wind conditions some building materials may be affected by flue products expelled in close proximity to unprotected surfaces. Sealing or shielding of the exposed surfaces with a corrosion resistant material (such as aluminum sheeting) may be required to prevent staining or deterioration. The protective material should be attached and sealed (if necessary) to the building before attaching the vent terminal.

A metal shield is recommended 18" x 18" (457mm x 457mm) min. or 18" (457mm) min. diameter around the vent termination at the exterior wall to protect the house exterior materials from flue product or condensation (freezing) damage.

Venting Through a Non-Combustible and Combustible Wall

Consult External Power Venter manufacturer instructions.

Air Inlet Pipe Connection

NOTE: The 50,000 and 75,000 BTU furnaces require the use of the 2" (50mm) diameter offset pipe provided. The 100,000 BTU furnace requires a 2" (50mm) diameter pipe to clear the top of the furnace before increasing size to 3" (75mm) diameter. The 125,000 BTU furnace may have 3" (75mm) diameter pipe attached directly to the air inlet collar on the burner box. Air Inlet Collar is sized for 3" PVC pipe. If 2" (50mm) or 2 1/2" (64mm) combustion air piping is used, a 3" (75mm) to 2" (50mm) or 3" (75mm) to 2 1/2" (64mm) reducer fitting is required. The reducing section can be before the 90° elbow in a horizontal section.

1. Install pipe section or pipe/reducer fitting (as required) to the inlet collar using RTV sealant **ONLY** to provide for future serviceability.

NOTE: On single pipe installation, using combustion air from inside the structure, it is recommended that a screen be placed inside the Combustion Air Inlet. A 3" plastic screen is available for this purpose. It will prevent small objects from falling into the combustion chamber. Use RTV sealant **ONLY** to provide for future serviceability.

Joining Pipe and Fittings

⚠ WARNING

Fire hazard.

Provide adequate ventilation and do NOT assemble near heat source or open flame. Do NOT smoke while using solvent cements and avoid contact with skin or eyes.

Observe all cautions and warnings printed on material containers to prevent possible personal injury and/or death.

NOTE: All PVC pipe fittings, solvent cement, primers and procedures **MUST** conform to American National Standard Institute and American Society for Testing and Materials (ANSI/ASTM) standards. Schedule 40 is the **ONLY** approved wall thickness.

- *Pipe and Fittings* – ASTM D1785, D2466, D2661, D2665, F-891
- *PVC Primer and Solvent Cement* – ASTM D2564
- *Procedure for Cementing Joints* – Ref ASTM D2855

NOTE: In order to create a seal that allows future removal of pipe, RTV sealant **MUST** be used on the inlet pipe where it joins to the furnace. PVC cement may be used on all other joints.

CAUTION

Do NOT use solvent cement that has become curdled, lumpy or thickened and do NOT thin. Observe precautions printed on containers. For applications below 32° F., use only low temperature type solvent cement.

1. Cut pipe end square, remove ragged edges and burrs. Chamfer end of pipe, then clean fitting, socket and pipe joint of all dirt, grease, or moisture.

NOTE: Stir the solvent cement frequently while using. Use a natural bristle brush or the dauber supplied with the cement. The proper brush size is one inch.

2. After checking pipe and socket for proper fit, wipe socket and pipe with cleaner-primer. Apply a liberal coat of primer to inside surface of socket and outside of pipe. Do **NOT** allow primer to dry before applying cement.
3. Apply a thin coat of cement evenly in the socket. Quickly apply a heavy coat of cement to the pipe end and insert pipe into fittings with a slight twisting movement until it bottoms out.

NOTE: Cement **MUST** be fluid while inserting pipe. If **NOT**, recoat pipe.

4. Hold the pipe in the fitting for 30 seconds to prevent the tapered socket from pushing the pipe out of the fitting.
5. Wipe all excess cement from the joint with a rag. Allow 15 minutes before handling. Cure time varies according to fit, temperature and humidity.

4. Horizontal Venting

Category I Furnaces With External Power Venters

In order to maintain a Category I classification of fan assisted furnaces when vented horizontally with sidewall termination, a power venter is **REQUIRED** to maintain a negative pressure in the venting system. Please consult the Fields Controls Co. or Tjernlund Products, Inc. for power venters certified for use with our furnaces.

Vent Termination

Venting Through a Non-Combustible and Combustible Wall

Connecting Vent Pipes and Termination

CAUTION

Maintain a minimum of 36" (1m) between combustion air inlet and clothes dryer vent. Terminate the combustion air intake as far as possible from any air conditioner, heat pump, swimming pool, swimming pool pumping, chlorinator or filtration unit.

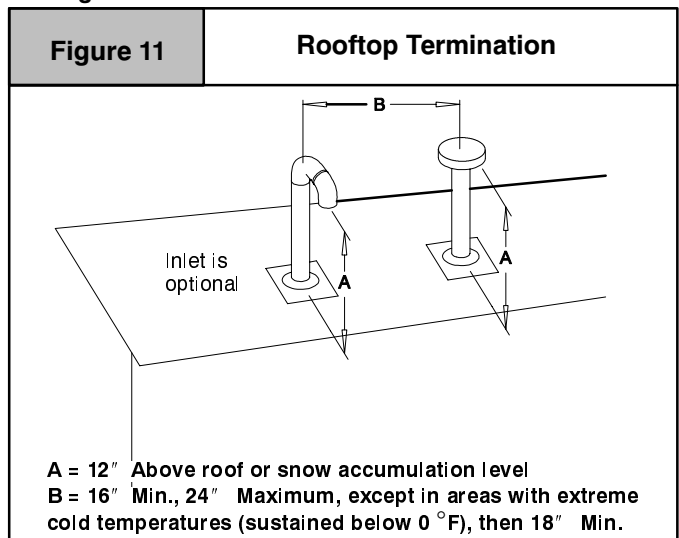
! WARNING

Carbon monoxide poisoning, fire and explosion hazard.

Inlet and outlet pipes may NOT be vented directly above each other.

Failure to properly vent this furnace can result in property damage, personal injury and/or death.

1. Install all couplings, nipples and elbows using proper procedures for **Joining Pipe and Fittings** and maintain spacing between vent and combustion air piping as indicated in **Figure 11**.



Consult External Power Venter manufacturer instructions.

CAUTION

It is the responsibility of the installer to properly terminate the vent and provide adequate shielding. This is essential in order to avoid water/ice damage to building, shrubs and walk-ways.

5. Masonry Chimney Venting with Optional Kit

Chimney Inspection

All masonry chimney construction must conform to Standard ANSI/NFPA211 and to any state or local codes applicable. The chimney must be in good condition and a complete investigation must be conducted prior to installation. If the inspection reveals damage or abnormal conditions, make necessary repairs or seek expert help. Measure area of tile-liner and exact height of chimney.

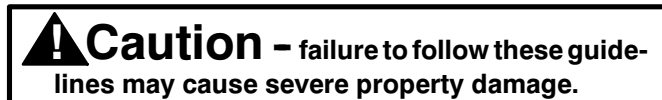
Connector Type

To reduce flue gas heat loss and the chance of condensate problems, the vent connector must be double wall Type B vent.

Venting Restrictions for Chimney Types

Interior Chimney – has no sides exposed to the outside ambient below the roofline. All installations can be single furnace using linerless chimney kit or common vented with another draft hood equipped Category I appliance.

Exterior Chimney – has one or more sides exposed to the outside below the roof line. All installations must be common vented only with another draft hood equipped Category I appliance.



NOTE: These instructions apply to the NTC7/GNL series furnaces only.

Draft Hood Assy. Installation (See Figure 13)

1. Disconnect power and gas supply to furnace.
2. Remove louvered door.
 - a. Remove logo from louvered door. Discard logo. Set aside louvered door.

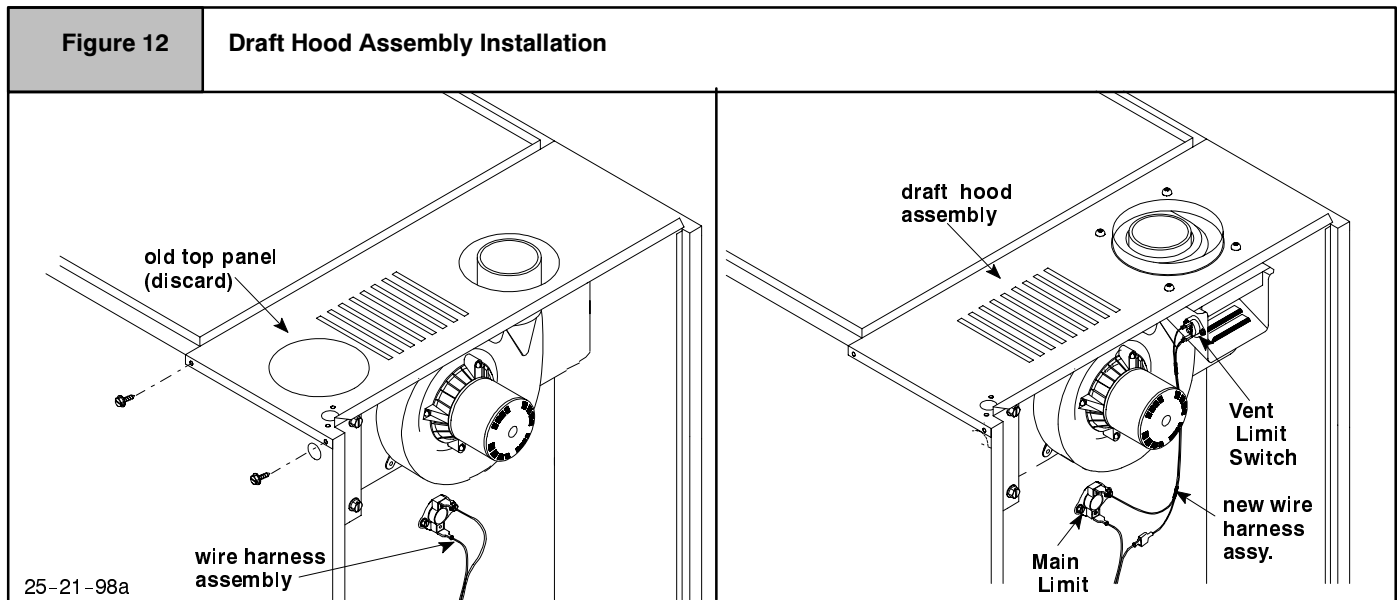
3. NTC7/GNL may be installed upflow or horizontal position per furnace application.
4. Detach field connect box from top panel by removing two screws. Set aside screws.
5. Remove four screws holding top panel to casing. Remove top panel. Discard top panel. Set screws aside.
6. Install draft hood assy. to casing using four screws previously set aside.
7. Attach field connect box to draft hood assy. using two screws previously set aside.

Vent Limit Switch Wiring (See Figure 13)

1. Locate wire harness assy. which is supplied with kit. Attach terminals on one end of wire harness assy. to vent limit switch located on draft hood assy.
2. Locate furnace's main limit. Detach wire with insulated terminal from one side of main limit.
3. Route wire harness assy. from vent limit switch to main limit. Attach female terminal of wire harness assy. to vacated main limit terminal. Attach male terminal of wire harness assy. to insulated terminal of wire previously detached from main limit.

Completion of Installation

1. NTC7/GNL Series furnaces – locate louvered door previously set aside. Install on furnace.
3. Refer to installation instructions provided with furnace to put the furnace into operation.



Masonry chimney venting shall be approached as follows: Using **Tables 1** and **2** in the masonry chimney draft hood kit instructions.

6. Gas Supply and Piping

⚠ WARNING

Fire and explosion hazard.

Natural Gas

Models designated for Natural Gas are to be used with Natural Gas ONLY.

Failure to follow these instructions can result in property damage, personal injury and/or death.

Gas Supply Requirements

- Use only the Type of gas approved for this furnace. See rating plate for approved gas type.
- Gas input must not exceed the rated input shown on the rating plate. Overfiring will result in failure of heat exchanger and cause dangerous operation.
- Do not allow minimum supply pressure to vary downward. Doing so will decrease input to furnace. Refer to **Table 2** for Gas supply and manifold pressures.

Table 2		Gas Pressures		
Gas Type	Supply Pressure			Manifold Pressure
	Recommended	Max.	Min.	
Natural	7" (1.7 kPa)	14" (3.5 kPa)	4.5" (1.1 kPa)	3.5" (0.9 kPa)
Propane	11" (2.7 kPa)	14" (3.5 kPa)	11" (2.7 kPa)	10" (2.5 kPa)

Natural Gas Input Rating Check

The gas meter can be used to measure input to furnace. Rating is based on a natural gas BTU content of 1,000 BTU's per cubic foot. Check with gas supplier for actual BTU content.

1. Turn **OFF** gas supply to all appliances other than furnace and start furnace.
2. Time how many seconds it takes the smallest dial on the gas meter to make one complete revolution. Refer to **Example**. **Note:** If meter uses a 2 cubic foot dial, divide results (seconds) by two.

Example			
Natural Gas BTU Content	No. of Seconds Per Hour	Time Per Cubic Foot in Seconds	BTU Per Hour
1,000	3,600	48	75,000
$1,000 \times 3,600 \div 48 = 75,000 \text{ BTUH}$			

3. Relight all appliances and ensure all pilots are operating.

Orifice Sizing

NOTE: Factory sized orifices for natural and LP gas are listed in the furnace Technical Support manual.

Ensure furnace is equipped with the correct main burner orifices. Refer to **Table 3** for correct orifice size for a given heating value and specific gravity for natural and propane gas. Note that this chart is **ONLY** for installations *below* 2000' in altitude.

Table 3		Orifice Sizes (below 2000')		
Gas Type	Manifold Pressure	Specific Gravity	Heating Value (BTU per Cubic Ft.)	Orifice Size (Drill #)
Natural	3.5" w.c. 0.9kPa w.c.	0.6	800	40
			900	41
			1000	42
			1100	43
Propane	10" w.c. 2.5kPa w.c.	1.53	2500	54

Operation Above 2000 Feet Altitude

⚠ WARNING

Fire, Explosion, Poison carbon monoxide gas hazard.

This conversion shall be done by a qualified service agency in accordance with the Manufacturer's instructions and all applicable codes and requirements, or in the absence of local codes, the applicable national codes.

Failure to follow these instructions exactly can result in property damage, personal injury and/or death.

These units may be used at full input rating when installed at altitudes up to 2000'. When installed above 2000', the input must be decreased 4% for each 1000' above sea level. This may be accomplished by a simple adjustment of manifold pressure or an orifice change, or a combination of a pressure adjustment and an orifice change. The changes required depend on the installation altitude and the heating value of the fuel. **Table 4** & **Table 5** show the proper furnace manifold pressure and gas orifice size to achieve proper performance based on elevation above sea level for both natural gas and propane.

To use the natural gas table, first consult your local gas utility for the heating value of the gas supply. Select the heating value on the vertical border and follow across the table until the appropriate elevation for the installation is reached. The first value in the box at the intersection of the heating value and elevation will be the manifold pressure required. If a gas orifice change is also required, the box is shaded. The required orifice size is shown at the bottom of the table.

Sea Level
High Altitude Input Rate = Nameplate x (Multiplier)
Input Rate

Elevation	High Altitude Multiplier	
	Natural	LP Gas
2000' - 2999'	0.96	0.92
3000' - 3999'	0.94	0.88
4000' - 4999'	0.92	0.84
5000' - 5999'	0.90	0.80
6000' - 6999'	0.88	0.76
7000' - 7999'	0.86	0.72

MANIFOLD PRESSURE AND ORIFICE SIZE FOR HIGH ALTITUDE APPLICATIONS

Table 4		NATURAL GAS					
HEATING VALUE BTU/CU. FT.	MEAN ELEVATION FEET ABOVE SEA LEVEL						
	0 to 1999	2000 to 2999	3000 to 3999	4000 to 4999	5000 to 5999	6000 to 6999	7000 to 8000
800	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.5" wc
850	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.5" wc
900	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.4" wc
950	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.3" wc	3.2" wc	3.1" wc
1000	3.5" wc	3.4" wc	3.3" wc	3.2" wc	3.0" wc	2.9" wc	2.8" wc
1050	3.2" wc	3.1" wc	3.0" wc	2.9" wc	2.7" wc	2.6" wc	2.5" wc
1100	2.9" wc	2.8" wc	2.7" wc	2.6" wc	2.5" wc	2.4" wc	2.3" wc
Orifice Size	#42	#42	#42	#42	#42	#42	#42

MANIFOLD PRESSURE CHANGE ONLY.

Table 5		PROPANE					
HEATING VALUE BTU/CU. FT.	MEAN ELEVATION FEET ABOVE SEA LEVEL						
	0 to 1999	2000 to 2999	3000 to 3999	4000 to 4999	5000 to 5999	6000 to 6999	7000 to 8000
2500	10.0" wc	10.0" wc	9.4" wc	10.0" wc	9.8" wc	8.8" wc	7.9" wc
Orifice Size	#54	#54	#54	#55	#55	#55	#55

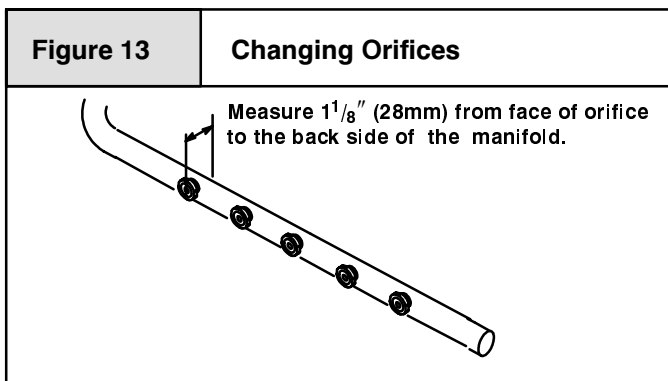
NOTE: NATURAL GAS DATA BASED ON 0.60 SPECIFIC GRAVITY. PROPANE DATA BASED ON 1.53 SPECIFIC GRAVITY. FOR FUELS WITH DIFFERENT SPECIFIC GRAVITY CONSULT THE LATEST EDITION OF THE NATIONAL FUEL GAS CODE ANSI Z223.1 and CAN B149.

High Altitude Air Pressure Switch

Altitudes over 6,000' require a different air pressure switch than the one installed at the factory. Consult your distributor or furnace *Parts List* for part number and availability. In Canada, provincial codes may govern installation of switch. Check with governing authorities.

Changing Orifices

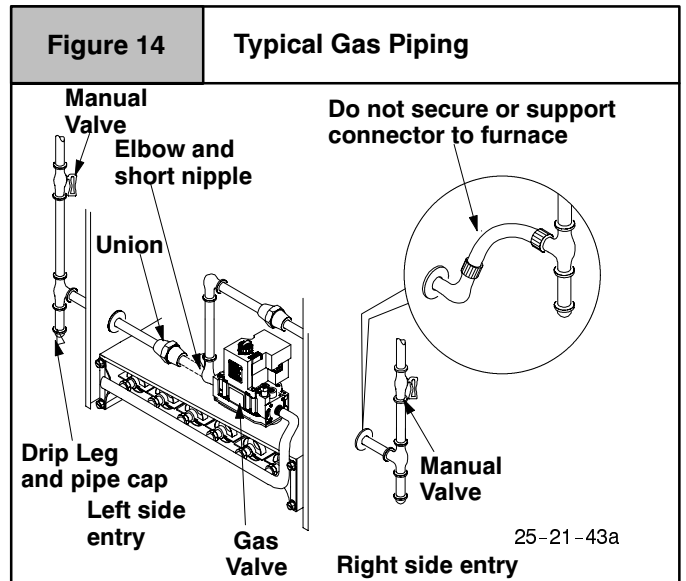
1. Disconnect gas line from gas valve.
2. Remove combustion box front cover and manifold from furnace.
3. Remove the orifices from the manifold and replace them with properly sized orifices.
4. Tighten orifices so there is $1\frac{1}{8}$ " (28mm) from the faces of the orifices to the back side of the manifold, **Figure 13**.



5. Reinstall manifold and combustion air box cover. Ensure burners do **NOT** bind on new orifices.

Gas Piping Requirements

1. Install gas piping in accordance with local codes, or in the absence of local codes, the applicable national codes.
2. It is recommended that a manual shutoff valve be installed in the gas supply line outside the unit. Locate valve as close to the furnace as possible where it is readily accessible. Refer to **Figure 14**.



3. Use black iron or steel pipe and fittings or other pipe approved by local code.
4. Use pipe thread compound which is resistant to natural and LP gases.
5. Install a drip leg no less than 3" long to trap dirt and moisture before it can enter gas valve.
6. Provide a $1\frac{1}{8}$ " inch plug for test gauge connection immediately up stream of gas supply connection to furnace.

7. Use two pipe wrenches when making connections to prevent gas valve from turning.
 8. Flexible corrugated metal gas connector may **NOT** be used inside the furnace or be secured or supported by the furnace or ductwork.
 9. Properly size gas pipe to handle combined appliance load or run gas pipe directly from gas meter or LP gas regulator.
 10. Install correct pipe size for run length and furnace rating.
 11. Measure pipe length from gas meter or LP second stage regulator.
- Test all pipe for leaks.
 - If orifices were changed, make sure they are checked for leaks.
 - During pressure testing of gas piping system, observe the following:
 - a. If test pressure does not exceed $1/2$ PSIG, isolate the furnace by closing its individual manual shutoff valve.
 - b. If test pressure exceeds $1/2$ PSIG, the furnace and its individual shutoff valve must be disconnected from the gas supply system.
 - To check for leaks apply soap suds or a liquid detergent to each joint. Bubbles forming indicate a leak.
 - Do not use an open flame to test for gas leaks. Fire or explosion could occur.
 - Correct even the smallest leak at once.

⚠ WARNING

Fire or explosion hazard.

Gas connector must be properly installed, cannot go through the side of the furnace, and can not be used inside the furnace.

Failure to properly install gas connector can result in property damage, bodily injury and/or death.

Additional LP Piping Requirements

- Have a licensed LP gas dealer make all connections at storage tank and check all connections from tank to furnace.
- If copper tubing is used, it **MUST** comply with limitation set in Local Codes, or in the absence of local codes, the gas codes of the country having jurisdiction.
- Two-stage regulation of LP gas is recommended.

Final Check

7. Electrical Wiring

Power Supply Wiring

The furnace **MUST** be electrically wired and grounded in accordance with local codes, or in the absence of local codes, the applicable national codes.

Field wiring connections must be made inside the furnace connection box. A suitable strain relief should be used at the point the wires exit the furnace casing.

Copper conductors must be used. Line voltage wires should be sized for the input amps stated on the rating plate. Furnace should be connected to its own separate circuit.

Thermostat

Thermostat location has an important effect on the operation of the unit. Follow instructions included with thermostat for correct mounting and wiring.

⚠ WARNING

Fire or explosion hazard.

Liquid petroleum (LP) gas is heavier than air and will settle and remain in low areas and open depressions.

Thoroughly ventilate area and dissipate gas. Do NOT use a match or open flame to test for leaks, or attempt to start up furnace before thoroughly ventilating area.

An open flame or spark can result in property damage, personal injury and/or death.

Low voltage connections to furnace must be made on terminal board to fan control.

Set thermostat heat anticipator in accordance with the *Technical Support Manual*.

Optional Equipment

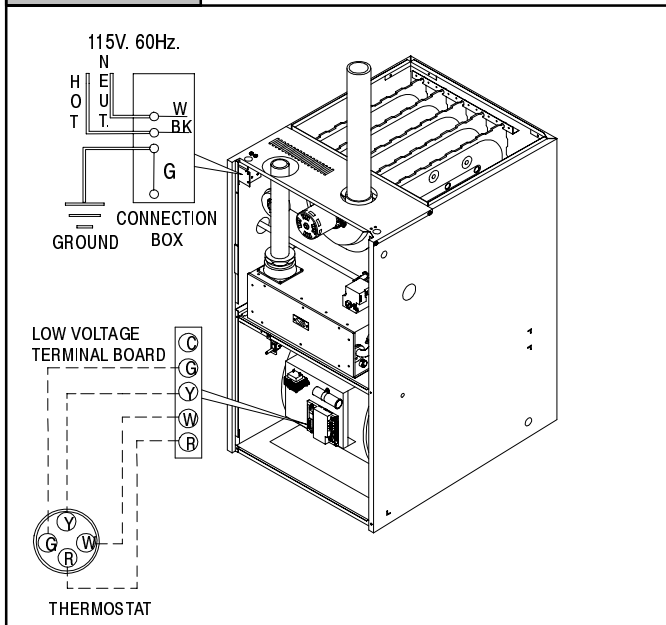
All wiring from furnace to optional equipment **MUST** conform to local codes or, in the absence of local codes, the applicable national codes. Install wiring in accordance with manufacturer's instructions.

Humidifier/Electronic Air Cleaner

The furnace is wired for humidifier and/or electronic air cleaner connection.

Figure 15

Electrical Connections

**CAUTION**

Do **NOT** exceed 115V/0.8 amp. maximum current load for both the EAC terminal and the HUM terminal combined.

NOTE: The humidifier will be powered when the furnace is fired and the circulating air blower comes on. The electronic air cleaner will be powered anytime the thermostat calls for air movement. However, the electronic air cleaner is **NOT** energized during continuous fan operation controlled by the electronic fan control.

8. Ductwork and Filter

⚠ WARNING

Poison carbon monoxide gas hazard.

Do NOT draw return air from inside a closet or utility room where furnace is located. Return air duct MUST be sealed to furnace casing.

Failure to properly seal duct can result in personal injury and/or death.

- It is recommended for furnaces installed without a cooling coil that the outlet duct be provided with a removable access panel. This panel should be accessible when the furnace is installed so that the heat exchanger can be viewed for inspections. The access panel **MUST** be sealed to prevent leaks.

NOTE: Dampers (purchased locally) can be either automatic or manual. Manually operated dampers **MUST** be equipped with a means to prevent furnace or air conditioning operation unless damper is in the full heat or cool position.

Installation

NOTE: Design and install air distribution system to comply with Air Conditioning Contractors of America manuals and/or NFPA pamphlets 90A and 90B or other approved methods that conform to local codes and good trade practices.

- When furnace supply ducts carry air outside furnace area, seal return air duct to furnace casing and terminate duct outside furnace space .
- Install air conditioning cooling coil (evaporator) on outlet side of furnace.
- If separate evaporator and blower unit are used, install good sealing dampers for air flow control. Chilled air going through the furnace could cause condensation and shorten furnace life.

⚠ WARNING

Poison carbon monoxide gas hazard.

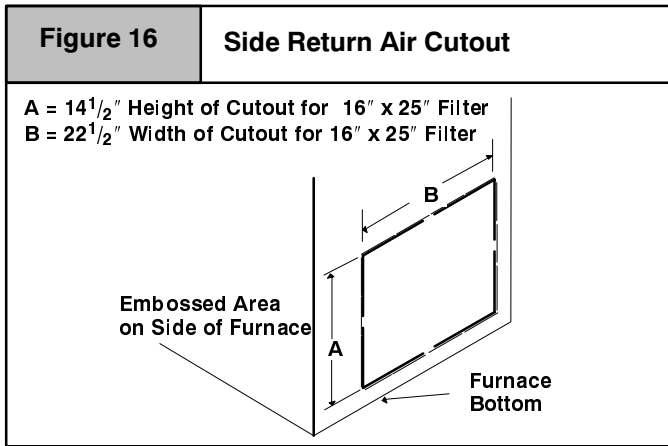
Cool air passing over heat exchanger can cause condensate to form resulting in heat exchanger failure.

This could result in personal injury and/or death.

Connections - Upflow Furnace

NOTE: Return air can enter through either side, both sides, or the bottom. Return air through the back of the unit is **NOT** allowed. When the furnace is located in an area near or adjacent to the living area, the system should be carefully designed with returns to minimize noise transmission through the return grille. Any blower moving a high volume of air will produce audible noise which could be objectionable to when the unit is located very close to living areas. It is advisable to route the return air ducts between floors or through the attic.

- For side connections using a 16" x 25" internal filter, cut out the embossed area shown in **Figure 16**. This will provide a 14¹/₂" x 22¹/₂" approximate opening.



NOTE: Furnaces with 1625 CFM or higher require two side returns or a bottom return.

- Bottom returns can be made by removing the knockout panel in the furnace base. Do **NOT** remove knock-out except for a bottom return. A 20" x 25" filter can be used for a bottom return for a 100,000 Btuh or greater furnace.
- An optional 20" x 25" duct standoff is available to be used in lieu of one filter on each side of furnace, or optional 16" x 25" external filter racks are available.
- Installation of locking-type dampers are recommended in all branches, or in individual ducts to balance system's air flow.
- Non-combustible, flexible duct connectors are recommended for return and supply connections to furnace.
- If air return grille is located close to the fan inlet, install at least one, 90° air turn between fan and inlet grille to reduce noise.

NOTE: To further reduce noise, install acoustical air turning vanes and/or line the inside of duct with acoustical material.

Sizing

Existing or new ductwork **MUST** be sized to handle the correct amount of airflow for either heating only or heating and air conditioning.

- Insulate ductwork installed in attics or other areas exposed to outside temperatures with a minimum of 2" insulation and vapor barrier.
- Insulate ductwork in indoor unconditioned areas with a minimum of 1" insulation with indoor type vapor barrier.

Subbase for Combustible Floors - Downflow Furnace Only

The Subbase for Combustible Floors **MUST** be used when a downflow furnace is set on combustible material even when the furnace is installed on a coil box.

- Cut the opening in the floor according to **Table 6**. The hole in the floor must be cut to the dimensions listed in **Table 6** since the base is equipped with locating tabs that center the base over the opening. See **Figure 17**.

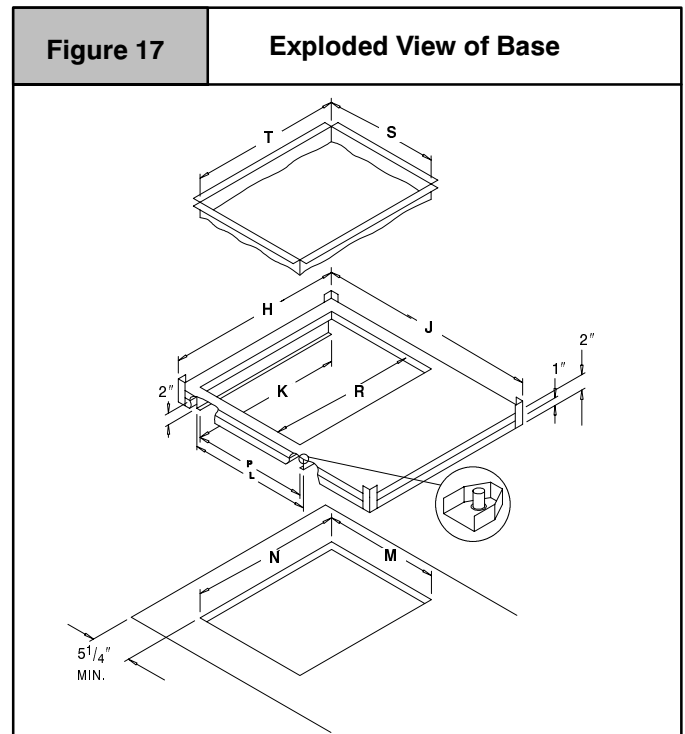


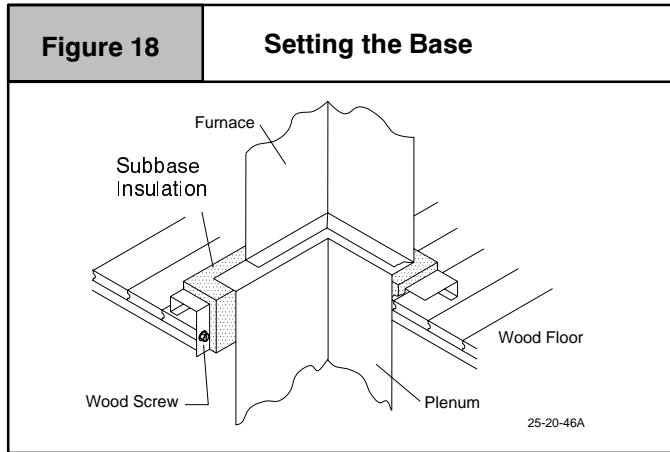
Table 6		Subbases for Combustible Floors Dimensions									
Subbase for Combustible Floors Part Number	Subbase for Combustible Floor Dimensions				Opening In Floor		Opening In Base For Plenum		Typical Plenum Dimensions		
	H ¹	J ¹	K ²	L	M	N	P	R	S	T	
Subbase for Combustible Floors (Furnace Only)											
NAHH002SB	19 ⁵ / ₁₆	28 ³ / ₄	18 ³ / ₁₆	16	16 ¹ / ₄	18 ¹ / ₄	15	17 ¹ / ₈	15	17 ¹ / ₈	
NAHH003SB	22 ¹⁵ / ₁₆	28 ³ / ₄	21 ¹³ / ₁₆	16	16 ¹ / ₄	21 ⁷ / ₈	15	19 ³ / ₄	15	19 ³ / ₄	
Subbase for Coil Box											
NAHH005SB	19 ⁵ / ₁₆	20 ⁹ / ₁₆	18 ³ / ₁₆	16	16 ¹ / ₄	18 ¹ / ₄	15	17 ¹ / ₈	15	17 ¹ / ₈	
NAHH006SB	22 ¹⁵ / ₁₆	20 ⁹ / ₁₆	21 ¹³ / ₁₆	16	16 ¹ / ₄	21 ⁷ / ₈	15	19 ³ / ₄	15	19 ³ / ₄	
Equivalents in mm	15 ¹¹ / ₁₆ = 398	28 ³ / ₄ = 730	14 ⁹ / ₁₆ = 370	16 = 406	16 ¹ / ₄ = 412	14 ⁵ / ₈ = 371	15 = 381	13 ¹ / ₂ = 343	15 = 381	13 ¹ / ₂ = 343	
	19 ⁵ / ₁₆ = 491	20 ⁹ / ₁₆ = 522	18 ³ / ₁₆ = 462			18 ¹ / ₄ = 464		17 ¹ / ₈ = 435		17 ¹ / ₈ = 435	
	22 ¹⁵ / ₁₆ = 583	21 ¹³ / ₁₆ = 554	21 ⁷ / ₈ = 556			19 ³ / ₄ = 502		19 ³ / ₄ = 502			

¹ Outside Dimension

² Base Spacer Side To Side

The opening in the base is 1¹/₄" (32mm) shorter and 1¹/₈" (29mm) narrower than the recommended size of the opening in the floor. This is done to maintain a 1" clearance between the floor and the plenum.

2. Fabricate the plenum to the dimensions given in **Table 6**. Note that the dimensions given are outside dimensions.
3. Set the base over the opening in the floor, centering the opening in the base over the opening in the floor. Fasten the base to the floor with screws or nails. See **Figure 18**.
4. Drop the plenum through the opening in the base. The flange of the plenum should rest on top of the installation of the combustible floor base.



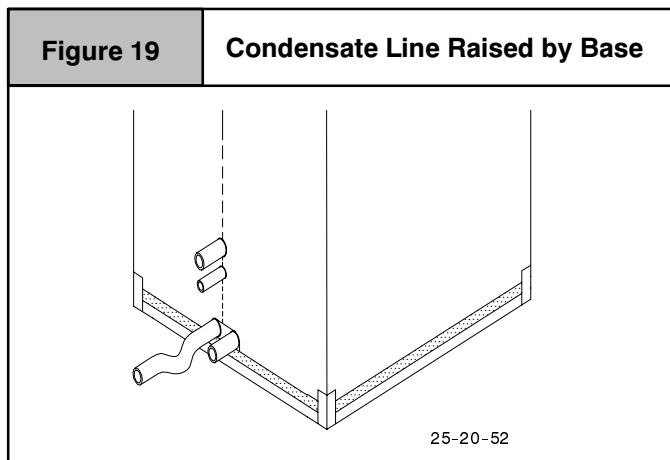
Subbase for Combustible Floors - Downflow Coil Box

The Subbase for Combustible Floors **MUST** be used when a downflow furnace, **used with a downflow coil box**, is set on combustible flooring.

1. Cut the opening in the floor according to **Table 6**. The hole in the floor must be cut to the dimensions listed in **Table 6** since the base is equipped with locating tabs that center the base over the opening.

The opening in the base is 1¹/₄" (32mm) shorter and 1¹/₈" (29mm) narrower than the recommended size of the opening in the floor. This is done to provide a 1" clearance between the floor and the plenum.

2. Fabricate the plenum to the dimensions given in **Table 6**. Note that the dimensions given are outside dimensions.
3. Set the base over the opening in the floor, centering the opening in the base over the opening in the floor. Fasten the base to the floor with screws or nails. See **Figure 19**.



4. Drop the plenum through the opening in the base. The flange of the plenum should rest on top of the installation of the combustible floor base.

This subbase for combustible floors has been designed so that the height of the subbase raises the downflow coil off the floor to allow easy installation of the condensate drain. See **Figure 20**.

Non-Combustible Floor:

Set the furnace over the opening in the floor. If necessary, grout around the base to seal air leaks between the base and the floor.

Filters:

NOTE: The size and type(s) of filter supplied with the furnace will handle the airflow required if central air conditioning is used with the furnace.

Use either filter type:

- Washable, high velocity filter based on a maximum air flow rating of 600 FPM.
- Disposable, low velocity filter based on a maximum air flow of 300 FPM when used with filter grille.

Filters and racks are shipped with unit.

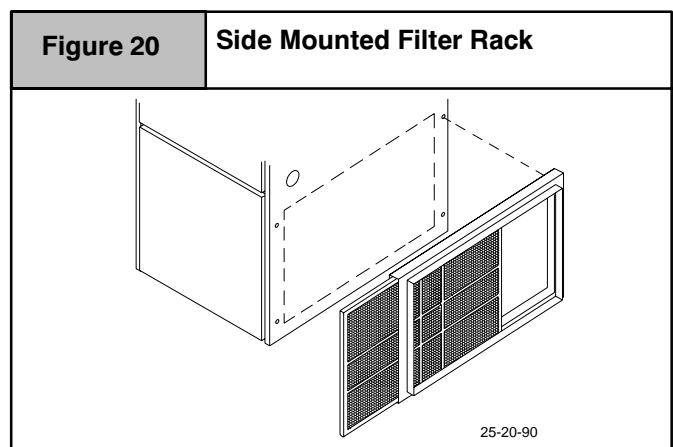
NOTE: Disposable, low velocity filters may be replaced with washable, high velocity filter providing they meet the minimum size areas. Washable, high velocity filters can be replaced **ONLY** with same type and size.

Return Air Duct

1. Non-combustible, flexible duct connectors are recommended for return and supply connections to furnace.
2. If air return grille is located close to the fan inlet, install at least one, 90° air turn between fan and inlet grille to reduce noise.

NOTE: To further reduce noise, install acoustical air turning vanes and/or line inside of duct with acoustical material.

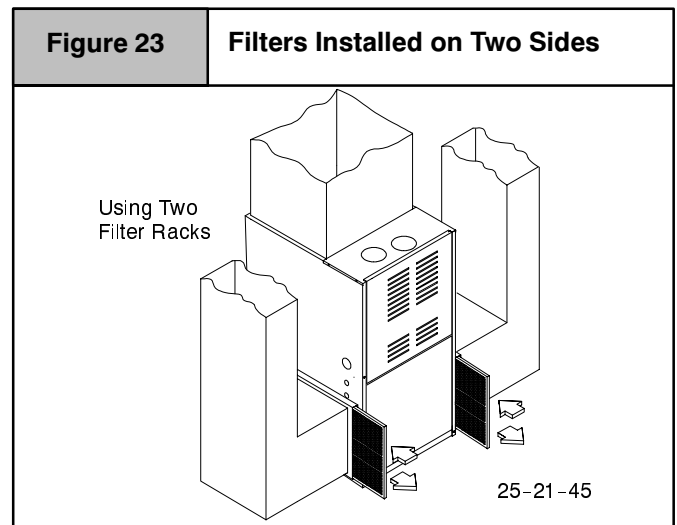
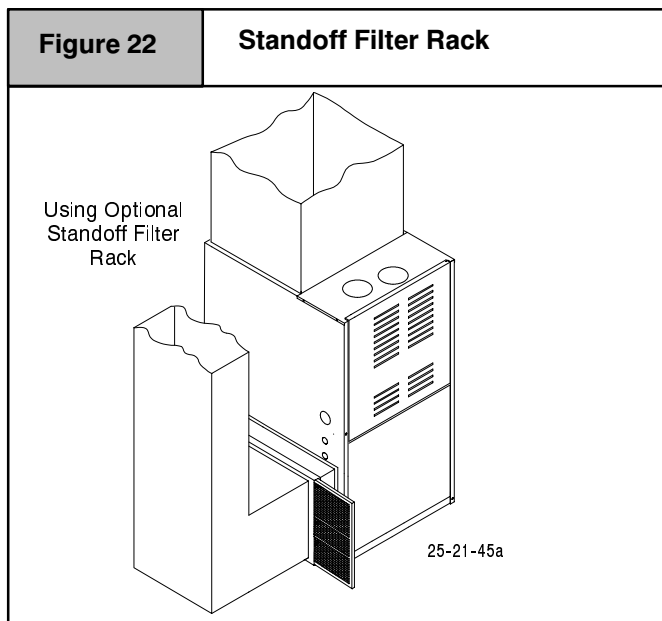
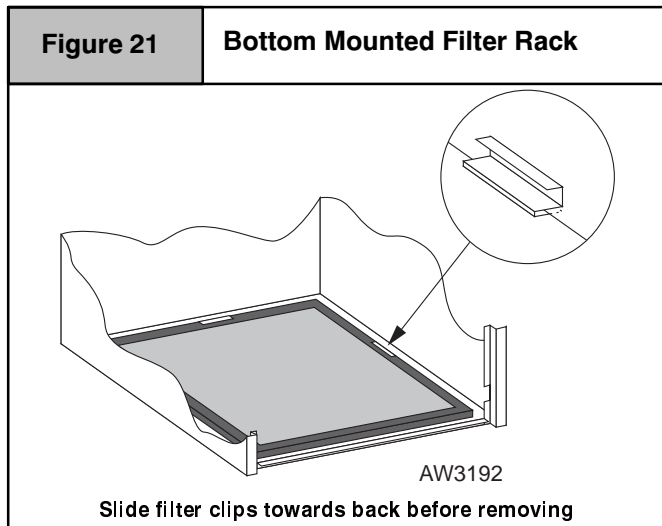
Filter Installation



Upflow furnace

When installing or removing a bottom mounted filter, slide the two side filter clips to the back of the furnace **BEFORE** installing or removing. This will allow the filter to clear the front raised edge of the furnace. Insert filter into side clips first and push filter back until it is fully engaged into back clip. When filter is in place, slide clips back into place midway on filter as shown in **Figure 21**.

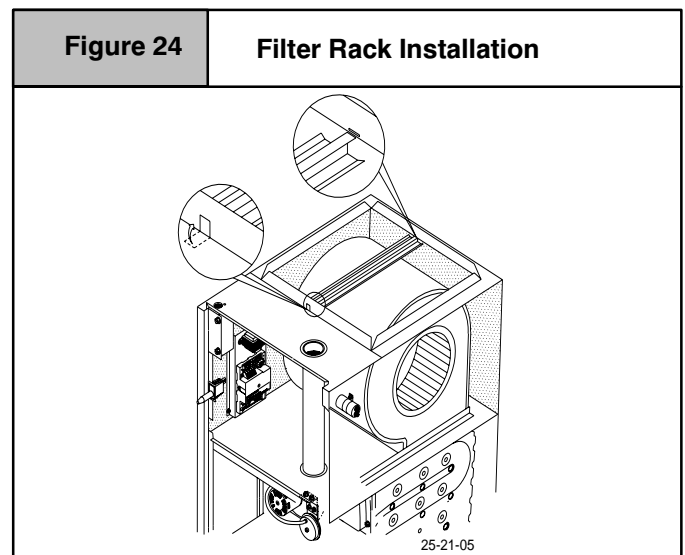
Refer to **Figure 22** through **Figure 25** for guidelines to install filters. Furnaces which require larger filter media and have limited clearances on one side of furnace, require a standoff filter rack, see **Figure 24**, available from your distributor.



Downflow Furnace

NOTE: The return air plenum **MUST** extend a sufficient height above dimension "A" (**Figure 25**) to provide for the attachment of a return air duct or grille above the filters.

1. Insert end of filter rack with $\frac{3}{4}$ " (19mm) flange into slot in the back of the unit. See **Figure 24**.
2. With filter rack pushed back, insert front end with $\frac{1}{4}$ " (6mm) flange into position and push into front slot. With filter rack pushed as far forward as it will go, bend $\frac{1}{4}$ " (6mm) flange and $\frac{3}{4}$ " (19mm) flange up 90° . See **Figure 24**.



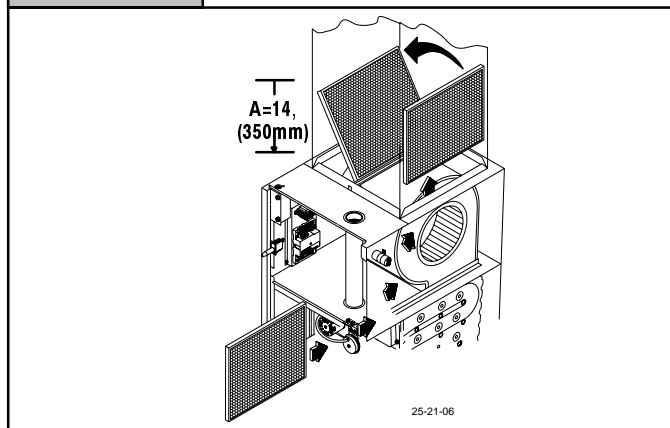
NOTE: Plenum must be fitted as close to the return air flange of the unit as possible to eliminate any air bypassing the filters.

3. Filters can only be installed through the right hand side of the unit blower opening. Slide filter into unit until it is in position to be pushed up and over into place on the left hand side of unit. See **Figure 25**.
4. Slide remaining filter into unit and up into place on left hand side of unit. See **Figure 25**.

If there is insufficient plenum height for this type of installation, filters may be installed in any accessible location in the return air system. In such a case, the filters should be of equivalent square inch area and style as originally supplied with the furnace.

Figure 25

Filter Installation



CAUTION

If filters are only suitable for heating application, advise homeowner that filter size may need to be increased if air conditioning is added.

Addition Of Air Conditioning

When a refrigeration coil is used in conjunction with this unit, it must be installed on the discharge side of the unit to avoid condensation on the heat exchanger. The coil installation instructions must be consulted for proper coil location and installation procedures. With a parallel flow arrangement, dampers must be installed to prevent chilled air from entering the furnace. If manually operated dampers are used, they must be equipped with a means to prevent operation of either unit unless the damper is in full heat or full cool position.

A 3" (75mm) clearance is required on the right side of the furnace in order to run the condensate drain line. Copper, iron or plastic tubing may be used for the condensate drain line.

9. Checks and Adjustments

Startup

NOTE: Refer to startup procedures in the *Users Information Manual*.

CAUTION

If any sparks, odors or unusual noises occur, immediately shut OFF power to furnace. Check for wiring errors or obstruction to blower.

Gas Supply Pressure

Gas supply pressure should be within minimum and maximum values listed on rating plate. Pressures are usually set by gas suppliers.

Manifold Gas Pressure Adjustment

NOTE: Make adjustment to manifold pressure with burners operating with combustion box cover removed.

⚠ WARNING

Fire or explosion hazard.

Turn OFF gas at shut off before connecting U-tube manometer.

Failure to turn OFF gas at shut off before connecting U-tube manometer can result in personal injury and/or death.

1. With gas **OFF**, Connect U-Tube manometer to tapped opening on gas valve. Use manometer with a 0 to min. 12" water column range.
2. Turn gas **ON** and remove adjustment screw cover on gas valve. Turn counterclockwise to decrease pressure and clockwise to increase.

NOTE: Adjustment screw cover **MUST** be placed on gas valve before reading manifold pressure and operating furnace.

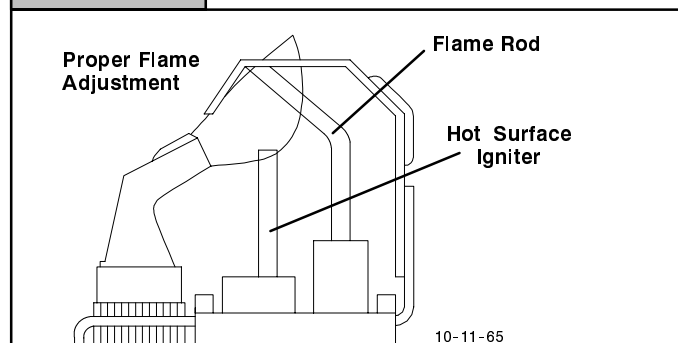
3. For altitudes up to 2000', set pressure to value shown in **Table 2**, $\pm 0.3"$ (8mm) water column. For altitudes of 2000' to 8000', see Section 5 "Gas Supply & Piping" for correct pressure valve.

Adjust Pilot Burner

The furnace has a pilot flame to light the main burner. The flame should surround $\frac{3}{8}"$ to $\frac{1}{2}"$ of the thermocouple. See **Figure 26**. To adjust, remove cap from pilot adjusting screw on gas valve. Turn screw counterclockwise to increase or clockwise to decrease flame as required. Replace cap for adjusting screw.

Figure 26

Pilot Burner



Main Burner Flame Check

Allow the furnace to run approximately 10 minutes then inspect the main burner and pilot flames. See **Figure 27**.

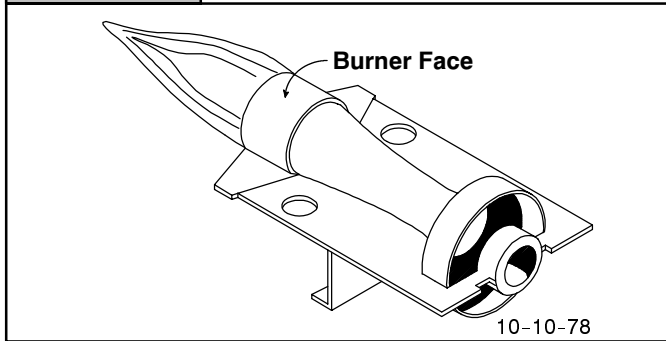
Check for the following (**Figure 27**):

- Stable and blue flames. Dust may cause orange tips or wisps of yellow, but flames **MUST NOT** have solid, yellow tips.
- Flames extending directly from burner into heat exchanger.
- Flames do **NOT** touch sides of heat exchanger

If any problems with main burner flames are noted, it may be necessary to adjust gas pressures, or check for drafts.

Figure 27

Main Burner



Temperature Rise Check

The blower speed **MUST** be set to give the correct air temperature rise through the furnace as marked on the rating plate. Temperature rise is the difference between supply and return air temperatures.

To check temperature rise, use the following procedure:

1. Place thermometers in supply and return air registers as close to furnace as possible, avoiding direct radiant heat from heat exchangers.
2. Operate furnace continuously for 15 minutes with all registers and duct dampers open.
3. Take reading and compare with range specified on rating plate.
4. If the correct amount of temperature rise is **NOT** obtained, it may be necessary to change blower speed. A higher blower speed will lower the temperature rise. A lower blower speed will increase the temperature rise.

Changing Blower Speed

⚠ WARNING

Electrical shock hazard.

Turn OFF power to furnace before changing speed taps.

Failure to do so can result in personal injury and/or death.

NOTE: The speed taps that the manufacture sets from the factory for this product are based on a nominal 400 CFM per ton cooling and the basic mid range on the temperature rise for heating.

Since the manufacturer cannot establish the static pressure that will be applied to the unit, it is the responsibility of the installer dealer/contractor to select the proper speed taps for the application when the unit is installed.

If it is necessary to change speeds, refer to steps below.

1. Refer to *Furnace Wiring Diagram* for location of the heating and cooling speed taps located on the electronic fan control as well as location of unused blower motor speed leads. Use the chart (**Table 7**) to determine the blower motor speed settings.

Table 7	Blower Speed Chart
Wire Color	Motor Speed
Black	High
Orange	Med-High
Blue	Medium-Low
Red	Low

2. Change the heat or cool blower motor speed by removing the motor lead from the "**Heat**" or "**Cool**" terminal and replace it with the desired motor speed tap from the "**Unused Motor Leads**" location. Connect the wire previously removed from the "**Heat**" or "**Cool**" terminal to the vacated "**Unused Motor Leads**" terminal.
3. If the same speed must be used for both heating and cooling, remove the undesired motor speed lead from the "**Heat**" or "**Cool**" terminal and connect that lead to the open terminal at "**Unused Motor Leads**" location. Attach a jumper between the "**Heat**" and "**Cool**" terminals and the remaining motor speed lead.

Note: When using the same speed for heating and cooling on motors with (4) speed leads, it may be necessary to tape off the terminal of the motor speed lead removed from the "**Heat**" or "**Cool**" terminal with electrical tape if an open terminal is not available at the "**Unused Motor Leads**" location.

Continuous Fan Operation

A terminal is provided on the electronic fan control located in the circulating blower compartment for operation of the continuous fan option. This connection is intended for the low speed motor tap, and has a lower contact rating (8 amps) than the heat and cool taps. When the low speed blower lead is connected to this terminal, this will provide low speed blower operation whenever the other two speeds (**Heat** or **Cool**) are not energized.

Thoroughly check the system after modification to ensure the proper operation of the circulating air blower in all modes of operation.

Separate speed selections for Heat, Cool, and Continuous Fan

Connect low speed lead from circulating motor to the "**Cont.**" terminal at the electronic fan control. The appropriate motor leads should already be connected to the "**Heat**" and "**Cool**" terminals.

Heating and Continuous Blower Speed the Same

If it is necessary to operate the heating speed and continuous blower speed using the same blower speed, connect a jumper between the "**Heat**" and "**Cont.**" terminals on the electronic fan control.

Note: There should be only **ONE** motor lead going to the "**Heat**" and "**Cont.**" terminals.

10. Furnace Maintenance

CAUTION

It is recommended that the furnace be inspected and serviced on an annual basis (before the heating season) by a qualified service technician.

See *“User’s Information Manual”*.

Labeling

CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Verify proper operation after servicing.

Pressure Switch

During regular yearly maintenance check for cracks in any tubes on the pressure switch.