


Installation Instructions

NTVM/VNK Series Two-Stage Condensing Furnace with Variable Speed DC Motor Drive

SAFETY REQUIREMENTS

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 words **DANGER**, **WARNING**, or **CAUTION**. These words are used with the safety-alert symbol. **DANGER** identifies the most serious hazards, those that **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 that **could** 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

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WARNING

Electric Shock Hazard

**Turn Off All Power
Before Servicing.**

**Failure to do so can result
in death, personal injury
and/or property damage.**



WARNING

Fire or Explosion hazard.

**This furnace is not designed for use in mobile
homes, trailers or recreational vehicles.**

**Such use could result in death, bodily injury
and/or property damage.**

1. Safe Installation Requirements

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 all governmental authorities having jurisdiction.

The information contained in this manual is intended for use by a qualified service technician who is experienced in such work, who is familiar with all precautions and safety procedures required in such work and is equipped with the proper tools and test instruments.

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

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 **Figure 1** and this manual, for proper installation.

- This furnace is **NOT** approved for installation in mobile homes, trailers or recreation vehicles.
- Do **NOT** use this furnace as a construction heater or to heat a building that is 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. (Furnaces can be converted to L.P. 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.

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

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 property damage. 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 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 a qualified service agency, if required.

START-UP CHECK SHEET

(Keep this page for future reference)

Dealer Name: _____

Address: _____

City, State(Province), Zip or Postal Code: _____

Phone: _____

Owner Name: _____

Address: _____

City, State(Province), Zip or Postal Code: _____

Model Number: _____

Serial Number: _____

Type of Gas: Natural: ☐ LP: ☐

Blower Motor H.P.: _____

Supply Voltage: _____

Which blower (DIP switch) setting is used?

Heating _____ Cooling _____ Continuous _____

Temperature of Supply Air: High Fire (°F) _____ or (°C) _____

Low Fire (°F) _____ or (°C) _____

Temperature of Return Air: (°F) _____ or (°C) _____

Temp. Rise Hi Fire (Supply - Return): (°F) _____ or (°C) _____

Lo Fire (Supply - Return): (°F) _____ or (°C) _____

Filter Type and Size: _____

Fan "Time **ON**" Setting: _____

Fan "Time **OFF**" Setting: _____

Manual Gas Shut-Off Upstream

of Furnace/Drip-Leg? YES ☐ NO ☐

Dealer Comments: _____

Business Card Here

Drip-Leg Upstream of Gas Valve? YES ☐ NO ☐

Condensate Drain Connected? YES ☐ NO ☐

Horizontal Condensate Drain Trapped? YES ☐ NO ☐

Blower Speed Checked? YES ☐ NO ☐

All Electrical Connections Tight? YES ☐ NO ☐

Electrical Polarity Checked? YES ☐ NO ☐

Furnace Properly Grounded? YES ☐ NO ☐

Gas Valve Status Light OK? YES ☐ NO ☐

Gas Valve Turned ON? YES ☐ NO ☐

Measured Line Pressure When Firing Unit: _____

Calculated Firing Rate: (High & Low Fire) (See *Checks and Adjustments* Section). _____

Measured Manifold Pressure: Hi Fire _____ Lo Fire _____

Thermostat OK? YES ☐ NO ☐

Thermostat: Single Stage _____ Two Stage _____

Subbase Level? YES ☐ NO ☐

Anticipator Set? YES ☐ NO ☐ Set At?: _____

Breaker On? YES ☐ NO ☐

Date of Installation: _____

Date of Start-Up: _____

2. Installation

⚠ WARNING

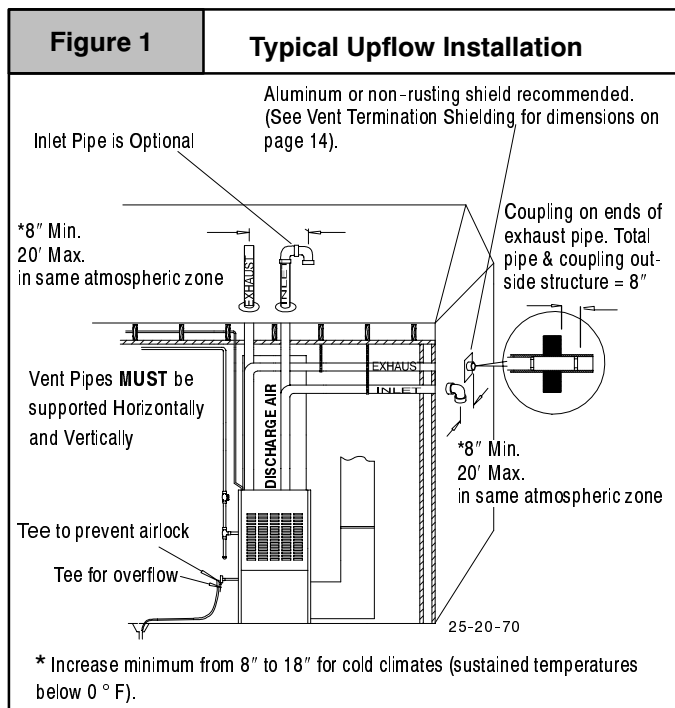
Poison carbon monoxide gas Hazard.

This furnace can NOT be common vented or connected to any type B, BW or L vent or vent connector, nor to any portion of a factory-built or masonry chimney. 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 appliance(s). See *Venting and Combustion Air Check* in *Combustion & Ventilation Air* section. This furnace MUST be vented to the outside.

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

Location and Clearances

1. Refer to **Figure 1** for typical installation and basic connecting parts required. Refer to **Figure 3** for typical horizontal direct vent or non-direct vent and basic connecting parts required. Supply and return air plenums and duct are also required.



2. 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 2**).

CAUTION

Special precautions **MUST** be made if installing furnace in an area which may drop below freezing. This can cause improper operation or damage to equipment. If furnace environment has the potential of freezing, the drain trap and drainline must be protected. The use of electric heat tape or RV antifreeze is recommended for these installations. (See "*Condensate Trap Freeze Protection*" section on page 12)

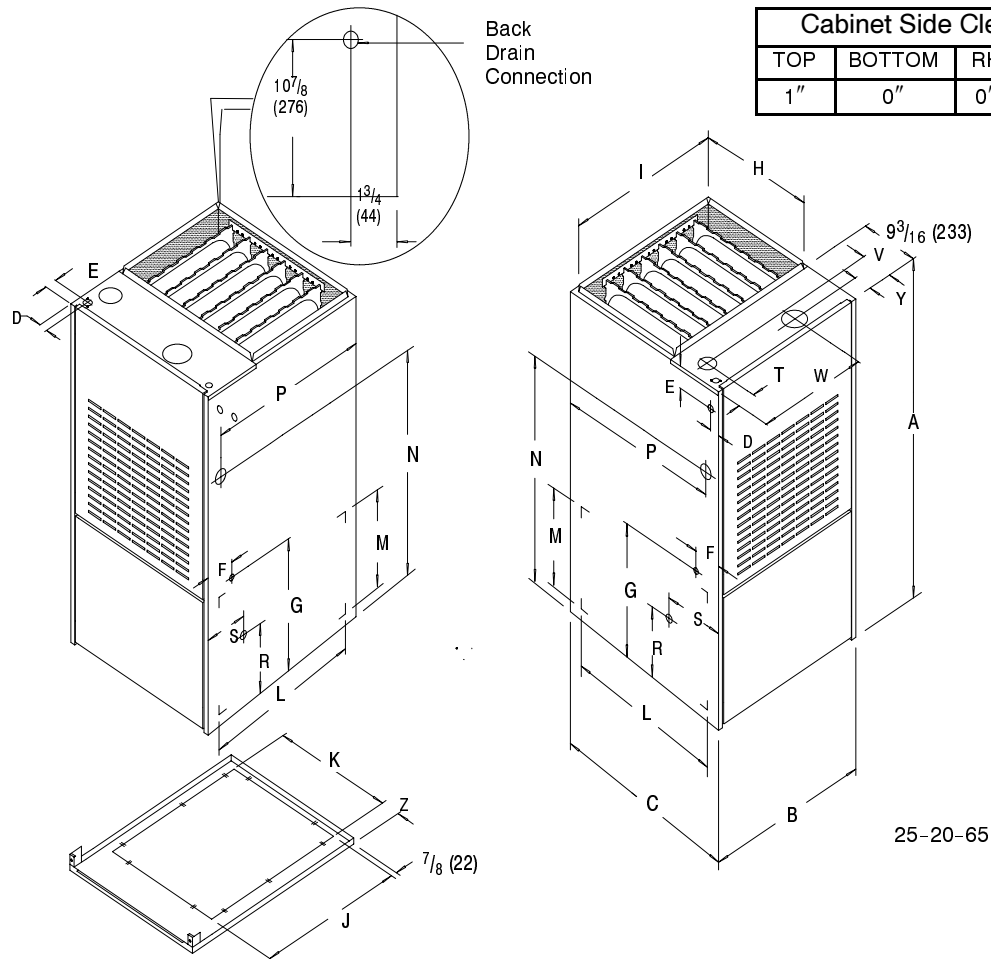
Do NOT operate furnace in a corrosive atmosphere containing chlorine, fluorine or any other damaging chemicals. Refer to *Vent and Combustion Air Piping* section, *Contaminated Combustion Air* on page 9.

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 on page 9).
5. Maintain clearance for fire safety and servicing. A front clearance of 30" is recommended for access to the burner, controls and filter.
6. Use a raised base if the floor is damp or wet at times.
7. Residential garage installations require:
 - Burners and ignition sources installed at least 18" above the floor.
 - Located or physically protected from possible damage by a vehicle.
8. Local codes may require a drain pan under the entire furnace and condensate trap when the furnace is installed in attic application.
9. When the installation is complete, check that all appliances have adequate combustion air and are venting properly. See *Venting And Combustion Air Check* on page 6 in this manual.
10. For horizontal installation over a finished living space, a field fabricated auxiliary drain pan with drain pipe is required to prevent damage by overflow due to blocked condensate drain.

Figure 2

Dimensions and Clearances (Upflow/Horizontal)



DIMENSIONAL INFORMATION

Unit Capacity	CABINET			ELECTRICAL CONNECTIONS						SUPPLY AIR		RETURN AIR			
				TOP		LEFT SIDE		LOW VOLT				BOTTOM		SIDE	
	A	B	C	D	E	D	E	F	G	H	I	J	K	L	M
50,000	48	19 ¹ / ₈	28 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ⁵ / ₈	2 ¹ / ₂	4 ¹ / ₂	17 ⁵ / ₁₆	18 ¹ / ₂	17 ⁵ / ₈	23 ¹ / ₈	14 ³ / ₄	22 ¹ / ₂	14 ¹ / ₂
75,000	48	19 ¹ / ₈	28 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ⁵ / ₈	2 ¹ / ₂	4 ¹ / ₂	17 ⁵ / ₁₆	18 ¹ / ₂	17 ⁵ / ₈	23 ¹ / ₈	14 ³ / ₄	22 ¹ / ₂	14 ¹ / ₂
100,000	48	22 ³ / ₄	28 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ⁵ / ₈	2 ¹ / ₂	4 ¹ / ₂	17 ⁵ / ₁₆	18 ¹ / ₂	21 ¹ / ₄	23 ¹ / ₈	18 ³ / ₄	22 ¹ / ₂	14 ¹ / ₂
125,000	48	26 ³ / ₈	28 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ⁹ / ₈	2 ¹ / ₂	4 ¹ / ₂	17 ⁵ / ₁₆	18 ¹ / ₂	24 ⁷ / ₈	23 ¹ / ₈	23 ¹ / ₂	22 ¹ / ₂	14 ¹ / ₂

Unit Capacity	GAS CONNECTIONS				DRAIN CONNECTIONS			SUPPLY AIR		TOP FRONT		
	RIGHT SIDE		LEFT SIDE		R	RIGHT SIDE	LEFT SIDE			W	Y	Z
	N	P	N	P		S	S	T	V			
50,000	32 ¹ / ₂	23 ⁷ / ₈	32 ¹ / ₂	26 ¹ / ₁₆	10 ⁷ / ₈	2 ³ / ₄	6 ¹ / ₂	2 ¹¹ / ₁₆	4 ¹³ / ₁₆	12 ⁷ / ₈	2 ¹¹ / ₁₆	2 ¹ / ₈
75,000	32 ¹ / ₂	23 ⁷ / ₈	32 ¹ / ₂	26 ¹ / ₁₆	10 ⁷ / ₈	2 ³ / ₄	6 ¹ / ₂	2 ¹¹ / ₁₆	4 ¹³ / ₁₆	12 ⁷ / ₈	2 ¹¹ / ₁₆	2 ¹ / ₈
100,000	32 ¹ / ₂	23 ⁷ / ₈	32 ¹ / ₂	26 ¹ / ₁₆	10 ⁷ / ₈	2 ³ / ₄	6 ¹ / ₂	2 ¹¹ / ₁₆	4 ¹³ / ₁₆	14 ¹¹ / ₁₆	2 ¹¹ / ₁₆	1 ⁷ / ₈
125,000	32 ¹ / ₂	23 ⁷ / ₈	32 ¹ / ₂	26 ¹ / ₁₆	10 ⁷ / ₈	2 ³ / ₄	6 ¹ / ₂	2 ¹¹ / ₁₆	4 ¹³ / ₁₆	18	2 ¹¹ / ₁₆	1 ⁷ / ₁₆

Horizontal Furnace Installation

NOTE: Inspect unit rating plate to be certain model number begins with "NTVM", or "VNK". This identifies unit as horizontally mountable. If unit does **NOT** bear this designation, you may **NOT** mount this unit horizontally. **Unit may 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 only a **right-to-left** airflow position. See **Figure 3**. **Do not** install furnace on its back as safety control operation will be adversely affected.

⚠ WARNING

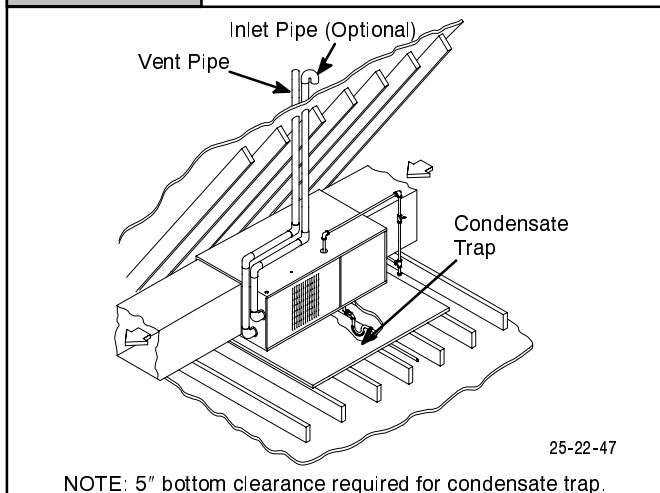
Fire, Explosion, and/or poison carbon monoxide gas hazard.

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 death, personal injury and/or property damage.

Figure 3

Typical Horizontal Installation



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 rigidly attach the furnace to prevent movement. 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 suitable concrete pad or blocks are recommended for crawl space installation on the ground.

NOTE: 5" bottom clearance required for condensate trap.

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

3. 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 death, personal injury and/or property damage.

Venting and Combustion Air Check

NOTE: This section of the manual applies to this furnace **IF venting as a non-direct vent (single pipe) appliance**. The following

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 as long as all required furnace clearances are met. See **Figure 2**.

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

For horizontal installation over a finished living space. A field fabricated auxiliary drain pan with drain pipe is required to prevent damage by overflow due to blocked condensate drain.

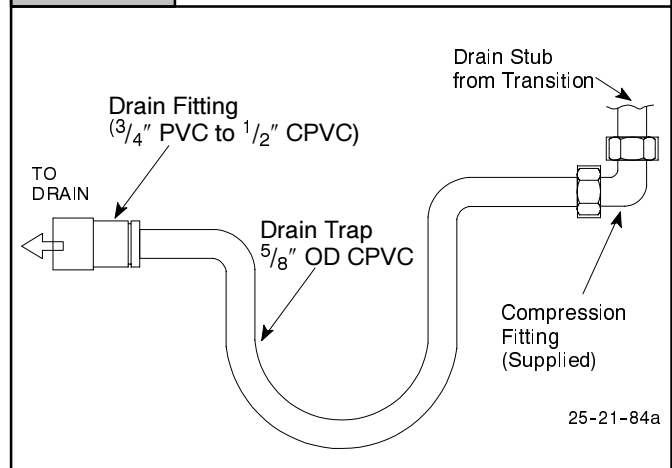
Condensate Drain Trap

For horizontal furnace installations, the supplied condensate drain trap **MUST** be installed below the furnace. See **Figure 4** for dimensions of the drain trap and the proper material to be used. The drain connection to the condensate trap must also be properly sloped to an open drain.

The condensate drain trap connects to the drain stub on the left side of the plastic transition. See **Figure 3** and **Figure 4**. Remove the plastic cap and clamp from the drain stub. Use the 90° compression fitting elbow (provided) to connect the drain trap to the drain stub. Replace the plastic cap and clamp over the remaining drain stub on the plastic transition.

Figure 4

Condensate Drain Trap

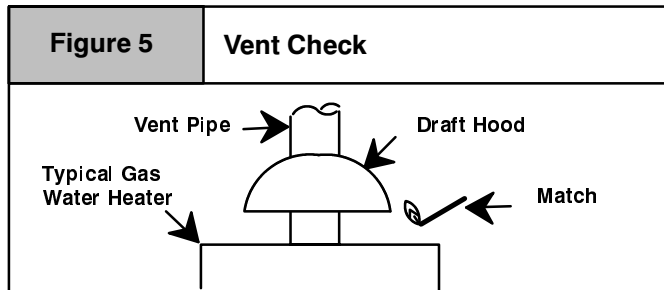


information is supplied to allow the installer to make adjustments to the setup of existing appliances, **IF REQUIRED**, based on good trade practices, local codes, and good judgment of the installer. Manufacturer does **NOT** take responsibility for modifications made to existing equipment.

NOTE: If this installation removes an existing furnace from a venting system serving one or more other 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) remain-ing 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 in-spected. Adjust thermostat so all 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 5**).



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 cor-rected using the appropriate tables in code books of coun-try 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 and electrical codes of the country having jurisdiction.

Air Openings and Connecting Ducts

1. Total input rating for all non direct vent gas appliances **MUST** be considered when determining free area of open-ings.
2. Connect ducts or openings directly to outside.
3. When screens are used to cover openings, they **MUST** be no less than $\frac{1}{4}$ " mesh.
4. The minimum dimension of rectangular air ducts **MUST NOT** be less than 3".
5. When sizing grille or louver, use the free area of opening. If free area is **NOT** stamped or marked on grill or louver, as-sume a 20% free area for wood and 60% for metal.

Confined Space Installation

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

Requirements

1. Provide confined space with sufficient air for proper com-bustion and ventilation of flue gases using horizontal or ver-tical ducts or openings.
2. **Figure 6** illustrates how to provide combustion and ventila-tion air. A minimum of two permanent openings, one inlet and one outlet, are required.
3. One opening **MUST** be within 12" of the floor and the se-cond opening within 12" of the ceiling.

Table 1		Free Area		
BTUH Input Rating	Minimum Free Area Required for Each Opening			
	Horizontal Duct (2,000 BTUH)	Vertical Duct or openings to outside (4,000 BTUH)	Round Duct (4,000 BTUH)	
	50,000	25 sq. in.	12.5 sq. in.	4"
	75,000	37.5 sq. in.	18.75 sq. in.	5"
	100,000	50 sq. in.	25 sq. in.	6"
	125,000	62.5 sq. in.	31.25 sq. in.	7"
	150,000	75 sq. in.	37.5 sq. in.	7"
EXAMPLE: Determining Free Area				
Appliance 1 Appliance 2 Total Input				
100,000 + 30,000 = (130,000 ÷ 4,000) = 32.5 Sq. In. Vertical				
Appliance 1 Appliance 2 Total Input				
100,000 + 30,000 = (130,000 ÷ 2,000) = 65 Sq. In. Horizontal				

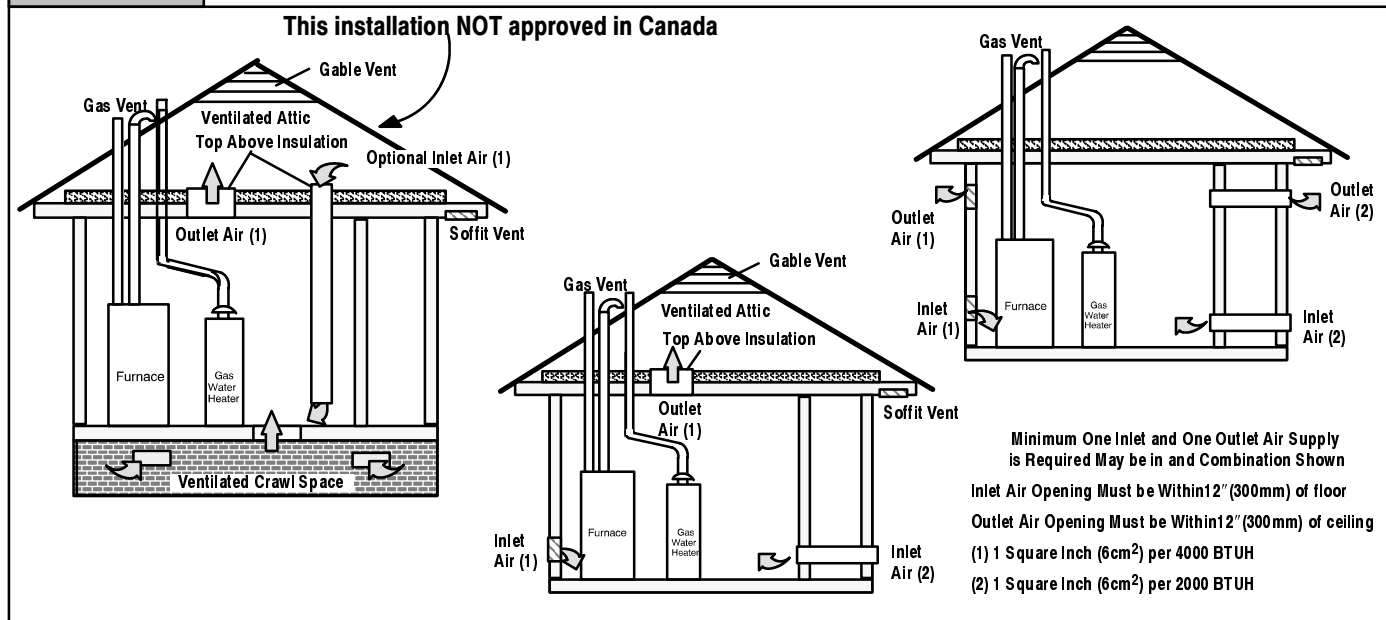
4. Size openings and ducts per **Table 1**.
5. Horizontal duct openings require 1" sq. of free area per 2,000 BTUH of combined input for all gas appliances in area (**see Table 1**).
6. Vertical duct openings or openings directly to outside re-quire 1" sq. of free area per 4,000 BTUH for combined input of all gas appliances in area (**see Table 1**).

One permanent opening, commencing within 12" of the top of the enclosure, shall be permitted where the equipment has clear-ances of at least 1" from the sides and back and 6" from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces (crawl or attic) that freely communi-cate with the outdoors, and shall have a minimum free area of:

- 1 sq. in per 3000 Btu per hr. of the total input rating of all equipment located in the enclosure, and
- Not less than the sum of the areas of all vent connectors in the confined space.

Figure 6

Outside Air (This is ONLY a guide. Subject to codes of country having jurisdiction.)



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 death, personal injury and/or property damage.

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. Refer to **Table 2** for minimum area required.

Table 2		Unconfined Space Minimum Area in Square Feet
BTUH Input Rating	Minimum Area in Square Feet	
50,000	312	
78,000	490	
114,000	712	
155,000	968	
EXAMPLE: NOTE: Square feet is based on 8 foot ceilings.		
<u>28,000 BTUH</u> X 50 Cubic Ft. = <u>1,400</u> = 175 Sq. Ft.		
1,000 8' Ceiling Height		

NOTE: Refer to definitions in section titled *Unusually Tight Construction*. If any one of the conditions apply, the space **MUST** be considered confined space regardless of size.

1. Adjoining rooms can be considered part of an unconfined area if there are openings without doors between rooms.

2. 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 of free area per 4,000 BTUH of total input rating for all gas appliances in area.
3. Install air intake a minimum of 12" above maximum snow level and clear of any obstruction. Duct or ventilation opening requires one square inch of free area per 4,000 BTUH of total input rating for all gas appliances in area.
4. Air inlet **MUST** be screened with not less than 1/4" mesh screen.

Unusually Tight Construction

In unconfined spaces, infiltration may 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* on pg 7:

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 or flue gases will condense in the heat exchanger. This will shorten the life of the heat exchanger and possibly void your warranty.

4. Vent and Combustion Air Piping

WARNING

Poison carbon monoxide gas, fire and explosion hazard.

Read and follow all instructions in this section.

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

Dual Certified Furnace

This furnace is certified as a category IV appliance and 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. If combustion air comes from inside the structure, adequate make up air **MUST** be provided to compensate for oxygen burned. See **Confined Space Installation** in the **Combustion and Ventilation Air** chapter on pg 7. If combustion air is drawn from outside the structure, it **MUST** be taken from the same atmospheric pressure zone as the vent pipe.

Contaminated Combustion Air

Installations in certain areas or types of structures will increase the exposure to chemicals or halogens that may harm the furnace.

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.

Vent and Combustion Air Piping Guidelines

1. Determine the best routing and termination for the vent pipe and air inlet pipe (when used) by referring to all of the instructions and guidelines in this Section.
2. Determine the size required for the vent pipe and air inlet pipe (when used).

3. Loosely assemble all venting parts without adhesive (pipe joint cement) for correct fit before final assembly.
4. Use of vertical piping is preferred because there will be some moisture in the flue gases that may condense as it leaves the vent pipe.
5. The vent **MUST** exit the furnace at the top left side.
6. The vertical vent pipe **MUST** be supported so that no weight is allowed to rest on the combustion blower.
7. Exhaust vent piping diameter **MUST NOT** be reduced.
8. All exhaust vent piping from the furnace to termination **MUST** slope upwards, away from furnace, a minimum of $\frac{1}{4}$ " per foot of run.
9. Use DWV type long radius elbows whenever possible, as they provide for the minimum slope on horizontal runs and they provide less resistance in the vent system. If DWV elbows cannot be used, use two, 45° elbows when possible. On horizontal runs the elbows can be slightly misaligned to provide the correct slope.
10. All horizontal pipe runs **MUST** be supported at least every five feet with galvanized strap or other rust resistant material. **NO** sags or dips are permitted.
11. All vertical pipe runs **MUST** be supported every six feet where accessible.
12. The maximum pipe length is 40' total in the inlet **or** outlet side of the system. Up to five, 90° elbows can be used on the inlet **or** the outlet. If more than five elbows are required, reduce the length of both the inlet and exhaust pipes 5' for each additional elbow used. (**See Table 3 or Table 4**).
13. The minimum pipe run length is 2'.
14. The piping can be run in the same chase or adjacent to supply or vent pipe for water supply or waste plumbing. It can also be run in the same chase with a vent from another 90+ furnace.
NOTE: In **NO** case can the piping be run in a chase where temperatures can exceed 140° F. or where radiated heat from adjacent surfaces would exceed 140° F.
15. If installing as a direct-vent appliance, the vent outlet **MUST** be installed to terminate in the same atmospheric pressure zone as the combustion air inlet.
16. The vent system can be installed in an existing unused chimney provided that:
 - Both the exhaust vent and air intake run the length of the chimney.
 - No other gas fired appliance or fireplace (solid fuel) is vented into the chimney.
 - The top of the chimney **MUST** be sealed flush or crowned up to seal against rain or melting snow so **ONLY** the piping protrudes.
 - The termination clearances shown in **Figure 12** are maintained.
17. Horizontal furnace applications with vertical vents requiring vent diameter increaser fittings **must** have increaser fittings installed in vertical portion of the vent after a 2" elbow turns upward. Condensate will be trapped in the vent if the vent diameter is increased prior to having an elbow turned upward. This could cause nuisance tripping of the pressure switch. (**This does not apply to horizontal venting.**)

Piping Insulation Guidelines

NOTE: In general, chimneys on an outside wall and attics are exposed to cold conditions which can cause the vent pipe to sweat from condensation. This can lead to moisture damage to living

spaces. It is highly recommended that piping in these cases be insulated to insure proper protection from condensation damage.

Use 1/2" wall, closed cell, neoprene insulation or equivalent. If Fiberglass or equivalent insulation is used it must have a vapor barrier. Use R values of 7 up to 10, R-11 if exposure exceeds 10'. If Fiberglass insulation is used, exterior to the structure, the pipe **MUST** be boxed in and sealed against moisture.

1. Insulate pipe when the exhaust vent passes through an unconditioned space or raceway.
2. If situations require pipe to be run on the exterior wall to reach a suitable termination point, it **MUST** be properly insulated.
3. If it is necessary to insulate piping when an inactive chimney is used as a chase, the top of the chimney **MUST** be sealed flush or crowned up to seal against rain or melting snow so **ONLY** the piping protrudes.
4. When the vent or combustion air pipe height above the roof exceeds 30" (762mm), or if an exterior vertical riser is used on a horizontal vent to get above snow levels, the exterior portion **MUST** be insulated.
5. When combustion air inlet piping is installed above a suspended ceiling, the pipe **MUST** be insulated with moisture resistant insulation such as Armaflex or other equivalent type of insulation.
6. Insulate combustion air inlet piping when run in warm, humid spaces such as basements.

Sizing Combustion Air and Vent Pipe

1. **Single Pipe Installation**—If installing as a non-direct vent appliance, (single outlet pipe and no inlet pipe) refer to **Table 3**. The table shows the maximum number of elbows allowed with any given pipe diameter and length of run.
2. **Double Pipe Installation**—If installing as a direct-vent appliance, consult **Table 4** to select the proper diameter exhaust and combustion air piping. Exhaust and combustion air piping is sized for each furnace Btuh size based on total lineal vent length (on inlet **or** outlet side), and number of 90° elbows required.
3. **Use of Elbows**—Two 45° elbows can be substituted for one 90° elbow. The elbow or elbows used for vent termination outside the structure **ARE** counted, including elbows needed to bring termination above expected snow levels. **When the vent system length used is borderline with the next size combination category, always use the next larger size.**

EXAMPLE: Refer to, 75,000 Btuh Furnace, Table 4.

- A vent system uses 25' of Inlet pipe and 24' of Outlet pipe. Use the maximum length found in your system, so 25' is the length to use in these tables. The 25-29 column should be used.
- There are 4 elbows on the Outlet and 2 elbows on the Inlet. Use the 4 elbows row because that is the maximum number of elbows on any **one** side (Inlet or Exhaust).
- In this example, combinations **C** or **F** are allowed. Using the legend at the bottom of the table, combination **C** is 3" Inlet with a 2 1/2" Exhaust. Combination **F** is a 3" Inlet with a 3" Exhaust. Either combination is allowed together, but they can **NOT** be mixed. In other words, part of a **C** combination can **NOT** be used with part of an **F** combination just because they are listed together in the same block.

Table 3		Pipe Diameter Table Single Piping ONLY						
50,000 & 75,000 Btuh Furnaces								
Max No. Of Elbows	Feet of Pipe							
	0-9	10-14	15-19	20-24	25-29	30-34	35-40	
UP TO 5	All combinations use "A" a 2" Exhaust							
100,000 Btuh Furnace								
Max No. Of Elbows	Feet of Pipe							
	0-9	10-14	15-19	20-24	25-29	30-34	35-40	
1	A	A	A	A	A	A	B,C	
2	A	A	A	A	A	B,C	B,C	
3	A	A	A	A	B,C	B,C	B,C	
4	A	A	A	B,C	B,C	B,C	B,C	
5	A	A	B,C	B,C	B,C	B,C	B,C	
125,000 Btuh Furnace								
Max No. Of Elbows	Feet of Pipe							
	0-9	10-14	15-19	20-24	25-29	30-34	35-40	
1	A	A	B,C	B,C	B,C	B,C	C	
2	A	B,C	B,C	B,C	B,C	C	C	
3	B,C	B,C	B,C	B,C	C	C	C	
4	B,C	B,C	B,C	C	C	C	C	
5	B,C	B,C	C	C	C	C	C	
A = 2" Exhaust B = 2½" Exhaust C = 3" Exhaust Elbows are DWV Long Radius Type for 2" and 3" vents. Schedule 40 (sharp radius) for 2½"								

If more than five elbows are required, reduce the length of the exhaust pipe 5' (1.5m) for each additional elbow used.

Table 4	Pipe Diameter Table Dual Piping ONLY						
50,000 Btuh Furnaces							
Max No. Of Elbows in One Side S	Feet of Pipe*						
	0-9	10-14	15-19	20-24	25-29	30-34	35-40
UP TO 5	All combinations use "A" a 2" Exhaust and 2" Air Inlet Pipe						
75,000 Btuh Furnace							
Max No. Of Elbows in One Side S	Feet of Pipe*						
	0-9	10-14	15-19	20-24	25-29	30-34	35-40
1	A	A	A	A	D,B	E,B	E,B
2	A	A	A	D,B	E,B	E,B	C,F
3	A	A	D,B	E,B	E,B	C,F	C,F
4	A	D,B	E,B	E,B	C,F	C,F	C,F
5	D,B	E,B	E,B	C,F	C,F	C,F	C,F
100,000 Btuh Furnace							
Max No. Of Elbows in One Side S	Feet of Pipe*						
	0-9	10-14	15-19	20-24	25-29	30-34	35-40
1	A	A	A	D,B	E,B	E,B	C,F
2	A	A	D,B	E,B	E,F	C,F	C,F
3	A	D,B	E,B	E,F	C,F	C,F	C,F
4	D,B	E,B	E,F	C,F	C,F	C,F	C,F
5	D,B	E,F	C,F	C,F	C,F	C,F	C,F
125,000 Btuh Furnace							
Max No. Of Elbows in One Side S	Feet of Pipe*						
	0-9	10-14	15-19	20-24	25-29	30-34	35-40
UP TO 5	All combinations use "F" a 3" Exhaust and 3" Air Inlet Pipe						
<p>Possible combination legend: A = 2" Inlet with a 2" Exhaust B = 3" Inlet with a 2" Exhaust C = 3" Inlet with a 2½" Exhaust D = 2½" Inlet with a 2" Exhaust E = 2½" Inlet with a 2½" Exhaust F = 3" Inlet with a 3" Exhaust</p> <p>Elbows are DWV Long Radius Type for 2" and 3" vents. Schedule 40 (sharp radius) for 2½"</p>							

\mathcal{S} - Signifies the maximum number of elbows, including the termination elbow(s), on any one part of the system. Example: 4 elbows on the exhaust and 5 elbows on the inlet would use the chart showing 5 elbows, because 5 is the maximum number on any one side.

If more than five elbows are required, reduce the length of the exhaust pipe 5' for each additional elbow used.

* Feet of pipe is whichever pipe run is the longest, either inlet or outlet side.

Vent Termination Clearances

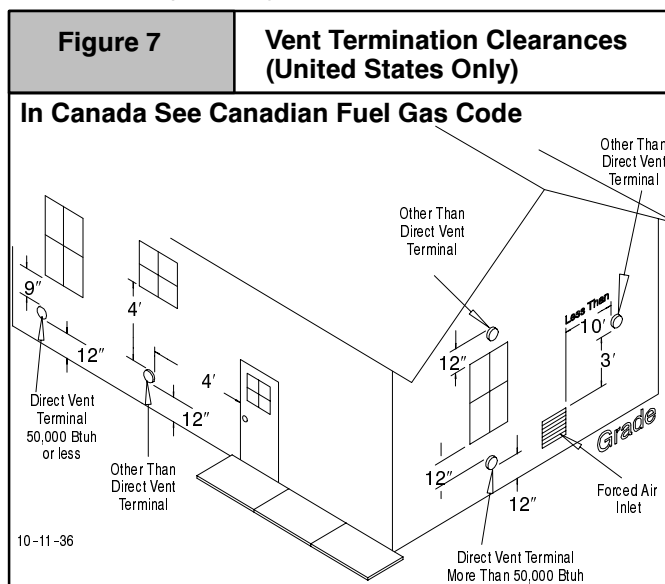
⚠ WARNING

Poison carbon monoxide gas, 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 death, personal injury and/or property damage.

1. Determine termination locations based on clearances specified in following steps and as shown in **Figure 7**, **Figure 10**, **Figure 11** and **Figure 12**.
2. The vent termination must be located at least 12" above ground or normally expected snow accumulation levels.
3. Do **NOT** terminate over public walkways. Avoid areas where condensate may cause problems such as above planters, patios, or adjacent to windows where steam may cause fogging.
4. The vent termination shall be located at least 4' horizontally from any electric meter, gas meter, regulator, or relief valve. These distances apply **ONLY** to U.S. installations.
5. The vent termination is to be located at least 3' above any forced air inlet located within 10'; and at least 10' from a combustion air intake of another appliance, except another direct vent furnace intake.
6. In Canada, the *Canadian Fuel Gas Code* takes precedence over the preceding termination instructions.



Condensate Drain Trap

This furnace removes both sensible and latent heat from the combustion flue gases. Removal of latent heat results in condensation of flue gas (water vapor). This condensed water vapor drains from the secondary heat exchanger, through a built-in drain trap transition, and out of the unit. Condensate line can exit from the right side, left side, or rear of the cabinet.

NOTE: The 90° compression fitting elbow (provided), requires the drain line to be 1/2" CPVC* (5/8" OD). 5/8" I.D. vinyl tubing may be used outside the furnace cabinet to connect to the drain line. Internal trap assembly provides the required 4" water column, so no additional trap is required.

* Make sure the 1/2" CPVC is 5/8" OD as there is also a schedule 40 available that will not work.

1. Do **NOT** put a loop in the drain piping. This would cause an extra water column pressure in addition to the pressure inside the built-in drain trap.
2. Drains must terminate at an inside drain to prevent freezing of condensate and possible property damage.
3. Consideration **MUST** be given to type of filter being installed. A 125,000 Btuh furnace may require 2-16"x25"x1/2" filters (one on each side of furnace). This configuration does **NOT** allow the condensate drain line to be run out the side of furnace. If line **MUST** be run out the side, an optional standoff filter rack with one 20"x25"x1/2" filter is needed. Install optional filter rack on side of furnace opposite the side where condensate drain line will exit.
4. A condensate or sump pump **MUST** be used if required by local codes, or if no indoor floor drain is available. The pump **MUST** be approved for use with acidic condensate.
5. A plugged condensate drain line or a failed condensate pump will allow condensate to spill. If the furnace is installed where a condensate spill could cause damage, then it is recommended that an auxiliary safety switch be installed to prevent operation of the equipment in the event of pump failure or plugged drain line. If used, an auxiliary safety switch should be installed in the R circuit (low voltage) **ONLY**.
6. Install an overflow line if routing to floor drain or sump pump. See **Figure 1** for example of proper routing and installation of overflow line.

⚠ WARNING

Frozen water pipe hazard.

When activated an auxiliary safety switch will cause a furnace not to operate.

During freezing temperatures the water pipes in your home could freeze and burst causing water damage to the home.

Do not leave the home unattended during freezing temperatures, or shut off the water supply and drain the pipes before leaving.

Condensate Drain Trap Freeze Protection

Special precautions **MUST** be made if installing furnace in an area which may drop below freezing. This can cause improper operation or damage to the equipment. If the the furnace environment has the potential of freezing, the drain trap and drain line must be

protected. Use 3 to 6 watt per foot at 115 volt, 40° F self-regulating shielded and waterproof heat tape. Wrap the drain trap and drain line with the heat tape and secure with the ties. Follow the heat tape manufacturer's recommendations.

Connecting Furnace and Piping

⚠ WARNING

Poison carbon monoxide gas hazard.

Cement or mechanically seal all joints, fittings, etc. to prevent leakage of flue gases.

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

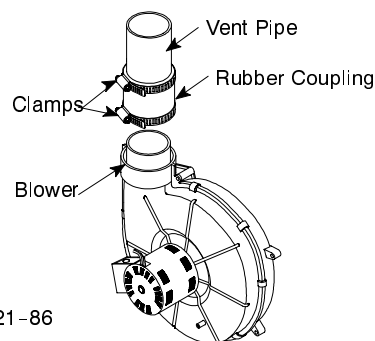
1. Preassemble the exhaust and combustion air piping from the furnace to the vent termination. Do **NOT** cement any joints together until the preassembly process is complete.

Vent Pipe Connection

1. Install the vent pipe to the combustion blower using the flexible coupling and clamps (provided). See **Figure 8** and **Figure 9**.

Figure 8

Proper Sealing Procedure for Combustion Blower



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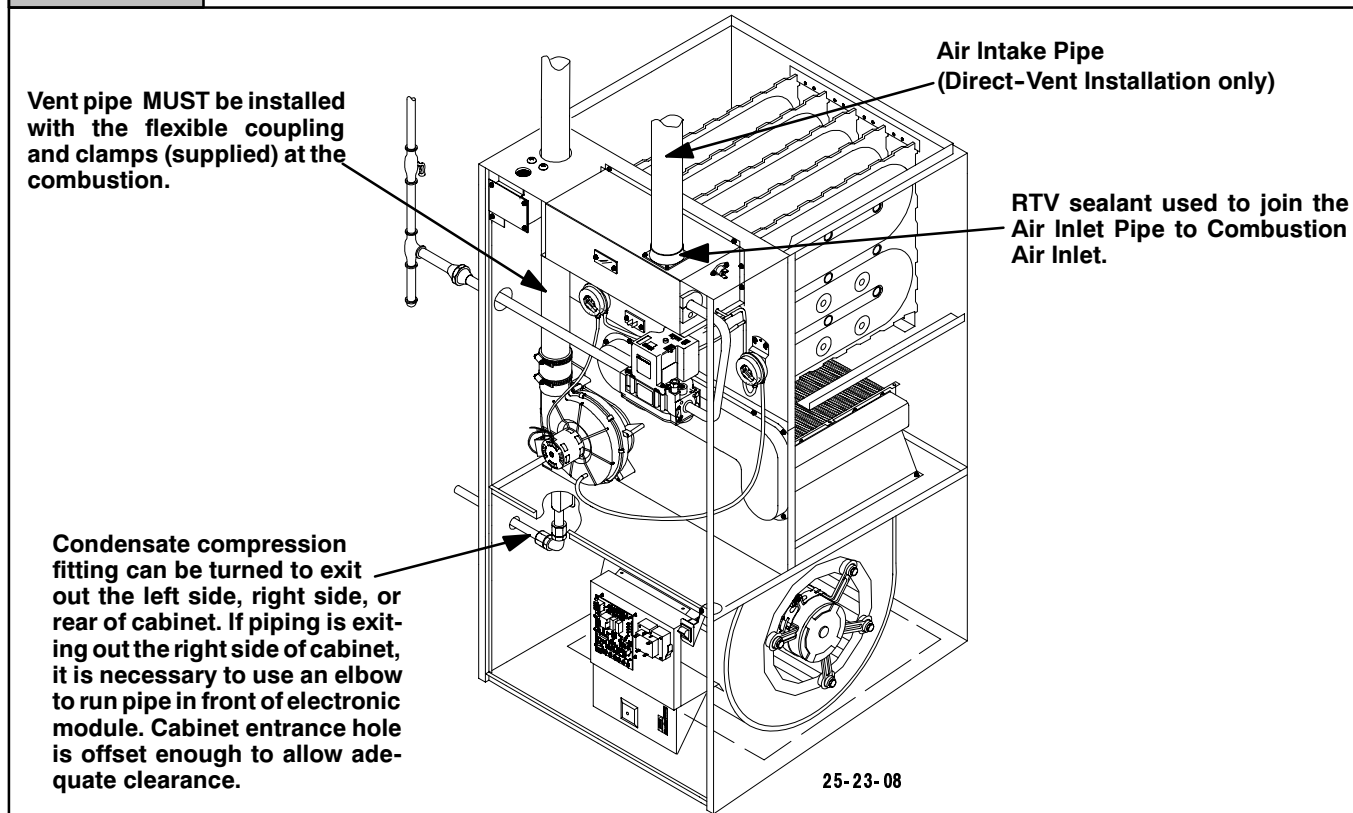
Air Inlet Pipe Connection

NOTE: Air Inlet Collar is sized for 3" PVC pipe. If 2" or 2 1/2" combustion air piping is used, a 3" to 2" or 3" to 2 1/2" 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.

Figure 9

Vent Trap and Furnace Connections



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 death, personal injury and/or property damage.

This furnace is approved for venting with Schedule 40 PVC, CPVC, ABS, Cellular Core pipe fittings and SDR-26 PVC. NOTE: SDR pipe is not approved for use in Canada.

NOTE: All PVC, CPVC, ABS, and Cellular Core pipe fittings, solvent cement, primers and procedures **MUST** conform to American National Standard Institute and American Society for Testing and Materials (ANSI/ASTM) standards.

- *Pipe and Fittings* - ASTM D1785, D2241, D2466, D2661, D2665, F-891, F-628
- *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 air inlet pipe where it joins to the furnace. PVC, CPVC, ABS, and Cellular Core pipe and 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.

Connecting Vent Pipes and Termination

NOTE: Combustion air intake and vent **MUST** terminate in the same atmospheric pressure zone. If installation is in a cold climate (sustained temperatures below 0° F), increase the minimum distance between vent pipe and air intake from 8" to 18".

CAUTION

Maintain a minimum of 36" 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.

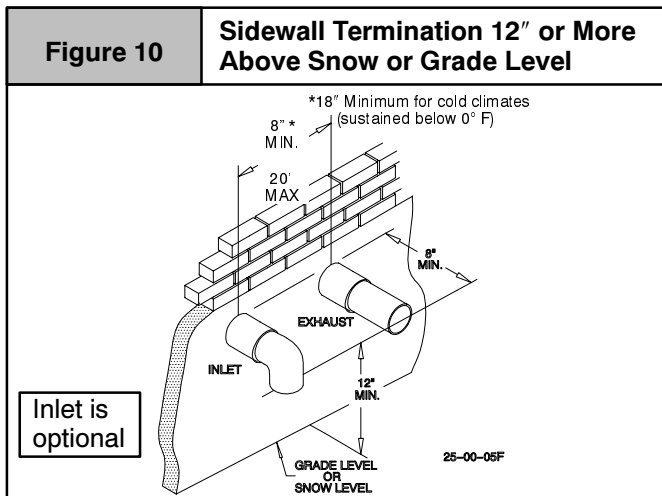
⚠ WARNING

Poison carbon monoxide gas hazard.

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

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

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 10** through **Figure 12**.

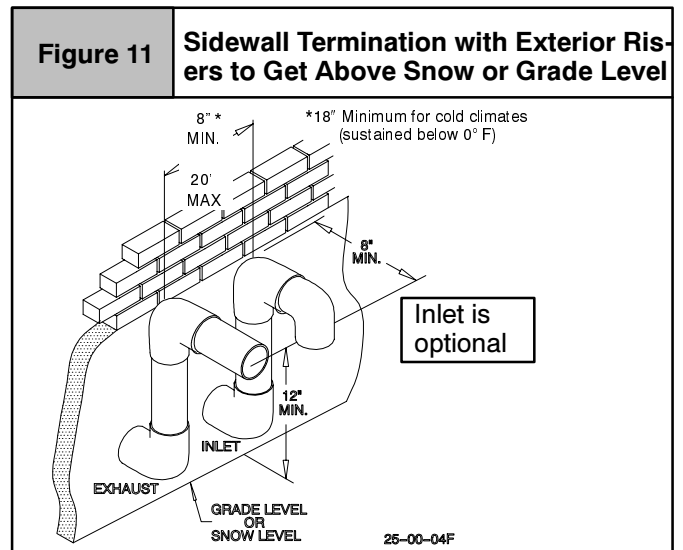


Horizontal Termination

1. If installing as a direct-vent appliance, cut two holes. 2 $\frac{1}{2}$ " for 2" pipe, 3" for 2 $\frac{1}{2}$ " pipe, or 3 $\frac{1}{2}$ " for 3" pipe. Do **NOT** make the holes oversized, or it will be necessary to add a sheet metal or plywood plate on the outside with the correct size hole in it. If venting as a single pipe appliance, cut only one hole.
2. Check hole sizes by making sure it is smaller than the couplings or elbows that will be installed on the outside. The couplings or elbows **MUST** prevent the pipe from being pushed back through the wall.
3. Extend vent pipe and combustion air pipe through the wall $\frac{3}{4}$ " to 1" and seal area between pipe and wall.
4. Install the couplings, nipple and termination elbows as shown and maintain spacing between vent and combustion air piping as indicated in **Figure 10** through **Figure 12**.

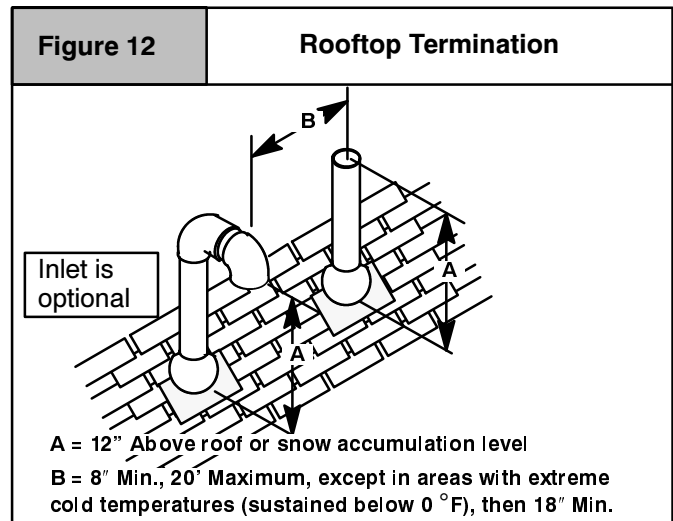
Using Exterior Risers

1. Install elbows and pipe to form riser as shown in **Figure 11**.
2. Secure vent pipe to wall with galvanized strap or other rust resistant material to restrain pipe from moving.
3. Insulate pipe with Armaflex or equivalent moisture resistant closed cell foam insulation or Fiberglass insulation if boxed in and sealed against moisture.



Vertical Termination

1. **Figure 12** 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" above the roof or snow accumulation level, and 12" away from a vertical wall or other protrusion.
2. If the vent system is installed in an existing chimney make sure clearances shown in **Figure 12** are maintained. Horizontal section before the termination elbow can be extended on the inlet air to provide necessary clearance.



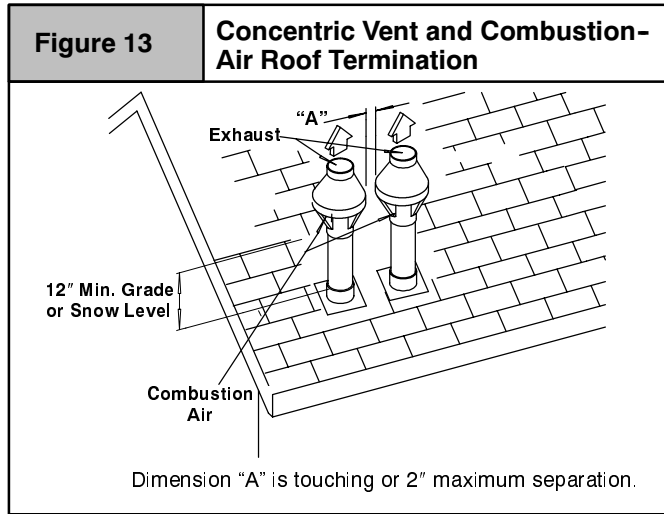
Vent Termination Shielding

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.

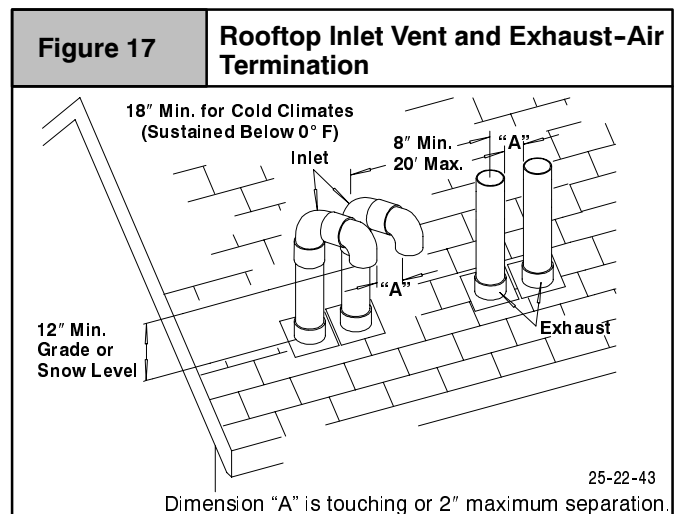
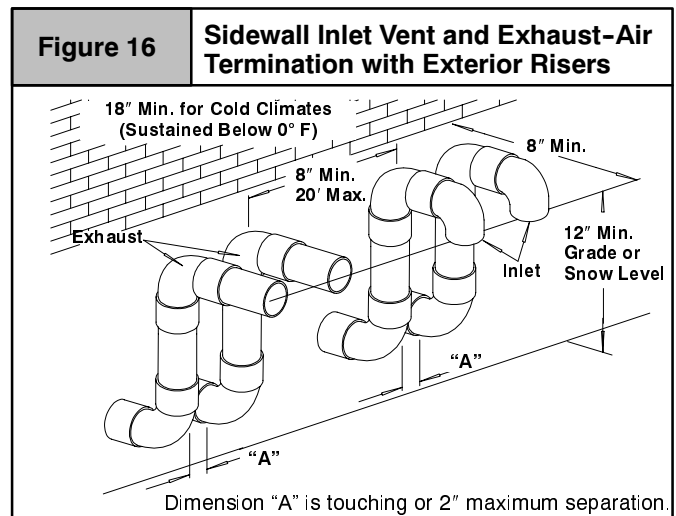
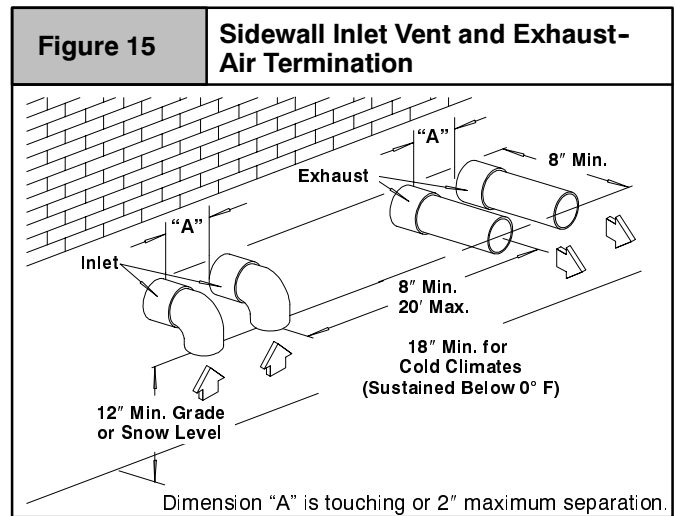
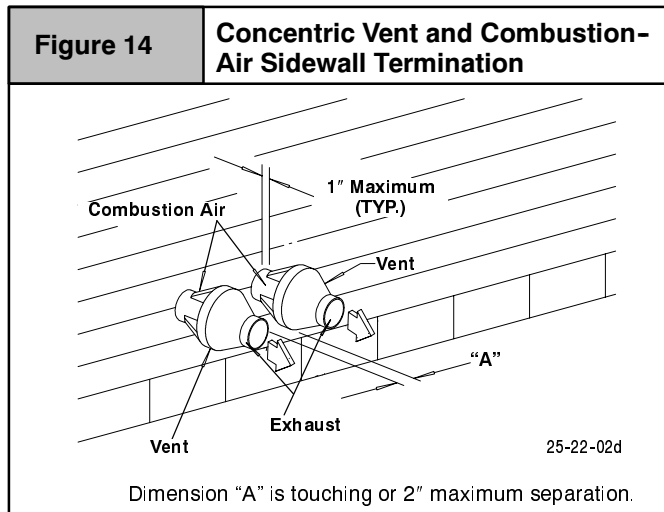
A metal shield is recommended 18" x 18" min. or 18" min. diameter around the vent termination at the exterior wall to protect the house exterior materials from flue product or condensation (freezing) damage.

Multi Vent Termination Clearances

When two (2) or more furnaces are vented near each other, each furnace must be individually vented.



When two (2) or more furnaces are vented near each other, two (2) vent terminations may be installed as shown in **Figure 13**, **Figure 14**, **Figure 15**, **Figure 16** and **Figure 17**, but the next vent termination must be at least 36" away from first 2 terminations. It is important that vent terminations be made as shown to avoid recirculation of flue gases.



5. Gas Supply and Piping

WARNING

Poison carbon monoxide gas, fire and explosion hazard.

Models designated for Natural Gas are to be used with Natural Gas Only, unless properly converted to use with LP gas.

Failure to use proper fuel gas/conversion can result in death, personal injury and/or property damage.

NOTE: The rating plate is stamped with the model number, gas type and gas input rating.

Supply Pressure

WARNING

Fire hazard.

Do NOT set gas input above that shown on rating plate.

Failure to properly set gas input pressure can result in death, personal injury and/or property damage.

1. Supply pressure can be checked using the $\frac{1}{8}$ " NPT port on the supply side of the gas manifold.
2. Gas input to burners **MUST NOT** exceed the rated input shown on rating plate.
3. Do **NOT** allow minimum gas supply pressure to vary downward. Doing so will decrease input to furnace. Refer to **Table 5** for normal gas supply and manifold pressures.

Table 5		Gas Pressures Below 2000 Ft.			
Gas Type	Supply Pressure			Manifold Pressure	
	Recom-mended	Max.	Min.	Hi Fire	Lo Fire
Natural	7"	14"	4.5"	3.5"	1.7"
LP	11"	14"	11"	10"	4.9"
Important Notes					
<ul style="list-style-type: none">• With Propane gas, the rated input is obtained when the BTU content is 2,500 BTU per cubic foot and manifold pressure set at 10 inches W.C.• If Propane gas has a different BTU content, orifices MUST be changed by licensed Propane installer.• Measured input can NOT exceed rated input.• Combustion Air Box Cover MUST be removed when adjusting manifold pressure.• Any major change in gas flow requires changing burner orifice size.					

Manifold Gas Pressure Adjustments (Hi/Lo Fire)

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

Make adjustment to manifold pressure with burners operating and combustion air box cover removed.

1. Remove combustion air box cover.
2. Connect manometer to the tapped opening on the outlet side of gas valve or on the manifold pipe. Use a manometer with a 0 to 12" minimum water column range.
3. Turn gas **ON**. Operate the furnace on high fire by using a jumper wire on the R to W1 & W2 thermostat connections on the fan board.
4. Remove the adjustment cover on the gas valve. Turn adjusting screw counterclockwise to decrease the manifold pressure and clockwise to increase. See **Figure 19**.
5. Set the manifold pressure to value shown in **Table 5** or **Table 6**.
6. Operate the furnace on low fire by using a jumper wire on the R to W1 thermostat connections on the fan board.
Note: The fourth (4th) DIP switch on the fan timer should be in the on position to set the low fire manifold pressure. (See wiring diagram)
7. Repeat steps 4 and 5 for low fire operation.
8. When the manifold pressures are properly set, replace the adjustment screw covers on the gas valve.
9. Remove the jumper wires from the thermostat connections on the fan board. Remove manometer and replace plug in manifold.
10. Replace combustion air box cover.
11. Return fourth (4th) DIP switch to previous setting.

General Derating Rules

1. For operation with natural gas at altitudes above 2,000', orifice change and/or manifold pressure adjustment may be required to suit gas supplied. Check with gas supplier. If orifice sizing is needed, it should be based on reducing the input rating by 4% for each 1,000' above sea level. See **Table 6** for required pressure change and/or orifice change for high altitudes.
2. For operation with LP gas at altitudes above 2,000', gas orifices **MUST** be changed and manifold pressure **MUST be maintained** as per **Table 5**. Orifice sizes for 0–2000' above sea level are #54. 2000–7000' above sea level, use #55. 7000–8000' above sea level, use #56 orifices. Orifices can be ordered through your distributor.

Table 6		High Altitude Pressure Chart 2000-8000 ft. (Natural Gas)													
Heat Value Btu/Cu. Ft.		Elevation Above Sea Level													
		0-1999		2000-2999		3000-3999		4000-4999		5000-5999		6000-6999		7000-7999	
		High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
800		3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7
850		3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7
900		3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.4	1.7
950		3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.3	1.6	3.2	1.6	3.1	1.5
1000		3.5	1.7	3.4	1.7	3.3	1.6	3.2	1.5	3.0	1.5	2.9	1.4	2.8	1.4
1050		3.2	1.6	3.1	1.5	3.0	1.5	2.9	1.4	2.7	1.3	2.6	1.3	2.5	1.2
1100		2.9	1.4	2.8	1.4	2.7	1.3	2.6	1.3	2.5	1.2	2.4	1.2	2.3	1.1
Orifice Size		#42		#42		#42		#42		#42		#42		#42	

Changing Orifices for High Altitude

⚠ WARNING

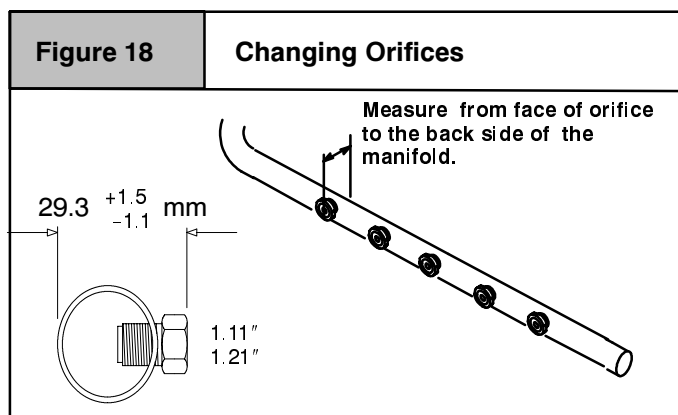
Electrical shock, fire or explosion hazard.

Turn OFF electric power (at disconnect) and gas supply (at manual valve in gas line) when installing orifices. Installation of orifices requires a qualified service technician.

Failure to properly install orifices can result in death, personal injury and/or property damage.

NOTE: Main burner orifices can be changed for high altitudes.

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 they are seated and gas tight. See (Figure 18).
5. Reinstall manifold and combustion air box cover. Ensure burners do **NOT** bind on new orifices.



High Altitude Air Pressure Switches

Altitudes over 4,000' require different air pressure switches than the ones installed at the factory. Check parts list for pressure

switches and consult your distributor for part number and availability. In Canada, provincial codes may govern installation of switch. Check with governing authorities.

Natural Gas Input Rating Check

NOTE: 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 meter. Check with gas supplier for actual BTU content.

1. Make sure combustion air box cover is in place and closed before performing the following steps.
2. Turn **OFF** gas supply to all appliances and start furnace. Use jumper wire on R to W1 and W2 for Hi fire.
3. Time how many seconds it takes the smallest dial on the gas meter to make one complete revolution. Refer to **Example**.
4. Repeat steps 2 and 3 with jumper wire on **R** to **W1** for low fire. **NOTE:** Fourth (4th) DIP switch on the fan timer must be in on position. (See furnace wiring diagram). Return fourth (4th) DIP switch to previous setting after check.

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
$1,000 \times 3,600 \div 48 = 75,000 \text{ BTUH}$			

NOTE: If meter uses a 2 cubic foot dial, divide results (seconds) by two.

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

Gas Piping Requirements

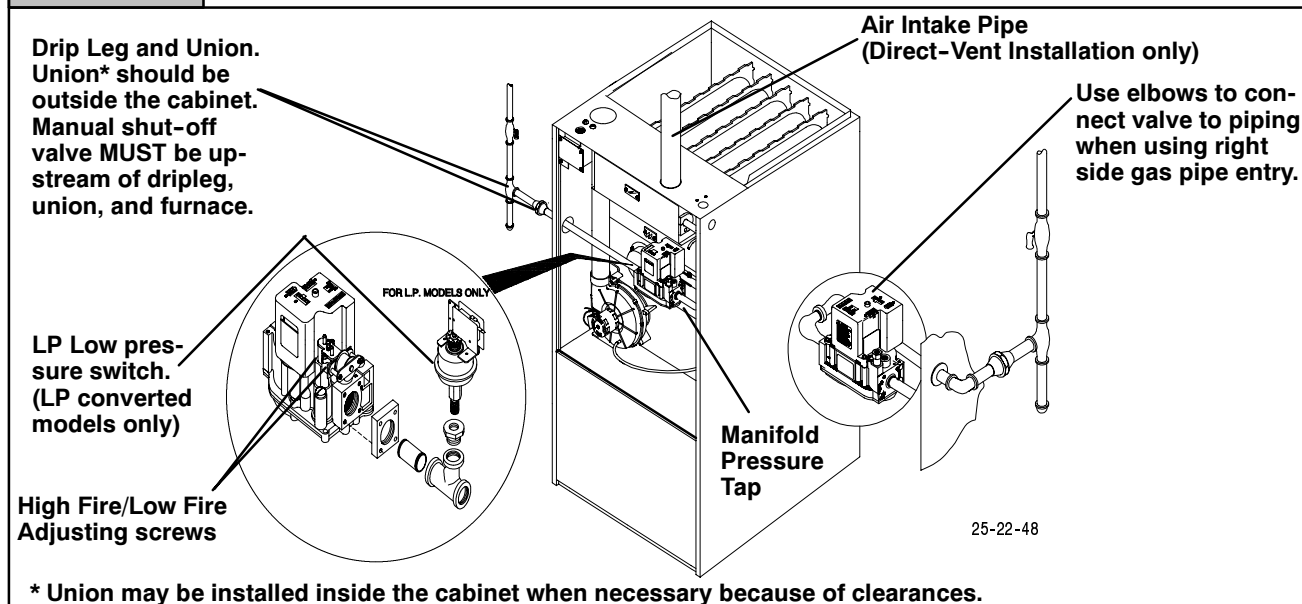
1. Properly size gas pipe to handle combined appliance load or run gas pipe directly from gas meter or LP gas regulator. Refer to NFPA and ANSI Z223.1 for proper gas pipe size.
2. Install correct pipe size for run length and furnace rating.
3. Measure pipe length from gas meter or LP second stage regulator.

Connections

NOTE: Refer to **Figure 19** for the general layout at the furnace. The rules listed apply to natural and LP gas pipe installations.

Figure 19

Typical Gas Piping (Upflow/Horizontal)



1. Use black iron or steel pipe and fittings or other pipe approved by local code.
2. Use ground joint unions and install a drip leg no less than 3" long to trap dirt and moisture before it can enter gas valve.
3. Use two pipe wrenches when making connections to prevent gas valve from turning.
4. Install a manual shut-off valve external to furnace casing and tighten all joints securely.

Additional LP Connection Requirements

1. Have a licensed LP gas dealer make all connections at storage tank and check all connections from tank to furnace.
2. If copper tubing is used, it **MUST** comply with limitation set in National Fuel Gas Code or CGA codes.
3. Two-stage regulation of LP gas is recommended.

6. Electrical Wiring

⚠ WARNING

Electrical shock hazard.

Turn OFF electric power at fuse box or service panel before making any electrical connections and ensure a proper ground connection is made before connecting line voltage.

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

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.

Final Check

1. The furnace and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of $\frac{1}{2}$ " PSIG (3.5 kPa).
The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than $\frac{1}{2}$ " PSIG (3.5 kPa).
2. Test all pipes for leaks.
3. Gas pressure **MUST NOT** exceed $\frac{1}{2}$ " PSIG to gas valve. Checking gas piping above $\frac{1}{2}$ " PSIG requires the furnace and manual shut-off valve to be disconnected during testing.
4. Apply soap suds (or a liquid detergent) to each joint. Bubbles forming indicate a leak.
5. Correct even the smallest leak at once.
6. If orifices were changed, make sure they are checked for leakage.

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.

NOTE: The furnace control is ground sensitive. The ground must be connected to the green ground wire as indicated on the wiring diagram or the control may not operate.

Thermostat

The 2-stage furnace control will operate with either a single stage or a two stage heating thermostat and will provide 2-stage heating operation. For single stage thermostat installations, the **R** and **W** wires from the thermostat connect to the **R** and **W1** connections on the furnace control. **Note:** The fourth (4th) DIP switch on the fan timer must be in the off position, failure to change DIP switch

will result in Lo Fire ONLY operation. (See furnace wiring diagram) See "Furnace Wiring Diagram" for switch settings. Failure to set DIP switch will result in Lo fire operation ONLY with single stage thermostat. During operation, the furnace will operate on low fire for 12 minutes. If the heat request exists for more that 12 minutes, the furnace will automatically shift to the high fire mode for the remaining duration of the heating cycle. For two stage thermostat installations, the **R**, **W1** and **W2** wires from the thermostat connect to the **R**, **W1** and **W2** connections on the furnace control. During operation, the furnace will shift from low fire to high fire as requested by the thermostat. The thermostat heat anticipators should be adjusted to a .10 setting for both types of thermostats. (See Figure 20)

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

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 115 VAC humidifier and/or electronic air cleaner connection.

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.

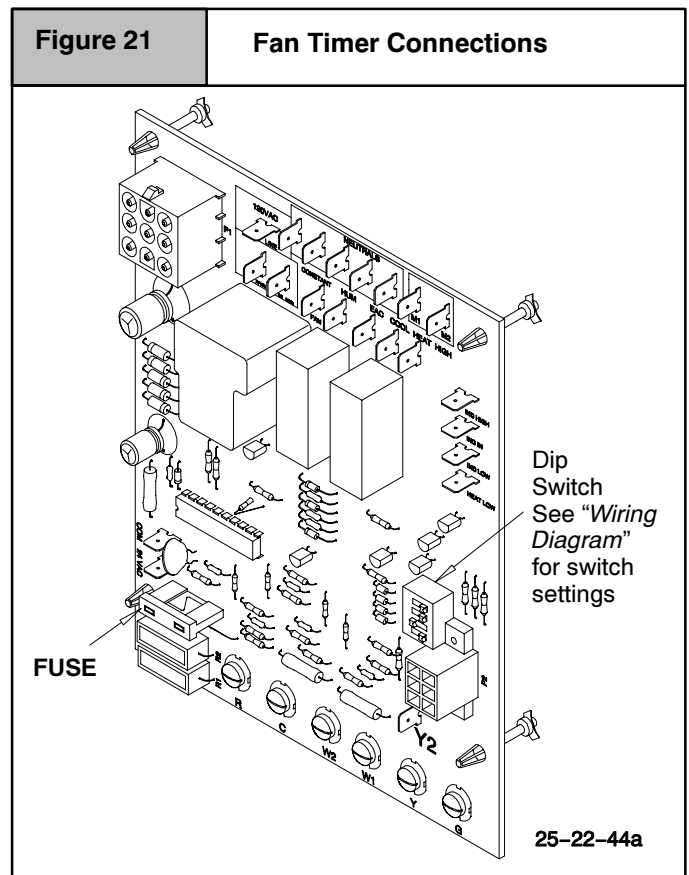
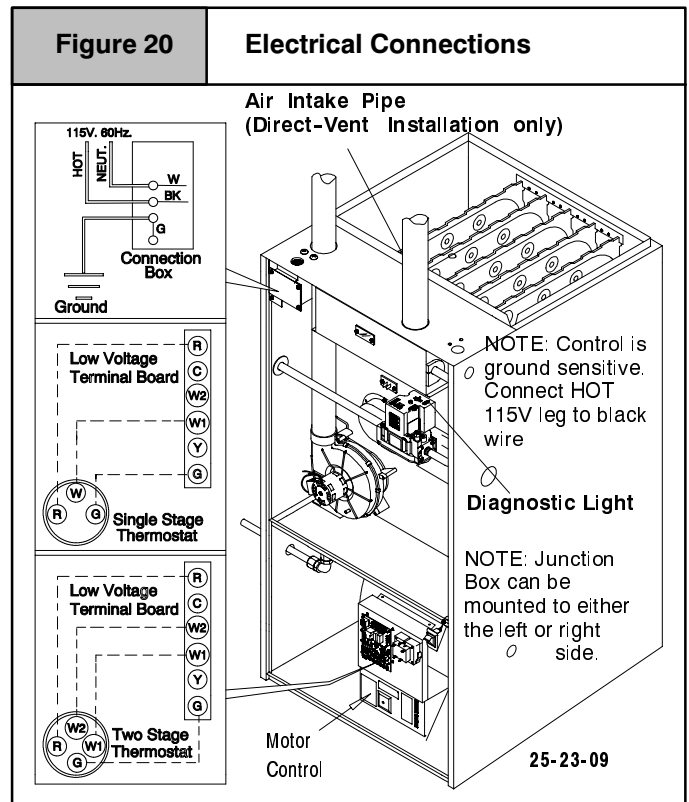
Dehumidification

The fan control is wired for 24 VAC normally open (N/O) dehumidistat connection. Connect dehumidistat to the R terminal and the 1/4" male quick connect Y2 terminal on the fan control (See Figure 21 and "Furnace Wiring Diagram"). A 20% reduction of cooling airflow will occur when the Y2 dehumidistat terminal is energized during a call for cooling from the thermostat.

Fan Control

The fan control is preset at the factory with an adjustable blower **ON** delay of 30 seconds in the heating mode. The blower **OFF** timing is preset at 140 seconds. If desired, the fan **ON** delay and **OFF** delay can be reset to obtain the longest delay times while still maintaining comfort levels. See "Furnace Wiring Diagram".

NOTE: It is recommended to achieve maximum efficiency that the fan control be set to turn on at 30 seconds after the burners light.



NOTE: For single stage thermostat operation the fourth (4th) DIP switch must be in the off position. (See furnace wiring diagram and Figure 21) failure to change switch with single stage thermostat will result in Lo fire operation ONLY.

7. Ductwork and Filter



WARNING

Poison carbon monoxide gas hazard.

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

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

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.

1. When furnace supply ducts carry air outside furnace area, seal return air duct to furnace casing and terminate duct outside furnace space.
2. Install air conditioning cooling coil (evaporator) on outlet side of furnace.
3. For furnaces installed without a cooling coil it is recommended that the outlet duct be provided with a removable access panel. This panel should be accessible when the furnace is installed so the exterior of the heat exchanger can be viewed for inspections. The access panel **MUST** be sealed to prevent leaks.
4. If separate evaporator and blower units are used, install good sealing dampers for air flow control. Chilled air going through the furnace could cause condensation and shorten the furnace life.

NOTE: Dampers (field supplied) 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.



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 death, personal injury and/or property damage.

Connections

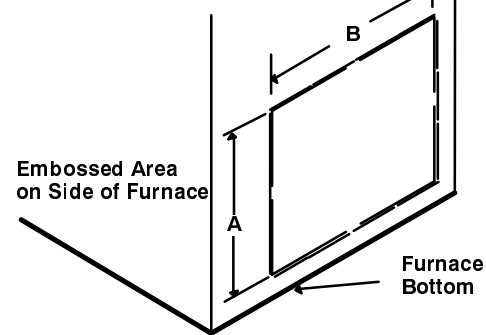
NOTE: Return air can enter through either side, both sides, or the bottom. Return air **can not** enter through rear of the furnace. When the furnace is located in an area near or adjacent to the living area, the system should be carefully designed with returns to minimize noise transmission through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

1. For side connections using a 16" x 25" filter, cut out the embossed area shown in **Figure 22**. This will provide a 14 $\frac{1}{2}$ " x 22 $\frac{1}{2}$ " approximate opening.

Figure 22

Side Return Air Cutout

A = 14 $\frac{1}{2}$ " Height of Cutout for 16" x 25" Filter
B = 22 $\frac{1}{2}$ " Width of Cutout for 16" x 25" Filter



NOTE: A 125,000 Btuh furnace requires two side returns or a bottom return for 5 tons cooling. If two side returns are used it does **NOT** allow the condensate drain line to be run out the side of furnace. If line **MUST** be run out the side, an optional standoff filter rack with one 20x25x $\frac{1}{2}$ " filter is needed. Install optional filter rack on side of furnace opposite the side where condensate drain line will exit.

2. 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 furnace. A 25" x 25" filter is required for 125,000 Btuh furnaces.
3. An optional 20" x 25" duct standoff (NAHA001TK) is available to be used in lieu of one filter on each side of furnace.
4. Installation of locking-type dampers are recommended in all branches, or in individual ducts to balance system's air flow.
5. Non-combustible, flexible duct connectors are recommended for return and supply connections to furnace.
6. 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.

Insulation

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

Filters

Use either filter type:

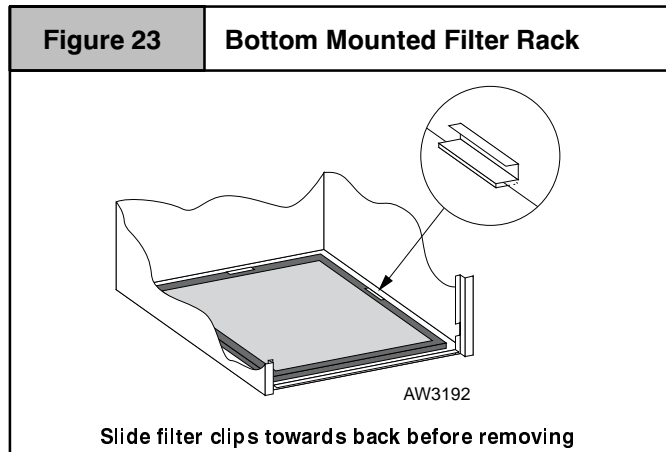
- Washable, high velocity filters are based on a maximum air flow rating of 600 FPM.
- Disposable, low velocity filters are based on a maximum air flow of 300 FPM when used with filter grille.

NOTE: Disposable, low velocity filters may be replaced with washable, high velocity filter providing they meet the minimum

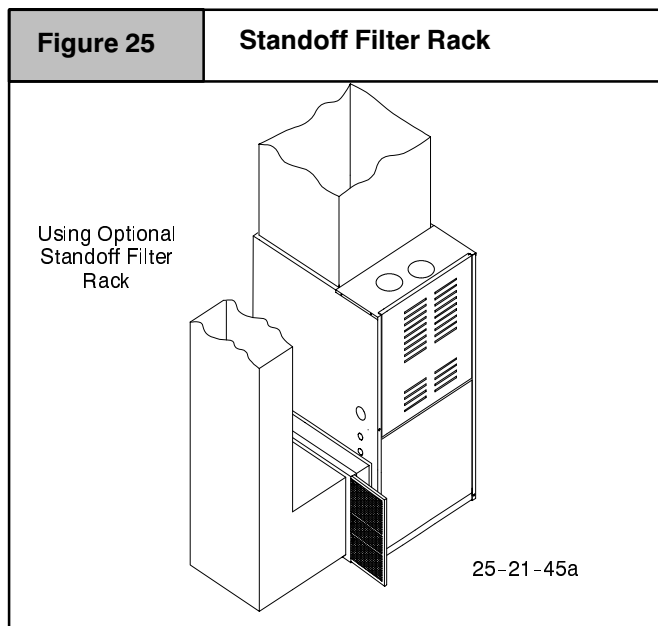
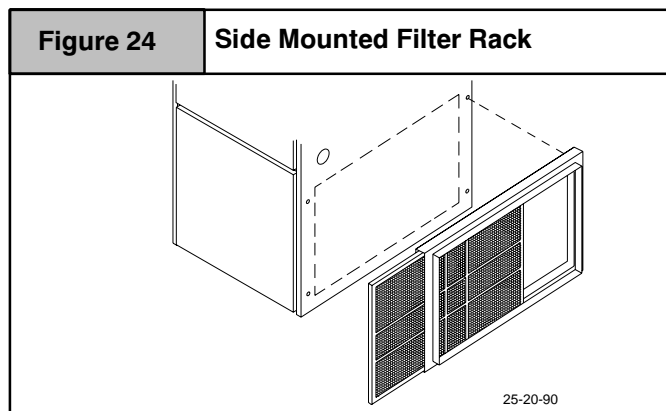
size areas. Washable, high velocity filters can be replaced **ONLY** with same type and size.

Filter Installation

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 23**.



Refer to **Figure 24** through **Figure 26** for guidelines to install side mounted filters. Furnaces which require larger filter media and have limited clearances on one side of furnace, require a standoff filter rack, see **Figure 25**, available from your distributor.



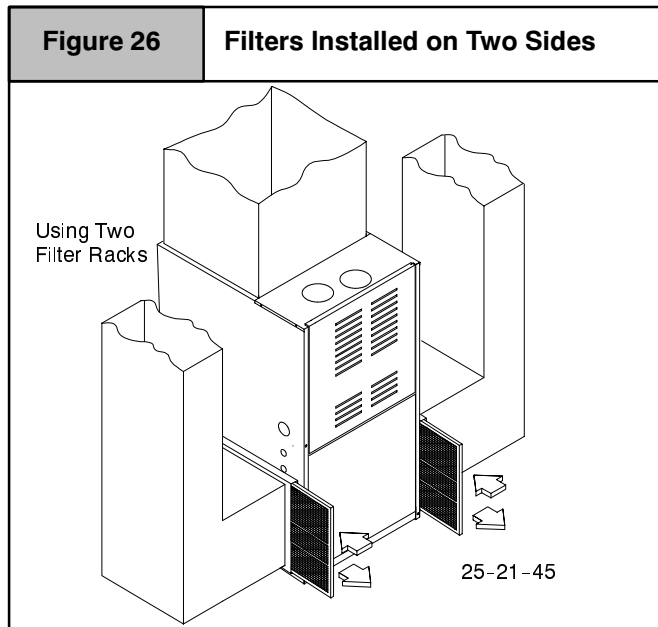
CAUTION

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" 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.



8. Checks and Adjustments

Startup

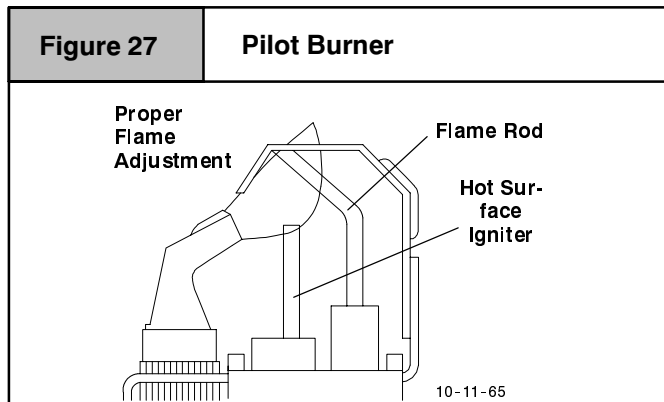
NOTE: Refer to Start-up procedures in the user's information manual.

CAUTION

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

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 flame rod. See **Figure 27** and **Figure 28**. 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.



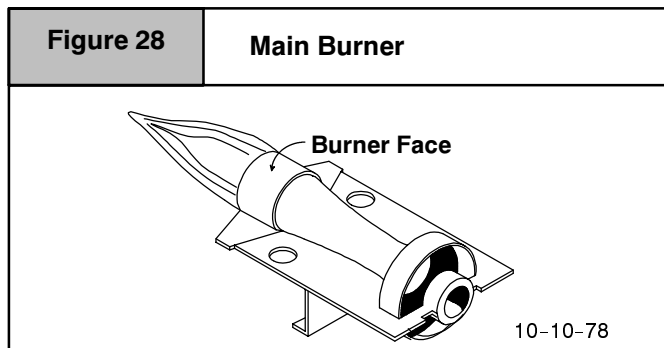
Main Burner Flame Check

Allow the furnace to run approximately 10 minutes then inspect the main burner and pilot flames. See **Figure 28**.

Check for the following (**Figure 28**):

- 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.




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 for both high fire and low fire operation. 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 on high fire for 10 minutes with all the registers and duct dampers open by using a jumper wire on R to W1 and W2 thermostat connections on the fan board. **Note:** The fourth (4th) DIP switch on the fan timer should be in the on position. (See furnace wiring diagram)
3. Take readings and compare with range specified on rating plate.
4. If the temperature rise is not in the correct range, the blower speed must be changed. A higher blower speed will lower the temperature rise. A lower blower speed will increase the temperature rise.
5. Repeat steps 2 thru 4 with the furnace operating on low fire for 10 minutes by using a jumper wire on the R to W1 thermostat connections on the fan board.
6. Remove the jumper wire after the adjustments are complete. Return fourth (4th) dip switch on the fan timer to previous setting.

Changing Blower Speed

**WARNING**

Electrical shock hazard.

Turn OFF power to furnace before changing speed taps.

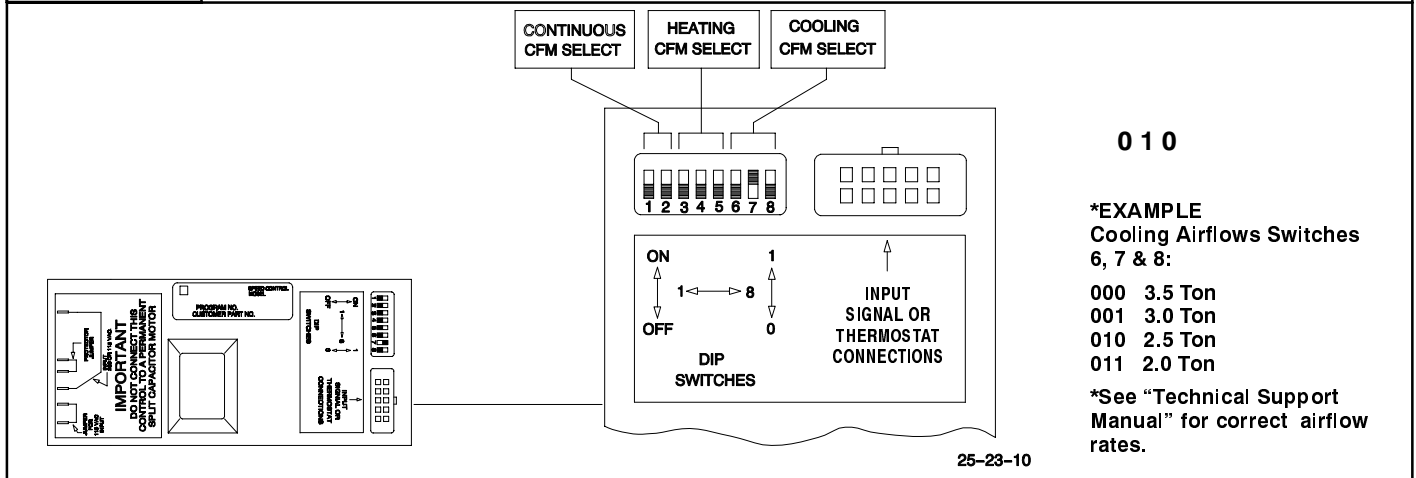
Failure to do so can result in personal injury and/or property damage.

NOTE: The blower speeds that the manufacturer sets from the factory for this product are based on a nominal 400 CFM per ton cooling and the 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. The 115 VAC power supply to the furnace must be turned OFF before making adjustments to the motor.
2. The heating, cooling and continuous blower speeds can be adjusted by changing the switch settings that are located on the motor control (see **Figure 29**). Switches #1 and #2 adjust the continuous blower speeds. Switches #3, #4 and #5 adjust the heating speeds. Switches #6, #7 and #8 adjust the cooling speed. See the "Technical Support Manual" for the switch settings for the desired airflow rates for the installation.

Figure 29**Blower Motor Control**

9. Furnace Maintenance

CAUTION

See "User's Information Manual".

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

10. Sequence of Operation & Diagnostics

The following is the normal operating sequence for the 2-stage control system.

Cooling (Y) Request:

24 VAC signals applied to Y & G terminals of EFT (electronic fan timer) control.

- Cool motor speed energized after 5 second Cool Fan On Delay time.

Y & G signals removed from EFT.

- Cool motor speed de-energized after 60 second Cool Fan Off Delay time.

Cooling (Y) and dehumidification (Y2) requests:

- 24 VAC signals applied to Y, Y2 & G terminals of EFT (electronic fan timer) control.
- Same operation as the cooling (Y) request, except the cooling speed is reduced 20% to compensate for high humidity conditions during cooling operation. The cooling speed returns to the normal setting after the Y2 signal is removed.

Circulating Fan (G) Request:

24 VAC signals applied to G terminals of EFT control.

- Low motor speed energized without delay.

G signal removed from EFT.

- Low motor speed de-energized without delay.

NOTE1) Furnaces with DC blower motors run a low circulating fan speed in response to G request.

NOTE2) Furnaces with PSC blower motors de-energize the Low Heat fan speed during the heat exchanger warm-up period on a call for Heating that occurs during a G request.

NOTE3) Heating or Cooling requests received during a Fan request cause the fan speed to change to the appropriate heat or cool speed after the selected Fan On Delay time expires. The fan returns to circulating speed after the selected Fan Off Delay time expires following loss of the Heating or Cooling request.

Heating (W1) Request (single stage thermostat operation, 4th DIP switch on the fan timer must be in off position) (see furnace wiring diagram):

24 VAC signals applied to W1 terminal of EFT control.

- Inducer motor turns on at high speed.
- The high fire solenoid energizes.
- Following a 3 second prepurge delay, the pilot valve opens and the ignitor begins to warm up.
- After the pilot lights, the main burners energize and light (burners now at high fire rate).

- Timed from the opening of the main gas valve, the control will delay the selected Heat Fan On Delay time before switching the inducer to low speed, de-energizing the high fire solenoid and the fan switches to Low Heat speed.
- Timed from initial application of the Heating request, if the W1 request is still present after the Low Fire Delay time expires (12 minutes), the inducer switches to high speed, the high fire solenoid energizes and the fan switches to High Heat speed.

W1 signal removed from EFT.

- The gas valve de-energizes and the main burners go out.
- The inducer runs at its present speed for a 5 second postpurge period.
- The fan switches to (or stays at) Low Heat speed.
- Timed from the gas valve de-energizing, the Low Heat fan speed de-energizes after the selected Heat Fan Delay time expires.

NOTE4) If a new Heating request arrives while the control is waiting in the Heat Fan Off Delay time, the fan speed switches to High Heat until the Heat Fan Off Delay expires or the Heat Fan On Delay expires for the new Heating request.

Heating Request (two stage thermostat operation, 4th DIP switch on the fan timer must be in on position) (see furnace wiring diagram):

24 VAC signals applied to W1 terminal of EFT control.

- Same response as single stage thermostat operation described above except the control will not go to high fire, High Heat fan speed unless a W2 signal is applied.

24 VAC signals applied to W1 and W2 terminals of EFT control.

- Same light-off routine as described for the signal stage thermostat operation except that at the end of the selected Heat Fan On Delay, the inducer remains on high fire, the high fire solenoid remains energized and the High Heat fan speed energizes.

NOTE5) The EFT control responds without delay to the presence or loss of W2 (with W1 constant). W1 & W2 results in high inducer, high fire and High Heat fan speed. W1 only results in low inducer, low fire and Low Heat fan speed.

Heating Request with Gas Supply Line Shut Off:

24 VAC signals applied to W1 terminal of EFT control.

- Inducer motor turns on at high speed.
- The high fire solenoid energizes.
- Following a 3 second prepurge delay, the pilot valve opens and the ignitor begins to warm up.
- The ignitor glows red-hot for 30 seconds, then turns off.
- The igniter stays off for 25 seconds, then begins to warm-up again.
- The igniter glows red-hot for 30 seconds, then turns off.
- The pilot valve closes 3 seconds after the igniter de-energizes.
- The inducer de-energizes 5 seconds after the pilot valve closes.
- The SmartValve proceeds to soft lockout and flashes error code 6.
- The control exits soft lockout after 5 minutes and begins another ignition sequence.

Gas Valve Diagnostic Codes (See Figure 30)

Steady Flash = Normal Operation

2 Flashes = Low Pressure Switch Stuck Closed

3 Flashes = Low Pressure Switch Stuck Open or
Manual ON/OFF Switch in OFF Position or
Aux. Limit Switch Open

4 Flashes = Limit Switch Open

5 Flashes = Flame Sensed Out of Sequence

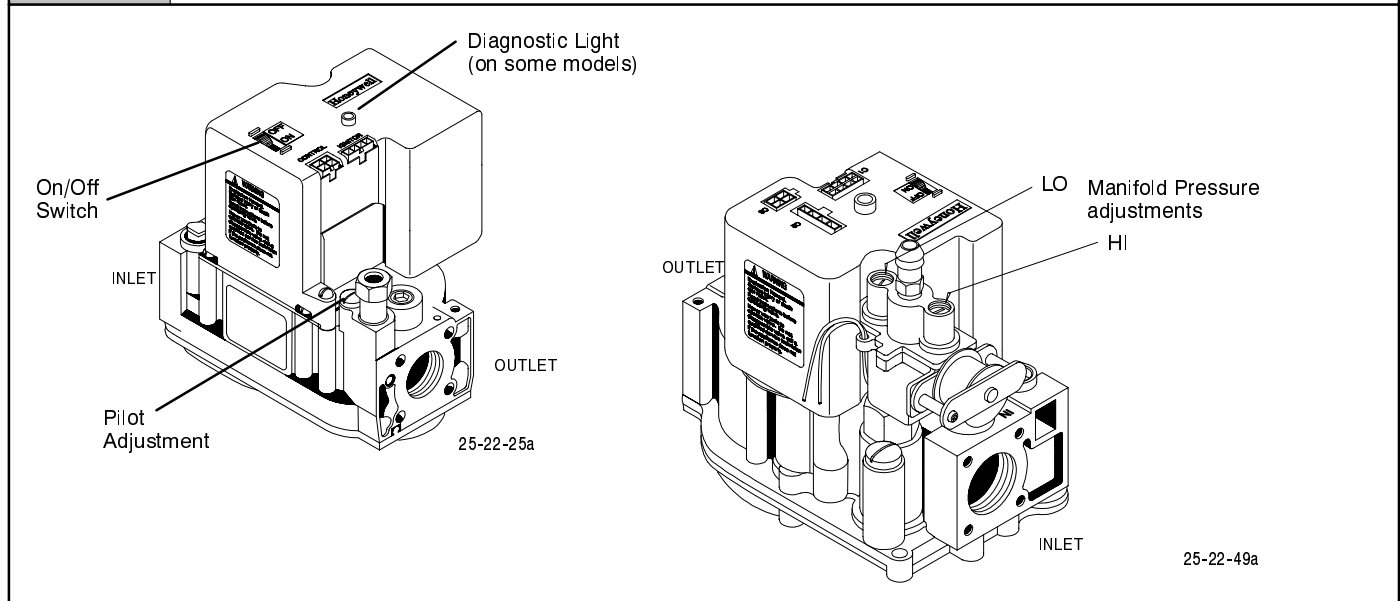
6 Flashes = Control in Soft Lockout (Automatic Restart
or Retry Delay)

8 Flashes = High Pressure Switch Stuck Closed

9 Flashes = High Pressure Switch Stuck Open

Figure 30

Typical Gas Valve Honeywell



11. Concentric Vent Termination

Vent Termination Clearances

⚠ WARNING

Poison carbon monoxide gas, fire and explosion hazard.

Inlet and outlet pipes may NOT be vented directly above each other (standard vent terminals).

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

1. Determine termination locations based on clearances specified in following steps and as shown in **Figure 7**, **Figure 32**, **Figure 33**, **Figure 34**, **Figure 35**, and **Figure 36**.
2. The vent termination must be located at least 12" above ground or normally expected snow accumulation levels.
3. Do **NOT** terminate over public walkways. Avoid areas where condensate may cause problems such as above planters, patios, or adjacent to windows where steam may cause fogging.
4. The vent termination shall be located at least 4' horizontally from any electric meter, gas meter, regulator, and any relief valves. These distances apply **ONLY** to U.S. installations.
5. The vent termination is to be located at least 3' above any forced air inlet located within 10'; and at least 10' from a combustion air intake of another appliance, except another direct vent furnace intake.
6. In Canada, the *Canadian Fuel Gas Code* takes precedence over the preceding termination instructions.

Concentric Vent Termination - Kit # NAHA001CV (See Figure 31)

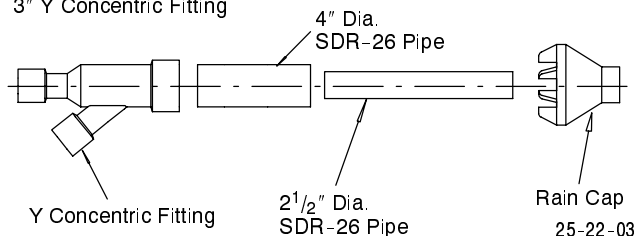
This kit is for vertical or horizontal termination of the combustion air inlet and the exhaust vent pipes on Category IV gas-fired condensing furnaces. The kit can be used for 2", 2 1/2" and 3" diameter pipe systems. Both the combustion air inlet and the exhaust vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed per the instructions outlined below for vertical or horizontal termination. Vertical termination is preferred. Field supplied pipe and fittings are required to complete the installation.

Figure 31

Kit Components

Kit Contents:

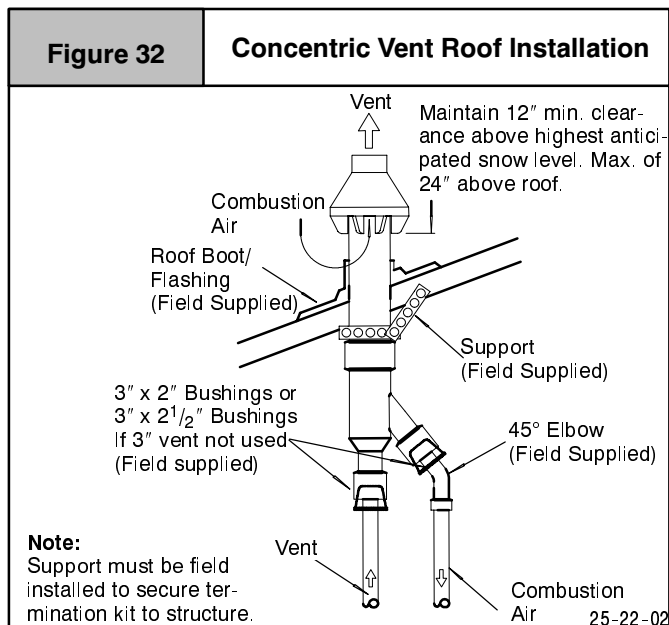
- 3" Rain Cap
- 4" Diameter SDR-26 Pipe, 37 1/8" Long
- 2 1/2" Diameter SDR-26 Pipe, 24" Long
- 3" Y Concentric Fitting



Vertical & Horizontal Termination

1. Determine the pipe diameters required for the installation from **Table 7**, and **Figure 33**.

- Determine the best location for the termination kit. See **Figure 32** for vertical termination or **Figure 35** and **Figure 36** for horizontal termination. Roof termination is preferred since it is less susceptible to damage, has reduced intake contaminants and less visible vent vapor. For side wall termination, consideration should be given to: 1) possible damage from the vapors to plants/shrubs, other equipment and building materials, 2) possible damage to the terminal from foreign objects, 3) wind effects that may cause recirculation of flue products, debris or light snow and 4) visible vent vapor.



- Cut one 5" (127mm) diameter hole through the structure.
- Dimension D may be lengthened to 60" max. or shortened by cutting the pipes to 12" min. Dimension A will change when D dimension changes.

If assembly needs to be extended to meet height or side wall thickness requirement, the two pipes supplied in the kit may be replaced by using the same diameter solid, single (no coupling connections) field supplied SDR-26 PVC (ASTM D2241) pipes. Do not extend dimension D more than 60". (See **Figure 33**)

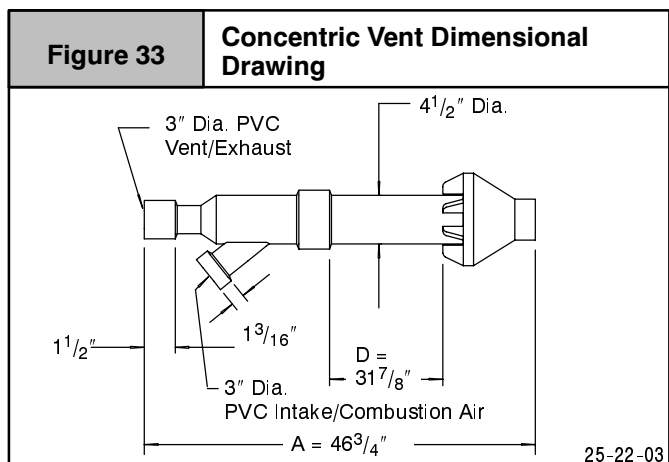


Table 7	3" Concentric Termination Kit NAHA001CV Venting Table Dual Piping ONLY						
	50,000 Btuh Furnaces						
No. of Elbows	0-9'	10-14'	15-19'	20-24'	25-29'	30-34'	35-40'
1	A	A	A	A	A	A	A
2	A	A	A	A	A	A	B
3	A	A	A	A	A	B	B
4	A	A	A	A	B	B	B
75,000 Btuh Furnace							
1	A	D,B	E,B	E,B	C,F	C,F	C,F
2	D,B	E,B	E,B	C,F	C,F	C,F	F
3	E,B	E,B	C,F	C,F	C,F	F	F
4	E,B	C,F	C,F	C,F	F	F	F
100,000 Btuh Furnace							
1	D,B	E,B	E,F	C,F	C,F	C,F	C,F
2	E,B	E,F	C,F	C,F	C,F	C,F	F
3	E,F	C,F	C,F	C,F	C,F	F	F
4	C,F	C,F	C,F	C,F	F	F	F
125,000 Btuh Furnace							
1	F	F	F	F	F	F	F
2	F	F	F	F	F	F	F
3	F	F	F	F	F	F	F
4	F	F	F	F	F	F	F

Possible combination legend:
A = 2" Inlet with a 2" Exhaust
B = 3" Inlet with a 2" Exhaust
C = 3" Inlet with a 2 1/2" Exhaust
D = 2 1/2" Inlet with a 2" Exhaust
E = 2 1/2" Inlet with a 2 1/2" Exhaust
F = 3" Inlet with a 3" Exhaust

- Do not include the field supplied 45° elbow in the total elbow count.
- If more than four elbows are required, reduce the length of both the inlet and the exhaust pipes five feet for each additional elbow used.
- Elbows are DWV long radius type for 2" and 3" vents; schedule 40 (sharp radius) for 2 1/2".

⚠

CAUTION

Do not use field supplied couplings to extend the pipes. Airflow restriction will occur and the furnace pressure switch may cause intermittent operation.

- Partially assemble the concentric vent termination kit. Clean and cement the parts using the procedures for Joining Pipe and Fittings section on page 13 of the manual. A) Cement the Y Concentric fitting to the 4" diameter SDR-26 pipe kit. B) Cement the 3" (76mm) rain cap to the 2 1/2" diameter kit part. (See **Figure 34**)

NOTE: A field supplied stainless steel screw may be used to secure the rain cap to the pipe instead of cementing when field disassembly is desired for cleaning (See **Figure 34**)

Figure 34**Rain Cap to Vent Pipe Assembly**

Drill clearance hole in rain cap and pilot hole in vent pipe.

25-22-02

Stainless steel screw
(Field supplied)

! WARNING

Poison carbon monoxide gas Hazard.

When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of the PVC components, allowing flue gases to be recirculated.

Failure to follow this warning could result in death, personal injury and/or property damage.

! WARNING

Poison carbon monoxide gas Hazard.

Do not operate the furnace with the rain cap removed as recirculation of the flue gases may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure.

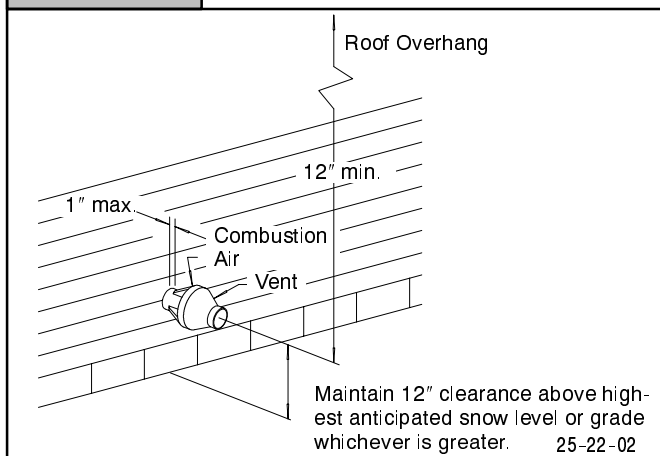
Failure to follow this warning could result in death, personal injury and/or property damage.

6. Install the Y concentric fitting and the pipe assembly through the structure's hole. For vertical termination, install the parts through the field supplied roof boot/flashing.

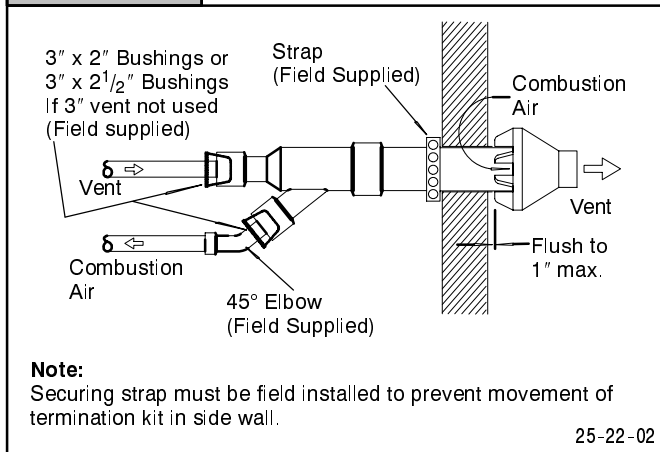
NOTE: Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the structure's hole.

7. Secure the assembly to the structure as shown in **Figure 32** or **Figure 36** using field supplied metal strapping or equivalent material.

NOTE: Ensure the termination height is above the roof surface or anticipated snow level as shown in **Figure 32** for vertical termination. Ensure the termination location clearance dimensions are as shown in **Figure 35** and **Figure 36** for horizontal termination.

Figure 35**Concentric Vent and Combustion-Air Side Termination**

8. Install the rain cap and the small diameter pipe assembly in the Y concentric fitting and the large pipe assembly. Ensure that the small diameter pipe is bottomed out and securely cemented in the Y concentric fitting.

Figure 36**Concentric Vent Sidewall Attachment**

9. Cement the furnace combustion air and vent pipes to the concentric vent termination assembly. See **Figure 32** or **Figure 36** for proper pipe attachment.
10. Operate the furnace through one heat cycle to ensure combustion air and vent pipes are properly connected to the concentric termination connections.