Installation Instructions

NCGM/GCK Series

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 (NFGC) NFPA No. 54/ANSIZ223.1. 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.

DESIGN AMERICAN GAS ASSOCIATION CERTIFIED
Design Certified by A.G.A.

EFFICIENCY RATING CERTIFIED Gama

CANADIAN GAS ASSOCIATION APPROVED

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

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⚠ DANGER

Electric Shock Hazard

Turn Off All Power Before Servicing.

⚠ WARNING

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

1. 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 the country having jurisdiction. See Appendix.

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

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

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

- **This furnace is NOT approved for installation in mobile homes, trailers or recreation vehicles.**
- Do **NOT** use this furnace as a construction heater.
- 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.
- Do **NOT** use open flame to test for gas leak.
- Ensure adequate combustion and ventilation air is provided to the furnace.
- Seal supply and return air ducts.
- The vent system **MUST** be checked to determine that it is the correct type and size.
- Install correct filter type and size.
- Unit **MUST** be installed so electrical components are protected from direct contact with water.
- It is the suggestion of this manufacturer to install fire and carbon monoxide detectors.

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

Safety Rules

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

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

B. There can be numerous sources of fire or smoke in a building or dwelling. Fire or smoke can cause serious bodily injury, death, and/or property damage. Therefore, in order to alert people of potentially dangerous fire or smoke, you should have fire and smoke detectors listed by Underwriters Laboratories installed and maintained in the building or dwelling (see Note below).

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

C. To ensure safe and efficient operation of your unit, you should do the the following:

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

Freezing Temperatures and Your Structure

⚠ WARNING

Freeze warning.

Turn off water system.

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

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

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

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

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:_____

Limit Opens at...(°F)_____or(°C)_____

Limit Closes at...(°F)_____or(°C)_____

Which blower speed tap is used?
(Heating)_____ (Cooling)_____

Temperature of Supply Air: (°F)_____or(°C)_____

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

Rise (Supply Temp.-Return Temp.): (°F)____or(°C)____

Filter Type and Size:_____

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

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

Business Card Here

Manual Gas Shut-Off Upstream of Furnace/Drip-Leg?
YES ❒ NO ❒

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

Condensate Drain Connected? YES ❒ NO ❒

Horizontal Condensate Switch Installed? YES ❒ NO ❒

Blower Speed Checked? YES ❒ NO ❒

All Electrical Connections Tight? YES ❒ NO ❒

Gas Valve OK? YES ❒ NO ❒

Measured Line Pressure When Firing Unit:_____

Calculated Firing Rate:(See *Gas Supply and Piping* Section).____

Measured Manifold Pressure:_____

Thermostat OK? YES ❒ NO ❒

Furnace Installed Level? YES ❒ NO ❒

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

Breaker On? YES ❒ NO ❒

Date of Installation:_____

Date of Start-Up:_____

Dealer Comments:_____

_____

_____

_____

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 applicable codes in appendix and *Venting and Combustion Air Check* in *Gas Vent Installation* section. This furnace MUST be vented to the outside.

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

These furnaces are shipped in the downflow orientation and can be used in the horizontal right (supply air flow direction) application with minor modifications. Follow the appropriate details outlined in the following sections.

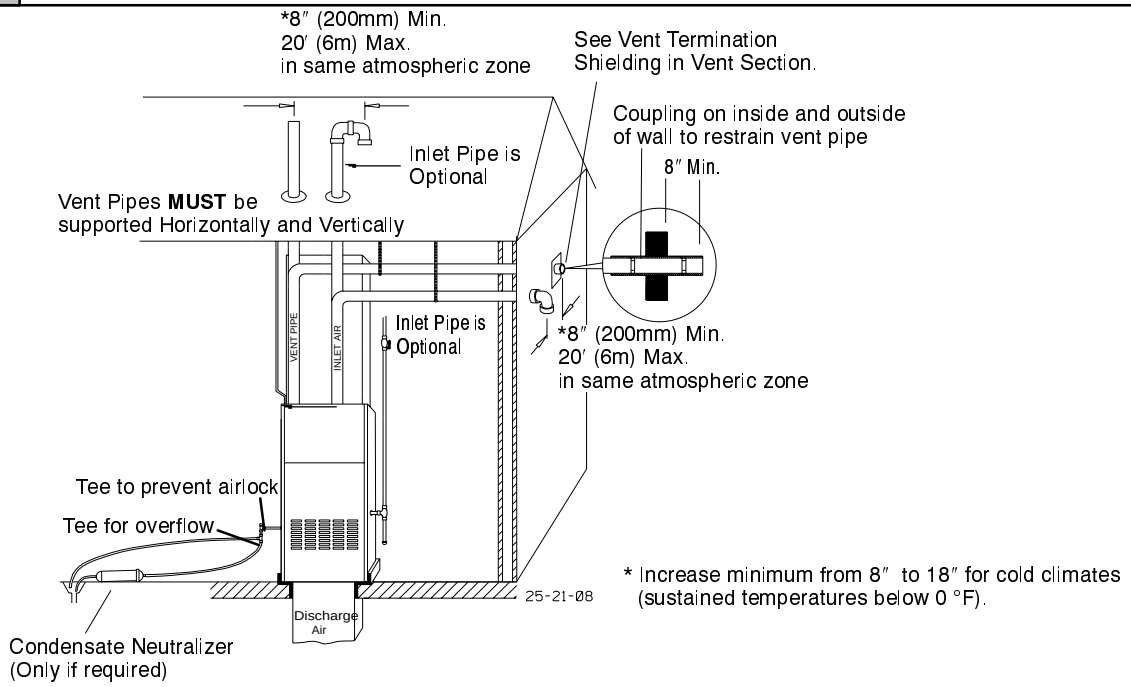
Dual Certified Furnace

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

Location and Clearances

1. Refer to **Figure 1** for typical downflow direct vent or non-direct vent installation and basic connecting parts required. Refer to **Figure 7** for typical horizontal direct vent or non-direct vent installation and basic connecting parts required. Supply and return air plenums and duct are also required.

Figure 1 **Typical Downflow Installation**



NOTE: Installation **MUST** conform with local building codes and local plumbing and waste water codes, or in the absence of local codes, with codes of the country having jurisdiction.

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.

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

Installation Requirements

1. Install furnace level.
2. Install furnace as centralized as practical with respect to the heat distribution system.
3. Install the vent pipes as short as practical. (See ***Vent and Combustion Air Piping*** section).
4. Maintain clearance for fire safety and servicing. A front clearance of 30″ (762mm) is recommended for access to the burner, controls and filter.

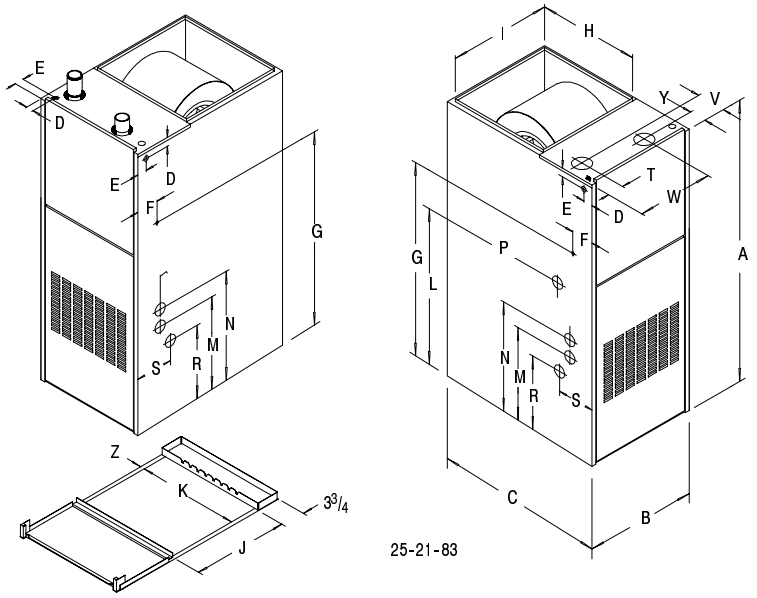
5. For downflow installations, non combustible subbase must be used under the furnace unless installation is on a non combustible floor surface. This requirement applies even when a coil box or cabinet is used.

6. For horizontal installations, line contact is permissible only between lines formed by intersection of back and two sides of furnace jacket, and building joists, studs or framing.

7. Residential garage installations require:
   - Burners and ignition sources installed at least 18″ (457mm) above the floor.
   - Located or physically protected from possible damage by a vehicle.

8. Local codes may require a drain pan under the entire furnace and condensate trap when the furnace is installed in attic applications.

Figure 2 **Dimensions and Clearances**



Cabinet Clearances						
TOP	BOT.	RH	LH	BACK	FRNT	FLUE
0″	0″ *	0″	0″	0″	3″	0″

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

ALL DIMENSIONS IN INCHES (mm)

UNIT CAPACITY	CABINET			ELECTRICAL CONNECTIONS						RETURN AIR TOP		SUPPLY AIR BOTTOM		
				TOP		LEFT SIDE		LOW VOLT						
	A	B	C	D	E	D	E	F	G	H	I	J	K	Z
50,000	48	19 1/8	28 1/2	1 1/2	1 1/2	1 5/8	2 1/2	3 3/4	34 1/2	18 1/2	17 5/8	17	17 5/8	3/4
75,000	48	19 1/8	28 1/2	1 1/2	1 1/2	1 5/8	2 1/2	3 3/4	34 1/2	18 1/2	17 5/8	17	17 5/8	3/4
100,000	48	22 3/4	28 1/2	1 1/2	1 1/2	1 5/8	2 1/2	3 3/4	34 1/2	18 1/2	21 1/4	17	22 1/2	3/4
125,000	48	26 3/8	28 1/2	1 1/2	1 1/2	1 5/8	2 1/2	3 3/4	34 1/2	18 1/2	24 7/8	17	24 7/8	3/4

UNIT CAPACITY	GAS CONNECTIONS				DRAIN CONNECTIONS						FLUE OUTLET		AIR INLET	
	RIGHT SIDE		LEFT SIDE		RIGHT SIDE		LEFT SIDE							
	M	N	M	N	R	S	L	P	R	S	T	V	W	Y
50,000	16 3/8	19 3/8	16 3/8	19 3/8	13	6 1/2	25 3/16	24	13	6 1/2	3	5 3/16	12 13/16	3 13/16
75,000	16 3/8	19 3/8	16 3/8	19 3/8	13	6 1/2	25 3/16	24	13	6 1/2	3	5 3/16	12 13/16	3 13/16
100,000	16 3/8	19 3/8	16 3/8	19 3/8	13	6 1/2	25 3/16	24	13	6 1/2	3	5 3/16	17	3 13/16
125,000	16 3/8	19 3/8	16 3/8	19 3/8	13	6 1/2	25 3/16	24	13	6 1/2	3	5 3/16	20	3 13/16

mm Equivalents
48 = (1219) 19 1/8 = (486) 22 3/4 = (578) 26 3/8 = (670) 28 1/2 = (724) 1 1/2 = (38) 1 5/8 = (41)
2 1/2 = (64) 3 3/4 = (95) 34 1/2 = (875) 18 1/2 = (470) 17 5/8 = (448) 21 1/4 = (540) 24 7/8 = (632) 17 = (432)
22 1/2 = (572) 3/4 = (19) 16 3/8 = (416) 19 3/8 = (492) 13 = (330) 6 1/2 = (165) 25 3/16 = (640) 24 = (610)
13 = (330) 6 1/2 = (165) 3 = (76) 5 3/16 = (132) 12 13/16 = (325) 20 = (508) 3 13/16 = (97)

Downflow Furnace Installation Non-Combustible Floor Installation

Fabricate a plenum to the dimensions given in **Figure 2**, for the furnace outlet. Plenum should be flanged, approximately 3/4″ for support.

1. Position plenum through the floor and set the furnace over the opening in the floor. If necessary, grout around the base to seal air leaks between the base and the floor.

Combustible Floor Installation

Subbase for Combustible Floor

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

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

The opening in the base is $1^1/_4$" (32mm) shorter and $1^1/_8$" (29mm) narrower than the recommended size of the opening in the floor. This is done to maintain clearance between the floor and the plenum.

2. Fabricate the plenum to the dimensions given in **Table 1**. Note that the dimensions given are outside dimensions.

Table 1 Subbases for Combustible Floors Dimensions

Subbase for Combustible Floors Part Number	Subbase for Combustible Floor Dimensions				Opening In Floor		Opening In Base For Plenum		Typical Plenum Dimensions	
	H_1	J_1	K_2	L	M	N	P	R	S	T
Furnace Subbase										
NAHH002SB	$19^5/_{16}$	$28^3/_4$	$18^3/_{16}$	16	$16^1/_4$	$18^1/_4$	15	$17^1/_8$	15	$17^1/_8$
NAHH003SB	$22^{15}/_{16}$	$28^3/_4$	$21^{13}/_{16}$	16	$16^1/_4$	$21^7/_8$	15	$19^3/_4$	15	$19^3/_4$
NAHH007SB	$26^9/_{16}$	$28^3/_4$	$25^7/_{16}$	16	$16^1/_4$	$25^1/_2$	15	$24^7/_8$	15	$24^3/_8$
Subbase for Coil Cabinets										
NAHH005SB	$19^5/_{16}$	$20^9/_{16}$	$18^3/_{16}$	16	$16^1/_4$	$18^1/_4$	15	$17^1/_8$	15	$17^1/_8$
NAHH006SB	$22^{15}/_{16}$	$20^9/_{16}$	$21^{13}/_{16}$	16	$16^1/_4$	$21^7/_8$	15	$19^3/_4$	15	$19^3/_4$
NAHH008SB	$26^9/_{16}$	$20^9/_{16}$	$25^7/_{16}$	16	$16^1/_4$	$25^1/_2$	15	$24^7/_8$	15	$24^3/_8$
Equivalents In. (mm)	$19^5/_{16}$ = 491 $22^{15}/_{16}$ = 583 $26^9/_{16}$ = 694	$28^3/_4$ = 730 $20^9/_{16}$=522	$18^3/_{16}$ = 462 $21^{13}/_{16}$ = 554 $25^7/_{16}$ = 646	16 = 406	$16^1/_4$ = 412	$18^1/_4$ = 464 $21^7/_8$ = 556 $25^1/_2$ = 647	15 = 381	$17^1/_8$ = 435 $19^3/_4$ = 502 $24^3/_8$ = 619	15 = 381	$17^1/_8$ = 435 $19^3/_4$ = 502 $24^3/_8$ = 619

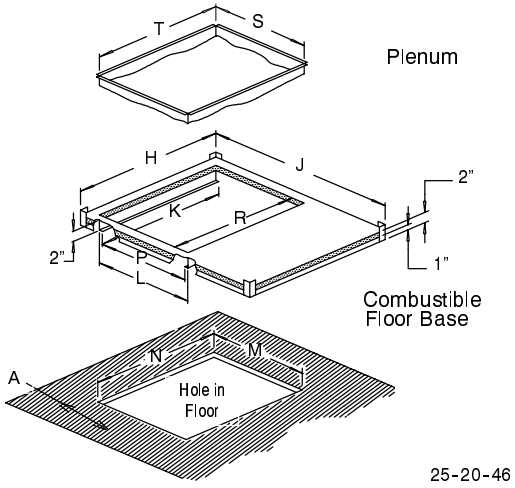
1 Outside Dimension
2 Base Spacer Side To Side

3. Set the base over the opening in the floor, centering it over the opening. Fasten the base to the floor with screws or nails. See **Figure 3, Figure 4** and **Figure 5**.

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

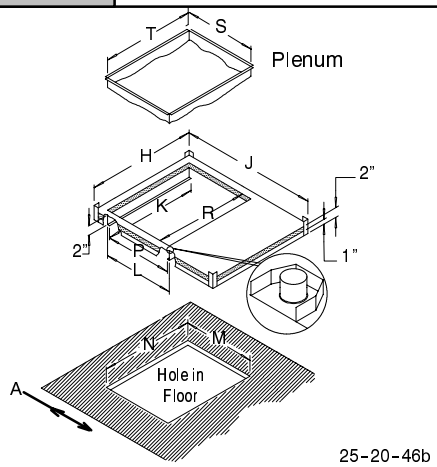
5. Position furnace or coil cabinet and furnace on subbase so it aligns between the locating tabs.

Figure 3 Furnace Subbase



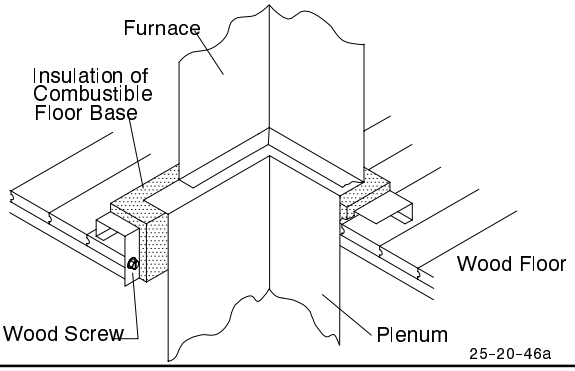
A = 4 1/4" Minimum clearance from back of hole to wall or other obstruction.

Figure 4 Coil Cabinet Subbase



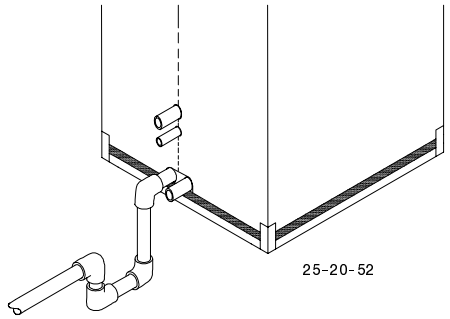
A = 4 1/4" Minimum clearance from back of hole to wall or other obstruction.

Figure 5 Setting the Subbase



This subbase for combustible floors has been designed so that the height of the subbase raises the downflow coil off the floor to allow easy installation of the condensate drain. See **Figure 6**.

Figure 6 **Condensate Line Raised by Base**



Horizontal Furnace Installation

⚠ WARNING

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

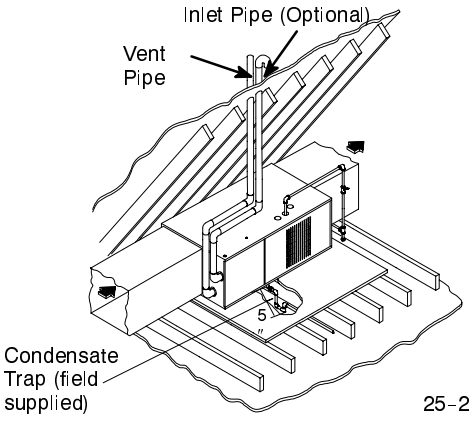
Make certain model installed is certified for use in multiple configurations.

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

NOTE: Inspect unit rating plate to be certain model number begins with **"NCGM/GCK".** 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 **left-to-right** airflow position. See **Figure 7. Do not** install furnace on its back or in the right-to-left airflow positions as safety control operation will be adversely affected.

Figure 7 **Typical Horizontal Installation**



NOTE: 5″ bottom clearance required for condensate trap.

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

If the furnace is to be installed in a crawl space, consult local codes. A suitable concrete pad or blocks are recommended for crawl space installation on the ground.

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

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

The horizontal furnaces may be installed directly on combustible wood flooring or supports as long as all required furnace clearances are met. See **Figure 2.**

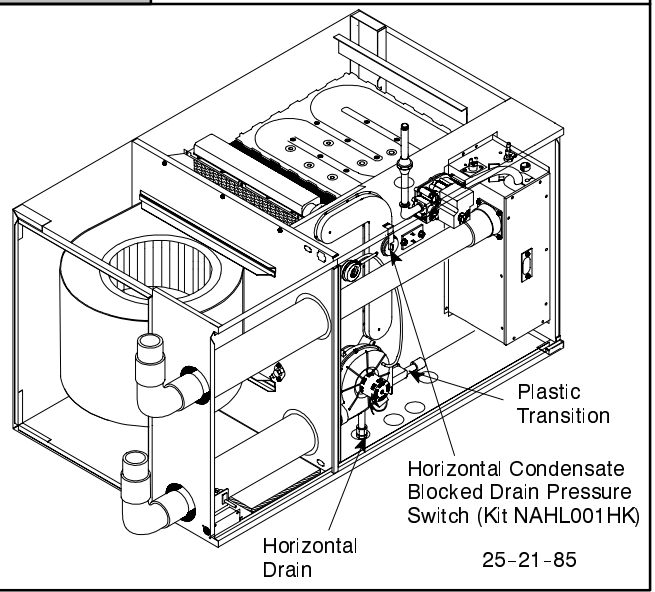
This furnace **MUST NOT** be installed directly on carpeting or tile or other combustible material other than wood flooring or supports.

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

Blocked Condensate Drain Pressure Switch (Accessory Kit NAHL001HK)

For horizontal furnace installations, a blocked condensate drain pressure switch **MUST** be used. Follow the directions outlined in the kit to properly install the switch into the furnace. See **Figure 8.**

Figure 8 **Blocked Drain (Horizontal Installation) Pressure Switch**

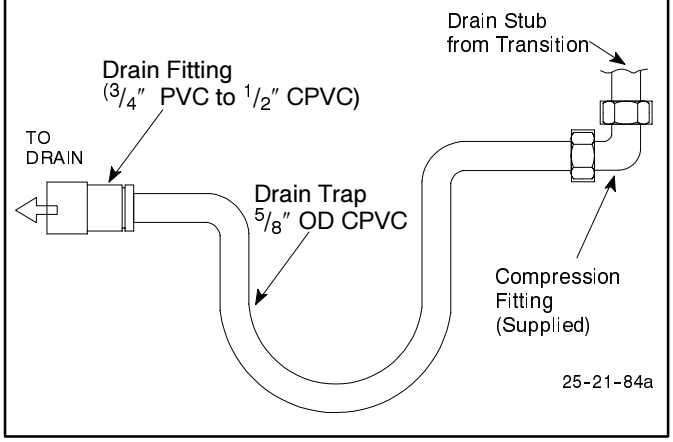


Condensate Drain Trap

For horizontal furnace installations, the condensate drain trap **MUST** be installed below the furnace. See **Figure 9** 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. See **Section 5** under "*Condensate Drain Trap and Neutralizer*".

The condensate drain trap connects to the drain stub on the left side of the plastic transition. See **Figure 8** and **Figure 9.** 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 (downflow drain stub) on the plastic transition.

Figure 9 **Condensate Drain Trap**



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 personal injury and/or death.

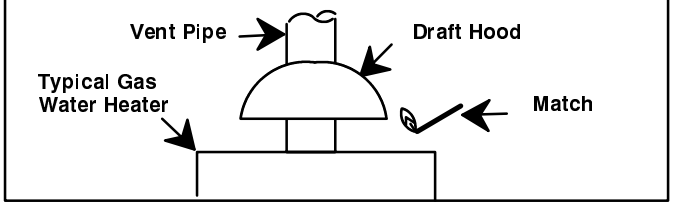
Venting and Combustion Air Check

NOTE: This section of the manual applies to this furnace **IF venting as a non-direct vent (single pipe) appliance.** The following 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) remaining connected to the venting system are located and other spaces of the building.
4. Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
5. Follow the lighting instructions for each appliance being inspected. Adjust thermostat so appliance(s) will operate continuously.
6. Allow 5 minutes of main burner operation, then check for spillage at the draft hood relief opening of each appliance. Use the flame of a match or candle (**Figure 10**).

Figure 10 **Vent Check**



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

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

NOTE: Non direct vent appliances occupying same enclosed space as furnace **MUST** have enough air for proper combustion and ventilation. All duct or openings for supplying combustion and ventilation air must comply with the gas and electrical codes of the country having jurisdiction.

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

Air Openings and Connecting Ducts

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

Confined Space Installation

NOTE: A confined space is defined as an area with less than 50 cubic feet(1.4m^3) per 1,000 BTUH input rating for all gas appliances installed in the area.

Requirements

1. Provide confined space with sufficient air for proper combustion and ventilation of flue gases using horizontal or vertical ducts or openings.
2. **Figure 11** illustrates how to provide combustion and ventilation air. A minimum of two permanent openings, one inlet and one outlet, are required.
3. One opening **MUST** be within 12″ (300mm) of the floor and the second opening within 12″ (300mm) of the ceiling.
4. Size openings and ducts per **Table 2**.
5. Horizontal duct openings require 1″ square (25sq. mm) of free area per 2,000 BTUH of combined input for all gas appliances in area **(**see **Table 2)**.
6. Vertical duct openings or openings directly to outside require 1″ square (6.5mm^3) of free area per 4,000 BTUH for combined input of all gas appliances in area **(**see **Table 2).**

Table 2 — 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.(161 cm.^{2})	12.5 sq. in.(81 cm.^{2})	4″
75,000	35.5 sq. in.(242 cm.^{2})	18.75 sq. in.(121 cm.^{2})	5″
100,000	50 sq. in.(323 cm.^{2})	25 sq. in.(161 cm.^{2})	6″
125,000	62.5 sq. in.(403 cm.^{2})	31.25 sq. in.(202 cm.^{2})	7″
150,000	71 sq. in.(484 cm.^{2})	37.5 sq. in.(242 cm.^{2})	7″

EXAMPLE: Determining Free Area

Appliance 1 Appliance 2 Total Input

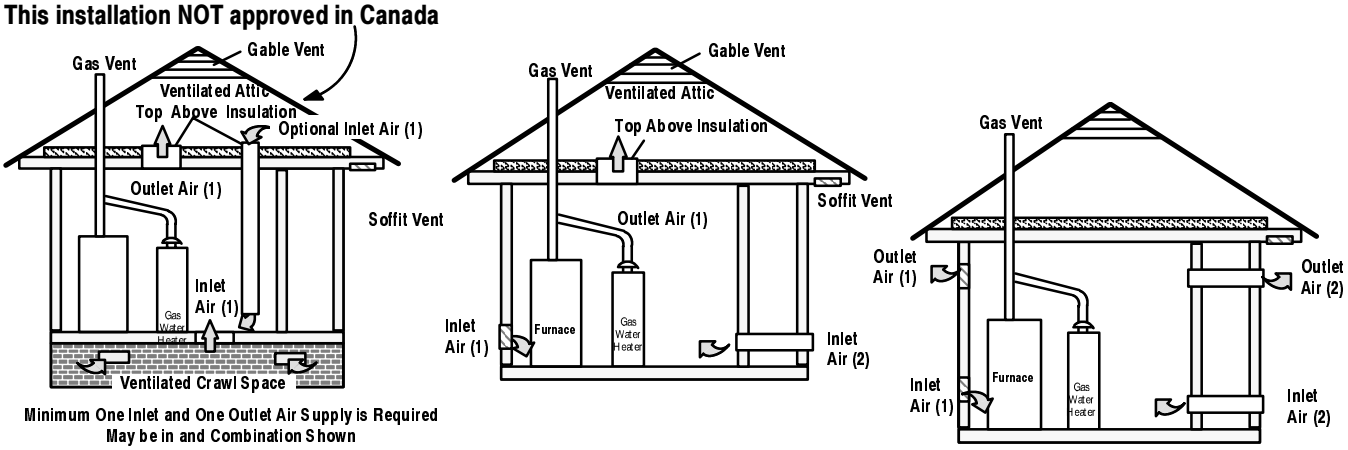
100,000 + 30,000 = (130,000 ÷ 4,000) = 210 cm.^{2}
(32.5 Sq. In.) Vertical

Appliance 1 Appliance 2 Total Input

100,000 + 30,000 = (130,000 ÷ 2,000) = 419 cm.^{2}
(65 Sq. In.) Horizontal

Figure 11 — Outside Air (This is ONLY a guide. Subject to codes of country having jurisdiction.)

This installation NOT approved in Canada



Minimum One Inlet and One Outlet Air Supply is Required
May be in and Combination Shown

Inlet Air Opening Must be Within12″(300mm) of floor

Outlet Air Opening Must be Within12″(300mm) of ceiling

(1) 1 Square Inch (6cm^2) per 4000 BTUH

(2) 1 Square Inch (6cm^2) per 2000 BTUH

Unconfined Space Installation

⚠ WARNING

Poison carbon monoxide gas hazard.

Most homes will require additional air.

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

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

An unconfined space is defined as an area having a minimum volume of 50 cubic feet(1.4m^3) per 1,000 Btuh total input rating for all gas appliances in area. Refer to **Table 3** for minimum area required.An unconfined space is defined as an area having a minimum volume of 50 cubic feet(1.4m^3) per 1,000 Btuh total input rating for all gas appliances in area. Refer to **Table 3** for minimum area required.

Table 3 — Unconfined Space Minimum Area in Square Feet

BTUH Input Rating	Minimum Area in Square Feet	Round Duct Size 1 Sq. Inch per 4,000 BTUH
50,000	312(29m^2)	4″ (100mm)
78,000	490(46m^2)	5″ (127mm)
114,000	712(66m^2)	6″ (152mm)
155,000	968(90m^2)	6″ (178mm)

EXAMPLE: NOTE: Square feet is based on 8 foot ceilings.

$$\frac{28{,}000\ \text{BTUH}}{1{,}000} \times 50\ \text{Cubic Ft.} = \frac{1{,}400}{8'\ \text{Ceiling Height}} = 175\ \text{Sq. Ft.}$$

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 (25mm^2) 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″ (300mm) 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 $^1/_4$″ (6mm) 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*:

Unusually tight construction is defined as: Construction with

1. Walls and ceilings exposed to the outside have a continuous, sealed vapor barrier. Openings are gasketed or sealed and
2. Doors and openable windows are weather stripped and
3. Other openings are caulked or sealed. These include joints around window and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, etc.

Ventilation Air

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

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 property damage, personal injury and/or death.

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. 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 which 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 **Section 4**.
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 (See *Special Instruction For Horizontal Vents*).
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 $^1/_4$″ per foot of run (6mm per 300mm).
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 metal pipe strapping. **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′ (12m) 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′ (1.5m) for each additional elbow used. **(See Vent Tables).**
13. The minimum pipe run length is 2′ (.6m).
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 17** are maintained.

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 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″ (760mm), 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 4.** 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 5** 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 25-30 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 4	Pipe Diameter Table Single Piping ONLY						
50,000 & 75,000 Btuh Furnaces							
Max No. Of Elbows in One Side ℑ	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							
	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							
	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

Possible combination legend:
A = 2″ Exhaust
B = $2^1/_2$″ Exhaust
C = 3″ Exhaust

Elbows are DWV Long Radius Type for 2″ and 3″ vents. Schedule 40 (sharp radius) for $2^1/_2$″

ℑ - ***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 both the inlet and exhaust pipes 5′ (1.5m) for each additional elbow used.

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

Table 5	Pipe Diameter Table Dual Piping ONLY						
50,000 Btuh Furnaces							
Max No. Of Elbows in One Side ℑ	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							
	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							
	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 ℑ	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						

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

Elbows are DWV Long Radius Type for 2″ and 3″ vents. Schedule 40 (sharp radius) for $2^1/_2$″

For *"Concentric Termination Kit"* Venting table, see *"Section 10"* in this manual.

Vent Termination Clearances

⚠ WARNING

Poison carbon monoxide poisoning, fire and explosion hazard.

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

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

1. Determine termination locations based on clearances specified in following steps and as shown in **Figure 12, Figure 15, Figure 16** and **Figure 17.**

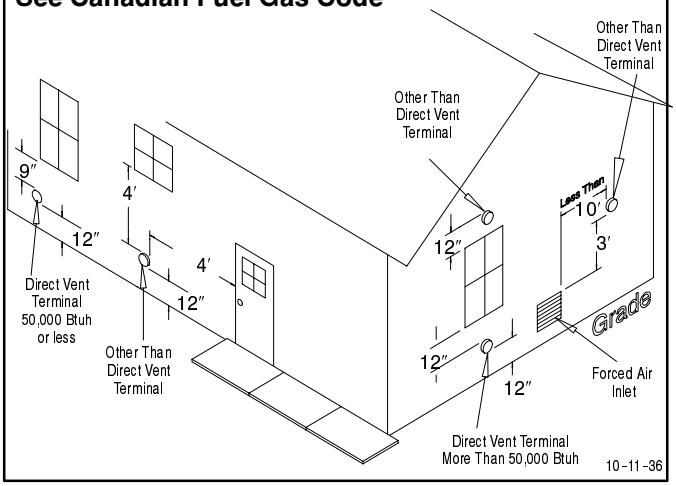
For *"Concentric Termination Kit"* clearances, see Figure 27, Figure 28, Figure 29, Figure 30 and **Figure 31 see *"Section 10"* in this manual.**

2. The vent termination must be located at least 12″ (300mm) 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′ (1220mm) horizontally from any electric meter, gas meter, regulator, and any relief equipment. These distances apply **ONLY** to U.S. installations.
5. The vent termination is to be located at least 3′ (914mm) above any forced air inlet located within 10′ (3m) ; and at least 10′ (3m) 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.

Figure 12 **Vent Termination Clearances (United States Only)**

See Canadian Fuel Gas Code



Condensate Drain Trap and Neutralizer

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 for downflow installations.

NOTE: The 90° compression fitting elbow (provided), requires the drain line to be $^1/_2$″ (13mm) CPVC***** ($^5/_8$″ OD). $^5/_8$″ (16mm) 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. A condensate or sump pump **MUST** be used if required by local codes, or if no indoor floor drain is available. A condensate neutralizer cartridge must be used if the pump is not approved for use with acidic condensate. Neutralizer cartridges **MUST** be installed in the drain line in a horizontal position **ONLY.**

4. 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**.

5. 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 wil 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.

Connecting Furnace and Piping

⚠ WARNING

Poison carbon monoxide gas hazard.

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

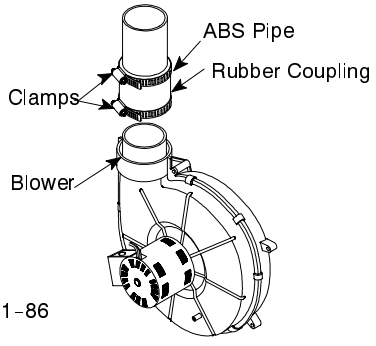
Failure to properly seal vent piping can result in personal injury and/or death.

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 section ABS vent pipe (supplied) to the combustion blower using the flexible coupling and clamps (provided). Remove the three screws holding the vent collar to the top panel. Remove the vent collar. Remove the two screws in the chase tube. Squeeze the chase tube together and slide the chase tube through the top panel. The blower snout is now accessible for installing the ABS pipe. **See Figure 13 and Figure 14.** Reassemble in reverse order.

Figure 13 **Proper Sealing Procedure for Combustion Blower**



2. Install the remaining flexible coupling and clamps (supplied) on the end of the ABS vent pipe from the combustion blower. This will be used to connect to the rest of the vent system. See **Figure 14.**

Air Inlet Pipe Connection

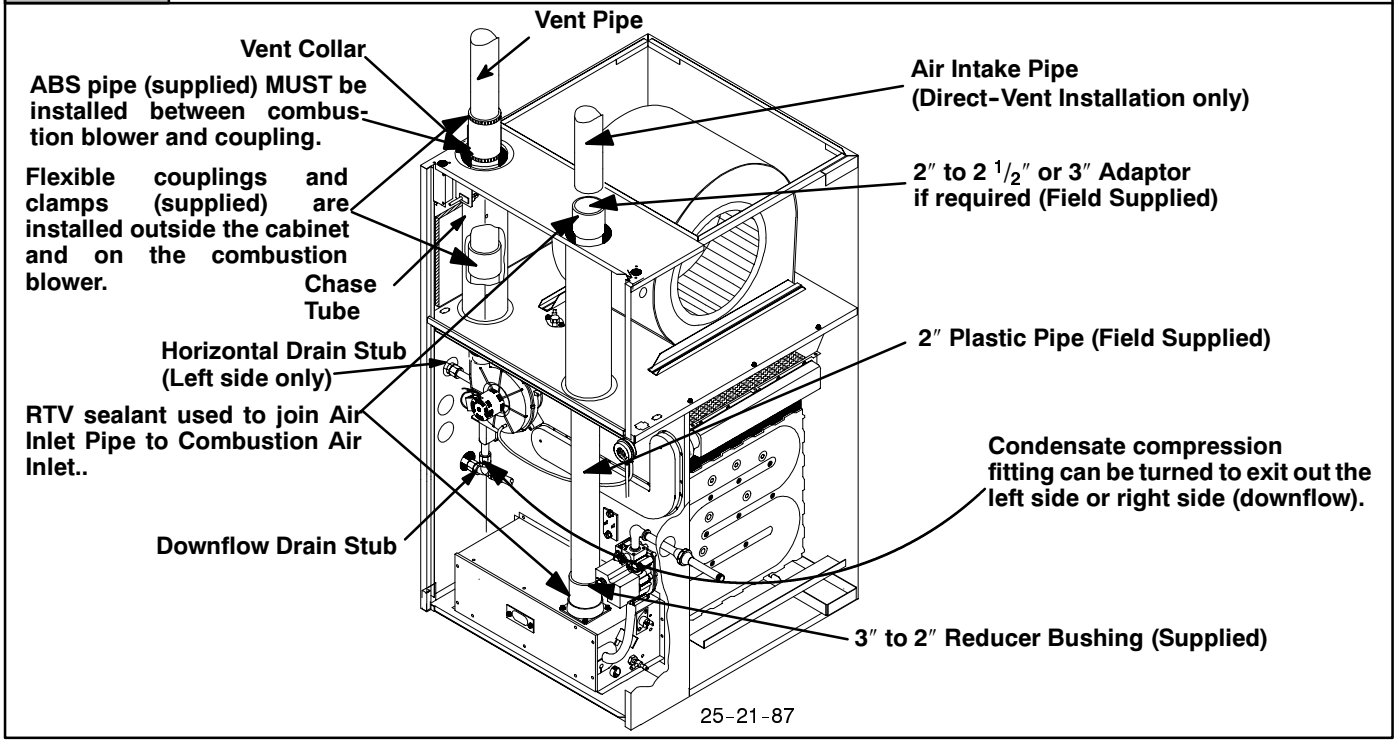
NOTE: Air Inlet Collar is sized for 3″ PVC pipe. A 3″ (75mm) to 2″ (50mm) reducer fitting and 2″ pipe is required to extend outside the furnace casing. The reducing section can extend up to the first 90° elbow for a horizontal section if the elbow is within 4 feet above the furnace.

1. Install 3″ to 2″ pipe/reducer fitting (supplied) to the inlet collar using RTV sealant **ONLY** to provide for future serviceability.
2. Connect 2″ plastic pipe into the fitting using RTV sealant **ONLY.** Pipe must be long enough to extend outside the furnace casing.

NOTE: If clearance is limited above the furnace, use two pieces of pipe joined (RTV only) with a coupling to reach from the Combustion Air Box to outside of casing.

3. Connect required size Air Intake Pipe using coupling or adaptor as required, using RTV sealant **ONLY** to provide for future serviceability.

Figure 14 **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 personal injury and/or death.

This furnace is approved for venting with PVC, CPVC, ABS, and Cellular Core pipe fittings.

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. Schedule 40 is the **ONLY** approved wall thickness.

- *Pipe and Fittings* - ASTM D1785, D2466, D2661, D2665, F-891, F-628, SDR-26
- *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 both the inlet and the exhaust pipes where they join 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″ (1m) between combustion air inlet and clothes dryer vent. Terminate the combustion air intake as far as possible from any air conditioner, heat pump, swimming pool, swimming pool pumping, chlorinator or filtration unit.

⚠ WARNING

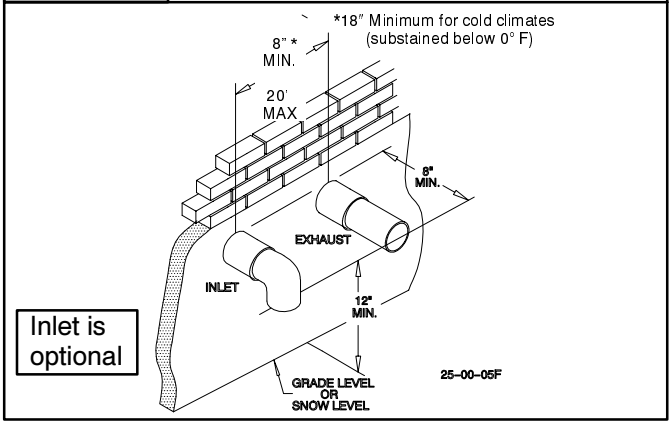
Poison carbon monoxide poisoning, fire and explosion hazard.

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

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

1. Install all couplings, nipples and elbows using proper procedures for **Joining Pipe and Fittings** and maintain spacing between vent and combustion air piping as indicated in **Figure 15** through **Figure 17**.

Figure 15 Sidewall Termination 12″ or More Above Snow Level or Grade Level



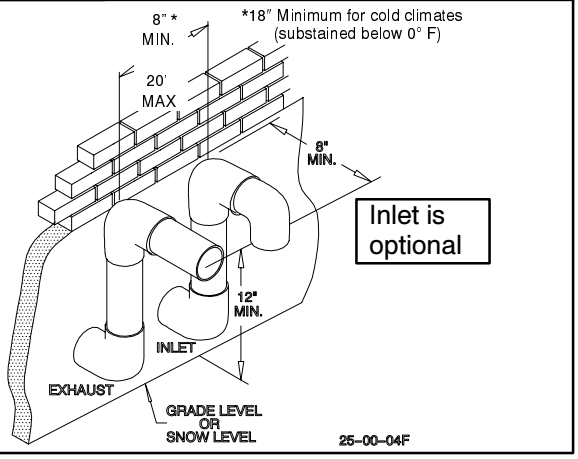
Vertical Termination

1. **Figure 17** shows the proper installation and clearances for vertical vent termination. The vertical roof termination should be sealed with a plumbing roof boot or equivalent flashing. The inlet of the intake pipe and end of the exhaust vent must be terminated no less than 12″ (300mm) above the roof or snow accumulation level, and 12″ (300mm) away from a vertical wall or other protrusion.
2. If the vent system is installed in an existing chimney make sure clearances shown in **Figure 17** are maintained. Horizontal section before the termination elbow can be extended on the inlet air to provide necessary clearance.

Horizontal Termination

1. If installing as a direct-vent appliance, cut two holes. $2^1/_2$″ (67mm) for 2″ (50mm) pipe, 3″(75mm) for $2^1/_2$″ (67mm) pipe, or $3^1/_2$″ (90mm) for 3″ (75mm) 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 $^3/_4$″ to 1″(19 to 25mm) 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 15** through **Figure 16**.

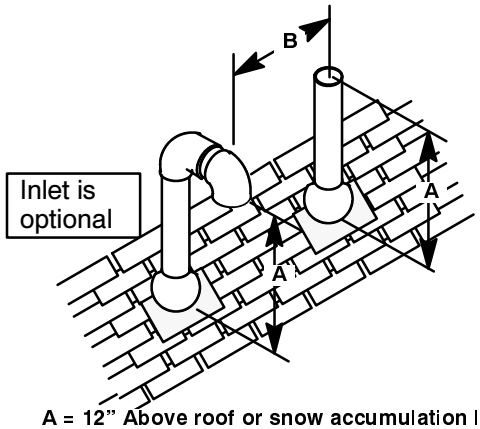
Figure 16 Sidewall Termination with Exterior Risers to Get Above Snow Level or Grade Level



Using Exterior Risers

1. Install elbows and pipe to form riser as shown in **Figure 16**.
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.

Figure 17 Rooftop Termination



A = 12" Above roof or snow accumulation level
B = 8″ Min., 20' Maximum, except in areas with extreme cold temperatures (sustained below 0 °F), then 18″ Min.

Optional Vent Screens

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

Vent Termination Shielding

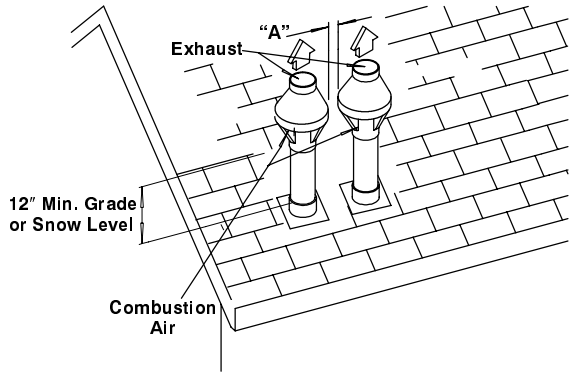
Under certain wind conditions some building materials may be affected by flue products expelled in close proximity to unprotected surfaces. Sealing or shielding of the exposed surfaces with a corrosion resistant material (such as aluminum sheeting) may be required to prevent staining or deterioration. 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″ (457mm x 457mm) min. or 18″ (457mm) min. diameter around the vent termination at the exterior wall to protect the house exterior materials from flue product or condensation (freezing) damage.

Multi Vent Termination Clearances

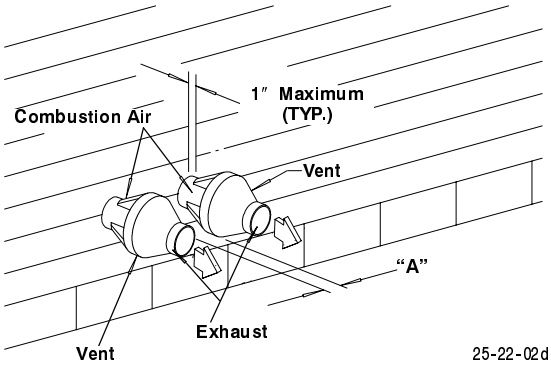
When two (2) or more furnaces are vented near each other, each furnace must be individually vented.

Figure 18 Concentric Vent and Combustion-Air Roof Termination



Dimension "A" is touching or 2″ maximum separation.

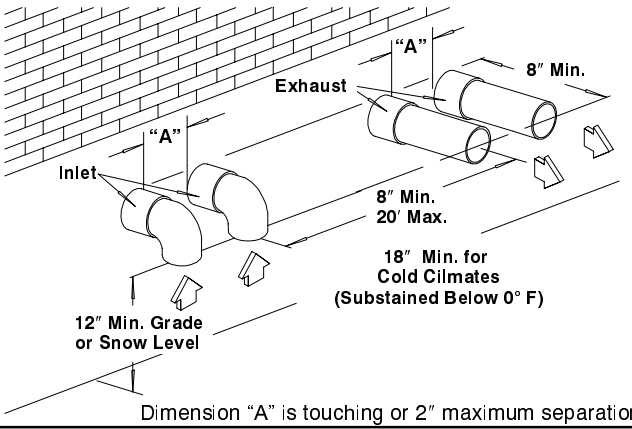
Figure 19 Concentric Vent and Combustion-Air Sidewall Termination



Dimension "A" is touching or 2″ maximum separation.

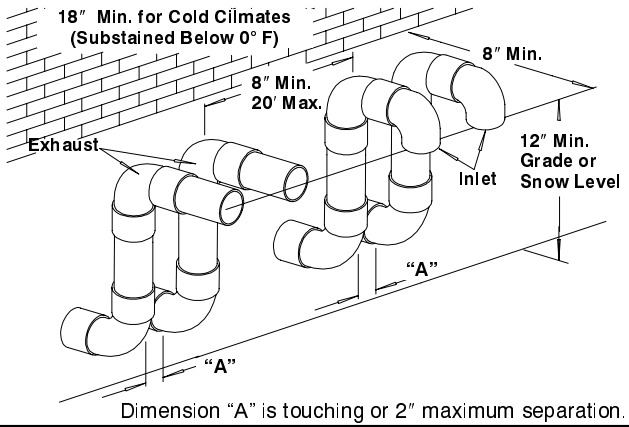
When two (2) or more furnaces are vented near each other, two (2) vent terminations may be installed as shown in **Figure 18, Figure 19, Figure 20, Figure 21** and **Figure 22**, but the next vent termination must be at least 36″ away from first 2 terminations. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

Figure 20 Sidewall Inlet Vent and Exhaust-Air Termination



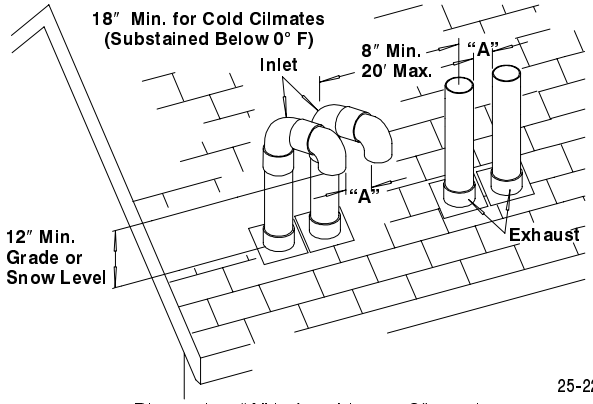
Dimension "A" is touching or 2″ maximum separation.

Figure 21	Sidewall Inlet Vent and Exhaust-Air Termination with Exterior Risers



Dimension "A" is touching or 2″ maximum separation.

Figure 22	Rooftop Inlet Vent and Exhaust-Air Termination



Dimension "A" is touching or 2″ maximum separation.

5. Gas Supply and Piping

⚠ WARNING

Fire and explosion hazard.

Natural Gas

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

NOTE: The rating plate is stamped with the model number, gas type and gas input rating. In addition, models manufactured for sale in Canada have orifice size information stamped on the rating plate.

Alternate BTUH Input Ratings (USA Only)

The input rating of these furnaces can be changed from the standard input rating to the alternate input rating shown in **Table 6,** by changing the main burner orifices. Changing of burner orifices MUST be done by a qualified service technician. See section on changing orifices.

Table 6	Alternate Input Ratings, USA ONLY.		
BTUH Standard Rating	BTUH Alternate Rating	Natural Gas Orifice	LP Gas Orifice
50,000	40,000	#44	#55
75,000	60,000	#44	#55
100,000	80,000	#44	#55
125,000	100,000	#44	#55

Supply Pressure

⚠ WARNING

Fire hazard.

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

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

1. Supply pressure can be checked using the $^1/_8$″(3.2mm) NPT port on the supply side of the gas valve.
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 7** for normal gas supply and manifold pressures.

Table 7	Gas Pressures Below 2000 Ft.			
Gas Type	Supply Pressure			Manifold Pressure
	Recommended	Max.	Min.	
Natural	7 inches	14 inches	4.5 inches	3.5 inches
LP	11 inches	14 inches	11 inches	10 inches

Important Notes

- **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″ 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 Adjustment

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 U-Tube manometer to the tapped opening on the outlet side of gas valve. Use manometer with a 0-min.12″ water column range.
3. Turn gas **ON,** fire the furnace and remove adjustment screw cover on gas valve.
4. Turn counterclockwise to decrease pressure and clockwise to increase.

5. Set pressure to value shown in **Table 7**. Refer to **Important Notes** in **Table 7** . Pressure is also listed on furnace rating plate.
6. When pressure is set, replace adjustment screw cover on gas valve.
7. Replace combustion air box cover.

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

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 2% (natural) 4% (LP) for each 1,000′ above sea level. See **Table 8** and **Figure 23** 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 7.** 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.

MANIFOLD PRESSURE AND ORIFICE SIZE FOR HIGH ALTITUDE APPLICATIONS

Table 8	NATURAL GAS						
Heat Value Btu/Cu.Ft.	Elevation Above Sea Level						
	0-1999 (″ wc)	2000-2999 (″ wc)	3000-3999 (″ wc)	4000-4999 (″ wc)	5000-5999 (″ wc)	6000-6999 (″ wc)	7000-7999 (″ wc)
800	3.5	3.5	3.5	3.5	3.5	3.5	3.5
850	3.5	3.5	3.5	3.5	3.5	3.5	3.5
900	3.5	3.5	3.5	3.5	3.5	3.5	3.4
950	3.5	3.5	3.5	3.5	3.3	3.2	3.1
1000	3.5	3.4	3.3	3.2	3.0	2.9	2.8
1050	3.2	3.1	3.0	2.9	2.7	2.6	2.5
1100	2.9	2.8	2.7	2.6	2.5	2.4	2.3
Orifice Size	#42	#42	#42	#42	#42	#42	#42

High Altitude Air Pressure Switch

Altitudes over 4,000′ require a different air pressure switch than the one installed at the factory. Check parts list for pressure switch and consult your distributor for part number and availability. In Canada, provincial codes may govern installation of switch. Check with governing authorities.

Changing Orifices for High Altitude

⚠ WARNING

Electrical shock, fire or explosion hazard.

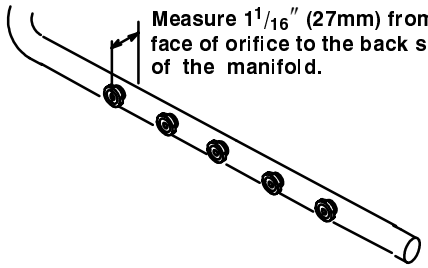
Turn OFF electric power (at disconnect) and gas supply (at manual valve in gas line) when installing orifices. Installation of orifices requires a qualified service technician.

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

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 there is $1^{1}/_{16}$″ (27mm) from the faces of the orifices to the back side of the manifold, **Figure 23**.

Figure 23 **Changing Orifices**



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

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.
3. Time how many seconds it takes the smallest dial on the gas meter to make one complete revolution. Refer to **Example**.

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 x 3,600 ÷ 48 = 75,000 BTUH			

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

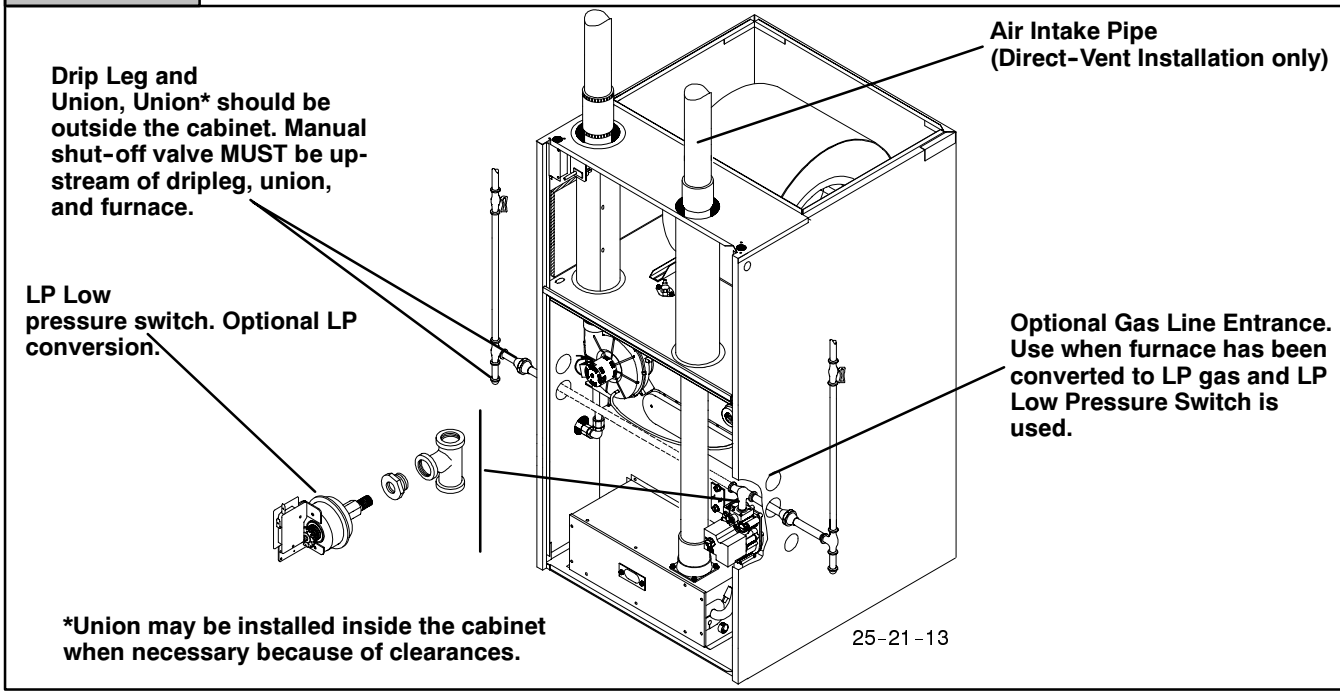
4. Relight all appliances and ensure all pilots are operating.

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 NFGC 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.

NOTE: Refer to **Figure 24** for the general layout at the furnace. The rules listed apply to natural and LP gas pipe installations.

Figure 24 **Typical Gas Piping**



4. Use black iron or steel pipe and fittings or other pipe approved by local code.
5. 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.
6. Use two pipe wrenches when making connections to prevent gas valve from turning.
7. 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.

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 $^1/_2$″ 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 $^1/_2$″ PSIG (3.5 kPa).
2. Test all pipes for leaks.
3. Gas pressure **MUST NOT** exceed $^1/_2$″ PSIG to gas valve. Checking gas piping above $^1/_2$″ 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.

6. Electrical Wiring

Power Supply Wiring

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

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

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

Thermostat

Thermostat location has an important effect on the operation of the unit. Follow instructions included with thermostat for correct mounting and wiring. "Y" terminal on thermostat sub-base must be connected to "Y" terminal on furnace fan timer for proper fan speed during operation in air conditioning mode.

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

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

Optional Equipment

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

Humidifier/Electronic Air Cleaner

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

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.

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" or use the following diagram.

Fan Delay DIP switch Settings

COOL ON DELAY: 30 SEC.
COOL OFF DELAY: 30 SEC.

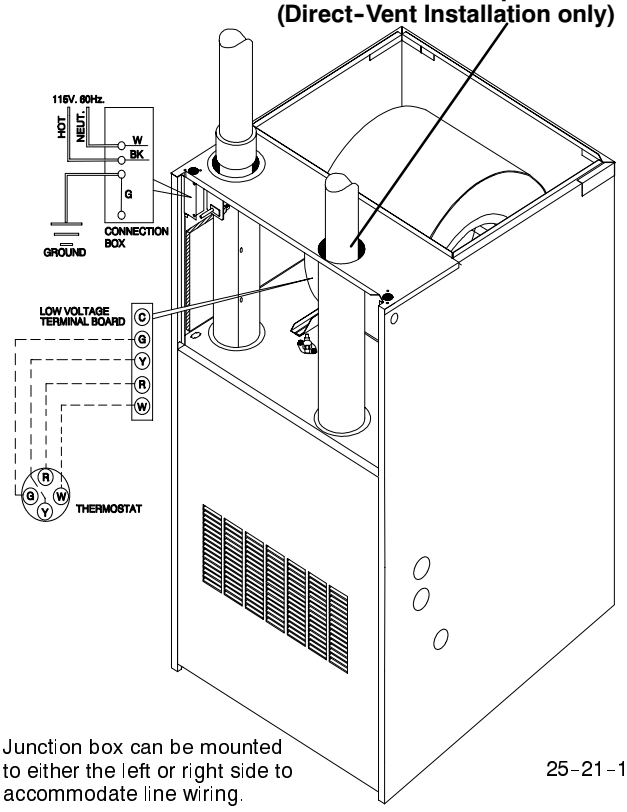
HEAT OFF DELAY				HEAT ON DELAY	
123	123	123	123	123	123
60 SEC	100 SEC	140 SEC	180 SEC	60 SEC	30 SEC

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

CAUTION

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

Figure 25 **Electrical Connections**



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 personal injury and/or death.

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 discharge side of furnace.
3. 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.
4. It is recommended for furnaces installed without a cooling coil that the outlet duct be provided with a removable access panel. This panel should be accessible when the furnace is installed so that the heat exchanger can be viewed for inspections. The access panel **MUST** be sealed to prevent leaks.

NOTE: Dampers (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 personal injury and/or death.

Connections

NOTE: Return air can enter through the top of the furnace only. When the furnace is located in an area near or adjacent to the living area, the system should be carefully designed with returns to minimize noise transmission through the return grille. Any blower moving a high volume of air will produce audible noise which could be objectionable to when the unit is located very close to living areas. It is advisable to route the return air ducts between floors or through the attic.

1. Installation of locking-type dampers are recommended in all branches, or in individual ducts to balance system's air flow.
2. Non-combustible, flexible duct connectors are recommended for return and supply connections to furnace.
3. 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

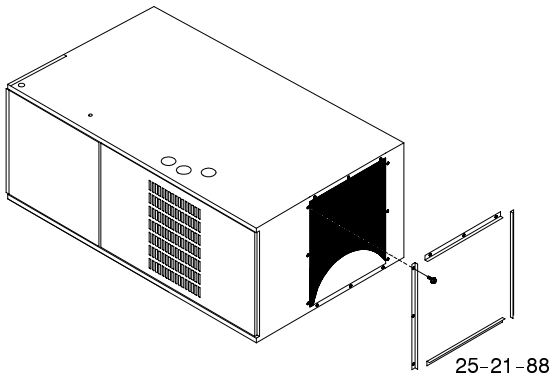
1. Insulate ductwork installed in attics or other areas exposed to outside temperatures with a minimum of 2″ insulation and vapor barrier.
2. Insulate ductwork in indoor unconditioned areas with a minimum of 1″ insulation with indoor type vapor barrier.

Horizontal Filters and Supply Duct Installation

For horizontal furnace applications it is necessary to install filter(s) in an accessible location in the return air system. In such a case, the filter(s) should be of equivalent size and style as originally supplied with the furnace.

For horizontal furnace applications, four field supplied angles are required to connect the supply duct to the furnace. See **Figure 26.** Size the metal angles to match the supply opening of the furnace. See **Figure 2** for supply air dimensions.

Figure 26 **Supply Duct Flanges**



Downflow Filters

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

Use either filter type:

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

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

The filters supplied with the furnace may be installed in the return air plenum above the furnace. A filter rack is supplied with each furnace. See **Figure 27**.

Figure 27 **Filter Rack Installation**

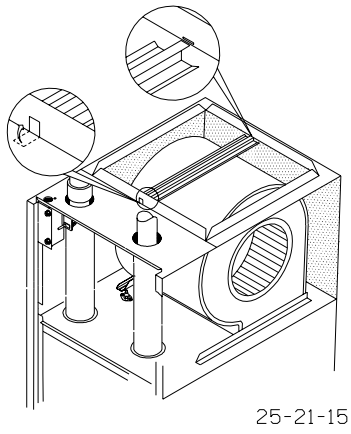
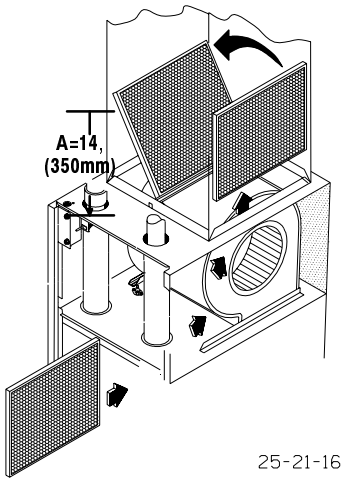


Figure 28 **Filter Installation**



NOTE: The return air plenum **MUST** extend a sufficient height above dimension "A" (**Figure 28**) to provide for the attachment of a return air duct or grille above the filters.

1. Insert end of filter rack with $^3/_4$" (19mm) flange into slot in the back of the unit. See **Figure 27**.

2. With filter rack pushed back, insert front end with $^1/_4$"(6mm) flange into position and push into front slot. with filter rack pushed as far forward as it will go, bend $^1/_4$"(6mm) flange and $^3/_4$"(19mm) flange up 90°. See **Figure 27.**

3. Filters can only be installed through the right hand side of the unit blower opening. Slide filter into unit until it is in position to be pushed up and over into place on the left hand side of unit. See **Figure 28**.

NOTE: Plenum must be fitted as close to the return air flange of the unit as possible to eliminate any air bypassing the filters. These instructions are stated for a person standing in front and facing the furnace, right will be to your right.

4. Slide remaining filter into unit and up into place on right hand side of unit. See **Figure 28**.

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

Filter Removal

NOTE: These instructions are stated for a person standing in front and facing the furnace, right will be to your right.

1. Remove blower compartment door.
2. Reach up above right side of blower and lift dirty filter up and out of rack at top of furnace.
3. Straighten up filter and pull straight down at side of blower. Pull straight out through door opening.
4. For left filter, reach up and across, straighten up filter and move across and down right side.
5. Vacuum clean or wash with warm water and dry thoroughly before replacing. Reinstall in reverse order.

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.

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.

Gas Supply Pressure

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

Manifold Gas Pressure Adjustment

NOTE: Make adjustment to manifold pressure with burners operating.

⚠ WARNING

Fire or explosion hazard.

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

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

1. With gas **OFF**, Connect U-Tube manometer to tapped opening on gas valve. Use manometer with a 0 to 12 inches water column range.

2. Turn gas **ON** and remove adjustment screw cover on gas valve. Turn counterclockwise to decrease pressure and clockwise to increase.

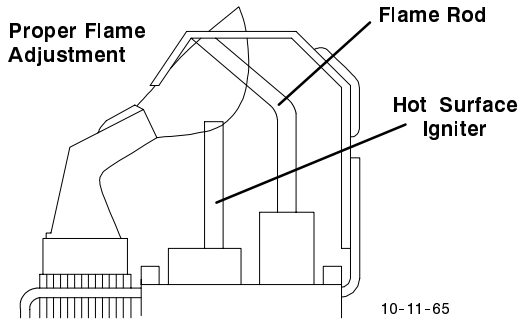
NOTE: Adjustment screw cover **MUST** be placed on gas valve before reading manifold pressure and operating furnace.

3. For altitudes up to 2000′, set pressure to value shown in **Table 7**, ± 0.3″ (8mm) water column. For altitudes of 2000′ to 8000′, see Section 6 for correct pressure valve.

Adjust Pilot Burner

The furnace has a pilot flame to light the main burner. The flame should surround $^3/_8$″ to $^1/_2$″ of the thermocouple. See **Figure 29.** To adjust, remove cap from pilot adjusting screw on gas valve. Turn screw counterclockwise to increase or clockwise to decrease flame as required. Replace cap for adjusting screw.

Figure 29 Pilot Burner



Main Burner Flame Check

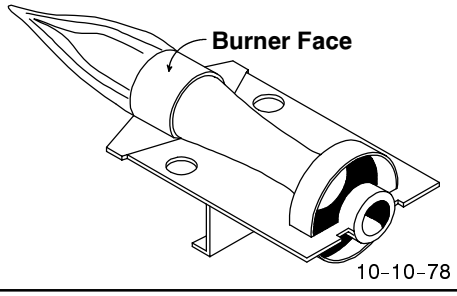
Allow the furnace to run approximately 10 minutes then inspect the main burner and pilot flames. See **Figure 30**.

Check for the following (**Figure 30**):

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

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

Figure 30 Main Burner



Temperature Rise Check

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

To check temperature rise,use the following procedure:

1. Place thermometers in supply and return air registers as close to furnace as possible, avoiding direct radiant heat from heat exchangers.

2. Operate furnace continuously for 15 minutes with all registers and duct dampers open.

3. Take reading and compare with range specified on rating plate.

4. If the correct amount of temperature rise is **NOT** obtained, it may be necessary to change blower speed. A higher blower speed will lower the temperature rise. A lower blower speed will increase the temperature rise.

Changing Blower Speed

⚠ WARNING

Electrical shock hazard.

Turn OFF power to furnace before changing speed taps.

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

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

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

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

1. Refer to *Furnace Wiring Diagram* for location of the heating and cooling speed taps located on the electronic fan control as well as location of unused blower motor speed leads. Use the chart (**Table 9**) to determine the blower motor speed settings.

Table 9	Blower Speed Chart
Wire Color	**Motor Speed**
Black	High
Orange*	Med-High
Blue	Medium
Red	Low
* Med-High speed may not be provided on all models.	

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

   Note: For motors with (4) speed leads, it will be necessary to tape off the terminal of the motor speed lead removed from the "**Heat**" or "**Cool**" terminal with electrical tape since an open terminal will not be available at the **"Unused Motor Lead**" location.

Continuous Fan Operation

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

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

Separate speed selections for Heat, Cool, and Continuous Fan

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

Heating and Continuous Blower Speed the Same

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

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

9. Furnace Maintenance

CAUTION

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

See *"User's Information Manual".*

Labeling

CAUTION

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

Pressure Switch

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

10. Concentric Termination

Vent Termination Clearances

⚠ WARNING

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

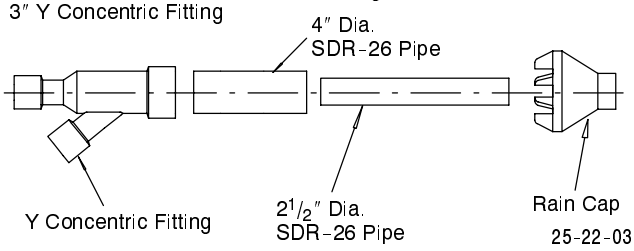
1. Determine termination locations based on clearances specified in following steps and as shown in **Figure 12, Figure 32, Figure 33, Figure 34, Figure 35,** and **Figure 36.**
2. The vent termination must be located at least 12″ (300mm) above ground or normally expected snow accumulation levels.
3. 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′ (1220mm) horizontally from any electric meter, gas meter, regulator, and any relief equipment. These distances apply **ONLY** to U.S. installations.
5. The vent termination is to be located at least 3′ (914mm) above any forced air inlet located within 10′ (3m) ; and at least 10′ (3m) 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

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″ (50mm), $2^1/_2$″ (67mm) and 3″(75mm) 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**

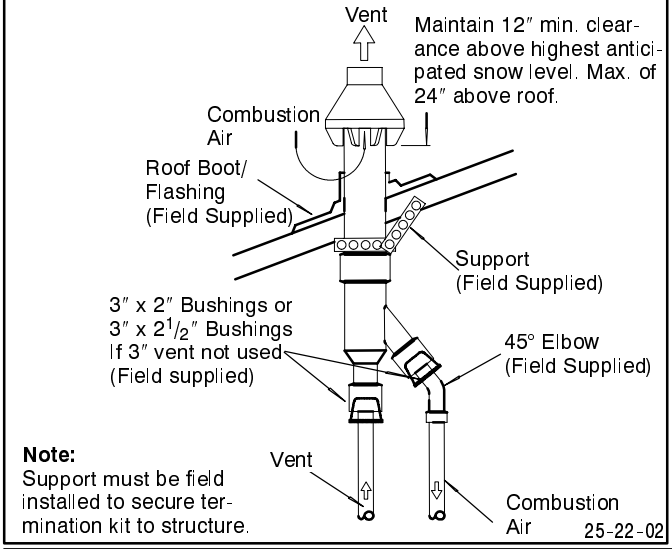
Kit Contents:
3″ Rain Cap
4″ Diameter SDR-26 Pipe, $37^1/_8$″ Long
$2^1/_2$″ Diameter SDR-26 Pipe, 24″ Long
3″ Y Concentric Fitting



Vertical & Horizontal Termination

1. Determine the pipe diameters required for the installation from **Table 10.**
2. 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 recalculation of flue products, debris or light snow and 4) visible vent vapor.

Figure 32 **Concentric Vent Roof Installation**



Note:
Support must be field installed to secure termination kit to structure.

Figure 33 **Concentric Vent Dimensional Drawing**

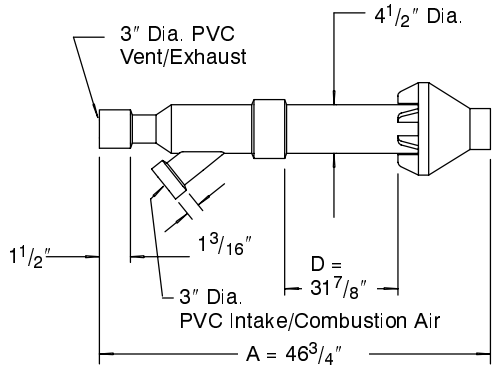


Table 10 **3″ Concentric Termination Kit NAHA001CV Venting Table Dual Piping ONLY**

No. of Elbows	0-9′	10-14′	15-19′	20-24′	25-29′	30-34′	35-40′
50,000 Btuh Furnaces							
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

1. Do not include the field supplied 45° elbow in the total elbow count.
2. 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.
3. Elbows are DWV long radius type for 2″ and 3″ vents; schedule 40 (sharp radius) for $2^1/_2$″.

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

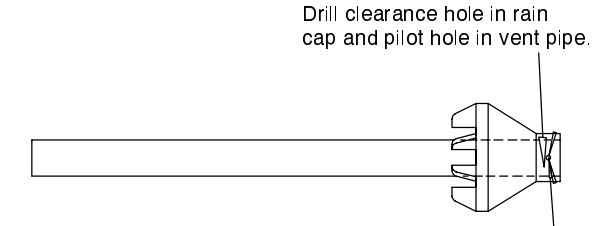
If assembly needs to be extended to meet height or side wall thickness requirement, the two pipes supplied in the kit may be replaced by using the same diameter solid, single (no coupling connections) field supplied SDR-26 PVC (ASTM D2241) pipes. Do not extend dimension D more than 60″. (See **Figure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

⚠ CAUTION

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

5. Partially assemble the concentric vent termination kit. Clean and cement the parts using the procedures for Joining Pipe and Fittings section of the manual. A) Cement the Y Concentric fitting to the 4″ (102mm) diameter kit pipe. (See **Figure 31)** B) Cement the 3″ (76mm) rain cap to the $2^1/_2$″ (mm) diameter kit part. (See **Figure 31) 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**



⚠ WARNING

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 property damage, personal injury and/or death.

⚠ WARNING

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 property damage, personal injury and/or death.

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**

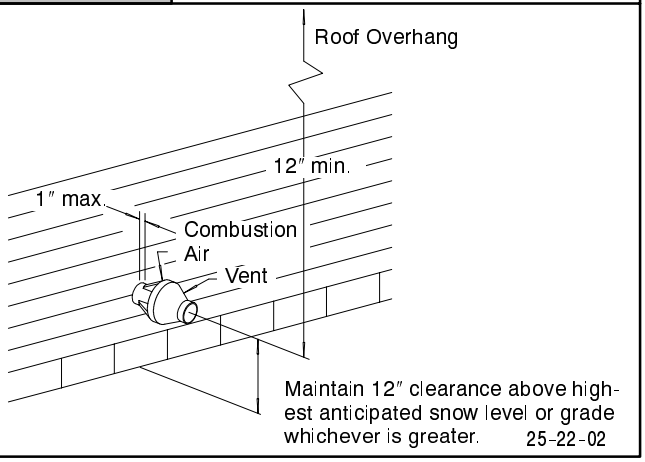
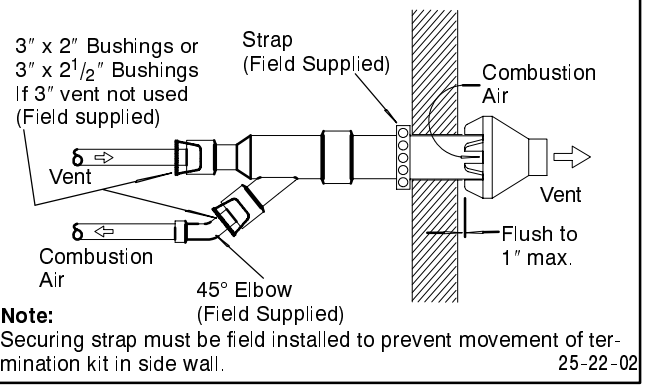


Figure 36 — **Concentric Vent Sidewall Attachment**



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.
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.