

Installation

80+ Single Stage Category I Furnace

See section 4 for Category I definition.

Instructions

Dedicated Downflow *8DNL

* Denotes Brands (C, H, T)

SAFETY REQUIREMENTS

Recognize safety information. This is the safety-alert symbol . When you see this symbol on the furnace and in instruction 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 **may** result in minor personal injury or product and property damage. *NOTE* is used to highlight suggestions that will result in enhanced installation, reliability, or operation.

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 furnace and other safety precautions that may apply.

Follow all safety codes. In the United States, follow all safety codes including the National Fuel Gas Code (NFGC) ANSI Z223.1-2002/NFPA 54-2002. In Canada, refer to the National Standard of Canada Natural Gas and Propane Installation Code (NSCNGPIC) CSA B149.1-00. 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.

International Comfort Products, LLC
Lewisburg, TN 37091



INSTALLER: Affix these instructions on or adjacent to the furnace.

CONSUMER: Retain these instructions for future reference.

Table of Contents

1. Safe Installation Requirements	3	7. Gas Supply and Piping	16
2. Installation	4	8. Electrical Wiring	18
3. Combustion & Ventilation Air	6	9. Ductwork and Filter	19
4. Gas Vent Installation	9	10. Checks and Adjustments	22
5. Horizontal Venting	11	11. Furnace Maintenance	26
6. Masonry Chimney Venting	13	12. Sequence of Operation & Diagnostics	27
		Tech Support and Parts	29



WARNING

ELECTRIC SHOCK HAZARD
Failure to follow safety warnings exactly could result in injury, death, and/or property damage.
Turn Off All Power Before Servicing.

WARNING

CARBON MONOXIDE POISONING AND FIRE HAZARD.
Failure to follow safety warnings exactly could result in serious injury, death, and/or property damage.
This furnace is not designed for use in mobile homes, trailers or recreational vehicles.

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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: _____

Dealer Comments: _____

Business Card Here

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

Drip-Leg Upstream of Gas Valve? 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 *Checks and Adjustments*
Section). _____

Measured Manifold Pressure: _____

Thermostat OK? YES NO

Subbase Level? YES NO

Anticipator Set? YES NO Set At?: _____

Breaker On? YES NO

Date of Installation: _____

Date of Start-Up: _____

1. Safe Installation Requirements

⚠ WARNING

FIRE, EXPLOSION, AND ASPHIXIATION HAZARD

Improper adjustment, alteration, service, maintenance or installation could cause serious injury, death and/or property damage.

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

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

NOTE: This furnace is design-certified by CSA International (formerly AGA and CGA) for installation in the United States and Canada. Refer to the appropriate codes, along with this manual, for proper installation.

- Use only the Type of gas approved for this furnace (see **Rating Plate** on unit). Overfiring will result in failure of heat exchanger and cause dangerous operation. (Furnaces can be converted to L.P. gas with approved kit.)
 - Install this furnace only in a location and position as specified in "2. *Installation*" of these instructions.
 - Provide adequate combustion and ventilation air to the furnace as specified in "3. *Combustion and Ventilation Air*" of these instructions.
 - Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in "4. *Gas Vent Installation*, 5. *Horizontal Venting* and 6. *Masonry Chimney Venting*" of these instructions.
 - Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections, as specified in "7. *Gas Supply and Piping, Final Check*" of these instructions.
 - Always install furnace to operate within the furnace's intended temperature-rise range with a duct system which has an external static pressure within the allowable range, as specified in "*Technical Support Manual*" of these instructions.
 - When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.
 - A gas-fired furnace for installation in a residential garage must be installed as specified in "2. *Installation*" of these instructions.
 - This furnace is not to be used for temporary heating of buildings or structures under construction. See "2. *Installation, item 10* "
- This furnace is **NOT** approved for installation in mobile homes, trailers or recreation vehicles.
 - Seal around supply and return air ducts.
 - Install correct filter type and size.
 - Unit **MUST** be installed so electrical components are protected from direct contact with water.

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 encourages installation of carbon monoxide alarms. 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. 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.

Therefore, to help alert people of potentially dangerous carbon monoxide levels, you should have a commercially available carbon monoxide alarm that is listed by a nationally recognized testing agency in accordance with Underwriters Laboratories Inc. Standard for Single and Multiple Station Carbon Monoxide Alarms, ANSI/UL 2034 or the CSA 6.19-01 Residential Carbon Alarming Devices installed and maintained in the building or dwelling concurrently with the gas-fired furnace installation (see Note below). The alarm should be installed as recommended by the alarm manufacturer's installation instructions.

- 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 extinguisher and smoke alarms 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 alarms and makes no representations regarding any brand or type of alarms.

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

1. **Thoroughly read this manual and labels on the unit.** This will help you understand how your unit operates and the hazards involved with gas and electricity.
2. **Do not use this unit if any part has been under water.** Immediately call a qualified service agency 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.

Frozen Water Pipe Hazard

⚠ WARNING

WATER DAMAGE TO PROPERTY HAZARD

Failure to protect against the risk of freezing could result in property damage and/or personal injury.

Do not leave your home unattended for long periods during freezing weather without turning off water supply and draining water pipes or otherwise protecting against the risk of frozen pipes and resultant damage.

Your furnace is designed solely to provide a safe and comfortable living environment. The furnace is NOT designed to ensure that water pipes will not freeze. It is equipped with several safety devices that are designed to turn the furnace off and prevent it from restarting in the event of various potentially unsafe conditions.

2. Installation

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD.

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

If this furnace is replacing a previously common-vented furnace, it may be necessary to resize the existing vent system to prevent oversizing problems for the other remaining appliances(s). See *Venting and Combustion Air Check* in the *4. Gas Vent Installation* section of this instruction.

Location and Clearances

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

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD.

Failure to follow safety warnings exactly could result in serious injury, death, or property damage.

Do NOT operate furnace in a corrosive atmosphere containing chlorine, fluorine or any other damaging chemicals, which could shorten furnace life.

Refer to *3. Combustion & Ventilation Air* section, *Contaminated Combustion Air* for combustion air evaluation and remedy.

Installation Requirements

1. Install furnace level.
2. This furnace is NOT to be used for temporary heat of buildings or structures under construction.

If your furnace remains off for an extended time, the pipes in your home could freeze and burst, resulting in serious water damage.

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

1. Turn off the water supply to the structure and drain the water lines if possible and add an antifreeze for potable water to drain traps and toilet tanks. Open faucets in appropriate areas.

-or-

2. Have someone check the structure frequently during cold weather to make sure it is warm enough to prevent pipes from freezing. Instruct them on a service agency to call to provide service, if required.

-or-

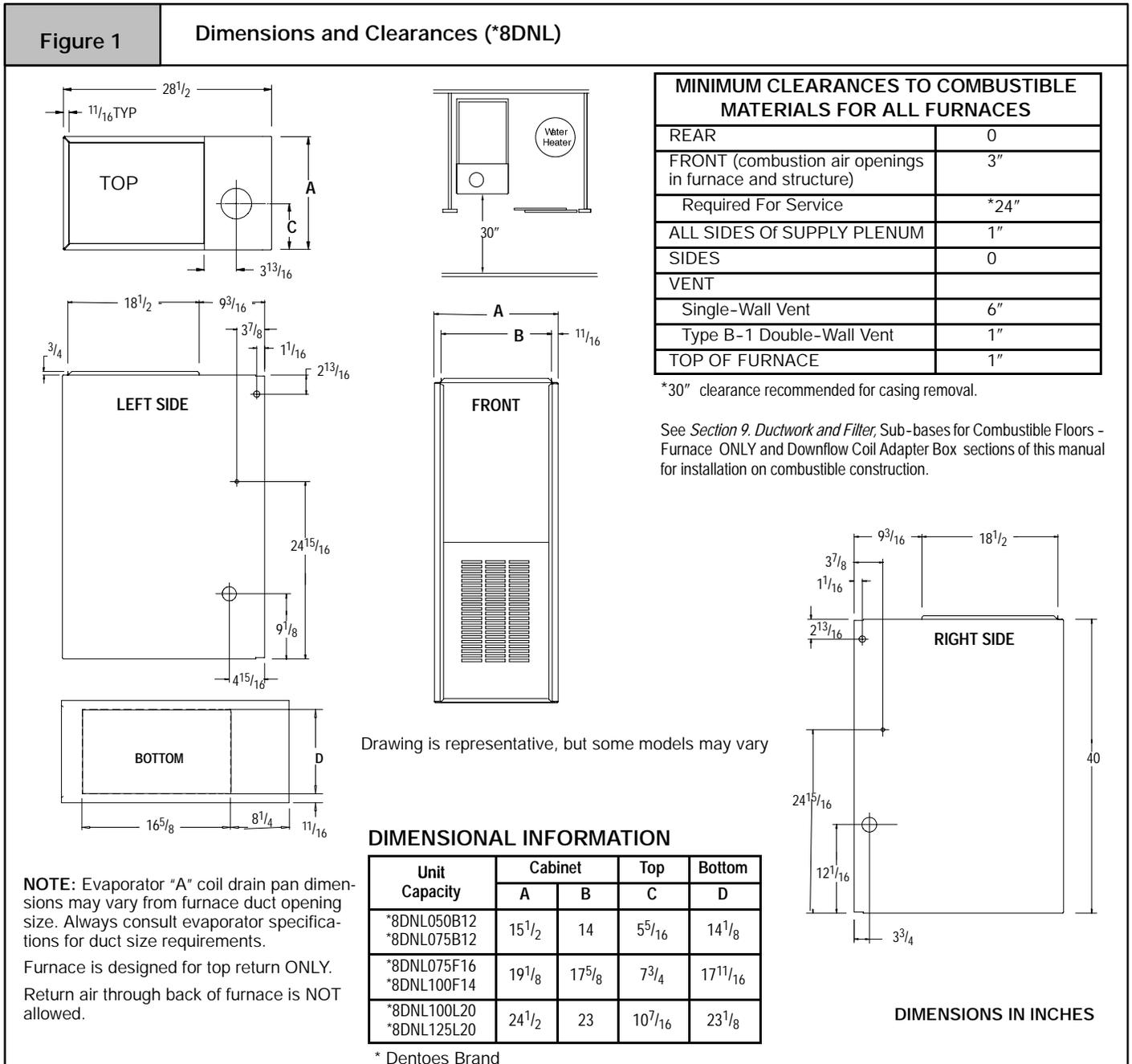
3. Install a reliable remote sensing device that will notify somebody of freezing conditions within the home.

3. Install furnace as centralized as practical with respect to the heat distribution system.
4. Install the vent pipes as short as practical. (See *4. Gas Vent Installation* section).
5. Do NOT install furnace directly on carpeting, tile or other combustible material. See *9. Ductwork and Filter* Sub-base for Combustible Floors.
6. Maintain clearance for fire safety and servicing. A front clearance of 30" is minimum for access to the burner, controls and filter. See clearance requirements in **Figure 1**.
7. Use a raised base if the floor is damp or wet at times.
8. Residential garage installations require:
 - Burners and ignition sources installed at least 18" (457 mm) above the floor.
 - Furnace must be located or physically protected from possible damage by a vehicle.
9. If the furnace is to be suspended from the floor joists in a basement or 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 bottom side 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.
10. This furnace may be used for construction heat provided that:
 - The furnace is permanently installed with all electrical wiring, piping, venting and ducting installed according to these installation instructions. A return air duct is provided, sealed to the furnace casing, and terminated outside the space containing the furnace. This prevents a negative pressure condition as created by the circulating air blower, causing a flame rollout and/or drawing combustion products into the structure.
 - The furnace is controlled by a thermostat. It may not be "hot wired" to provide heat continuously to the structure without thermostatic control.
 - Clean outside air is provided for combustion. This is to minimize the corrosive effects of adhesives, sealers and other construction materials. It also prevents the entrainment of drywall dust into combustion air, which can cause fouling and plugging of furnace components.

- The temperature of the return air to the furnace is maintained between 55° F (13° C) and 80° F (27° C) , with no evening setback or shutdown. The use of the furnace while the structure is under construction is deemed to be intermittent operation per our installation instructions.
- The air temperature rise is within the rated rise range on the furnace rating plate, and the firing rate has been set to the rating plate value.
- The filters used to clean the circulating air during the

construction process must be either changed or thoroughly cleaned prior to occupancy.

- The furnace, ductwork and filters are cleaned as necessary to remove drywall dust and construction debris from all HVAC system components after construction is completed.
- Verify proper furnace operating conditions including ignition, gas input rate, air temperature rise, and venting according to these installation instructions.



Furnace Installation

Inspect the rating plate to be certain the model number begins with "***8DNL**". This identifies the furnace as a dedicated downflow furnace that is permitted to be installed in a Downflow position. (see Figure 2).

* Denotes Brand

Downflow

⚠ WARNING

FIRE HAZARD.

Failure to install furnace on noncombustible subbase could result in death, personal injury and/or property damage.

Place furnace on noncombustible subbase on downflow applications, unless installing on noncombustible flooring.

The minimum clearances to combustion construction **MUST** be maintained between the furnace and adjacent construction, as shown in **Figure 1**.

In addition to clearances in **Figure 1**, clearance for the vent pipe must be considered.

A subbase for combustible floors **MUST** be used when the furnace is installed as a downflow on combustible material. See "9. Ductwork and Filter".

3. Combustion & Ventilation Air

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD.

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

Use methods described here to provide combustion and ventilation air.

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

Combustion and ventilation air must be supplied in accordance with one of the following:

1. Section 8.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, (NFGC), ANSI Z223.1-2002/NFPA 54-2002 in the U.S.,
2. Sections 7.2, 7.3, 7.5, 7.6, 7.7, and 7.8 of National Standard of Canada, Natural Gas and Propane Installation Code (NSCNGPIC), CSA B149.1-00 in Canada,
3. Applicable provisions of the local building code.

When the installation is complete, check that all appliances have adequate combustion air and are venting properly. See *Venting And Combustion Air Check* in "4. Gas Vent Installation" Section in this manual.

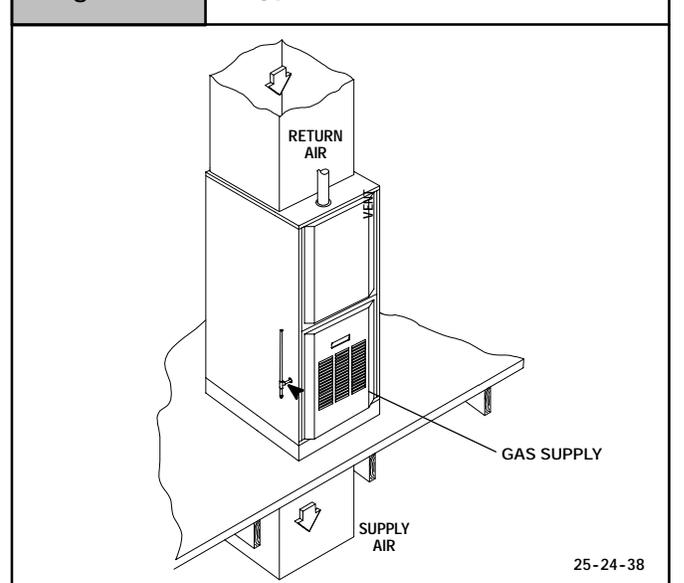
Contaminated Combustion Air

Installations in certain areas or types of structures could cause excessive exposure to contaminated air having chemicals or halogens that will result in safety and performance related problems and may harm the furnace. These instances must use only outdoor air for combustion.

The following areas or types of structures may contain or have exposure to the substances listed below. The installation must be

Figure 2

Typical Downflow Installation



evaluated carefully as it may be necessary to provide outdoor 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.

Outdoor Combustion Air Method

A space having less than 50 cubic feet per 1,000 BTUH input rating for all gas appliances installed in the space requires outdoor air for combustion and ventilation.

Air Openings and Connecting Ducts

1. Total input rating for all gas appliances in the space **MUST** be considered when determining free area of openings.
2. Connect ducts or openings directly to the outdoors.
3. When screens are used to cover openings, the openings **MUST** be no smaller than $1/4$ " mesh.
4. The minimum dimension of air ducts **MUST NOT** be less than 3" .
5. When sizing a grille, louver, or screen 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. Screens shall have a mesh size not smaller than $1/4$ ".

Requirements

- Provide the space with sufficient air for proper combustion and ventilation of flue gases using horizontal or vertical ducts or openings.
- Figure 3 illustrates how to provide combustion and ventilation

air when two permanent openings, one inlet and one outlet, are used.

- One opening **MUST** commence within 12" of the floor and the second opening **MUST** commence within 12" of the ceiling.
- Size openings and ducts per Table 1.

Figure 3 **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 Within 12" (300mm) of floor
Outlet Air Opening Must be Within 12" (300mm) of ceiling

(1) 1 Square Inch (6cm²) per 4000 BTUH
(2) 1 Square Inch (6cm²) per 2000 BTUH

- Horizontal duct openings require 1 square inch of free area per 2,000 BTUH (1,100 mm²/kW) of combined input for all gas appliances in the space (see Table 1).
 - Vertical duct openings or openings directly communicating with the outdoors require 1 square inch of free area per 4,000 BTUH (550 mm²/kW) for combined input of all gas appliances in the space (see Table 1).
- When one permanent outdoor opening is used, the opening requires:
 - 1 sq. in. of free area per 3,000 BTUH (700 mm²/kW) for combined input of all gas appliances in the space (see Table 1) and
 - not less than the sum of the areas of all vent connectors in the space.

nicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

- Combination of Indoor and Outdoor Air shall have:
 - Indoor openings that comply with the **Indoor Combustion Air** Method below and
 - Outdoor openings located as required in the **Outdoor Combustion Air** Method above and
 - Outdoor openings sized as follows.
 - Calculate the **Ratio** of all Indoor Space volume divided by required volume for **Indoor Combustion Air** Method.
 - Outdoor opening size reduction **Factor** is 1 minus the **Ratio** in 1) above.
 - Minimum size of Outdoor openings shall be the size required in **Outdoor Combustion Air** Method above multiplied by reduction **Factor**.

The opening shall commence within 12" of the top of the enclosure. Appliances shall have clearances of at least 1" from the sides and back and 6" from the front. The opening shall directly commu-

Table 1		Free Area			
BTUH Input Rating	Minimum Free Area Required for Each Opening or Duct to Outdoors				
	Two Horizontal Ducts (sq. in./2,000 BTUH)	Single Opening (sq. in./3,000 BTUH)	Two Vertical Ducts or Openings (sq. in./4,000 BTUH)	Round Duct (sq. in./4,000 BTUH)	
50,000	25 sq. in.	16.7 sq. in.	12.5 sq. in.	4"	
75,000	37.5 sq. in.	25 sq. in.	18.75 sq. in.	5"	
100,000	50 sq. in.	33.3 sq. in.	25 sq. in.	6"	
125,000	62.50 sq. in.	41.7 sq. in.	31.25 sq. in.	7"	
150,000	75 sq. in.	50 sq. in.	37.5 sq. in.	7"	

EXAMPLE: Determining Free Area

Furnace	Water Heater		Total Input	
100,000	30,000	=	(130,000 ÷ 4,000)	= 32.5 Sq. In. Vertical
Furnace	Water Heater		Total Input	
100,000	30,000	=	(130,000 ÷ 2,000)	= 65 Sq. In. Horizontal

Indoor Combustion Air

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD.

Failure to supply adequate combustion air could result in death and/or personal injury.

Most homes will require additional air from outdoors for combustion and ventilation. A space with at least 50 cubic feet per 1,000 BTUH input rating or homes with tight construction may need outdoor air, supplied through ducts, to supplement air infiltration for proper combustion and ventilation of flue gases.

Standard and Known-Air-Infiltration Rate Methods

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Indoor air is permitted for combustion and ventilation, if the **Standard** or **Known-Air-Infiltration Rate** Method is used.

The **Standard** Method may be used, if the space has no less volume than 50 cubic feet per 1,000 BTUH input rating for all gas appliances installed in the space. The **standard** method permits indoor air to be used for combustion and ventilation air.

The **Known Air Infiltration Rate** Method shall be used if the infiltration rate is known to be less than 0.40 air changes per hour (ACH) and equal to or greater than 0.10 ACH. Infiltration rates greater than 0.60 ACH shall not be used. The minimum required volume of the space varies with the number of ACH and shall be determined per **Table 2** or **Equations 1 and 2**. Determine the minimum required volume for each appliance in the space, and add the volumes together to get the total minimum required volume for the space.

Table 2	MINIMUM SPACE VOLUME FOR 100% COMBUSTION AND VENTILATION AIR FROM INDOORS (ft ³)							
	Other Than Fan-Assisted Total (1,000's Btuh)			Fan-assisted Total (1,000's Btuh)				
ACH	30	40	50	50	75	100	125	150
0.60	1,050	1,400	1,750	1,250	1,875	2,500	3,125	3,750
0.50	1,260	1,680	2,100	1,500	2,250	3,000	3,750	4,500
0.40	1,575	2,100	2,625	1,875	2,813	3,750	4,688	5,625
0.30	2,100	2,800	3,500	2,500	3,750	5,000	6,250	7,500
0.20	3,150	4,200	5,250	3,750	5,625	7,500	9,375	11,250
0.10	6,300	8,400	10,500	7,500	11,250	15,000	18,750	22,500
0.00	NP	NP	NP	NP	NP	NP	NP	NP

NP = Not Permitted

Table 2 Minimum Space Volumes were determined by using the following equations from the National Fuel Gas Code ANSI Z223.1/NFPA 54-2002, 8.3.3.2:

1. For **other than fan-assisted appliances** such as a draft hood-equipped water heater,

$$\text{Volume}_{\text{other}} = \frac{21 \text{ ft}^3}{\text{ACH}} \left(\frac{I_{\text{other}}}{1000 \text{ Btu / hr}} \right)$$

2. For **fan-assisted appliances** such as this furnace,

$$\text{Volume}_{\text{fan}} = \frac{15 \text{ ft}^3}{\text{ACH}} \left(\frac{I_{\text{fan}}}{1000 \text{ Btu / hr}} \right)$$

If:

I_{other} = combined input of all **other than fan-assisted appliances** in Btu/hr

I_{fan} = combined input of all **fan-assisted appliances** in Btu/hr

ACH = air changes per hour (ACH shall not exceed 0.60.)

The following requirements apply to the **Standard** Method and to the **Known Air Infiltration Rate** Method.

- Adjoining rooms can be considered part of a space, if there are no closable doors between rooms.
- Combining spaces on the same floor level. Each opening shall have a free area of at least 1 in²/1,000 BTUH (2,000 mm²/kW) of the total input rating of all gas appliances in the space, but not less than 100 in² (0.06 m²). Once opening shall commence within 12" (300 mm) of the ceiling and the second opening shall commence within 12" (300 mm) of the floor. The minimum dimension of air openings shall be at least 3 in. (80 mm).

- An attic or crawl space may be considered a space that freely communicates with the outdoors provided there are adequate ventilation openings directly to outdoors. Openings **MUST** remain open and **NOT** have any means of being closed off. Ventilation openings to outdoors **MUST** be at least 1 square inch of free area per 4,000 BTUH of total input rating for all gas appliances in the space.
- In spaces that use the **Indoor Combustion Air** Method, infiltration should be adequate to provide air for combustion, ventilation and dilution of flue gases. However, in buildings with unusually tight construction, additional air **MUST** be provided using the methods described in section titled **Outdoor Combustion Air Method**.
- Unusually tight construction is defined as Construction with:
 1. Walls and ceilings exposed to the outdoors 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° continuously, or 55° on an intermittent basis so that flue gases will not condense excessively in the heat exchanger. Excessive condensation will shorten the life of the heat exchanger and possibly void your warranty.

4. Gas Vent Installation

⚠ WARNING

CARBON MONOXIDE POISONING, FIRE AND EXPLOSION HAZARD.

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

Read and follow all instructions in this section.

Install the vent in compliance with codes of the country having jurisdiction, local codes or ordinances and these instructions.

This Category I furnace is fan-assisted. A fan assisted appliance is an appliance equipped with an integral mechanical means to either draw or force products of combustion through the heat exchanger.

Category I furnace definition: A central furnace which operates with a non-positive vent static pressure and with a flue loss not less than 17 percent. These furnaces are approved for common-venting and multi-story venting with other fan-assisted or draft hood-equipped appliances in accordance with the NFGC or NSCNPGIC.

Category I Safe Venting Requirements

Category I furnace vent installations shall be in accordance with Parts 10 and 13 of the National Fuel Gas Code (NFGC), ANSI Z223.1-2002/NFPA 54-2002; and/or Section 7 and Appendix C of the CSA B149.1-00, National Standard of Canada, Natural Gas and Propane Installation Code; the local building codes; furnace and vent manufacturer's instructions.

NOTE: The following instructions comply with the ANSI Z223.1/NFPA 54 National Fuel Gas Code and CSA B149.1 Natural Gas and Propane Installation code, based on the input rate on the furnace rating plate.

1. If a Category I vent passes through an attic, any concealed space or floor, use **ONLY** Type B or Type L double wall vent pipe. If vent pipe passes through interior wall, use Type B vent pipe with ventilated thimble **ONLY**.
2. Do **NOT** vent furnace into any chimney serving an open fireplace or solid fuel burning appliance.
3. Use the same diameter Category I connector or pipe as permitted by:
 - the **National Fuel Gas Code** Code (NFGC) ANSI Z223.1-2002 / NFPA 54-2002 sections 10 and 13 venting requirements in the United States

or

- the National Standard of Canada **Natural Gas and Propane Installation Code** (NSCNPGIC) CSA B149.1-00 section 7 and appendix C venting requirements in Canada.
4. Push the vent connector onto the furnace flue collar of the venter assembly until it touches the bead (at least $\frac{5}{8}$ " overlap) and fasten with at least two field-supplied, corrosion-resistant, sheet metal screws located at least 140° apart.
 5. Keep vertical Category I vent pipe or vent connector runs as short and direct as possible.
 6. Vertical outdoor runs of Type-B or **ANY** single wall vent pipe below the roof line are **NOT** permitted.
 7. Slope all horizontal runs up from furnace to the vent terminal a minimum of $\frac{1}{4}$ " per foot (21 mm/m).
 8. Rigidly support all horizontal portions of the venting system every 6' or less using proper clamps and metal straps to prevent sagging and ensure there is no movement after installation.
 9. Check existing gas vent or chimney to ensure they meet clearances and local codes. See **Figure 1**
 10. The furnace **MUST** be connected to a factory built chimney or vent complying with a recognized standard, or a masonry or concrete chimney lined with a lining material acceptable to the authority having jurisdiction. **Venting into an unlined masonry chimney or concrete chimney is prohibited. See the 6. Masonry Chimney Venting section in these instructions.**
 11. Fan-assisted combustion system Category I furnaces shall not be vented into single-wall metal vents.
 12. Category I furnaces must be vented vertically or nearly vertically, unless equipped with a listed mechanical venter.
 13. Vent connectors serving Category I furnaces shall not be connected into any portion of mechanical draft systems operating under positive pressure.
- A 4-to-3 inch reducer is permitted at the flue collar when installing a 50,000 Btuh gas input furnace, if the installation meets all the following requirements for sizing the vent connectors and vents:
1. The National Fuel Gas Code, ANSI Z223.1/NFPA-54-2002, sections 10.5.3.1(1), 10.6.3.1(2), 10.10.3.1, 13.1.2, 13.1.10, and 13.2.21(1) through (3) in the U.S. or
 2. The Natural Gas and Propane Installation Code CSA B149.1-00, sections 7.13.1(b), 7.13.2(b), 7.18.5(b), and Appendix C-GVR no. 2. in Canada.

Venting and Combustion Air Check

NOTE: When an existing Category I furnace is removed or replaced, the original venting system may no longer be sized to properly vent the attached appliances, and to make sure there is adequate combustion air for all appliances, **MAKE THE FOLLOWING CHECK.**



WARNING

CARBON MONOXIDE POISONING HAZARD

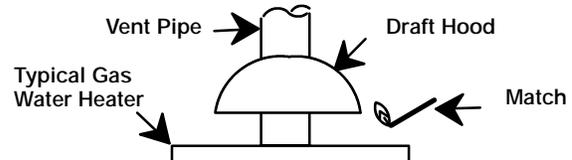
Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation, could result in carbon monoxide poisoning or death:

The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:

1. Seal any unused openings in the venting system.
2. Inspect the venting system for proper size and horizontal pitch, as required in the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* or *CSA B149.1, Natural Gas and Propane Installation Code* and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. As far as practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building.
4. Close fireplace dampers.
5. 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 are operating at maximum speed. Do not operate a summer exhaust fan.
6. Follow the lighting instructions. Place the appliance being inspected into operation. Adjust the thermostat so appliance is operating continuously.
7. Test for spillage from draft hood equipped appliances at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle. (Figure 4)
8. If improper venting is observed, during any of the above tests, the venting system must be corrected in accordance with the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* and/or *CSA B149.1, Natural Gas and Propane Installation Code*.
9. After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-fired burning appliance to their previous conditions of use.

Figure 4

Vent Check



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

Venting to Existing Masonry Chimney

Dedicated venting of one fan assisted furnace into any masonry chimney is restricted. A chimney must first be lined with either Type B vent sized in accordance with NFGC tables 13.1 or 13.2 or a listed metal lining system, sized in accordance with the NFGC section 13.1.7 for a single appliance or 13.2.19 for multiple appliances, or NSCNGPIC Appendix C, section 10; or Venting into a masonry chimney is permitted as outlined with use of an optional listed masonry chimney kit. (See Section 6 *Masonry Chimney Venting* of these instructions.)

Listed, corrugated metallic chimney liner systems in masonry chimneys shall be sized in the U.S. by using NFGC tables per 13.1.7 for dedicated venting and per 13.2.19 for common venting with the maximum capacity reduced by 20% (0.80 X maximum capacity) and the minimum capacity as shown in the applicable table. Corrugated metal vent systems installed with bends or offsets require additional reduction of 5% of the vent capacity for each bend up to 45° and 10% of the vent capacity for each bend from 45° up to 90°. In Canada, use the NSCNGPIC.

NOTE: Two(2) 45° elbows are equivalent to one (1) 90° elbow.

Combined Venting into a Masonry Chimney

Venting into a masonry or concrete chimney is only permitted as outlined in the NFGC or NSCNGPIC venting tables. Follow all safe venting requirements.

Note: See section "6. *Masonry Chimney Venting*".

5. Horizontal Venting

Category I Furnaces With External Power Venters

In order to maintain a Category I classification of fan-assisted furnaces when vented horizontally with sidewall termination, a power venter is **REQUIRED** to maintain a negative pressure in the venting system.

In the U.S.: Per the NFGC, a listed power venter may be used, when approved by the authority having jurisdiction.

In Canada: Only power venters approved by the appliance manufacturer and where allowed by the authority having jurisdiction may be used

Please consult the Fields Controls Co. or Tjernlund Products, Inc. for power venters certified for use with our furnaces.

Vent Termination

Venting Through a Non-Combustible and Combustible Wall

Consult External Power Venter manufacturer instructions.

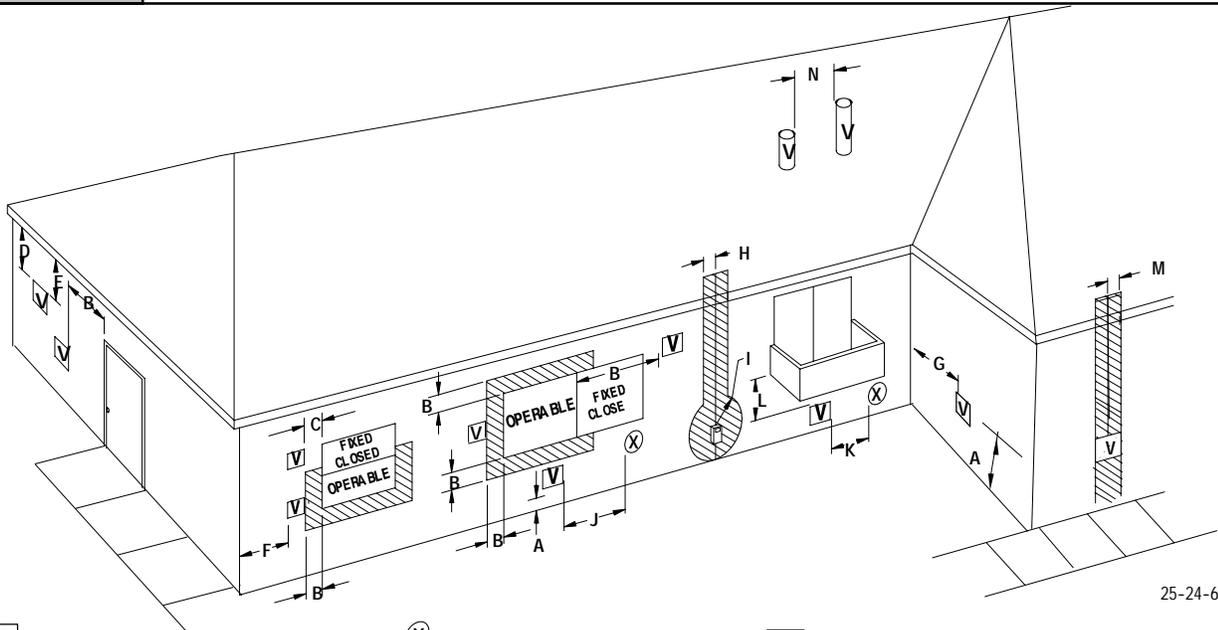
Select the power venter to match the Btuh input of the furnace being vented. Follow all of the power venter manufacturer's installation requirements included with the power venter for:

- venting installation,
- vent terminal location,
- preventing blockage by snow,
- protecting building materials from degradation by flue gases,
- see **Figure 5** for required vent termination.

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

Figure 5

Other than Direct Vent Termination Clearance



25-24-65-2

V VENT TERMINAL **X** AIR SUPPLY INLET **▨** AREA WHERE TERMINAL IS NOT PERMITTED

Item	Clearance Descriptions	Canadian Installation (1)	U.S. Installation (2)
A	Clearance above grade, veranda, porch, deck, balcony, or anticipated snow level	12" (30cm) #	12" (30 cm)
B	Clearance to a window or door that may be opened	6" (15 cm) for appliances ≤ 10,000 BTUH (3kW), 12" (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36" (91 cm) for appliances > 100,000 Btuh (30 kW)	4' (1.2 m) below or to the side of the opening. 1' (30 cm) above the opening.
C	Clearance to a permanently closed window	*	*
D	Vertical clearance to a ventilated soffit located above the terminal within a horizontal distance of 2' (61cm) from the centerline of the terminal	*	*
E	Clearance to an unventilated soffit	*	*
F	Clearance to an outside corner	*	*
G	Clearance to an inside corner	*	*
H	Clearance to each side of the centerline extended above electrical meter or gas service regulator assembly	3' (91 cm) within 15' (4.5 m) above the meter/regulator assembly	3' (91 cm) within 15' (4.5 m) above the meter/regulator assembly
I	Clearance to service regulator vent outlet	3' (91 cm)	*
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6" (15 cm) for appliances ≤ 10,000 BTUH (3kW), 12" (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36" (91 cm) for appliances > 100,000 Btuh (30 kW)	4' (1.2 m) below or to the side of opening; 1' (30 cm) above opening.
K	Clearance to a mechanical air supply inlet	6' (1.83 m)	3' (91 cm) above if within 10' (3m horizontally)
L	Clearance under a veranda, porch, deck, or balcony	12" (30 cm) +	*
M	Clearance to each side of the centerline extended above or below vent terminal of the furnace to a dryer or water heater vent, or other appliance's direct vent intake or exhaust.	*	*
N	Clearance from a plumbing vent stack	3' (91 cm)	3' (91 cm)

(1.) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

(2.) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

18" (46 cm) above roof surface

+ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

* For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier and the manufacturer's installation instructions.

Notes:

1. The vent for this appliance shall not terminate
 - a. Over public walkways; or
 - b. Near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or property damage; or
 - c. Where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.
2. When locating vent terminations, consideration must be given to prevailing winds, location, and other conditions which may cause recirculation of the combustion products of adjacent vents. Recirculation can cause poor combustion, inlet condensate problems, and accelerated corrosion of the heat exchangers.

6. Masonry Chimney Venting

Chimney Inspection

All masonry chimney construction must conform to Standard ANSI/NFPA 211-2003 and to any state or local codes applicable. The chimney must be in good condition and a complete chimney inspection must be conducted prior to furnace installation. If the inspection reveals damage or abnormal conditions, make necessary repairs or seek expert help. See "The Chimney Inspection Chart" **Figure 6**. Measure inside area of tile-liner and exact height of chimney from the top of the chimney to the highest appliance flue collar or draft hood outlet.

Connector Type

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

Venting Restrictions for Chimney Types

Interior Chimney - has no sides exposed to the outdoors below the roofline. All installations can be single furnace or common vented with another draft hood equipped Category I appliance.

Exterior Chimney - has one or more sides exposed to the outdoors below the roof line. All installations with a 99% Winter Design Temperature* below 17°F must be common vented only with a draft hood equipped Category I appliance.

* The 99% Winter Design Dry-Bulb (db) temperatures are found in the 1993 ASHRAE Fundamentals Handbook, Chapter 24, Table 1 (United States) and 2 (Canada), or use the 99.6% heating db temperatures found in the 1997 or 2001 ASHRAE Fundamentals Handbook, Climatic Design Information chapter, Table 1A (United States) and 2A (Canada).

1. Vent connector is Type-B double-wall, and
2. This furnace is common vented with at least 1 draft hood-equipped appliance, and
3. The combined appliance input rating is less than the maximum capacity given in Table A, and
4. The input rating of each space-heating appliance is greater than the minimum input rating given in Table B for Masonry Chimneys for the local 99% Winter Design Temperature. Chimneys having internal areas greater than 38 square inches require furnace input ratings greater than the input ratings of these furnaces. See footnote at bottom of Table B, and
5. The authority having jurisdiction approves.

If all of these conditions cannot be met, an alternative venting design shall be used, such as a listed chimney-lining system, or a Type-B vent.



WARNING

CARBON MONOXIDE POISONING, FIRE AND EXPLOSION HAZARD.

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

These furnaces are CSA (formerly AGA and CGA) design-certified for venting into exterior clay tile-lined masonry chimneys with a factory accessory Chimney Adapter Kit. Refer to the furnace rating plate for correct kit usage. The Chimney Adapter Kits are for use with ONLY furnaces having a Chimney Adapter Kit number marked on the furnace rating plate.

If a clay tile-lined masonry chimney is being used and it is exposed to the outdoors below the roof line, relining might be required. Chimneys shall conform to the Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances ANSI/NFPA 211-2003 in the United States and to a Provincial or Territorial Building Code in Canada (in its absence, the National Building Code of Canada) and must be in good condition.

U.S.A. - Refer to Sections 13.1.9 or 13.2.20 of the NFGC or the authority having jurisdiction to determine whether relining is required. If relining is required, use a properly sized listed metal liner, Type-B vent, or a listed alternative venting design.

This model (*8DNL) is not listed for use with Chimney Adapter kits. A multi-position furnace in the downflow position that is listed for use with one of the Chimney Adapter Kits NAHA001DH or NAHA002DH may be used with a masonry chimney.

Canada (and U.S.A.) - This furnace is permitted to be vented into a clay tile-lined masonry chimney that is exposed to the outdoors below the roof line, provided:

Exterior Masonry Chimney, FAN+NAT Installations with Type-B Double-Wall Vent Connectors

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**Table A-
Combined Appliance
Maximum Input Rating in
Thousands of Btu per Hr**

VENT HEIGHT (FT)	INTERNAL AREA OF CHIMNEY (SQ IN.)			
	12	19	28	38
6	74	119	178	257
8	80	130	193	279
10	84	138	207	299
15	NR	152	233	334
20	NR	NR	250	368
30	NR	NR	NR	404

**Table B-
Minimum Allowable Input Rating of
Space-Heating Appliance in
Thousands of Btu per Hr**

VENT HEIGHT (FT)	INTERNAL AREA OF CHIMNEY (SQ IN.)				
	12	19	28	38	
17 to 26°F	Local 99% Winter Design Temperature: 17 to 26° F*				
	6	0	55	99	141
	8	52	74	111	154
	10	NR	90	125	169
	15	NR	NR	167	212
	20	NR	NR	212	258
5 to 16°F	Local 99% Winter Design Temperature: 5 to 16° F*				
	6	NR	78	121	166
	8	NR	94	135	182
	10	NR	111	149	198
	15	NR	NR	193	247
	20	NR	NR	NR	293
-10 to 4°F	Local 99% Winter Design Temperature: -10 to 4° F*				
	6	NR	NR	145	196
	8	NR	NR	159	213
	10	NR	NR	175	231
	15	NR	NR	NR	283
	20	NR	NR	NR	333
-11° F or lower	Local 99% Winter Design Temperature: -11° F or lower*				
	Not recommended for any vent configuration				

* The 99% Winter Design Dry-Bulb (db) temperatures are found in the 1993 ASHRAE Fundamentals Handbook, Chapter 24, Table 1 (United States) and 2 (Canada), or use the 99.6% heating db temperatures found in the 1997 or 2001 ASHRAE Fundamentals Handbook, Climatic Design Information chapter, Table 1A (United States) and 2A (Canada).

Inspections before the sale and at the time of installation will determine the acceptability of the chimney or the need for repair and/or (re)lining. Refer to the Chimney Inspection Chart to perform a chimney inspection.

If the inspection of a previously used tile-lined chimney:

- a. Shows signs of vent gas condensation, the chimney should be relined in accordance with local codes and the authority having jurisdiction. The chimney should be relined with a listed metal liner or Type-B vent to reduce condensation. If a condensate drain is required by local code, refer to the NFGC, Section 10.9 for additional information on condensate drains.
- b. Indicates the chimney exceeds the maximum permissible size in the tables, the chimney should be rebuilt or relined to conform to the requirements of the equipment being installed and the authority having jurisdiction.

A chimney without a clay tile liner, which is otherwise in good condition, shall be rebuilt to conform to ANSI/NFPA 211 or be lined with a UL listed (ULC listed in Canada) metal liner or UL listed Type-B vent. Relining with a listed metal liner or Type-B vent is considered to be a vent-in-a-chase.

If a metal liner or Type-B vent is used to line a chimney, no other appliance shall be vented into the annular space between the chimney and the metal liner.

APPLIANCE APPLICATION REQUIREMENTS

Appliance operation has a significant impact on the performance of the venting system. If the appliances are sized, installed, adjusted, and operated properly, the venting system and/or the appliances should not suffer from condensation and corrosion. The venting system and all appliances shall be installed in accordance with applicable listings, standards, and codes.

The furnace should be sized to provide 100 percent of the design heating load requirement plus any margin that occurs because of furnace model size capacity increments. Heating load estimates can be made using approved methods available from Air Conditioning Contractors of America (Manual J); American Society of Heating, Refrigerating, and Air-Conditioning Engineers; or other approved engineering methods. Excessive oversizing of the furnace could cause the furnace and/or vent to fail prematurely.

When a metal vent or metal liner is used, the vent or liner must be in good condition and be installed in accordance with the vent or liner manufacturer's instructions.

To prevent condensation in the furnace and vent system, the following precautions must be observed:

1. The return-air temperature must be at least 60°F db except for brief periods of time during warm-up from setback at no lower than 55°F db or during initial start-up from a standby condition.
2. Adjust the gas input rate per the installation instructions. Low gas input rate causes low vent gas temperatures, causing condensation and corrosion in the furnace and/or venting system. Derating is permitted only for altitudes above 2000'.
3. Adjust the air temperature rise to the midpoint of the rise range or slightly above. Low air temperature rise can cause low vent gas temperature and potential for condensation problems.
4. Set the thermostat heat anticipator or cycle rate to reduce short cycling.

Air for combustion must not be contaminated by halogen compounds which include chlorides, fluorides, bromides, and iodides. These compounds are found in many common home products such as detergent, paint, glue, aerosol spray, bleach, cleaning solvent, salt, and air freshener, and can cause corrosion of furnaces and vents. Avoid using such products in the combustion-air sup-

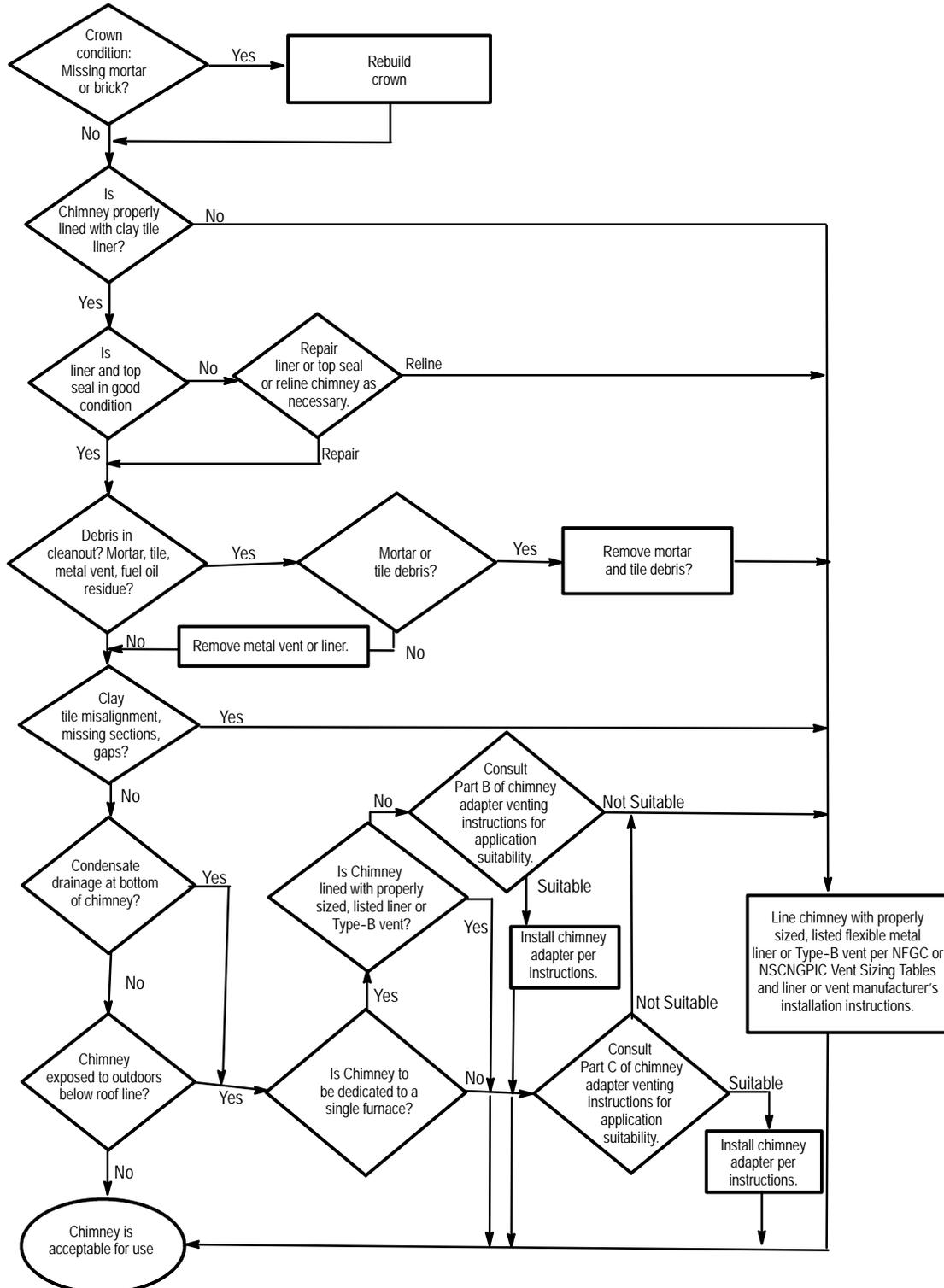
ply. Furnace use during construction of the building could cause the furnace to be exposed to halogen compounds, causing premature failure of the furnace or venting system due to corrosion. Vent dampers on any appliance connected to the common vent

can cause condensation and corrosion in the venting system. Do not use vent dampers on appliances common vented with this furnace.

Figure 6

CHIMNEY INSPECTION CHART

For additional requirements refer to the National Fuel Gas Code NFPA 54/ANSI Z223.1-2002 and ANSI/NFPA 211-2003 Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances in the U.S.A. or to the Canadian Installation Code CSA B149.1-00 in Canada.



7. Gas Supply and Piping

⚠ WARNING
CARBON MONOXIDE POISONING, FIRE AND EXPLOSION HAZARD.
 Failure to follow safety warnings exactly could result in serious injury, death, and/or property damage.
 Models designated for Natural Gas are to be used with Natural Gas ONLY, unless properly converted to use with LP gas.

Gas Supply Requirements

- Use only the Type of gas approved for this furnace. See rating plate for approved gas type.
- Gas input must not exceed the rated input shown on the rating plate. Overfiring will result in failure of heat exchanger and cause dangerous operation.
- Do not allow minimum supply pressure to vary downward. Doing so will decrease input to furnace. Refer to **Table 3** for gas supply. Refer to **Table 5** or **Table 6** for manifold pressures.

Table 3		Gas Pressures		
Gas Type	Supply Pressure			
	Recommended	Max.	Min.	
Natural	7"	14"	4.5"	
Propane	11"	14"	11"	

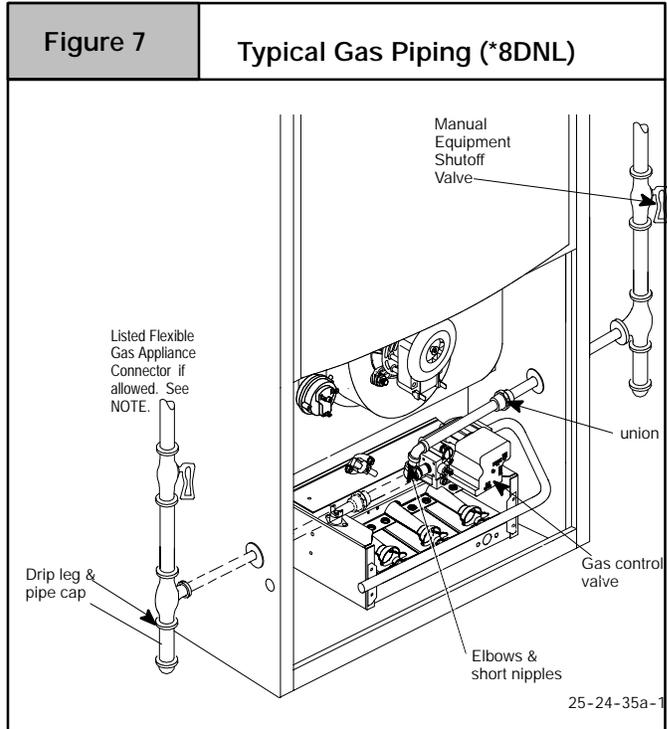
Gas Piping Requirements

NOTE: The gas supply line must be installed by a qualified service technician in accordance with all building codes.

NOTE: In the state of Massachusetts.

- Gas supply connections **MUST** be performed by a licensed plumber or gas fitter).
 - When flexible connectors are used, the maximum length shall not exceed 36" (915 mm).
 - When lever handle type manual equipment shutoff valves are used, they shall be T-handle valves.
 - The use of copper tubing for gas piping is **NOT** approved.
- Install gas piping in accordance with local codes, or in the absence of local codes, the applicable national codes.
 - It is recommended that a manual equipment shutoff valve be installed in the gas supply line outside the furnace. Locate valve as close to the furnace as possible where it is readily accessible. Refer to **Figure 7**.

⚠ WARNING
FIRE HAZARD
 Failure to follow safety warnings exactly could result in serious injury, death, and/or property damage.
 Use wrench to hold furnace gas control valve when turning elbows and gas line to prevent damage to the gas control valve and furnace.



3. Use black iron or steel pipe and fittings or other pipe approved by local code.
4. Use pipe thread compound which is resistant to natural and LP gases.
5. Use ground joint unions and install a drip leg no less than 3" long to trap dirt and moisture before it can enter gas control valve inside furnace.
6. Provide a 1/8" NPT plugged tapping for test gauge connection immediately up stream of gas supply connection to furnace.
7. Use two pipe wrenches when making connections to prevent gas valve from turning.

NOTE: If local codes allow the use of a flexible gas appliance connector, always use a new listed connector. Do not use a connector which has previously served another gas appliance.

8. Flexible corrugated metal gas connector may **NOT** be used inside the furnace or be secured or supported by the furnace or ductwork.
9. Properly size gas pipe to handle combined appliance load or run gas pipe directly from gas meter or LP gas regulator.
10. Install correct pipe size for run length and furnace rating.
11. Measure pipe length from gas meter or LP second stage regulator to determine gas pipe size.

Left Side Gas Supply Piping

Gas line can be installed directly to the gas valve through the hole provided in the left side of the cabinet. See **Figure 7**

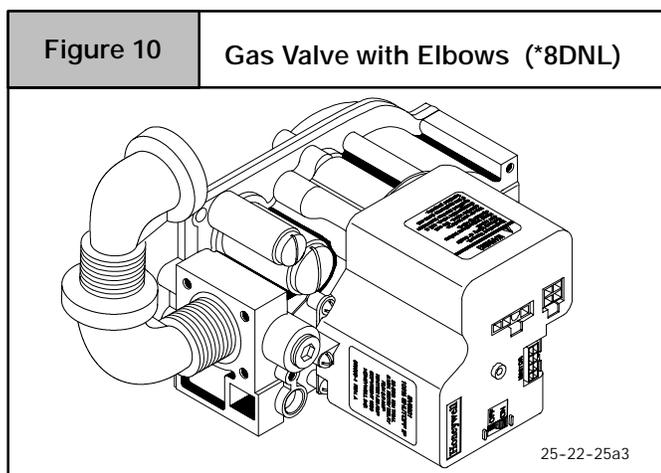
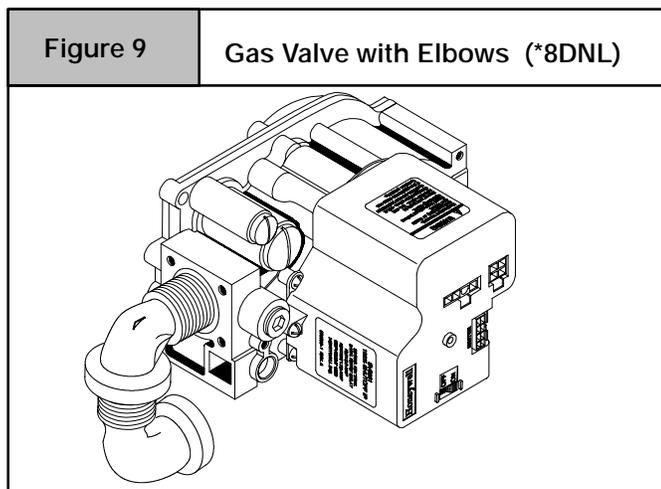
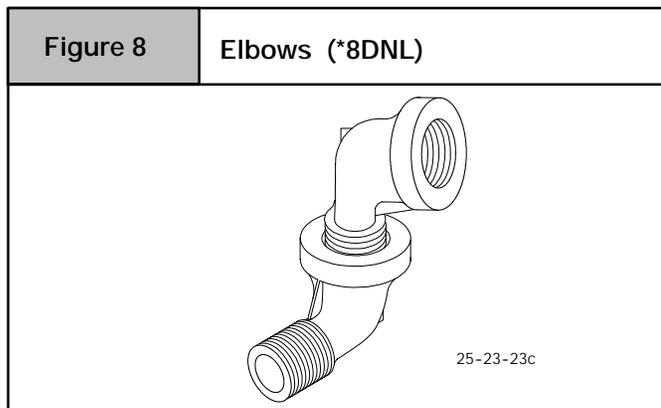
Right Side Gas Supply Piping

Two(2) 90° street elbows or two(2) 90° standard elbows and two(2) close nipples are required for right side gas supply. See **Figure 7**.

Piping with Street Elbows

1. Assemble the elbows so that the outlet of one(1) elbow is 90° from the inlet of the other. The elbows should be tight enough to be leak proof. An additional 1/4 turn will be required at the end of step 2, see **Figure 8**.

2. Screw elbow assembly into gas valve far enough to be leak proof. Position elbow assembly so that the inlet of the elbow is at the bottom of the gas valve. An additional $\frac{1}{2}$ turn will be required in step 3. Turn open end of inlet elbow to face the right side of the furnace ($\frac{1}{4}$ turn), see **Figure 9**.
3. Turn assembly an additional $\frac{1}{2}$ turn to position inlet near the top of the gas valve and in line with gas opening on right side of furnace, see **Figure 7** and **Figure 10**.



4. Gas supply line then can be run directly into opening of elbow.

Piping with Close Nipples and Standard Elbows

1. Assemble elbows and nipples similar to street elbows shown in **Figure 8**.

2. Follow steps 2 through 4 *Piping with Street Elbows*.

⚠ WARNING

FIRE OR EXPLOSION HAZARD.

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

A flexible corrugated metal gas connector must be properly installed, shall not extend through the side of the furnace, and shall not be used inside the furnace.

Black iron pipe shall be installed at the furnace gas control valve and extend a minimum of 2" outside furnace.

Additional LP Piping Requirements

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

⚠ WARNING

FIRE OR EXPLOSION HAZARD.

A natural gas or LP gas leak ignited by an open flame or spark could result in death, personal injury and/or property damage.

Natural gas is lighter than air and will rise. Liquefied petroleum (LP) gas is heavier than air and will settle and remain in low areas and open depressions.

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

Final Check

- Test all pipes for leaks.
- If orifices were changed, make sure they are checked for leaks.
- During pressure testing of gas supply piping system:
 - a. If test pressure does not exceed $\frac{1}{2}$ psi, isolate the furnace from the gas supply piping system by closing the equipment shutoff valve.
 - b. If test pressure exceeds $\frac{1}{2}$ psi, the furnace and its manual equipment shutoff valve must be disconnected from the gas supply piping system.
- To check for leaks apply soap suds or a liquid detergent to each joint. Bubbles forming indicate a leak.
- Do not use an open flame to test for gas leaks. Fire or explosion could occur.
- Correct even the smallest leak at once.

8. Electrical Wiring

⚠ WARNING

ELECTRICAL SHOCK HAZARD.

Failure to follow safety warnings exactly could result in serious injury, death, and/or property damage.

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

Power Supply Wiring

The furnace **MUST** be electrically wired and grounded in accordance with local codes, or in the absence of local codes, with the National Electrical Code (NEC), ANSI/NFPA 70-2002 in the U.S., or the Canadian Electrical Code (CEC), CSA C22.1 in Canada.

The power supply to the furnace connections must be between 104 VAC and 127 VAC during furnace operation for acceptable performance.

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 shall be used. Line voltage wires should conform to temperature limitation of 63° F (35° C) rise. Wire and circuit breaker sizing shall be based on the ampacity of the furnace electrical components plus the amps for all installed accessories (0.8 amps total for EAC and HUM). Ampacity can be determined by using the NEC or CEC.

Furnace must be installed so the electrical components are protected from water and connected to its own separate circuit.

J-Box Relocation

The J-box is installed on left side of casing. An alternate J-box location on right side can be used.

1. Remove bag containing two hole plugs and two self-tapping screws from loose parts bag in blower compartment.
2. Remove and discard two screws holding J-box to casing.
3. Move large hole plug from right to left J-box location.
4. Move J-box to alternate location and attach using two self-tapping screws from bag.
5. Apply two hole plugs from bag at left J-box location.
6. Position all wires away from sharp edges and moving parts. Do not pinch J-box or other wires when reinstalling blower compartment door.

Thermostat

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

Low voltage connections to furnace must be made on terminal board to fan control. (See **Figure 11**)

If cooling is used, the **Y** from the thermostat must be connected to the control board **Y** to energize cooling blower speed.

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

Optional Equipment

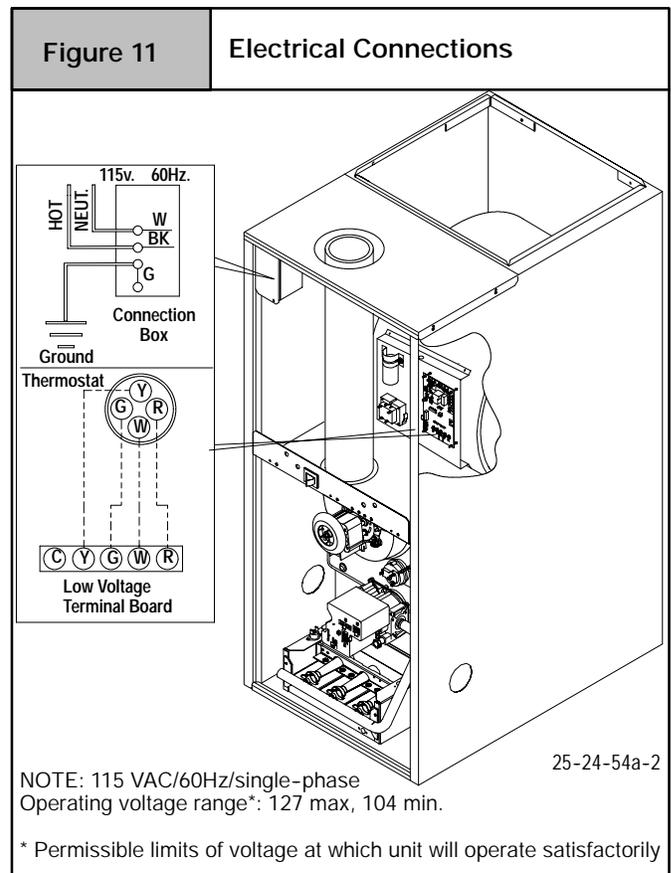
All wiring from furnace to optional equipment **MUST** conform to local codes or, in the absence of local codes, the applicable national codes. Install wiring in accordance with manufacturer's instructions.

Humidifier/Electronic Air Cleaner

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

NOTE: 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

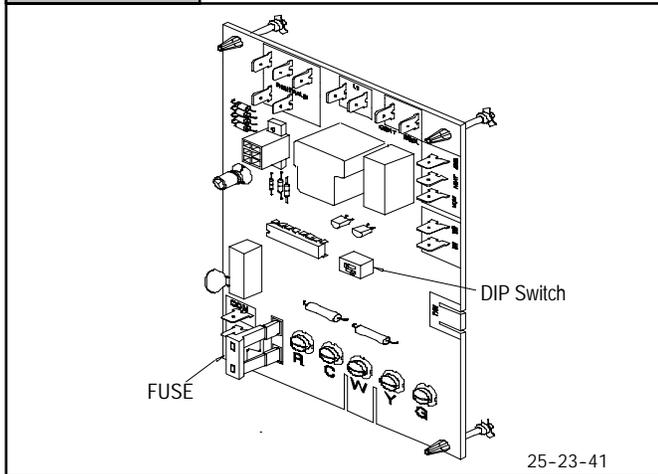
The fan control is preset at the factory with ON delay of 30 seconds in the heating mode. The blower **OFF** timing is preset at 140 seconds. If desired, the fan **OFF** delay can be reset to obtain the longest delay times while still maintaining comfort levels. See "Furnace Wiring Diagram".

Control Center Fuse

The 24V circuit contains a 5-amp, automotive-type fuse located on control center. (See **Figure 12**) Any electrical shorts of 24V wiring during installation, service, or maintenance may cause fuse to blow. If fuse replacement is required, use only a fuse of identical size (5 amp).

Figure 12

Fan Timer Connections



25-23-41

9. Ductwork and Filter

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD.

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

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

⚠ WARNING

FIRE HAZARD.

Failure to install furnace on noncombustible subbase could result in death, personal injury and/or property damage.

Place furnace on noncombustible subbase on downflow applications, unless installing on non-combustible flooring.

Duct Connections

This furnace may be installed in only a top return-air application. Return air duct connection through the side(s) or back of the furnace is **NOT** permitted. Supply duct connection is permitted to **ONLY** the bottom of the furnace.

Duct Design

Design and install air distribution system to comply with Air Conditioning Contractors of America manuals or other approved methods that conform to local codes and good trade practices.

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 supply and return air grilles. Any blower moving a high volume of air will produce audible noise which could be objectionable when the unit is located very close to a living area. It is often advisable to route the supply air ducts under the floor and return air ducts through the attic.

- Refer to furnace Technical Support Manual (BlowerData) for airflow information.

- Size ductwork to handle airflow for heating and air conditioning if used.

Duct Installation Requirements

- When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside of the space containing the furnace, the return air shall also be handled by duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD.

Failure to follow safety warning exactly could result in serious injury, death, and/or property damage.

Install cooling coil on furnace discharge. Cool air passing over heat exchanger could cause condensate to form resulting in heat exchanger failure.

- When the furnace is used with a cooling unit, the furnace shall be installed parallel with or on the upstream side of the cooling unit to avoid condensation in the heating element.
- With a parallel flow arrangement, the dampers or other means used to control flow of air shall be adequate to prevent chilled air from entering the furnace. Chilled air going through the furnace could cause condensation and shorten furnace life. Dampers (purchased locally) can be either automatic or manual. Manually or automatically operated dampers **MUST** be equipped with a means to prevent furnace or air conditioning operation, unless damper is in the full heat or cool position
- Installation of locking-type dampers is recommended in all branches, or in individual ducts to balance system's air flows.
- Non-combustible, flexible duct connectors are recommended for return and supply connections to furnace.
- If air return grille is located close to the fan inlet, install at least one, 90° air turn between fan and inlet grille to reduce noise.
- Ductwork installed in attic, or exposed to outside temperatures requires a minimum of 2" of insulation with outdoor type vapor barrier.
- Ductwork installed in an indoor unconditioned space requires a minimum of 1" of insulation with indoor type vapor barrier.

Inspection Panel on Some Models

For a furnace not equipped with a cooling coil, the outlet duct shall be provided with a removable access panel. This opening shall be accessible when the furnace is installed and shall be of such a size that the heat exchanger can be viewed for possible openings using light assistance or a probe can be inserted for sampling the air stream. This access cover shall be attached in such a manner as to prevent air leaks.

Sub-Bases for Combustible Floors - Furnace Only

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.

NOTE: Supply opening is $3\frac{7}{8}$ " from the rear of the furnace. Therefore maintain a $3\frac{7}{8}$ " clearance from a wall behind the furnace (where applicable).

1. Cut the opening in the floor according to the dimensions in **Table 4** because the base is equipped with locating tabs that center the base over the opening.

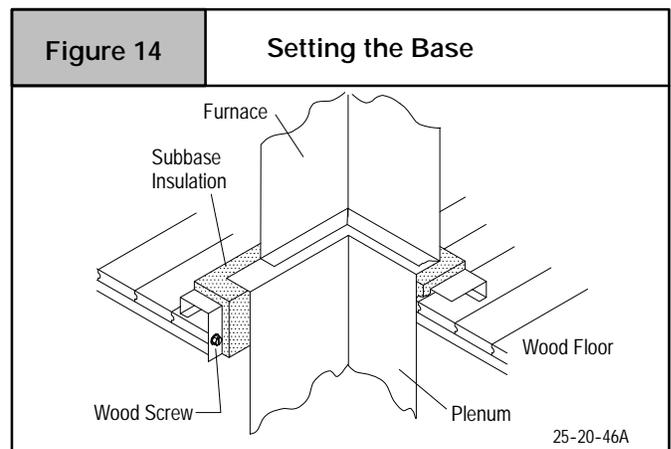
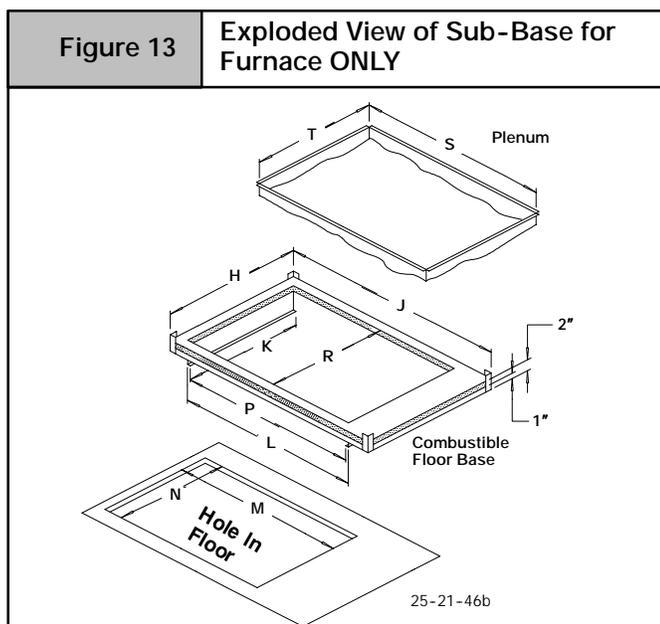
The opening in the base is $1\frac{1}{4}$ " shorter and $1\frac{1}{8}$ " narrower than the minimum required size of the opening in the floor. This is done to maintain a 1" clearance between the floor and the plenum.

2. Fabricate the plenum to the dimensions given in **Table 4**. Note that the dimensions given are outside dimensions.

Table 4		Sub-bases for Combustible Floors Dimensions									
sub-base for Combustible Floors Part Number	sub-base for Combustible Floor Dimensions				Opening In Floor		Opening In Base For Plenum		Typical Plenum Dimensions		
	H*	J*	K**	L	M	N	P	R	S	T	
Furnace Only											
NAHH001SB	15 $\frac{11}{16}$	28 $\frac{3}{4}$	14 $\frac{9}{16}$	16	16 $\frac{1}{4}$	14 $\frac{5}{8}$	15	13 $\frac{1}{2}$	15	13 $\frac{1}{2}$	
NAHH002SB	19 $\frac{5}{16}$	28 $\frac{3}{4}$	18 $\frac{3}{16}$	16	16 $\frac{1}{4}$	18 $\frac{1}{4}$	15	17 $\frac{1}{8}$	15	17 $\frac{1}{8}$	
NAHH010SB	24 $\frac{3}{4}$	28 $\frac{3}{4}$	23 $\frac{9}{16}$	16	16 $\frac{1}{4}$	23 $\frac{5}{8}$	15	22 $\frac{1}{2}$	15	22 $\frac{1}{2}$	
Subbase for Coil Box											
NAHH004SB	15 $\frac{11}{16}$	20 $\frac{9}{16}$	14 $\frac{9}{16}$	16	16 $\frac{1}{4}$	14 $\frac{5}{8}$	15	13 $\frac{1}{2}$	15	13 $\frac{1}{2}$	
NAHH005SB	19 $\frac{5}{16}$	20 $\frac{9}{16}$	18 $\frac{3}{16}$	16	16 $\frac{1}{4}$	18 $\frac{1}{4}$	15	17 $\frac{1}{8}$	15	17 $\frac{1}{8}$	
NAHH009SB	24 $\frac{11}{16}$	20 $\frac{9}{16}$	23 $\frac{9}{16}$	16	16 $\frac{1}{4}$	23 $\frac{5}{8}$	15	22 $\frac{1}{2}$	15	22 $\frac{1}{2}$	

* Outside Dimension
** Base Spacer Side To Side

3. Set the base over the opening in the floor, centering the opening in the base over the opening in the floor. Fasten the base to the floor with screws or nails. See **Figure 13** and **Figure 14**.
4. Drop the plenum through the opening in the base. The flange of the plenum should rest on top of the combustible floor base.



Sub-base for Combustible Floors- Downflow Coil Adapter Box

The subbase for combustible floors is required when a downflow furnace, **used with a downflow coil box**, is set on combustible flooring.

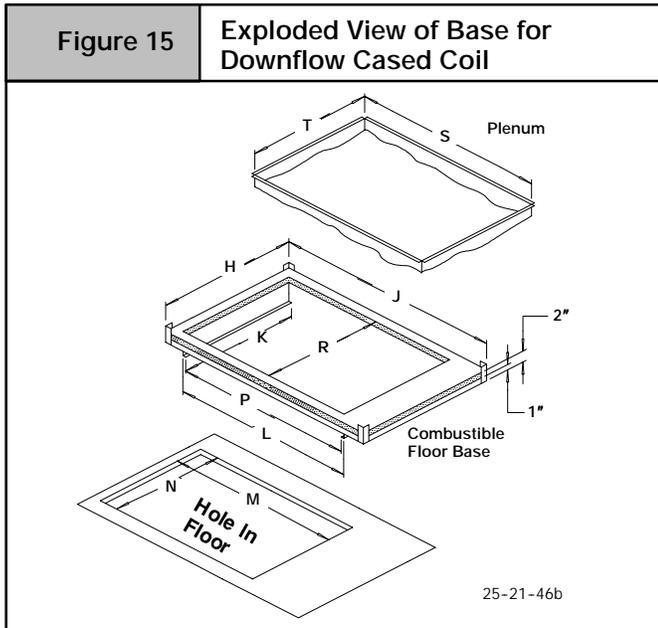
NOTE: Supply opening is $3\frac{7}{8}$ " from the rear of the furnace. Therefore maintain a $3\frac{7}{8}$ " clearance from wall (where applicable).

1. Cut the opening in the floor according to the dimensions in **Table 4** because the base is equipped with locating tabs that center the base over the opening.

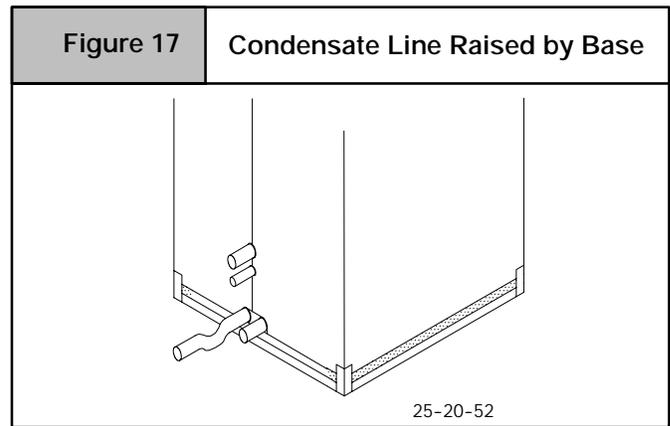
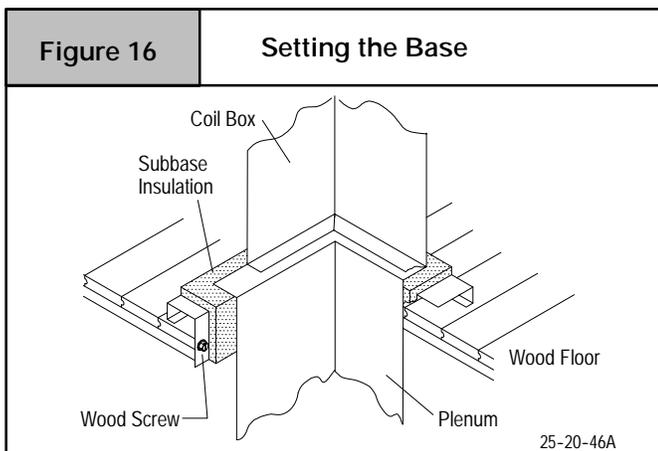
The opening in the base is $1\frac{1}{4}$ " shorter and $1\frac{1}{8}$ " narrower than the minimum required size of the opening in the floor. This is done to maintain a 1" clearance between the floor and the plenum.

2. Fabricate the plenum to the dimensions in **Table 4**. Note that the dimensions given are outside dimensions.

- Set the base over the opening in the floor, centering the opening in the base over the opening in the floor. Fasten the base to the floor with screws or nails. See **Figure 15** and **Figure 16**.
- Drop the plenum through the opening in the base. The flange of the plenum should rest on top of the combustible floor base.



Consideration must be given to the height of the base to allow for easy installation of the condensate drain. See **Figure 17**. 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



Non-Combustible Floor:

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

Filters:

A filter **MUST** be used.

The 18¹/₄" X 15³/₄" framed high-velocity 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 18**.

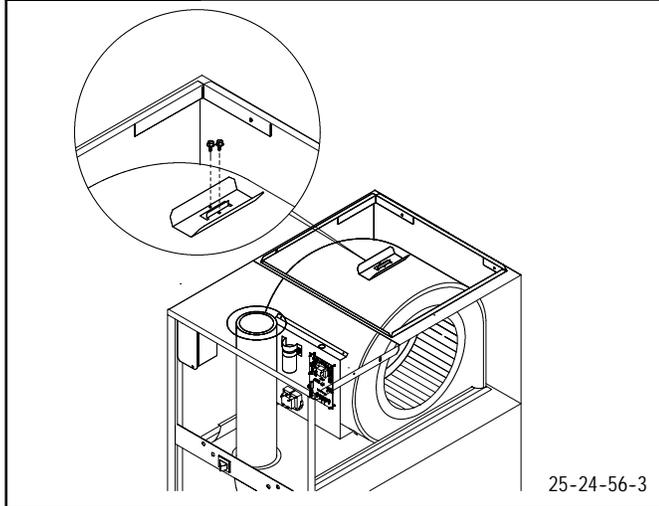
Use either filter type:

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

⚠ CAUTION
REDUCED FURNACE LIFE HAZARD
Failure to follow caution instructions may result in reduced furnace life.
Use of excessively dirty and/or restrictive air filters may increase furnace operating temperatures and shorten the life of the furnace.
Filters supplied with the furnace are rated at a maximum of 600 fpm air velocity and sized for the furnace's airflow rate. Replacement filters must be of equivalent type, size, and rating except as described below.
Disposable, low-velocity filters may be used to replace washable, high-velocity filters, providing they are sized for 300 FPM or less.

Figure 18

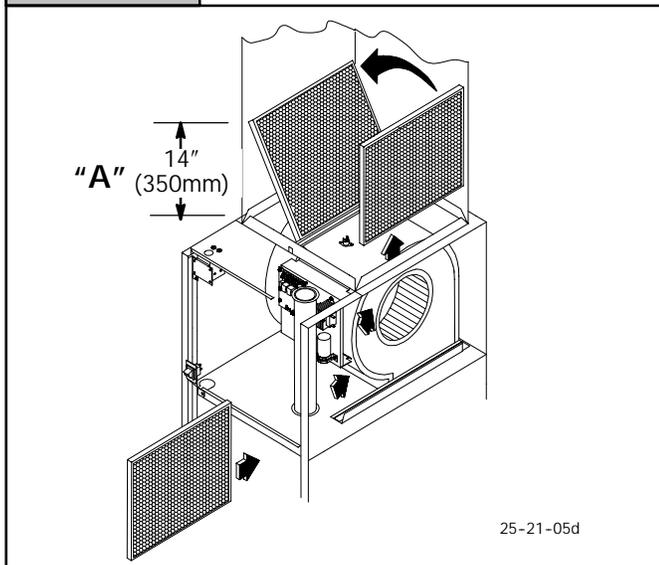
Filter Rack Installation



NOTE: The return air plenum **MUST** extend a sufficient height above the furnace (dimension "A" in Figure 19) to provide for the attachment of a return air duct or grille above the filters.

Figure 19

Filter Installation



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

Filters can only be installed through the right hand side of the furnace blower opening. Slide filter into furnace until it is in position to be pushed up and over into place on the left hand side of furnace. See Figure 19.

Slide remaining filter into furnace and up into place on right hand side of furnace. See Figure 19.

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

Filter Removal

1. Remove blower compartment door.
2. Reach up above right side of blower and lift dirty filters out of rack at top of furnace.
3. Straighten up filters and pull straight down at side of blower. Pull out through right door opening.
4. Vacuum clean or wash with warm water and dry thoroughly before replacing.

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

Addition Of Air Conditioning

When a refrigeration coil is used in conjunction with this furnace, it must be installed on the discharge side of the furnace 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.

Copper or plastic tubing may be used for the condensate drain line.

10. Checks and Adjustments

Startup

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

⚠ WARNING

ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZRD.

Failure to follow safety warnings exactly could result in serious injury, death, and/or property damage.

If any sparks, odors or unusual noises occur, immediately shut OFF gas and 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.

(See L.P. Gas Conversion Kit instruction manual for furnaces converted to L.P. gas)

Manifold Gas Pressure Adjustment

NOTE: Make adjustment to manifold pressure with burners operating.

⚠ **WARNING**

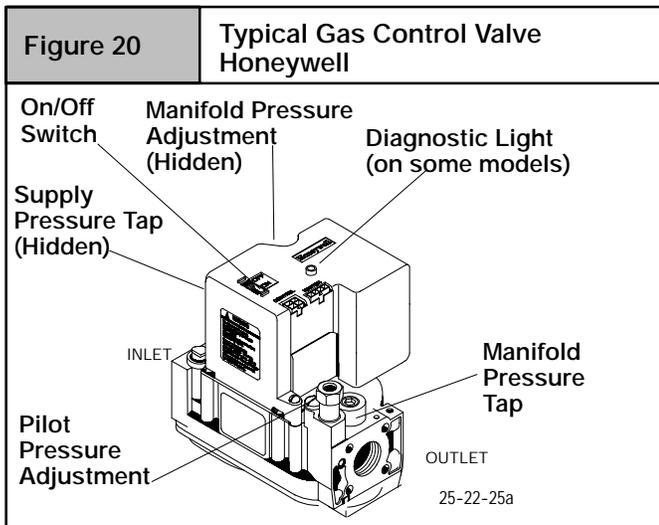
FIRE OR EXPLOSION HAZARD.

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

Turn OFF gas at shut off before connecting manometer.

1. With gas OFF, connect manometer to manifold pressure tap on outlet of gas control valve. See **Figure 20**. Use a manometer with a 0" to 12" water column range.
2. Turn gas ON. Operate the furnace by using a jumper wire on the R to W thermostat connections on the fan board.
3. Remove manifold pressure adjustment screw cover on furnace gas control valve. Turn screw counterclockwise to decrease manifold pressure and clockwise to increase pressure. See **Figure 20**.

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

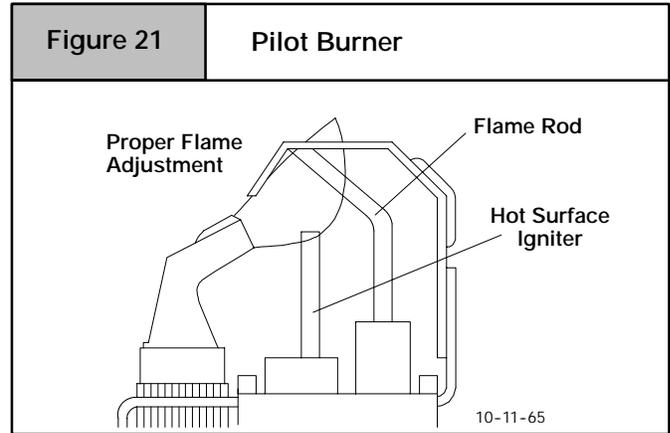


4. Set manifold pressure to value shown in **Table 5** or **Table 6**.
5. When the manifold pressure is properly set, replace the adjustment screw cover on the gas control valve.
6. Remove jumper wire from thermostat connection on fan board. Remove manometer connection from manifold pressure tap, and replace plug in manifold.
7. Check for leaks at plug.

Adjust Pilot Burner

The furnace has a pilot flame to light the main burner. The flame should surround $\frac{3}{8}$ " to $\frac{1}{2}$ " of the flame rod. See **Figure 21**. To adjust, remove cap from pilot adjusting screw on gas control valve.

Turn adjusting screw counterclockwise to increase or clockwise to decrease flame as required. Replace cap after adjusting screw.



Natural Gas Input Rating Check

The gas meter can be used to measure input to furnace.

Check with gas supplier for actual BTU content.

1. Turn OFF gas supply to all appliances other than furnace and start furnace.
2. Time how many seconds it takes the smallest dial on the gas meter to make one complete revolution.

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

Refer to **Example**. The Example is based on a natural gas BTU content of 1,000 BTU's per cubic foot.

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

Refer to **Example**. The Example is based on a natural gas BTU content of 1,000 BTU's per cubic foot.

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

Orifice Sizing

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

Ensure furnace is equipped with the correct main burner orifices. Refer to **Table 5** or **Table 6** for correct orifice size and manifold pressure for a given heating value and specific gravity for natural and propane gas.

Operation Above 2000' Altitude

⚠ **WARNING**

FIRE, EXPLOSION, CARBON MONOXIDE POISONING HAZARD.

Failure to follow safety warnings exactly could result in serious injury, death, and/or property damage.

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

These furnace may be used at full input rating when installed at altitudes up to 2000'. When installed above 2000', the input must be decreased 2% (natural gas) or 4% (LP gas) for each 1000' above sea level. This may be accomplished by a simple adjustment of manifold pressure or an orifice change, or a combination of a pressure adjustment and an orifice change. The changes required depend on the installation altitude and the heating value of the fuel. **Table 5** & **Table 6** show the proper furnace manifold pressure and gas orifice size to achieve proper performance based on elevation above sea level for both natural gas and propane gas.

To use the natural gas table, first consult your local gas utility for the heating value of the gas supply. Select the heating value in the first column and follow across the table until the appropriate elevation for the installation is reached. The value in the box at the intersection of the altitude and heating value provides not only the manifold pressure but also the orifice size. In the natural gas tables

the factory-shipped orifice size is in bold (42). Other sizes must be obtained from service parts.

**High Altitude Input Rate =
Namelevationeplate Sea Level Input Rate x (Multiplier)**

Elevation	High Altitude Multiplier	
	Natural Gas	LP Gas
2001' - 3000'	0.95	0.90
3001' - 4000'	0.93	0.86
4001' - 5000'	0.91	0.82
5001' - 6000'	0.89	0.78
6001' - 7000'	0.87	0.74
7001' - 8000'	0.85	0.70

* Based on mid-range of elevation.

MANIFOLD PRESSURE AND ORIFICE SIZE FOR HIGH ALTITUDE APPLICATIONS

Table 5	NATURAL GAS MANIFOLD PRESSURE (" w.c.)													
	MEAN ELEVATION FEET ABOVE SEA LEVEL													
	0 to 2000		2001 to 3000		3001 to 4000		4001 to 5000		5001 to 6000		6001 to 7000		7001 to 8000	
HEATING VALUE at ALTITUDE BTU/CU. FT.	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
700	--	--	--	--	--	--	--	--	--	--	--	--	41	3.7
725	--	--	--	--	--	--	--	--	--	--	41	3.7	41	3.4
750	--	--	--	--	--	--	--	--	--	--	41	3.5	42	3.6
775	--	--	--	--	--	--	--	--	41	3.6	42	3.6	42	3.3
800	--	--	--	--	--	--	--	--	42	3.7	42	3.4	42	3.1
825	--	--	--	--	41	3.7	41	3.6	42	3.5	42	3.2	42	2.9
850	--	--	--	--	41	3.5	41	3.4	42	3.3	42	3.0	42	2.8
875	--	--	41	3.6	42	3.6	42	3.4	42	3.1	42	2.8	42	2.6
900	--	--	42	3.7	42	3.4	42	3.2	42	2.9	42	2.7	42	2.5
925	41	3.7	42	3.5	42	3.3	42	3.0	42	2.8	42	2.5	42	2.3
950	41	3.5	42	3.3	42	3.1	42	2.9	42	2.6	42	2.4	43	2.7
975	42	3.7	42	3.2	42	2.9	42	2.7	42	2.5	42	2.3	43	2.6
1000	42	3.5	42	3.0	42	2.8	42	2.6	42	2.4	43	2.7	43	2.4
1050	42	3.2	42	2.7	42	2.5	42	2.3	43	2.6	--	--	--	--
1100	42	2.9	42	2.5	42	2.3	43	2.6	--	--	--	--	--	--

NOTE: Natural gas data is based on 0.60 specific gravity. For fuels with different specific gravity consult the National Fuel Gas Code ANSI Z223.1-2002/NFPA 54-2002 or National Standard of Canada, Natural Gas And Propane Installation Code CSA B149.1-00.

Table 6	LPG or PROPANE GAS MANIFOLD PRESSURE (" w.c.)						
	MEAN ELEVATION FEET ABOVE SEA LEVEL						
	0 to 2000	2001 to 3000	3001 to 4000	4001 to 5000	5001 to 6000	6001 to 7000	7001 to 8000
HEATING VALUE at ALTITUDE BTU/CU. FT.							
2500	10.0	10.0	9.0	10.0	9.4	8.5	10.0
Orifice Size	#54	#54	#54	#55	#55	#55	#56

NOTE: Propane data is based on 1.53 specific gravity. For fuels with different specific gravity consult the National Fuel Gas Code ANSI Z223.1-2002/NFPA 54-2002 or National Standard Of Canada, Natural Gas And Propane Installation Code CSA B149.1-00.

NOTE: The derating of these furnaces at 2% (Natural Gas) and 4% (Propane Gas) has been tested and design-certified by CSA.

High Altitude Air Pressure Switch

The factory-installed pressure switch need NOT be changed for any furnace installations from sea level up to and including 8,000' altitude.

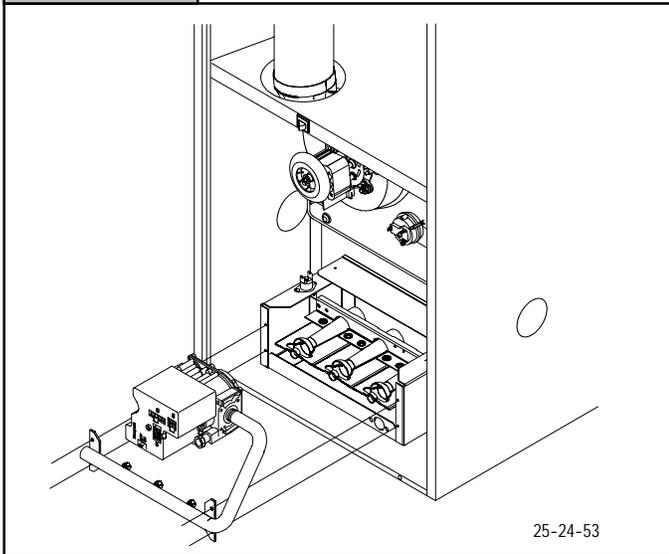
Changing Orifices

1. After disconnecting power and gas supply to the furnace, remove the burner compartment door, exposing the burner compartment.

2. Disconnect gas line and pilot tubing from gas control valve so manifold can be removed.
3. Disconnect wiring at gas control valve. Be sure to note the proper location of all electrical wiring before being disconnected.
4. Remove the four (4) screws holding the manifold and gas control valve to the manifold supports. Do not discard any screws. See **Figure 22**.
5. Carefully remove the manifold assembly.

Figure 22

Manifold

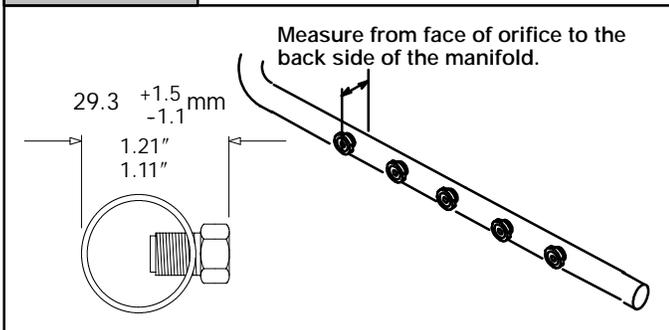


25-24-53

- Remove the orifices from the manifold and replace them with proper sized orifices. See **Figure 23**.
- Tighten orifices so they are seated and gas-tight. See **Figure 23**.

Figure 23

Clearances



- Reassemble all parts in reverse order as removed. Be sure to engage the main burner orifices in the proper openings in the burners.
- After reassembling, turn gas on and check all joints for gas leaks using a soapy solution. All leaks must be repaired immediately.

Main Burner Flame Check

Allow the furnace to run approximately 10 minutes. Then inspect the main burner and pilot flames. See **Figure 24**.

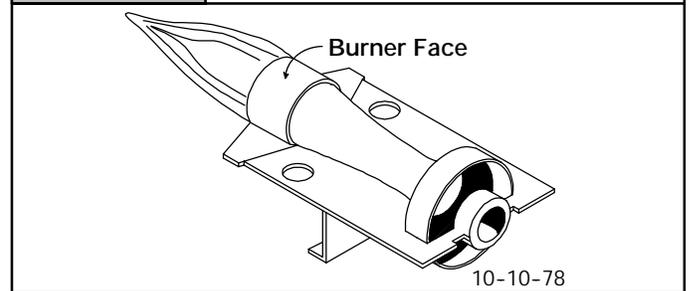
Check for the following (**Figure 24**):

- 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 manifold gas pressure, or check for drafts.

Figure 24

Main Burner



Air Temperature Rise Check

⚠ CAUTION

REDUCED FURNACE LIFE HAZARD

Failure to properly set the air temperature rise may result in reduced furnace life.

Use **ONLY** the blower motor speed taps marked "Y" for YES for setting air temperature rise.

Blower Motor Speed Taps for *8DNL Model Sizes

Model Sizes	LO RED	M LO BLUE	M HI ORN	HI BLK
050B12	Y	Y	N	N
075B12	N	N	Y	Y
075F16	N	Y	Y	Y
100F14	N	N	Y	Y
100L20	Y	Y	Y	Y
125L20	Y	Y	Y	Y

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 air temperature rise, use the following procedure:

- Place thermometers in supply and return air registers as close to furnace as possible, avoiding direct radiant heat from heat exchangers.
- Operate the furnace for 10 minutes with all the registers and duct dampers open by using a jumper wire on R to W thermostat connections on the fan board.
- Take readings and compare with range specified on rating plate.
- If the air temperature rise is not in the correct range, the blower speed must be changed. A higher blower speed will lower the temperature rise. A lower blower speed will increase the temperature rise.
- Remove the jumper wire after the adjustments are complete.

Changing Blower Speed

⚠ WARNING

ELECTRICAL SHOCK HAZARD.

Failure to disconnect power could result in death, personal injury and/or property damage.

Turn OFF power to furnace before changing speed taps.

NOTE: The speed taps that the manufacturer sets at the factory for this furnace 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 predict the static pressure that will be applied to the furnace, it is the responsibility of the installer dealer/contractor to select the proper speed tap leads for the application when the furnace 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 on the electronic fan control as well as location of unused blower motor speed leads. Use the chart (Table 7) to determine the blower motor speed settings.

Table 7		Blower Speed Chart	
Wire Color		Motor Speed	
Black		High	
Orange*		Med-High	
Blue		Med-Low	
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 speed 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 or tape off. Attach a jumper between the "Heat" and "Cool" terminals and the remaining motor speed lead.

Note: When using the same speed on 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.

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

Continuous-Fan Operation

A terminal is provided on the electronic fan control located in the circulating air 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 air 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-Fan Speed the Same

If it is necessary to operate the heating speed and continuous-fan 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.

11. Furnace Maintenance

⚠ WARNING

FIRE, EXPLOSION, OR CARBON MONOXIDE POISONING HAZARDS

Failure to have the furnace inspected and maintained could result in death, personal injury and/or property damage.

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

See "User's Information Manual".

⚠ WARNING

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.

Improper servicing could result in dangerous operation, serious injury, death or property damage.

- Before servicing, disconnect all electrical power to furnace.
- When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.
- Verify proper operation after servicing.

12. Sequence of Operation & Diagnostics

The following is the normal operating sequence.

Cooling (Y) Request:

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

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

Y & G signals removed from EFT.

- Cool motor speed is de-energized after 90 second Cool Fan Off Delay time.

Continuous Circulating Fan (G) Request:

24 VAC signals applied to G terminals of EFT control.

- Heat motor speed is energized without delay.

G signal removed from EFT.

- Heat motor speed is de-energized without delay.

NOTE 1) Furnace de-energizes the fan during the heat exchanger warm-up period on a call for Heating that occurs during a G request unless a blower motor lead is connected to the **Cont** terminal on the EFT, in which case see NOTE 2).

NOTE 2) Heating or Cooling requests received during a Fan request cause the fan speed to change to the appropriate heat or cool speed after the selected Fan On Delay time expires. The fan returns to continuous circulating speed after the selected Fan Off Delay time expires following loss of the Heating or Cooling request.

Heating (W) Request:

24 VAC signals applied to W terminal of EFT control.

- Inducer motor turns on.
- Following a 3 second prepurge delay, the pilot gas valve opens and the ignitor begins to warm up.
- After the pilot lights, the gas control valve is energized and main burners light.
- Timed from the opening of the main gas control valve, the furnace control will delay blower operation for the Heat Fan On Delay time.

W signal removed from EFT.

- The gas valve de-energizes and the main burners go out.
- The inducer runs for a 30 second postpurge period.
- The fan stays at Heat speed.
- Timed from the gas valve de-energizing, the circulating fan de-energizes after the selected Heat Fan Delay time expires.

Heating Request with Gas Shut Off:

24 VAC signals applied to W1 terminal of EFT control.

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

Gas Control Valve Diagnostic Codes (See Figure 25)

OFF	= Control not powered
Heartbeat	= Normal Operation (Standby or call for heat)
1 Flash	= Not used
2 Flashes	= Low Pressure switch closed when should be open
3 Flashes	= Low Pressure switch circuit was still sensed as open 30 seconds after the inducer was energized. System is in 5 minute delay mode, with inducer off. After 5-minute delay, a new ignition sequence will

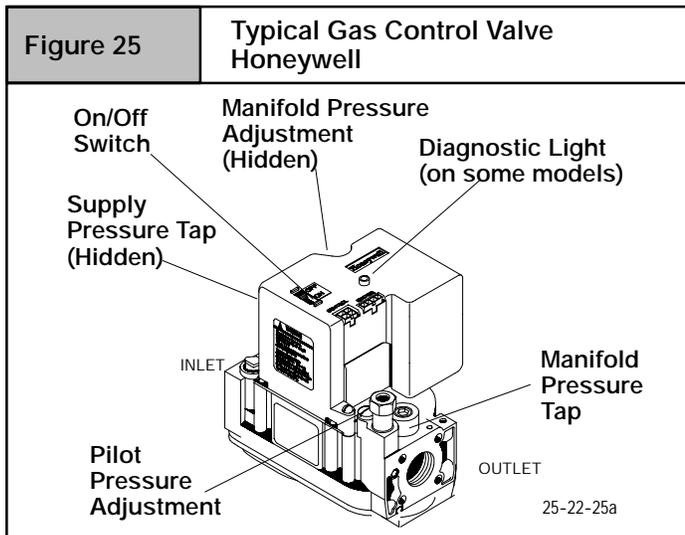
be initiated.

(Note: SV9541M On/Off switch in off position during a call for heat will generate this diagnostic code)

4 Flashes	= Limit switch string open
5 Flashes	= Flame sensed out of sequence - Flame signal still present.
6 Flashes + 1 Note 1	= Soft Lockout -Maximum retry count exceeded (failed to light within 4 trials for ignition)
6 Flashes + 2 Notes 1,2	= Soft Lockout -Maximum recycle count exceeded - Last failure was Flame Sense Lost During Run, Cycling Pressure Switch or Blocked Condensate.
6 Flashes + 3 Notes 1,2	= Soft Lockout -Maximum recycle count exceeded - Last failure was Airflow Proving Circuit Opened During Run
6 Flashes + 4 Notes 1,2	= Soft Lockout -Maximum recycle count exceeded - Last failure was Limit Circuit Opened During Run
7 Flashes	= Soft Lockout Due to Limit Trips Taking Longer than 2 minutes to Reset; Auto Reset After 1 Hour if Call for Heat Still Present. Reset by Cycling Call for Heat at Any Time.

NOTE 1: The 6 + X designation indicates a combination of flash codes: 6 flashes shows the control is in soft lockout, followed by X flashes to indicate the reason the control went into soft lockout. When the 6+ X code is flashing, the SV9541M will attempt a new ignition sequence after a five minute delay period, if the call for heat is still present. Reset of the thermostat will initiate a new ignition sequence immediately.

NOTE 2: Any combination of 5 'abnormal' events during a single call for heat will result in soft lockout. An 'abnormal' event is a Flame Sense Failure During Run, Airflow Proving Circuit Open During Run, or Limit Circuit Open During Run. The flash code will indicate which was the last 'abnormal' event that put the system into the soft lockout state based on the table above.



Technical Support Manual

Save This Manual For Future Reference

Models

- *8DNL050B12A1
- *8DNL075B12A1
- *8DNL075F16A1
- *8DNL100F14A1
- *8DNL100L20A1
- *8DNL125L20A1

* Denotes Brand

International Comfort Products, LLC
Lewisburg, TN 37091
Fast Parts Division
(866) 380-3278



FAN ASSISTED COMBUSTION GAS FURNACES

Model Specifications

Manufacturers Number (Mfr No -See Rating Plate)												
ALL Models												
Specifications												
	*8DNL050B12		*8DNL075B12		*8DNL075F16		*8DNL100F14		*8DNL100L20		*8DNL125L20	
General												
Input (Btuh)	50,000		75,000		75,000		100,000		100,000		125,000	
Output (Btuh)	40,000		61,000		61,000		81,000		81,000		101,000	
Temp. Rise (°F)	35-65		35-65		35-65		35-65		30-60		35-65	
Electrical (Volts/Hz)	115/60		115/60		115/60		115/60		115/60		115/60	
Rating Plate Amps	9.3		9.4		12.4		10.0		11.5		11.5	
Gas Type	Nat	LP										
Transformer Size (VA)	40	40	40	40	40	40	40	40	40	40	40	40
T'stat Heat Anticipator	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
Gas & Ignition												
Std. Main Orifices (No/Size)	2/#42	2/#54	3/#42	3/#54	3/#42	3/#54	4/#42	4/#54	4/#42	4/#54	5/#42	5/#54
Gas Valve Honeywell SV	9541	9541	9541	9541	9541	9541	9541	9541	9541	9541	9541	9541
Regulation Type	SNAP	SNAP										
Manifold Press. (Inch's WC)	3.5	10.0	3.5	10.0	3.5	10.0	3.5	10.0	3.5	10.0	3.5	10.0
Pilot Orifice Size	.018	.011	.018	.011	.018	.011	.018	.011	.018	.011	.018	.011
Ignition Type/Series	HW HSP											
Lock-Out Time	NA											
Combustion												
Flue Outlet Size (Inches)	4		4		4		4		4		4	
Std. Outlet Temp (°F)	<480		<480		<480		<480		<480		<480	
Limits & Controls												
Thermal Sensor (°F)	300		300		300		300		300		300	
Limit Control	See Parts List											
Std. Pressure Sw. (Part No)	1013529		1013529		1013529		1013529		1013529		1013529	
Press (Close)	-0.69		-0.69		-0.69		-0.69		-0.69		-0.69	
Press (Open)	-0.59		-0.59		-0.59		-0.59		-0.59		-0.59	
Fan Control (Type)	HW ST9160											
Fan Control On	30		30		30		30		30		30	
(Timed-secs) Off	60,100,140,180		60,100,140,180		60,100,140,180		60,100,140,180		60,100,140,180		60,100,140,180	
Blower Data												
Type & Size	11-8		11-8		11-10		11-10		11-10		11-10	
Motor Amps/Rpm	8/1050		8/1050		10/1050		8/900		11.9/900		11.9/900	
Motor Type/H.p.	PSC ¹ / ₂		PSC ¹ / ₃		PSC ¹ / ₂		PSC ¹ / ₂		PSC ³ / ₄		PSC ³ / ₄	
Cap. Mfd/Volts	7.5/370		5.0/370		10/370		7.5/370		40/370		40/370	
Filter Type (600 FPM)	Washable											
Filter Size (")	16x18x1 (2)		16x18x1 (2)		16x18x1 (2)		16x18x1(2)		16x18x1 (2)		16x18x1 (2)	
Min. Cool Cap. (Tons)	1.5		1.5		3		2		3		3	
Max. Cool Cap. (Tons)	3		3		4		3.5		5		5	
Gas Conversion Kits												
Nat to LP NAHL002LP (*1160991)												
LP to Nat NAHF002NG,(*1009510)												
* Must be ordered from Service Parts												

Circulation Air Blower Data

***8DNL050B12**

External Static Pressure Inches of W.C.	Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)				
	TAP	LOW	MED L	MED H	HIGH
.10	702	963	1260	1537	
.30	624	845	1183	1416	
.50	510	760	1088	1308	
.70	412	617	917	1111	
.90	310	468	664	948	
1.00	249	436	529	808	

***8DNL100F14**

External Static Pressure Inches of W.C.	Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)				
	TAP	LOW	MED L	MED H	HIGH
.10	756	1012	1372	1881	
.30	585	888	1273	1724	
.50	491	780	1176	1606	
.70	387	697	1035	1481	
.90	255	561	873	1281	
1.0	210	444	767	1132	

***8DNL075B12**

External Static Pressure Inches of W.C.	Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)				
	TAP	LOW	MED L	MED H	HIGH
.10	634	728	975	1353	
.30	533	653	936	1307	
.50	454	559	861	1225	
.70	373	473	737	1087	
.90	255	392	605	884	
1.00	232	294	529	764	

***8DNL100L20**

External Static Pressure Inches of W.C.	Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)				
	TAP	LOW	MED L	MED H	HIGH
.10	1798	2024	2212	2375	
.30	1709	1896	2081	2205	
.50	1614	1774	1922	2026	
.70	1470	1614	1752	1860	
.90	1282	1428	1548	1645	
1.00	1065	1263	1407	1508	

***8DNL075F16**

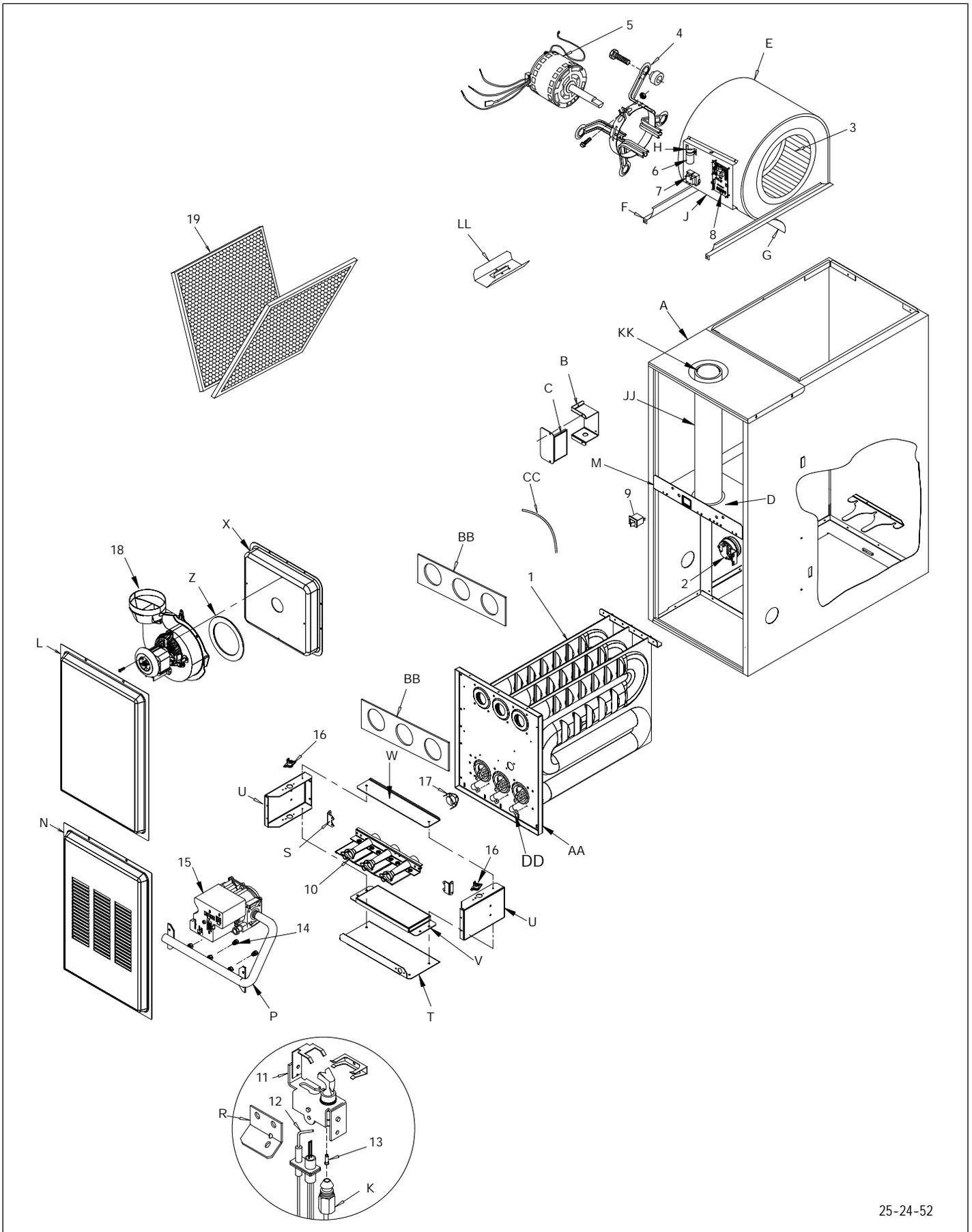
External Static Pressure Inches of W.C.	Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)				
	TAP	LOW	MED L	MED H	HIGH
.10	648	900	1285	1789	
.30	628	916	1328	1747	
.50	611	889	1309	1680	
.70	557	843	1240	1588	
.90	485	748	1122	1452	
1.00	441	680	1041	1374	

***8DNL125L20**

External Static Pressure Inches of W.C.	Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)				
	TAP	LOW	MED L	MED H	HIGH
.10	1936	2165	2319	---	
.30	1845	2028	2246	2334	
.50	1728	1902	2061	2172	
.70	1536	1695	1856	1952	
.90	1331	1490	1600	1687	
1.00	1215	1352	1424	1537	

* Denotes Brand

Parts for *8DNL



25-24-52

Replacement Parts - *8DNL (Natural Gas)

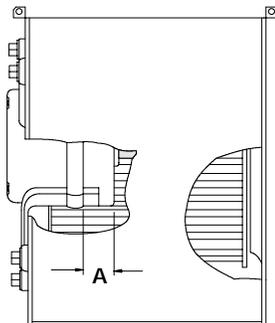
Models - *8DNL050B12A1, *8DNL075B12A1, *8DNL075F16A1, *8DNL100F14A1, *8DNL100L20A1, *8DNL125L20A1

Replacement part supplied will be current active part. For parts not listed, consult place of purchase.

Key No.	Functional Parts Description	Part Number	*8DNL					
			050B12A1	075B12A1	075F16A1	100F14A1	100L20A1	125L20A1
1	Heat Exchanger	1014316	1	-	-	-	-	-
		1014317	-	1	-	-	-	-
		1014318	-	-	1	-	-	-
		1014319	-	-	-	1	-	-
		1014320	-	-	-	-	1	-
		1014321	-	-	-	-	-	1
2	Switch, Pressure	1013529	1	1	1	1	1	1
3	Wheel, Blower	1013011	1	1	-	-	-	-
		1011420	-	-	1	1	1	1
4	Mount, Motor kit*	1014824	1	-	-	-	-	-
		1014825	-	1	-	-	-	-
		1014823	-	-	1	-	1	1
		1014822	-	-	-	1	-	-
5	Motor, Blr 1/115 1/2 CCW	1172487	1	-	-	1	-	-
		1172493	-	1	-	-	-	-
		1172488	-	-	1	-	-	-
		1172489	-	-	-	-	1	1
		1172489	-	-	-	-	1	1
6	Capacitor 7.5uF	1171728	1	-	-	1	-	-
		1171727	-	1	-	-	-	-
		1171729	-	-	1	-	-	-
		1171982	-	-	-	-	1	1
7	Transformer	1012722	1	1	1	1	1	1
8	Control, Fan Timer	1014460	1	1	1	1	1	1
9	Switch, Interlock	1012351	1	1	1	1	1	1
10	Burner Assembly	1008723	1	-	-	-	-	-
		1008724	-	1	1	-	-	-
		1008725	-	-	-	1	1	-
		1008726	-	-	-	-	-	1
		1008726	-	-	-	-	-	1
11	Pilot/Igniter	1008731	1	1	1	1	1	1
12	Igniter/Sensor with Clip	1009524	1	1	1	1	1	1
13	Orifice, Pilot .018	503211	1	1	1	1	1	1
14	Orifice, Burner # 42	1011351	2	3	3	4	4	5
15	Valve, Gas	1013350	1	1	1	1	1	1
16	Switch, Limit (Rollout)	1013102	2	2	2	2	2	2
17	Switch, Limit (Main)	34335001	1	1	-	-	-	-
		1009169	-	-	1	-	-	-
		1008417	-	-	-	1	-	-
		1065294	-	-	-	-	1	-
		1320362	-	-	-	-	-	1
		1320362	-	-	-	-	-	1
18	Blower, Combustion	1014433	1	1	1	1	1	-
		1013517	-	-	-	-	-	1
19	Filter, Air	1009750	2	2	2	2	2	2

*See Table below for bellyband location on motor

Bellyband Location on Motor	
Model *8DNL	A(in.)
050B12A1	1.38"
075B12A1	1.65"
075F16A1	1.81"
100F14A1	1.38"
100L20A1	1.65"
125L20A1	1.65"



Replacement Parts - *8DNL (Natural Gas)

Models - *8DNL050B12A1, *8DNL075B12A1, *8DNL075F16A1, *8DNL100F14A1, *8DNL100L20A1, *8DNL125J20A1

Replacement part supplied will be current active part. For parts not listed, consult place of purchase.

Key No.	Non-Functional Description	Part Number	*8DNL					
			050B12A1	075B12A1	075F16A1	100F14A1	100L20A1	125L20A1
A	Panel, Top	1013593	1	1	-	-	-	-
		1013594	-	-	1	1	-	-
		1014410	-	-	-	-	1	1
B	Box, Junction	1012349	1	1	1	1	1	1
C	Cover, Junction box	1012350	1	1	1	1	1	1
D	Partition, Blower	1013571	1	1	-	-	-	-
		1013572	-	-	1	1	-	-
		1014416	-	-	-	-	1	1
E	Housing, Blower	1012972	1	1	-	-	-	-
		1012888	-	-	1	1	1	1
F	Hanger, Blower	1012328	2	2	2	2	2	2
G	Panel, Blower Cutoff	721020013	1	1	-	-	-	-
		721020008	-	-	1	1	1	1
H	Clamp, Capacitor	1170643	1	1	1	1	-	-
		1014315	-	-	-	-	1	1
J	Bracket, Control Mounting	1013678	1	1	1	1	1	1
K	Tube, Pilot	1013596	1	-	-	-	-	-
		1013597	-	1	1	-	-	-
		1013598	-	-	-	1	1	1
L	Door, Blower (Heil Only) (Heil Only) (Heil Only) (Comfortmaker Only) (Comfortmaker Only) (Comfortmaker Only) (Tempstar Only) (Tempstar Only) (Tempstar Only)	1014001	1	1	-	-	-	-
		1014375	-	-	1	1	-	-
		1014436	-	-	-	-	1	1
		1014002	1	1	-	-	-	-
		1014378	-	-	1	1	-	-
		1014437	-	-	-	-	1	1
		1013606	1	1	-	-	-	-
		1013607	-	-	1	1	-	-
		1014434	-	-	-	-	1	1
M	Bracket, Door	1013976	1	1	-	-	-	-
		1013977	-	-	1	1	-	-
		1014417	-	-	-	-	1	1
N	Door, Louver (Heil Only) (Heil Only) (Heil Only) (Comfortmaker Only) (Comfortmaker Only) (Comfortmaker Only) (Tempstar Only) (Tempstar Only) (Tempstar Only)	1014088	1	1	-	-	-	-
		1014091	-	-	1	1	-	-
		1014431	-	-	-	-	1	1
		1014078	1	1	-	-	-	-
		1014081	-	-	1	1	-	-
		1014430	-	-	-	-	1	1
		1013609	1	1	-	-	-	-
		1013610	-	-	1	1	-	-
1014435	-	-	-	-	1	1		
P	Manifold, Gas	1013478	1	-	-	-	-	-
		1013479	-	1	1	-	-	-
		1013480	-	-	-	1	1	-
		1013481	-	-	-	-	-	1
R	Bracket, Pilot	1010901	1	1	1	1	1	1
S	Bracket, Manifold Support	1012377	2	2	2	2	2	2
T	Top, Burner Box	1013705	1	1	1	-	-	-
		1013015	-	-	-	1	1	-
		1013016	-	-	-	-	-	1
U	Bracket, Burner Box Sides	1012532	2	2	2	2	2	2
V	Baffle, Burner Box	1012338	1	1	1	-	-	-
		1012339	-	-	-	1	1	-
		1012340	-	-	-	-	-	1
W	Bottom, Burner Box	1012334	1	-	1	-	-	-
		329721-401	-	1	-	-	-	-
		1012335	-	-	-	1	1	-
		1012336	-	-	-	-	-	1

Replacement Parts - *8DNL (Natural Gas)

Models - *8DNL050B12A1, *8DNL075B12A1, *8DNL075F16A1, *8DNL100F14A1, *8DNL100L20A1, *8DNL125J20A1

Replacement part supplied will be current active part. For parts not listed, consult place of purchase.

Key No.	Non-Functional Description	Part Number	*8DNL					
			050B12A1	075B12A1	075F16A1	100F14A1	100L20A1	125L20A1
X	Collector Box	1013483	-	1	1	-	-	-
		1013484	-	-	-	1	1	-
		1013485	-	-	-	-	-	1
		1014033	1	-	-	-	-	-
Z	Gasket, Combustion Blower	1013540	1	1	1	1	1	1
AA	Partition, Front Heat Exchanger	1013543	1	-	-	-	-	-
		1013521	-	1	-	-	-	-
		1013545	-	-	1	-	-	-
		1013546	-	-	-	1	-	-
		1013547	-	-	-	-	1	-
		1013548	-	-	-	-	-	1
BB	Gaskets, Heat Exchanger	1013991	2	-	-	-	-	-
		1013992	-	2	2	-	-	-
		1013993	-	-	-	2	2	-
		1013994	-	-	-	-	-	2
CC	Tubing, Silicone	1170886	1	1	1	1	1	1
DD	Baffle, Nox	1014019	2	3	3	4	4	5
JJ	Shield, Flue Pipe	1013975	1	1	1	1	1	1
KK	Pipe, Flue	1014031	1	1	1	1	1	1
LL	Rack, Filter	1014020	1	1	1	1	1	1
)	PART NOT ILLUSTRATED							
)	Fuse, 5 Amp	1083348	1	1	1	1	1	1
)	Harness, Wire	1013950	1	1	1	1	1	1
)	Manual, Installation	441 01 2313 04	1	1	1	1	1	1
)	Manual, Users	441 02 2010 04	1	1	1	1	1	1