


Installation Instructions

NUG3/GUJ Upflow Only Series

SAFETY REQUIREMENTS

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

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

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

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

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

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



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

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WARNING

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

1. Installation

WARNING

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

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

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

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

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

Safety Rules

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

- A. The U.S. Consumer Product Safety Commission recommends that users of gas-burning appliances install carbon monoxide detectors. There can be various sources of carbon monoxide in a building or dwelling. The sources could be gas-fired clothes dryers, gas cooking stoves, water heaters, furnaces, gas-fired fireplaces, wood fireplaces,

and several other items. Carbon monoxide can cause serious bodily injury and/or death. Therefore, to help alert people of potentially dangerous carbon monoxide levels, you should have carbon monoxide detectors listed by a nationally recognized agency (e.g. Underwriters Laboratories or International Approval Services) installed and maintained in the building or dwelling (see Note below).

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

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

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

Freezing Temperatures and Your Structure

WARNING

Freeze warning.

Turn off water system.

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

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

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

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

WARNING

Poison carbon monoxide gas hazard.

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

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

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

CAUTION

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

Location and Clearances

1. Refer to **Figure 1** for typical installation and basic connecting parts required. Supply and return air plenums and duct are also required.

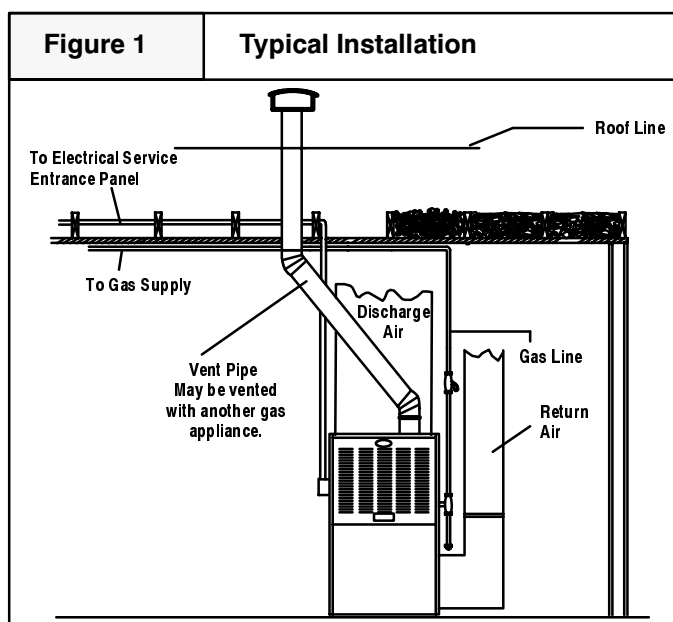
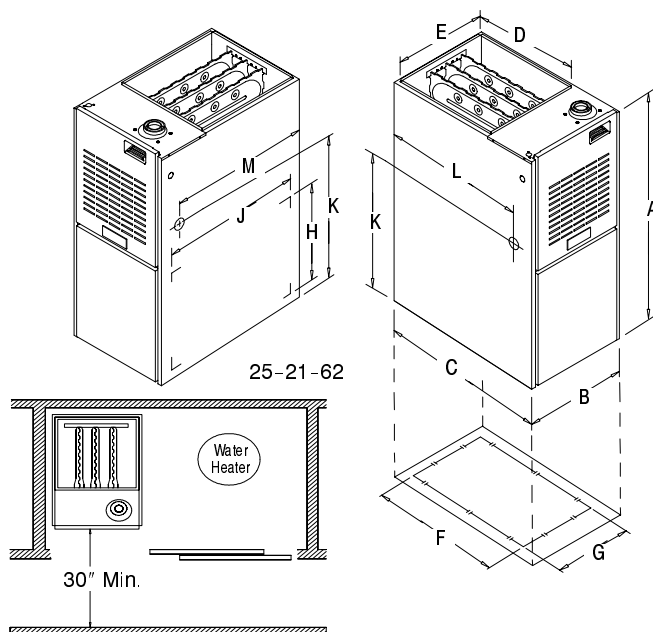


Figure 2

Dimensions and Clearances



MINIMUM CLEARANCES	
REAR	0
FRONT ¹	6" (150mm)
ALL SIDES OF SUPPLY PLENUM	1" (25mm)
SIDES	0
VENT ²	6" (150mm)
TOP OF FURNACE	6" (150mm)

¹ SERVICE ACCESS SHALL TAKE PRECEDENCE OVER CLEARANCE TO COMBUSTIBLE MATERIALS.

² 1" (25mm) WITH TYPE B-1 VENT PIPE, 6" (150mm) WITH SINGLE WALL VENT PIPE

DIMENSIONAL INFORMATION

MODEL NUG3 / GUJ	CABINET			SUPPLY AIR		RETURN AIR				GAS CONNECTION		
						BOTTOM		SIDE				
	A	B	C	D	E	F	G	H	J	K	L	M
050/075	40 (1016)	15 ¹ / ₂ (394)	28 ¹ / ₂ (724)	18 ¹ / ₂ (470)	14 (356)	23 ¹ / ₈ (587)	12 ⁵ / ₈ (321)	12 ¹ / ₄ (311)	22 ¹ / ₂ (572)	28 ¹ / ₄ (717)	26 (660)	23 ⁷ / ₈ (606)
100	40 (1016)	19 ¹ / ₈ (486)	28 ¹ / ₂ (724)	18 ¹ / ₂ (470)	17 ⁵ / ₈ (448)	23 ¹ / ₈ (587)	14 ³ / ₄ (375)	14 ¹ / ₂ (369)	22 ¹ / ₂ (572)	28 ¹ / ₄ (717)	26 (660)	23 ⁷ / ₈ (606)
125	40 (1016)	22 ³ / ₄ (578)	28 ¹ / ₂ (724)	18 ¹ / ₂ (470)	21 ¹ / ₄ (539)	23 ¹ / ₈ (587)	18 ³ / ₄ (476)	17 (432)	22 ¹ / ₂ (572)	28 ¹ / ₄ (717)	26 (660)	23 ⁷ / ₈ (606)

ALL DIMENSIONS IN INCHES (mm)

Installation Requirements

1. Install furnace level.
2. Install furnace as centralized as practical with respect to the heat distribution system.
3. Install the vent pipes as short as practical. (See **Gas Vent Installation** section).
4. Do **NOT** install furnace directly on carpeting, tile or other combustible material other than wood flooring.
5. Maintain clearance for fire safety and servicing. A front clearance of 30" (760mm) is recommended for access to the burner, controls and filter.
6. Use a raised base if the floor is damp or wet at times.
7. Residential garage installations require:
 - Burners and ignition sources installed at least 18" (457mm) above the floor.
 - Furnace must be coated or physically protected from possible damage by a vehicle.

2. Combustion & Ventilation Air

WARNING

Poison carbon monoxide gas hazard.

Use methods described here to provide combustion and ventilation air.

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

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

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

Contaminated Combustion Air

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

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

- Commercial buildings.
- Buildings with indoor pools.
- Furnaces installed in laundry rooms.
- Furnaces installed in hobby or craft rooms.
- Furnaces installed near chemical storage areas.
- Permanent wave solutions for hair.
- Chlorinated waxes and cleaners.
- Chlorine based swimming pool chemicals.
- Water softening chemicals.
- De-icing salts or chemicals.
- Carbon tetrachloride.
- Halogen type refrigerants.
- Cleaning solvents (such as perchloroethylene).
- Printing inks, paint removers, varnishes, etc..
- Hydrochloric acid.
- Sulfuric Acid.
- Solvent cements and glues.
- Antistatic fabric softeners for clothes dryers.
- Masonry acid washing materials.

Confined Space Installation

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

Air Openings and Connecting Ducts

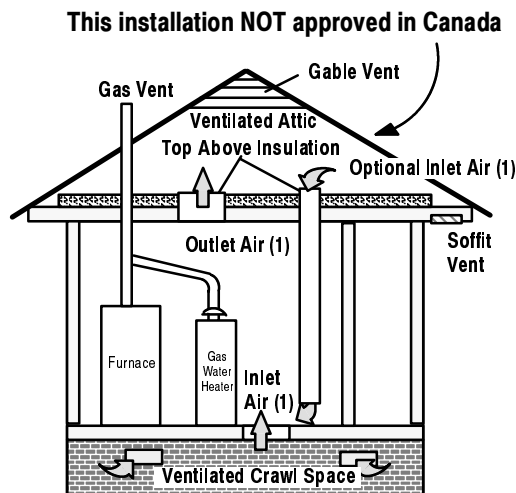
- Total input rating for all gas appliances **MUST** be considered when determining free area of openings.
- Connect ducts or openings directly to outside.
- Air intakes must be a minimum of 12" (305mm) above maximum snow level and clear of any obstruction.
- When screens are used to cover openings, the openings **MUST** be no smaller than 1/4" (6mm) mesh.
- The minimum dimension of rectangular air ducts **MUST NOT** be less than 3" (75mm).
- When sizing grille or louver, use the free area of opening. If free area is **NOT** stamped or marked on grill or louver, assume a 20% free area for wood and 60% for metal.

Requirements

- Provide confined 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. A minimum of two permanent openings, one inlet and one outlet, are required.
- One opening **MUST** be within 12" (300mm) of the floor and the second opening within 12" (300mm) of the ceiling.
- Size openings and ducts per **Table 1**.
- Horizontal duct openings require 1 sq. in. (25sq. mm) of free area per 2,000 BTUH of combined input for all gas appliances in area (**see Table 1**).
- Vertical duct openings or openings directly to outside require 1 sq. in. (6.5mm³) of free area per 4,000 BTUH for combined input of all gas appliances in area (**see Table 1**).

Figure 3

Outside Air (This is ONLY a guide. Subject to codes, or in the absence of local codes, the applicable national codes.)



Minimum One Inlet and One Outlet Air Supply is Required
May be in any 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 (6cm.²) per 4000 BTUH
- (2) 1 Square Inch (6cm.²) per 2000 BTUH

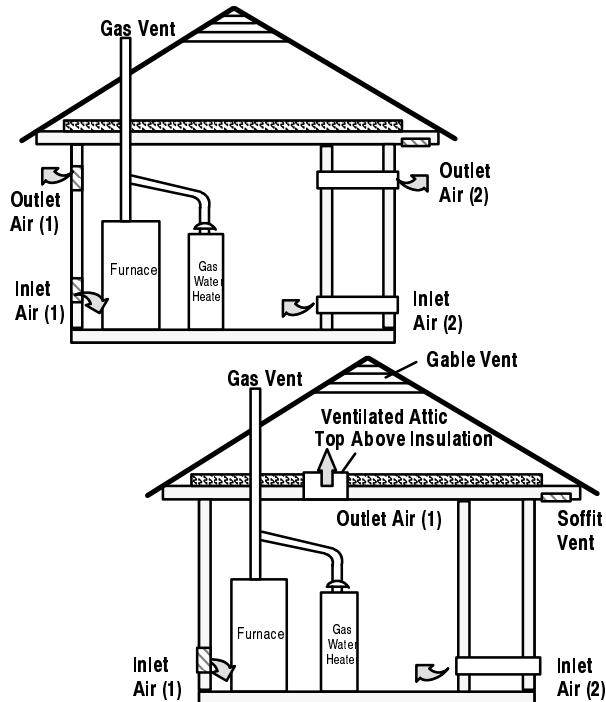


Table 1

Free Area

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

EXAMPLE: Determining Free Area**Furnace Water Heater Total Input**

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

Furnace Water Heater Total Input

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

One permanent opening, commencing within 12" (30 cm.) of the top of the enclosure, shall be permitted where the equipment has clearances of at least 1" (2.5 cm.) from the sides and back and 6" (16 cm.) from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces (crawl or attic) that freely communicate with the outdoors, and shall have a minimum free area of:

- 1 sq. in. per 3000 Btu per hr (7cm.² per kW) of the total input rating of all equipment located in the enclosure, and
- Not less than the sum of the areas of all vent connectors in the confined space.

Unconfined Space Installation

! WARNING

Poison carbon monoxide gas hazard.

Most homes will require additional air.

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

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

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

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

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

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

Unusually tight construction is defined as: Construction with

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

3. Gas Vent Installation

This furnace must be vented vertically. Horizontal venting is not allowed. This furnace is classified as a Category I appliance. This means that the furnace must operate with a negative vent pressure. The furnace must not be connected into any portion of a mechanical vent system operating under positive pressure.

This furnace is equipped with a draft hood. Although this furnace uses a fan assisted combustion system. The connector and Type B vent system must be sized using the "Nat. Max" table in the National Fuel Gas Code NFPA54/ANSI Z2231.1 latest edition. Install the vent system in compliance with the local codes.

Note: The vent connector must be attached to the vent collar on the top of the furnace. Do not attach vent connector to combustion blower housing.

WARNING

Poison carbon monoxide Gas, fire and explosion hazard.

Read and follow all instructions in this section

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

Safe Venting Requirements

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

- All vent material used to vent this furnace must be approved by a nationally recognized agency.
- The furnace **MUST** be connected to a factory built chimney or vent complying with a recognized standard.
- Check existing gas vent or chimney to ensure they meet clearances and local codes.
- Do **NOT** vent furnace into any chimney serving an open fireplace or solid fuel burning appliance.
- Maintain minimum 6" clearance to combustible material for single wall vent pipe and minimum 1" clearance for Type B double wall vent pipe.
- Keep vertical Category I vent pipe or vent connector runs as short and direct as possible.
- 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**.
- Vertical outdoor runs of type B or **ANY** single wall vent pipe below the roof line are **NOT** permitted.

Ventilation Air

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

- Vent pipe sections must be securely fastened together and fastened to the furnace flue collar using screws where required.
- Slope all horizontal runs upwards away from furnace a minimum of 1/4" (6mm) per foot.
- Support all horizontal vent pipe every 6 feet(2m) using proper clamps and metal straps to prevent sagging.

Existing Vent or Chimney Inspection

1. Before connecting the vent connector to a chimney, examine all parts and the passage way for condition and to make sure it is clear and free of obstructions.
2. Examine any cleanouts to make sure they will remain tightly closed when not in use.
3. If the chimney is not suitable for use it must be replaced, rebuilt or relined to conform to nationally recognized standards.

Venting to Existing Masonry Chimney

Dedicated venting of one NUG3/GUJ furnace into any masonry chimney is prohibited. The chimney must first be lined with either type B vent or a listed single wall, metal lining system, sized in accordance with the **GAMA** vent tables.

This furnace may be common vented into an interior tile lined chimney provided the chimney serves at least one additional draft hood equipped appliance.

WARNING

Poison carbon monoxide gas hazard.

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

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

Venting and Combustion Air Check

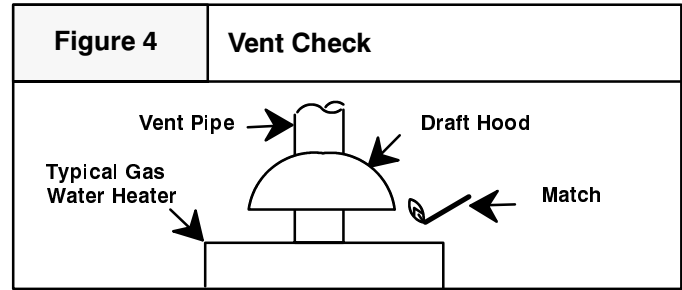
If this installation removes an existing furnace from a venting system to make sure there is adequate combustion air for all appliances, **MAKE THE FOLLOWING CHECK.**

1. Seal any unused openings in the venting system.
2. Inspect the venting system for proper size and horizontal pitch to ensure there is no blockage or restriction, leakage,

corrosion or other deficiencies which could cause an unsafe condition.

3. Insofar as is practical, close all doors and windows and all doors between the space in which the appliance(s) remaining connected to the venting system are located and other spaces of the building.
4. Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
5. Follow the lighting instructions for each appliance being inspected. Adjust thermostat so appliance(s) will operate continuously.
6. Allow 5 minutes of main burner operation, then check for spillage at the draft hood relief opening of each appliance. Use the flame of a match or candle (**Figure 4**).

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



7. After it has been determined that each appliance vents properly, return doors, windows, appliances etc. to their normal condition.
8. If improper venting is observed, the cause **MUST** be corrected.

4. Gas Supply and Piping

⚠ WARNING

Fire and explosion hazard.

Natural Gas

Models designated for Natural Gas are to be used with Natural Gas ONLY. (Furnace can be converted to LP Gas with approved kit.)

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

Gas Supply Requirements

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

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

Natural Gas Input Rating Check

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

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

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

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

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

Orifice Sizing

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

Ensure furnace is equipped with the correct main burner orifices. Refer to **Table 3 & Table 4** for correct orifice size for a given heating value and specific gravity for natural and propane gas. Note that this chart is **ONLY** for installations *below* 2000 feet in altitude.

Operation Above 2000 Feet Altitude

WARNING

Fire, Explosion, Poison carbon monoxide gas hazard.

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

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

These units may be used at full input rating when installed at altitudes up to 2000'. When installed above 2000', the input must be decreased 4% for each 1000' above sea level. This may be accomplished by a simple adjustment of manifold pressure or an orifice change, or a combination of a pressure adjustment and an orifice change. The changes required depend on the installation altitude and the heating value of the fuel. **Table 3** and **Table 4** show the proper furnace manifold pressure and gas orifice size to achieve proper performance based on elevation above sea level for both natural gas and propane.

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

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

Elevation	High Altitude Multiplier
2000' - 2999'	0.92
3000' - 3999'	0.88
4000' - 4999'	0.84
5000' - 5999'	0.80
6000' - 6999'	0.76
7000' - 8000'	0.72

MANIFOLD PRESSURE AND ORIFICE SIZE FOR HIGH ALTITUDE APPLICATIONS

Table 3	NATURAL GAS						
HEATING VALUE BTU/CU. FT.	MEAN ELEVATION FEET ABOVE SEA LEVEL						
	0 to 1999	2000 to 2999	3000 to 3999	4000 to 4999	5000 to 5999	6000 to 6999	7000 to 8000
800	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.2" wc	2.9" wc
850	3.5" wc	3.5" wc	3.5" wc	3.5" wc	3.2" wc	2.9" wc	2.6" wc
900	3.5" wc	3.5" wc	3.4" wc	3.1" wc	2.8" wc	2.5" wc	2.3" wc
950	3.5" wc	3.3" wc	3.1" wc	2.8" wc	2.5" wc	2.3" wc	3.5" wc
1000	3.5" wc	3.0" wc	2.8" wc	2.5" wc	2.3" wc	3.5" wc	3.1" wc
1050	3.2" wc	2.7" wc	2.5" wc	2.3" wc	3.5" wc	3.2" wc	2.8" wc
1100	2.9" wc	2.5" wc	2.3" wc	3.5" wc	3.2" wc	2.9" wc	2.6" wc
Orifice Size	#42	#42	#42	#45	#45	#45	#45

SHADED AREA REQUIRES ORIFICE CHANGE. NO SHADING INDICATES MANIFOLD PRESSURE CHANGE ONLY.

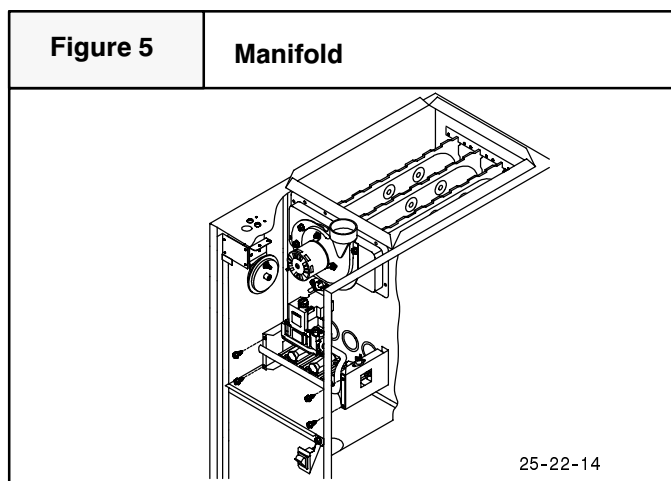
Table 4	PROPANE						
HEATING VALUE BTU/CU. FT.	MEAN ELEVATION FEET ABOVE SEA LEVEL						
	0 to 1999	2000 to 2999	3000 to 3999	4000 to 4999	5000 to 5999	6000 to 6999	7000 to 8000
2500	10.0" wc	10.0" wc	9.4" wc	10.0" wc	9.8" wc	8.8" wc	7.9" wc
Orifice Size	#54	#54	#54	#55	#55	#55	#55

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

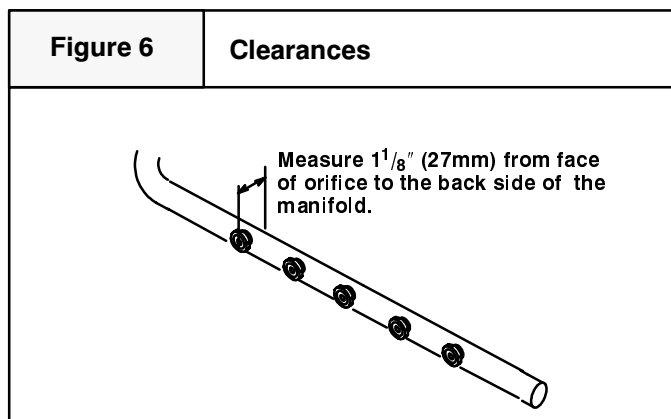
Changing Orifices

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

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



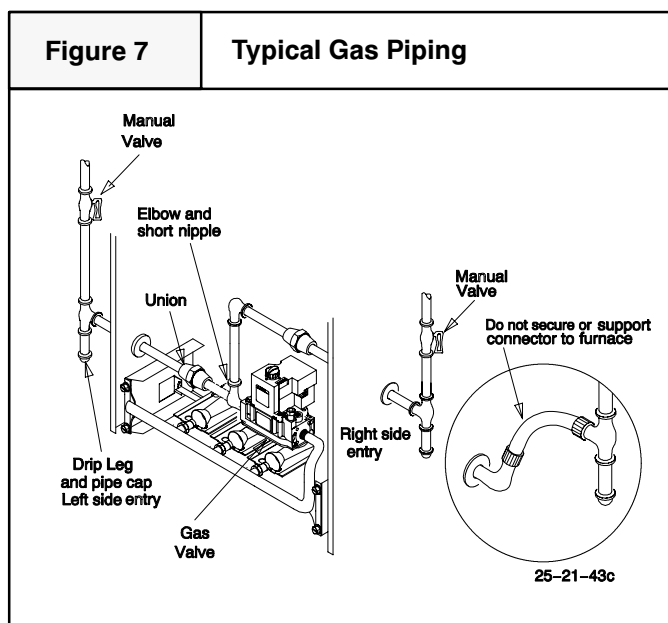
5. Carefully remove the manifold assembly.
6. Remove the orifices from the manifold and replace them with proper sized orifices. See **6**.



7. Tighten orifices so there is 1 1/8" from the face of the orifice to the back side of the manifold.
8. Reassemble all parts in reverse order as removed. Be sure to engage the main burner orifices in the proper opening in the burners.
9. After reassembling, turn gas on and check all joints for gas leaks using a soapy solution. All leaks must be repaired immediately.

Gas Piping Requirements

1. Install gas piping in accordance with local codes, or in the absence of local codes, the applicable national codes.
2. It is recommended that a manual shutoff valve be installed in the gas supply line outside the unit. Locate valve as close to the furnace as possible where it is readily accessible. Refer to **Figure 7**.



3. Use black iron or steel pipe and fittings or other pipe approved by local code.
4. Use pipe thread compound which is resistant to natural and LP gases.
5. Install a drip leg no less than 3" long to trap dirt and moisture before it can enter gas valve.
6. Use two pipe wrenches when making connections to prevent gas valve from turning.
7. Flexible corrugated metal gas connector may **NOT** be used inside the furnace or be secured or supported by the furnace or ductwork.
8. Properly size gas pipe to handle combined appliance load or run gas pipe directly from gas meter or LP gas regulator.
9. Install correct pipe size for run length and furnace rating.
10. Measure pipe length from gas meter or LP second stage regulator.

⚠ WARNING

Fire or explosion hazard.

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

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

Additional LP Piping Requirements

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

Final Check

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

- Correct even the smallest leak at once.

⚠ WARNING

Fire or explosion hazard.

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

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

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

5. Electrical Wiring

Power Supply Wiring

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

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

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

Thermostat

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

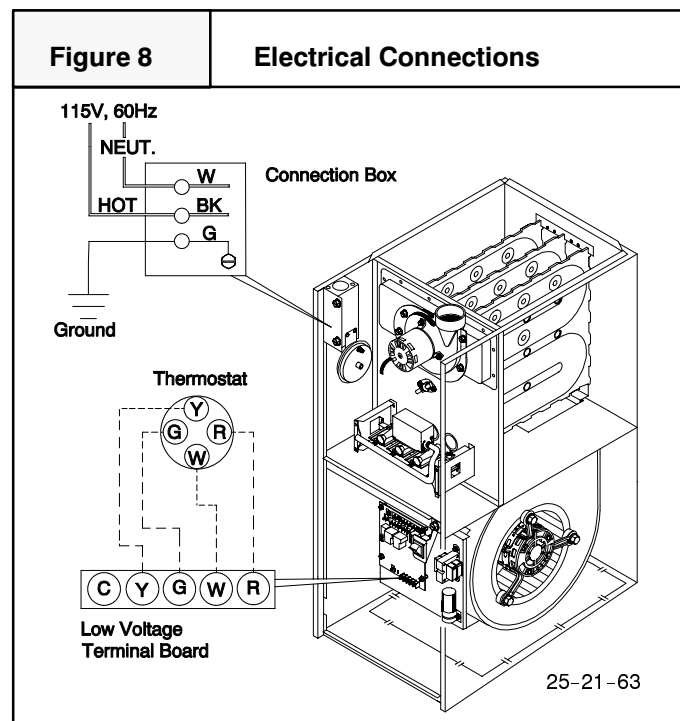
Low voltage connections to furnace must be made on terminal board to fan control.

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

Optional Equipment*

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

*"Y" terminal on thermostat sub-base must be connected to "Y" terminal on furnace fan timer for proper fan speed during operation in air conditioning mode.



Fan Timer

HEATING DELAY ON: FIXED 30 SEC.
HEATING DELAY OFF: FIXED 140 SEC.
COOLING DELAY ON/OFF: FIXED 30 SEC.

6. Ductwork and Filter

⚠ WARNING

Poison carbon monoxide gas hazard.

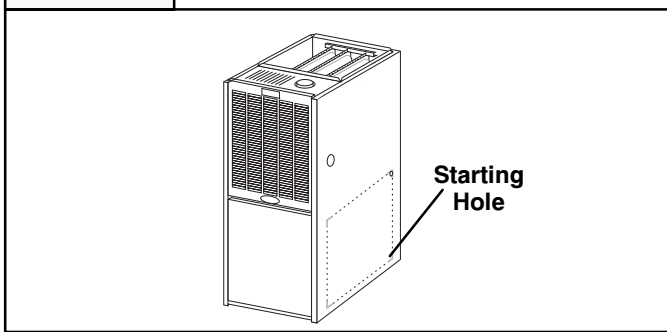
Do NOT draw return air from inside a closet or utility room where furnace is located. Return air duct MUST be sealed to furnace casing.

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

Duct Connections

This furnace may be installed in only a bottom or side return application. Return air through the back of the unit is **NOT** allowed.

Side connections can be made by cutting out the embossed area shown in **Figure 9**.

Figure 9**Cutting Side Return Air Opening**

Bottom returns can be made by removing the knockout panel in the furnace base. Do **NOT** remove knock-out except for a bottom return.

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

- Refer to furnace **Technical Support Manual** (Blower Data) for air flow information.
- Size ductwork to handle air flow for heating and air conditioning.

Duct Installation Requirements

- When furnace supply ducts carry air outside furnace area, seal return air duct to furnace casing and terminate duct outside furnace space .
- When a refrigeration coil is used in conjunction with this unit, it must be installed on the discharge side of the unit to avoid condensation on the heat exchanger.
- If separate evaporator and blower unit is used, install good sealing dampers for air flow control. Chilled air going through the furnace could cause condensation and shorten furnace life. Dampers (purchased locally) can be either automatic or manual. Manually operated dampers **MUST** be equipped with a means to prevent furnace or air conditioning operation unless damper is in the full heat or cool position.

⚠ WARNING

Poison Monoxide Gas hazard.

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

This could result in personal injury and/or death.

- Installation of locking-type dampers are recommended in all branches, or in individual ducts to balance system's air flow.
- Non-combustible, flexible duct connectors are recommended for return and supply connections to furnace.
- If air return grille is located close to the fan inlet, install at least one, 90 degree air turn between fan and inlet grille to reduce noise.
- Insulate ductwork installed in attics or other areas exposed to outside temperatures with a minimum of R-6 value insulation and vapor barrier.
- It is recommended to insulate ductwork in indoor unconditioned areas with a minimum of R-2 value insulation with indoor type vapor barrier.

Inspection Panel

A removable access panel should be provided in the outlet duct when the furnace is installed without a cooling coil. This will allow smoke or reflected light to be observable inside the casing to indicate the presence of leaks in the heat exchanger. This access cover shall be attached in such a manner as to prevent air leaks.

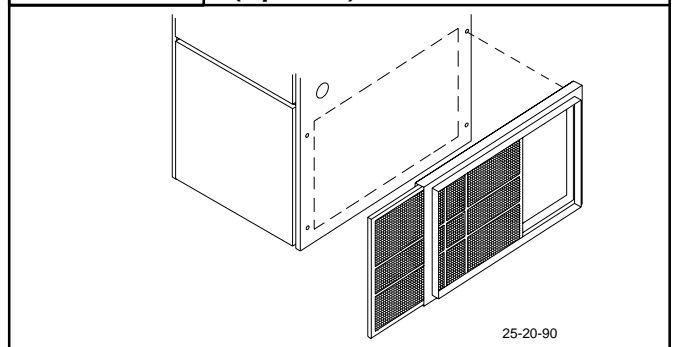
Filters

Filters must be used. The can be field supplied or purchased separately.

Use either filter type:

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

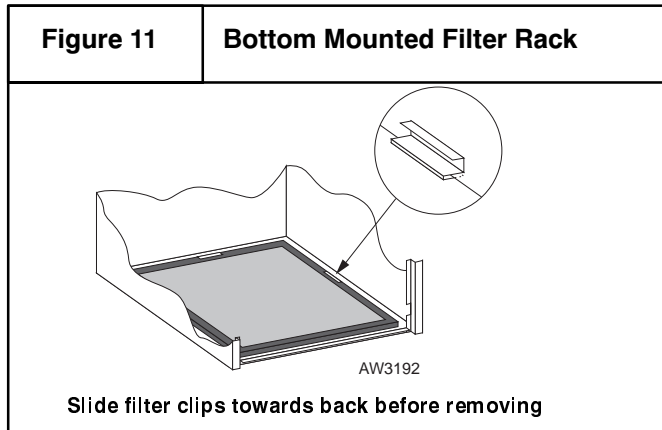
NOTE: Disposable, low velocity filters may be replaced with washable, high velocity filter providing they meet the minimum size areas. Washable, high velocity filters can be replaced **ONLY** with same type and size.

Figure 10**Side Mounted Filter Rack (Optional)**

25-20-90

Filter Installation

When installing or removing a bottom mounted filter, slide the two side filter clips to the back of the furnace **BEFORE** installing or removing. This will allow the filter to clear the front raised edge of the furnace. Insert filter into side clips first and push filter back until it is fully engaged into back clip. When filter is in place, slide clips back into place midway on filter as shown in **Figure 11**.



Refer to **Figure 10** through **Figure 13** for guidelines to install filters. Furnaces which require larger filter media and have limited clearances on one side of furnace, require a standoff filter rack, see **Figure 12**, available from your distributor.

CAUTION

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

Addition Of Air Conditioning

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

7. Checks and Adjustments

Startup

Furnace has pilot burner which must be lighted by hand. Refer to lighting instructions on unit.

CAUTION

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

Gas Supply Pressure

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

Manifold Gas Pressure Adjustment

NOTE: Make adjustment to manifold pressure with burners operating.

Figure 12

Standoff Filter Rack (OPTIONAL)

Using Optional
Standoff Filter
Rack

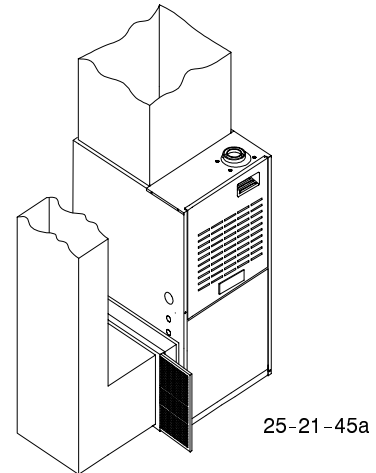
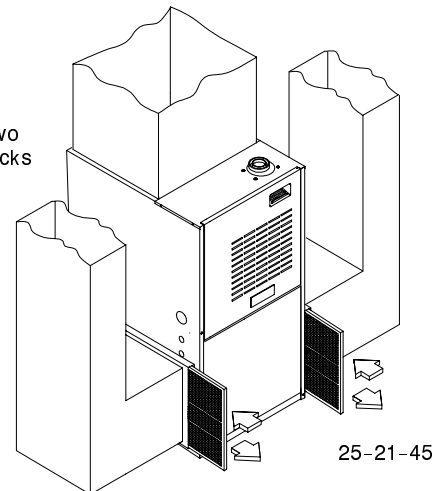


Figure 13

Filters Installed on Two Sides

Using Two
Filter Racks



WARNING

Fire or explosion hazard.

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

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

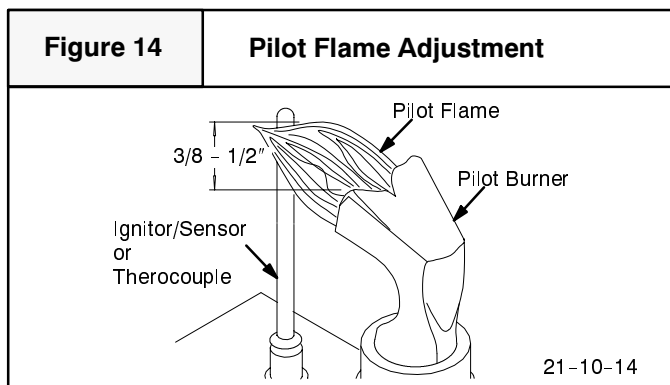
1. With gas **OFF**, Connect U-Tube manometer to tapped opening on gas valve. Use manometer with a 0 to min. 12" water column range.
2. Turn gas **ON** and remove adjustment screw cover on gas valve. Turn counterclockwise to decrease pressure and clockwise to increase.

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

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

Adjust Pilot Burner

The furnace has a pilot flame to light the main burner. The flame should surround $\frac{3}{8}"$ to $\frac{1}{2}"$ of the thermocouple. See **Figure 14**. To adjust, remove cap from pilot adjusting screw on gas valve. Turn screw counterclockwise to increase or clockwise to decrease flame as required. Replace cap for adjusting screw.



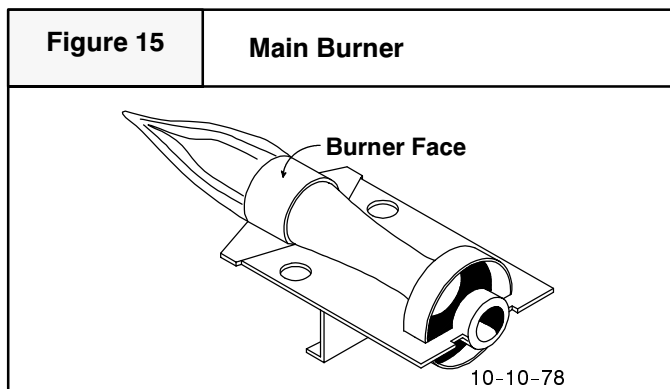
Main Burner Flame Check

Allow the furnace to run approximately 10 minutes then inspect the main burner and pilot flames. See **Figure 14** & **Figure 15**.

Check for the following (**Figure 15**):

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

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



Temperature Rise Check

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

To check 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 furnace continuously for 15 minutes with all registers and duct dampers open.
- Take reading and compare with range specified on rating plate.
- If the correct amount of temperature rise is **NOT** obtained, it may be necessary to change blower speed. A higher blower speed will lower the temperature rise. A lower blower speed will increase the temperature rise.

Changing Blower Speed

⚠ WARNING

Electrical shock hazard.

Turn OFF power to furnace before changing speed taps.

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

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

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

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

- Refer to *Furnace Wiring Diagram* for location of the heating and cooling speed taps located on the electronic fan control as well as location of unused blower motor speed leads. Use the chart (**Table 5**) to determine the blower motor speed settings.

Table 5	Blower Speed Chart	
	Wire Color	Motor Speed
	Black	High
	Orange*	Med-High
	Blue	Medium
	Red	Low
* Med-High speed may not be provided on all models.		

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

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

8. Furnace Maintenance

CAUTION

The furnace must be inspected and serviced on an annual basis (before the heating season) by a qualified service technician. See User’s Manual for details.

See “*User’s Information Manual*”.

Pressure Switch

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