VersaPro™
80% Gas Furnace
Installation Manual

MODELS:

- **MGA80EE040A3B**
- **MGA80EE060B4B**
- **MGA80EE080B4B**
- **MGA80EE080C4B**
- **MGA80EE100C5B**
- **MGA80EE120D5B**



Read this manual carefully before installation and keep it where the operator can easily find it for future reference.

Due to updates and constantly improving performance, the information and instructions within this manual are subject to change without notice.

Version Date: March 22, 2024
Please visit www.mrcool.com/documentation to ensure you have the latest version of this manual.

MRCOOL®
COMFORT MADE SIMPLE

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Safety Precautions

Read Before Using

Incorrect usage may cause serious damage or injury.

Keep this manual for future reference.

The figures shown in this manual are for reference only and may be slightly different from the actual product.

WARNING	Indicates the most serious hazards which will result in severe personal injury or death.
CAUTION	Indicates hazards which could result in personal injury or death.
NOTE	Indicates suggestions which will result in enhanced installation, reliability, or operation.

WARNING: FIRE & EXPLOSION

FAILURE TO FOLLOW SAFETY WARNINGS COULD RESULT IN SERIOUS INJURY, DEATH, OR PROPERTY DAMAGE.

INSTALLATION & SERVICE MUST BE PERFORMED BY A QUALIFIED INSTALLER, SERVICE AGENCY, OR THE GAS SUPPLIER.

DO NOT store gasoline or other flammable vapors and liquids in the vicinity of the unit or any other appliance.

What to do if you smell gas:

- **Do not attempt to light any appliance.**
- **Do not touch any electrical switches**
- **Do not use any phone in the building.**
- **Immediately call your gas supplier from a phone outside of the building and follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

WARNING: FIRE & EXPLOSION (CONTD.)

- The furnace is designed and approved for use with Natural Gas and Liquid Propane Gas ONLY. DO NOT BURN ANY LIQUID FUEL OR SOLID FUEL IN THIS FURNACE.
- Burning any unapproved fuel will result in damage to the furnace heat exchanger, which could result in fire, personal injury, and/or property damage.
- Do not use this furnace if any part has been under water. A flood-damaged furnace is extremely dangerous. Attempts to use the furnace can result in fire or explosion. A qualified service agency should be contacted to inspect the furnace and to replace all gas controls, control system parts, and electrical parts that have been wet. Replacement of the furnace may be deemed necessary.

GENERAL WARNINGS FOR SAFETY

1. Improper installation, adjustment, alteration, service, maintenance, or use could cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified service agency, local gas supplier, or MRCOOL for information or assistance. The qualified service agency must use only factory-authorized and listed kits or accessories when modifying this product.
2. Should the gas supply fail to shut off or if overheating occurs, shut off the gas valve to the furnace before shutting off the electrical supply.
3. 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 the "Gas Supply and Piping" section.

CAUTION: LOCATION SELECTION

1. Only use this unit in well-ventilated spaces and ensure that there are no obstructions that could impede the airflow into and out of the unit.
   Do not use this unit in the following locations:
   - Locations with mineral oil.
   - Locations with a saline atmospheres, such as seaside locations.
   - Locations with sulfurous atmospheres, such as near natural hot springs.
   - Where high voltage electricity is present, such as in certain industrial locations.
   - On vehicles or vessels, such as trucks or ferry boats.
   - Where exposure to oily or very humid air may occur, such as kitchens.
   - In proximity to sources of electromagnetic radiation, such as high-frequency transmitters or other high-strength radiation devices.
2. The unit is CSA (formerly A.G.A. and C.G.A.) design-certified for use with natural and propane gases (see furnace rating plate) and for installation in alcoves, attics, basements, closets, utility rooms, crawlspaces, and garages. The furnace is factory-shipped for use with natural gas. A CSA-listed accessory gas conversion kit is required to convert furnace for use with propane gas.
3. The furnaces must be kept free and clear of insulating materials. Inspect the surrounding area to ensure insulation material is in safe distance when installing furnace or adding insulation materials. Insulation materials may be combustible. Maintain a 1 in. (25mm) clearance from combustible materials to supply air ductwork for a distance of 36 in. (914mm) horizontally from the furnace. See NFPA 90B or local code for further requirements.
4. The furnace should not be installed directly on carpeting, tile, or any other combustible material other than wood flooring. In downflow installations, factory accessory floor base must be used when installed on combustible materials and wood flooring. Special base is not required when installed on manufacturer's coil assembly.
5. Furnace operation needs air for combustion and ventilation. Do not block or obstruct air openings on furnace or spacing around furnace required for supplying sufficient combustion air and ventilation.

GENERAL CAUTIONS FOR SAFETY

- Follow all safety codes. Consult local building codes, the current editions of the National Fuel Gas Code (NFGC) NFPA 54/ANSI Z223.1 and the National Electrical Code (NEC) NFPA 70. In Canada, refer to the current editions of the National Standards of Canada CAN/CSA-BI49.1 and .2 Natural Gas and Propane Installation Codes, and Canadian Electrical Code CSA C22.1.
- Wear safety glasses, protective clothing, and work gloves.
- Have a fire extinguisher available.
- Read these instructions thoroughly as well as those attached to the unit.
- Improper installation or misapplication of furnace may require excessive servicing or cause premature component failure. Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rate, air temperature rise, unit leveling, and unit sizing.
- Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in the "Venting" section of this manual.
- 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 the "Start-Up, Adjustments, and Safety Check" section. Also see the furnace rating plate.
- 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 duct(s) sealed to the furnace casing and terminating outside the space containing the furnace. See "Air Ducts" section.
- A gas-fired furnace for installation in a residential garage must be installed as specified in the "Caution: Location Selection" box.
- The furnace may be used for construction heat provided that the furnace installation and operation complies with the requirements in the "Caution: Location Selection" box.

NOTE FOR OPTIMAL OPERATION

Before heating season begins, examine the furnace to determine that:

- All flue gas carrying areas external to the furnace (i.e. chimney, vent connector) are clear and free of obstructions.
- The vent connector is in place, slopes upward, and is physically sound without holes or excessive corrosion.
- The return-air duct connection(s) is physically sound, is sealed to the furnace casing, and terminates outside the space containing the furnace.
- The physical support of the furnace is sound without sagging, cracks, gaps, etc. around the base so as to provide a seal between the support and the base.
- There are no obvious signs of deterioration of the furnace.
- The burner flames are adjusted appropriately.

FOR YOUR SAFETY, READ BEFORE OPERATING.

WARNING: If these instructions are not followed exactly, it may result in a fire or explosion causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. DO NOT try to light the burner by hand.

B. Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor as some gas is heaver than air and will setting on the floor.

What to do if you smell gas:

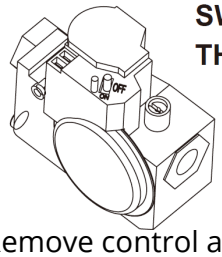
- Do not try to light any appliance.
- Do not touch any electrical switch; do not use a phone inside the building.
- Immediately call your gas supplier from a phone outside of the building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control switch. Never use tools. If the switch will not turn by hand, do not try to repair it; call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS:

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.



SWITCH SHOWN IN THE "OFF" POSITION

5. Remove control access panel.
6. Wait five (5) minutes to clear out any gas. If you smell gas, STOP. Follow "B" in the safety information above. If you don't smell gas, go to the next step.
7. Push gas control switch to "ON". Do not force.
8. Replace control access panel.
9. Turn on all electric power to the appliance.
10. Set the thermostat to the desired setting.
11. If the appliance will not operate, follow the instructions below regarding turning off the gas to the appliance and call your service technician or gas supplier.

TURNING OFF GAS TO APPLIANCE

1. Set the thermostat to its lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove control access panel.
4. Push gas control to "OFF". Do not force.
5. Replace control access panel.

2.1 Dimensions

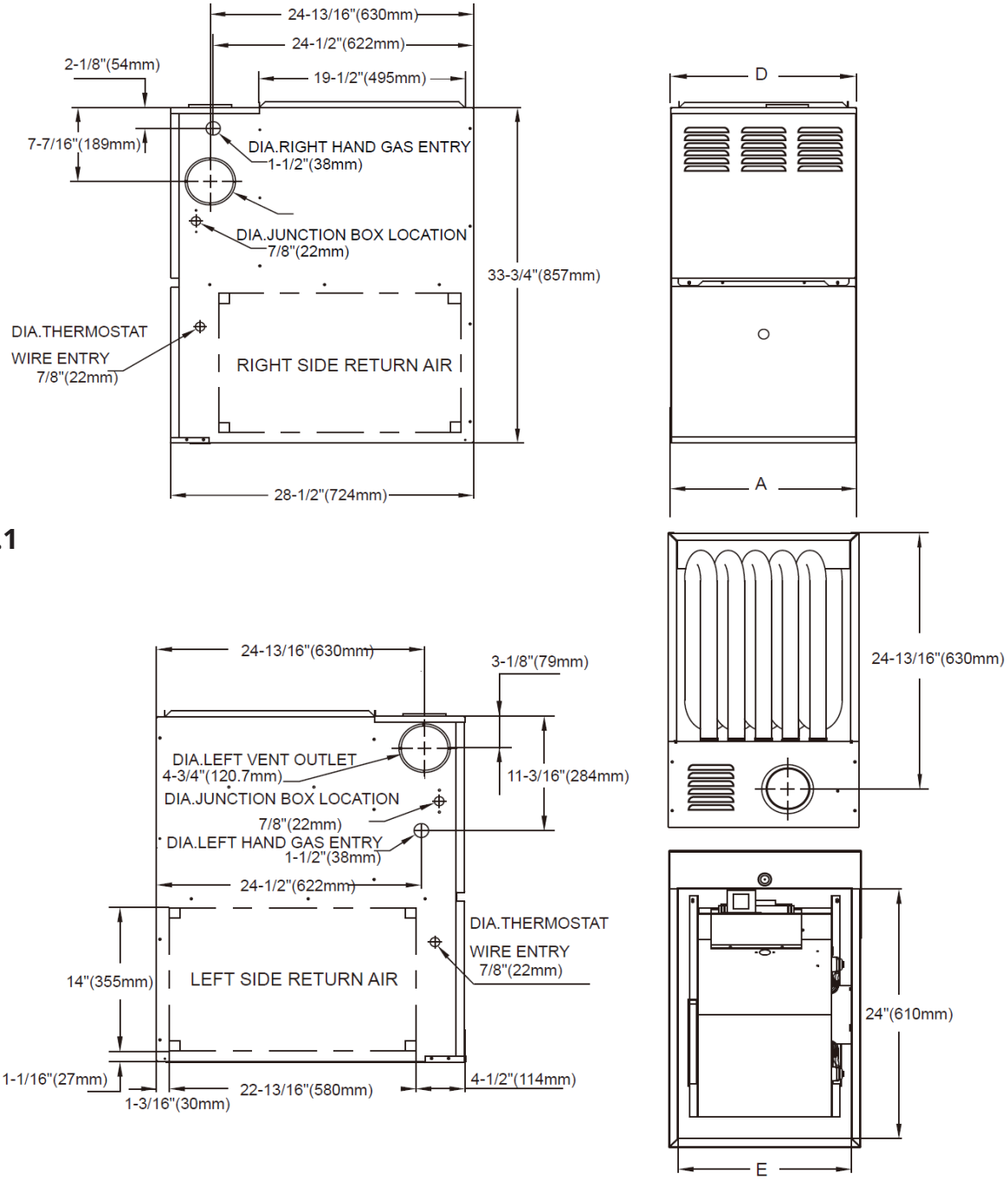


Figure 2.1

Table 2.1

Furnace Size	A Cabinet Width in. (mm)	D Supply Air Width in. (mm)	E Return Air Width in. (mm)	Ship Weight (lbs)
MGA80EE040A3B	14.5 (368)	13 (330)	15-57/32 (326)	132
MGA80EE060B4B	17.5 (446)	16 (406)	15-27/32 (402)	141
MGA80EE080B4B	17.5 (446)	16 (406)	15-27/32 (402)	155
MGA80EE080C4B	21 (533)	19.5 (495)	19-13/32 (493)	163
MGA80EE100C5B	21 (533)	19.5 (495)	19-13/32 (493)	177
MGA80EE120D5B	24.5 (622)	23 (584)	22-27/32 (580)	190

2.2 Unit Description

This 4-way multipurpose Category I fan-assisted furnace is CSA design-certified. A Category I fan-assisted furnace is an appliance equipped with an integrated mechanical means to either draw or force products of combustion through the combustion chamber and/or heat exchanger. The furnace is factory-shipped for use with natural gas.

This furnace is not approved for installation in mobile homes, recreational vehicles, or outdoors. The unit is designed for a minimum continuous return-air temperature of 60°F (16°C) or intermittent operations down to 55°F (13°C) such as when used with a night setback thermostat. Return-air temperatures must not exceed 85°F (29°C). Failure to follow these return-air temperature limits may affect reliability of heat exchangers, motors, and controls.

For accessory installation details, refer to its accompanying instruction literature.

NOTE

Remove all shipping brackets and materials before operating the furnace.

! CAUTION

Check the entire gas assembly for leaks after lighting this appliance.

2.3 Code Requirements

Safety

Follow all national and local codes and standards in addition these instructions. The installation must comply with regulations of the serving gas supplier, local building, heating, plumbing, and other codes. In absence of local codes, the installation must comply with the national codes listed below and all authorities having jurisdiction. In the United States and Canada, follow all codes and standards for the following:

- USA: National Fuel Gas Code (NFGC) NFPA 54-2006/ ANSI Z223.1-2006 and the Installation Standards, Warm Air Heating and Air Conditioning Systems ANSI/NFPA 90B
- CANADA: CSA B149.1-05 National Standard of Canada Natural Gas and Propane Installation Codes (CAN/CSA-B149.1-05)

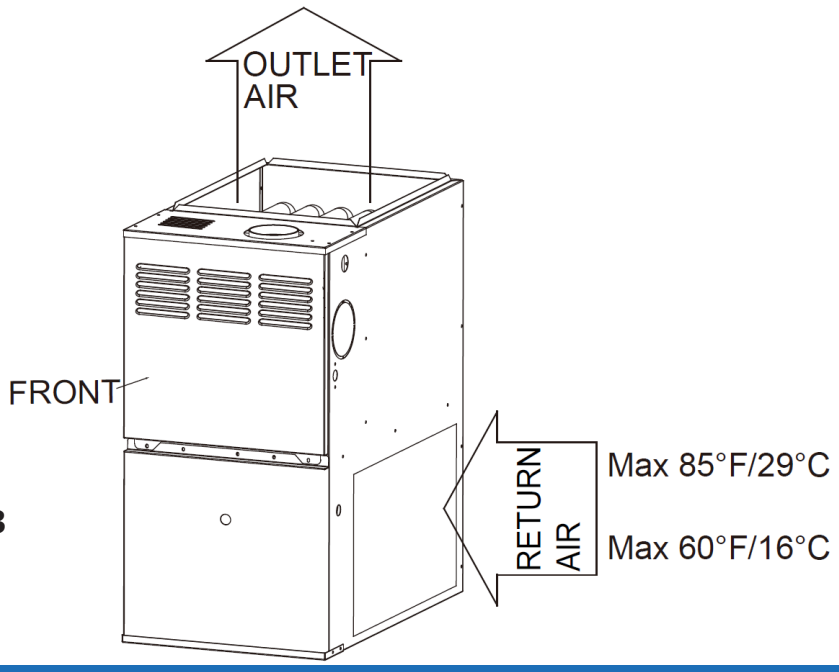


Figure 2.3

General Installation

- USA: Current edition of the NFGC and the NFPA 90B. For copies, contact the National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269; (www.NFPA.org) or for only the NFGC, contact the American Gas Association, 400 N. Capitol Street, N.W., Washington, DC 20001 (www.AGA.org).
- CANADA: CAN/CSA-B149.1-05. For a copy, contact Standard Sales, CSA International, 178 Rexdale Boulevard, Etobicoke (Toronto), Ontario, M9W 1R3 Canada.

Combustion & Ventilation Air

- US: Section 9.3 of the NFGC, NFPA 54/ANSI Z223.1-2006 Air for Combustion and Ventilation.
- CANADA: Part 8 of CAN/CSA-B149.1-05, Venting Systems and Air Supply for Appliances.

Duct Systems

- US and CANADA: Air Conditioning Contractors Association (ACCA) Manual D, Sheet Metal and Air Conditioning Contractors National Association (SMACNA), or American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 2001 Fundamentals Handbook Chapter 34 or 2000 HVAC Systems and Equipment Handbook Chapters 9 and 16.

Acoustal Lining & Fibrous Glass Duct

- US and CANADA: current edition of SMACNA and NFPA 90B as tested by UL Standard 181 for Class I Rigid Air Ducts.

Gas Piping & Gas Pipe Pressure Testing

- US: NFPA 54/ANSI Z223.1-2006 Chapters 5,6, 7, and 8 and National Plumbing Codes.
- CANADA: CAN/CSA-B149.1-05 Parts 4, 5, and 6 and Appendices A, B, E, and H.

Electrical Connections

- US: National Electrical Code (NEC) ANSI/NFPA 70-2008.
- CANADA: Canadian Electrical Code CSA C22.I.

Electrical Power Supply

- Voltage: ANSI C84.1-2006 (104-127 volt)

Venting

- US: NFGC NFPA 54/ANSI Z223.1-2006 ; chapters 12 and 13.
- CANADA: CAN/CSA-B149.1-05 Part 8 and Appendix C.

2.4 Electrostatic Discharge Precautions Procedure

FURNACE RELIABILITY HAZARD

- **Improper installation or service of furnace may cause premature furnace component failure. Electrostatic discharge can affect electronic components.**
- **Follow the Electrostatic Discharge Precautions Procedure listed below during furnace installation and servicing to protect the furnace electronic control. Precautions will prevent electrostatic discharges from personnel and hand tools which are held during the procedure.**
- **These precautions will help to avoid exposing the control to electrostatic discharge by putting the furnace, the control, and the person at the same electrostatic potential.**

- Disconnect all power to the furnace Disconnect all power to the furnace. Multiple disconnects maybe required. DO NOT TOUCH THE CONTROL OR ANY WIRE CONNECTED TO THE CONTROL PRIOR TO DISCHARGING YOUR BODY'S ELECTROSTATIC CHARGE TO GROUND.
- Firmly touch the clean, unpainted, metal surface of the furnace chassis which is close to the control. Tools held in a person's hand during grounding will be satisfactorily discharged.
- After touching the chassis, you may proceed to service the control or connecting wires as long as you do nothing to recharge your body with static electricity (for example; DO NOT move or shuffle your feet, do not touch ungrounded objects, etc.).
- If you touch ungrounded objects (and recharge your body with static electricity), firmly touch a clean, unpainted metal surface of the furnace again before touching control or wires.
- Use this procedure for installed and un-installed (ungrounded) furnaces.
- Before removing a new control from its container, discharge your body's electrostatic charge to ground to protect the control from damage. If the control is to be installed in a furnace, follow items 1 through 4 before bringing the control or yourself in contact with the furnace. Put all used and new controls into containers before touching ungrounded objects.
- An ESD service kit (available from commercial sources) may also be used to prevent ESD damage.

3.1 Location Selection

General

This multipurpose furnace is shipped in packaged configuration. Some assembly and modifications are required when used in any of the four applications. This furnace must:

- Be installed so the electrical components are protected from water.
- Not to be installed directly on any combustible material other than wood flooring.
- Downflow installation and horizontal installation in attics have additional requirements.
- Be located as close to the chimney or vent and attached to an air distribution system.
- Be provided ample space for servicing and cleaning. Always comply with minimum fire protection clearances shown on the furnace clearance to combustible label.

The following types of furnace installations may require outdoor air for combustion due to chemical exposures:

- Commercial buildings
- Buildings with indoor pools
- Laundry rooms
- Hobby or craft rooms
- Chemical storage areas

CARBON MONOXIDE POISONING HAZARD

- **Failure to follow this warning could result in personal injury or death, and unit component damage.**
- **Corrosive or contaminated air may cause failure of parts containing flue gas, which could leak into the living space. Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements can corrode heat exchangers and shorten furnace life. Air contaminants are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products. Do not install furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements are met, in addition to all local codes and ordinances.**

If air is exposed to the following substances, it should not be used for combustion air, and outdoor air may be required for combustion:

- Permanent wave solutions
- 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
- Cements and glues
- Antistatic fabric softeners for clothing dryers
- Masonry acid washing materials

All fuel-burning equipment must be supplied with air for fuel combustion. Sufficient air must be provided to avoid negative pressure in the equipment room or space. A positive seal must be made between the furnace cabinet and the return-air duct to prevent pulling air from the burner area and from draft safeguard opening.

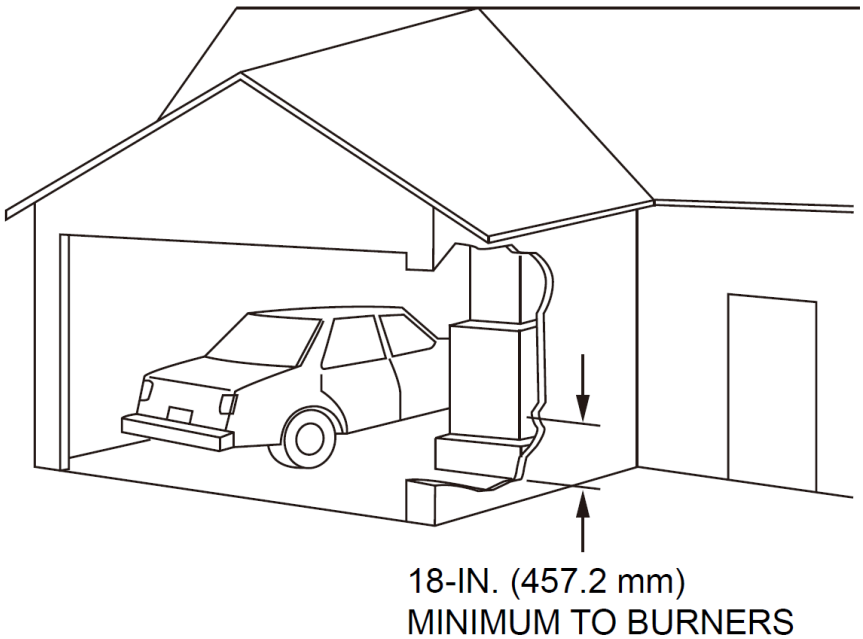


Figure 3.1a

3 INDOOR UNIT INSTALLATION

FIRE, INJURY, OR DEATH HAZARD

- **Failure to follow this warning could result in personal injury, death, and/or property damage. When the furnace is installed in a residential garage, the burners and ignition sources must be located at least 18 inches (457 mm) above the floor. The furnace must be located or protected to avoid damage by vehicles. When the furnace is installed in a public garage, airplane hangar, or other building having a hazardous atmosphere, the furnace must be installed in accordance with the NFGC or CAN/CSA - B149 .1-05.**

PERSONAL INJURY AND/OR PROPERTY DAMAGE HAZARD

Improper use or installation of this furnace may cause premature furnace component failure. This gas furnace may be used for heating buildings under construction 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 60°F (16°C) and 85°F (29°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 gas input rate has been set to the nameplate 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.**

Clearance Requirements

The furnace is approved for UPFLOW, DOWNFLOW, and HORIZONTAL installations.

The clearance arrows do not change with furnace orientation.

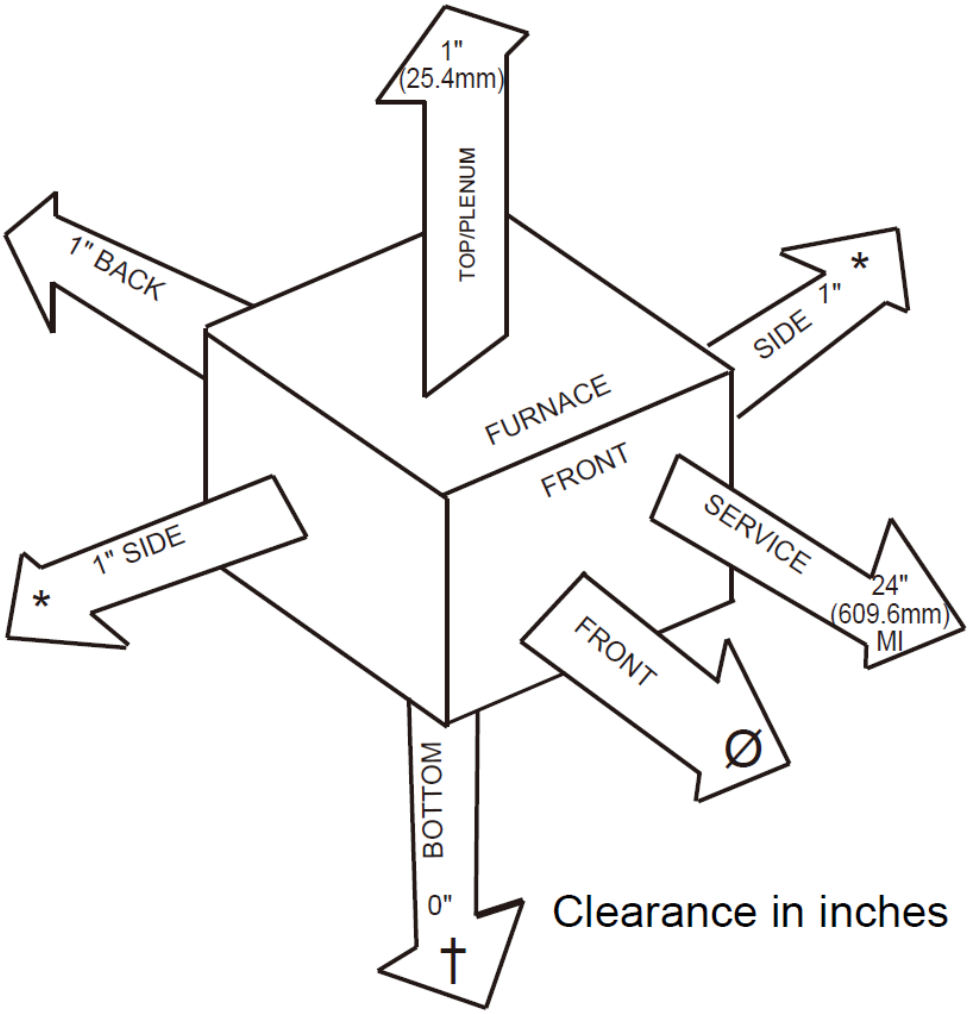


Figure 3.1b

Vent clearance to combustibles:

For single wall vents: 6 inches

For Type B-1 vent type: 1 inch

Downflow Positions:

† Installation on non-combustible floors only.

-For installation on combustible flooring only when installed on sub-base provided by installer or manufacturer.

Ø 18 inches (457.2mm) front clearance required for alcove.

Horizontal Positions:

- Indicated supply or return sides when furnace is in the horizontal position. Line contact only permissible between lines formed by intersections of the top and two sides of the furnace jacket, building joists, studs, and framing.
- A special base is required.

FIRE, INJURY, OR DEATH HAZARD

- **Check the power supply before installation. Ensure that the power supply must be reliable grounded following local, state, and National Electrical Codes. If not, for example, if the ground wire is detected charged, installation is prohibited before it is corrected. Otherwise, there is a risk of fire and electric shock, causing physical injury or death.**
- **Check the electric wire, water, and gas pipeline layout inside the wall, floor, and ceiling before installation. Do no implement drilling unless safety is confirmed, especially for the hidden power wire. An electro-probe can be used to test whether a wire is passing by at the drilling location, to prevent physical injury or death caused by insulation broken cords.**

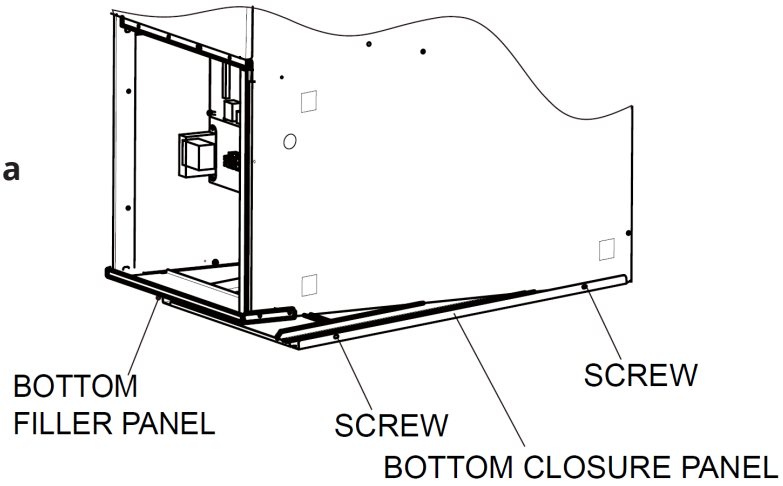
3.2 Upflow Installation

Bottom Return Air Inlet

The furnace is shipped with its bottom closure panel installed in the bottom return-air opening. Remove and discard this panel when bottom return air is used. To remove bottom closure panel, perform the following:

1. Tilt or raise the furnace and remove the screw holding the bottom filler panel.
2. Remove the bottom closure panel.

Figure 3.1a



Side Return Air Inlet

The furnace is shipped with its bottom closure panel installed in the bottom return-air opening. This panel MUST be in place when only side-return air is used.

NOTE

Side return-air openings can be used in UPFLOW and most HORIZONTAL configurations. Do not use side return-air openings in DOWNFLOW configuration.

3.3 Downflow Installation

NOTE

For downflow applications, this furnace is approved for use on combustible flooring when any one of the following 3 accessories are used:

- Special Base
- Cased Coil Assembly
- Coil Box

1. Determine the application being installed from Table 3.3.
2. Construct a hole in the floor according to requirements in Table 3.3 and Figure 3.3a.
3. Construct plenum to dimensions specified in Table 3.3 and Figure 3.3a.
4. If a downflow subbase is used, install as shown in Figure 3.3b. If Coil Assembly or Coil Box is used, install as shown in Figure 3.3c.

NOTE

- It is recommended that the supply-air duct flanges be completely folded over or removed from the furnace when installing the furnace on a factory-supplied cased coil or coil box.
- To remove the supply-air duct flange, use wide-duct pliers or hand seamers to bend flange. Be careful of sharp edges.

Bottom Return Air Inlet

Do not use side return openings in a downflow configuration.

The furnace is shipped with its bottom closure panel installed in the bottom return-air opening. Remove and discard this panel when bottom return air is used. See Figure 3.2 for bottom closure removal.

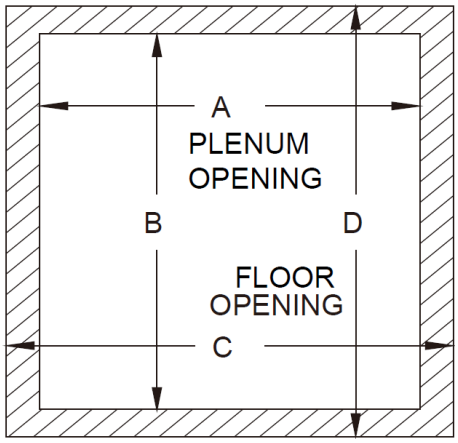


Figure 3.3a

Table 3.3

Furnace Casing Width	Application	Plenum Opening		Floor Opening	
		A	B	C	D
14-1/2 (368)	Downflow Applications on Noncombustible Flooring	13-3/16 (335)	16-11/16 (424)	13-13/16 (351)	17-21/64 (440)
	Downflow Applications on Combustible Flooring Using Special Base	12-11/64 (309)	16-1/32 (407)	12-63/64 (330)	16-13/16 (427)
	Downflow Applications on Combustible Flooring with Manufacturer Supplied Coil Assembly or Coil Box	13-3/16 (335)	16-3/16 (411)	13-13/16 (351)	16-13/16 (427)
17-1/2 (445)	Downflow Applications on Noncombustible Flooring	16-3/16 (411)	19-11/16 (500)	16-13/16 (427)	20-5/16 (516)
	Downflow Applications on Combustible Flooring Using Special Base	15-3/16 (385)	19 (483)	16 (406)	19-3/4 (503)
	Downflow Applications on Combustible Flooring with Manufacturer Supplied Coil Assembly or Coil Box	16-3/16 (411)	19-3/16 (487)	16-13/16 (427)	19-13/16 (503)
21 (553)	Downflow Applications on Noncombustible Flooring	19-11/16 (500)	19-11/16 (500)	20-5/16 (516)	20-5/16 (516)
	Downflow Applications on Combustible Flooring Using Special Base	18-11/16 (474)	19 (483)	19-1/2 (495)	19-3/4 (503)
	Downflow Applications on Combustible Flooring with Manufacturer Supplied Coil Assembly or Coil Box	19-11/16 (500)	19-3/16 (487)	20-5/16 (516)	19-13/16 (503)
24-1/2 (622)	Downflow Applications on Noncombustible Flooring	23-3/16 (589)	19-11/16 (500)	23-13/16 (605)	20-5/16 (516)
	Downflow Applications on Combustible Flooring Using Special Base	22-3/16 (563)	19 (483)	23 (584)	19-3/4 (503)
	Downflow Applications on Combustible Flooring with Manufacturer Supplied Coil Assembly or Coil Box	19-11/16 (500)	19-3/16 (487)	20-5/16 (516)	19-13/16 (503)

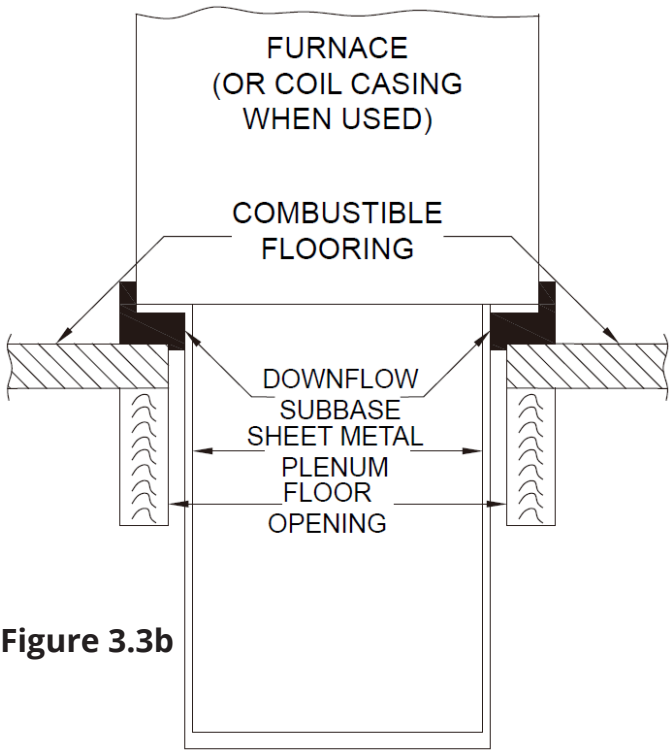


Figure 3.3b

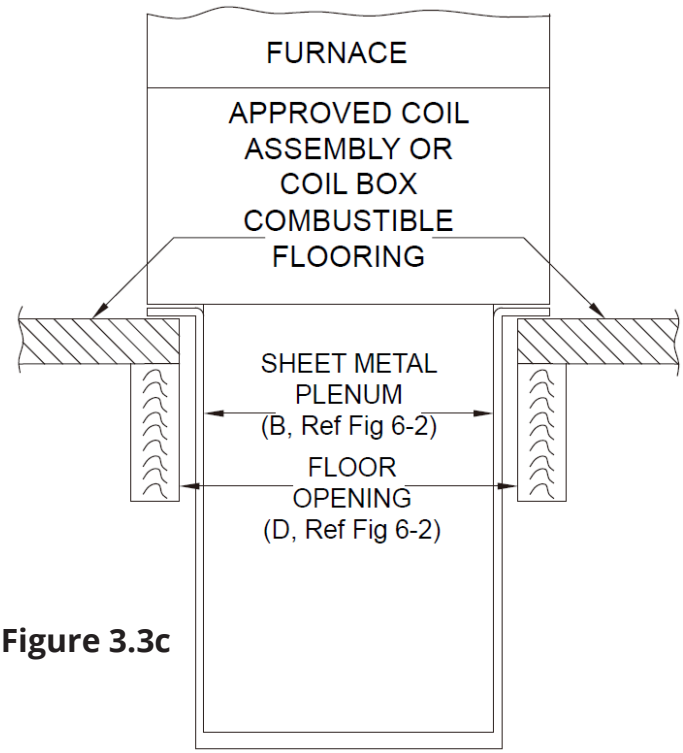


Figure 3.3c

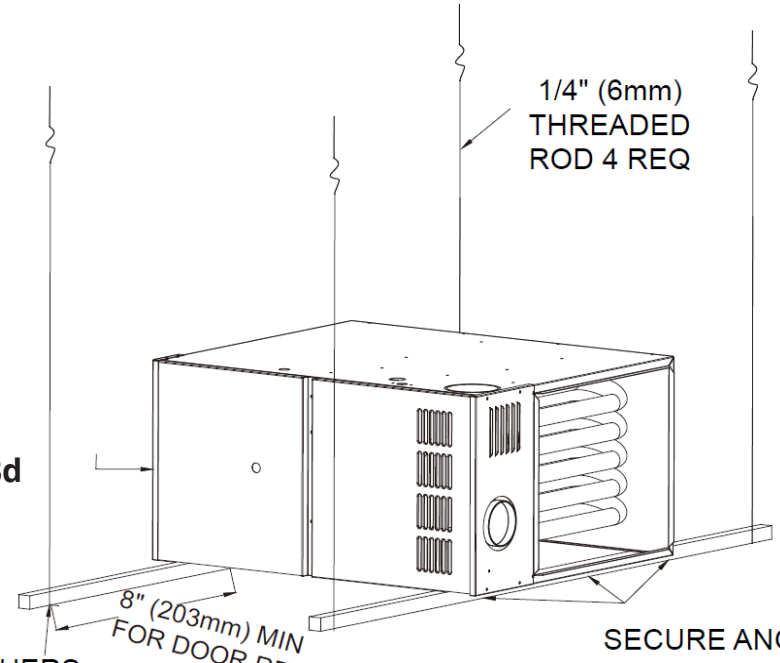


Figure 3.3d

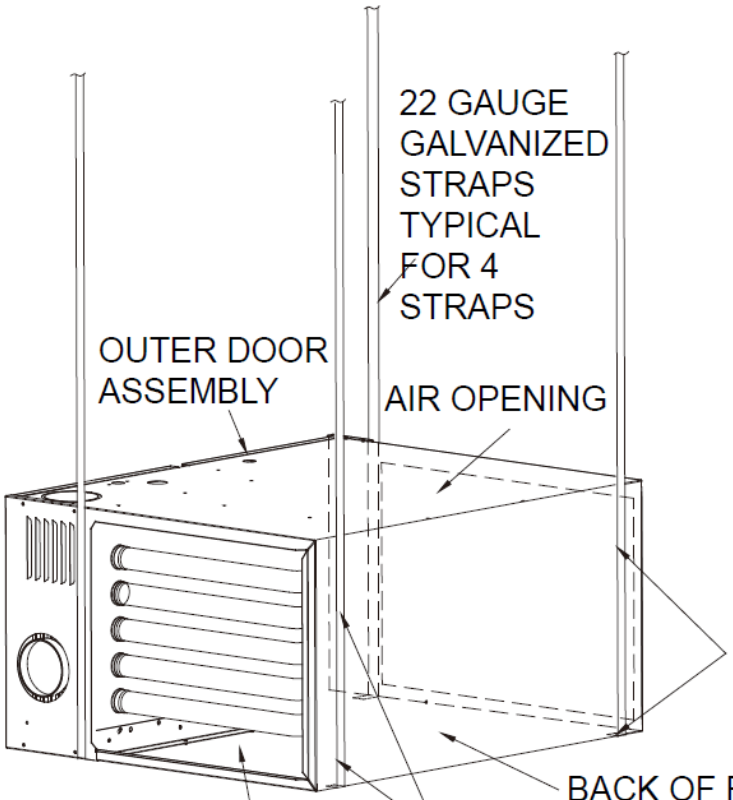


Figure 3.3e

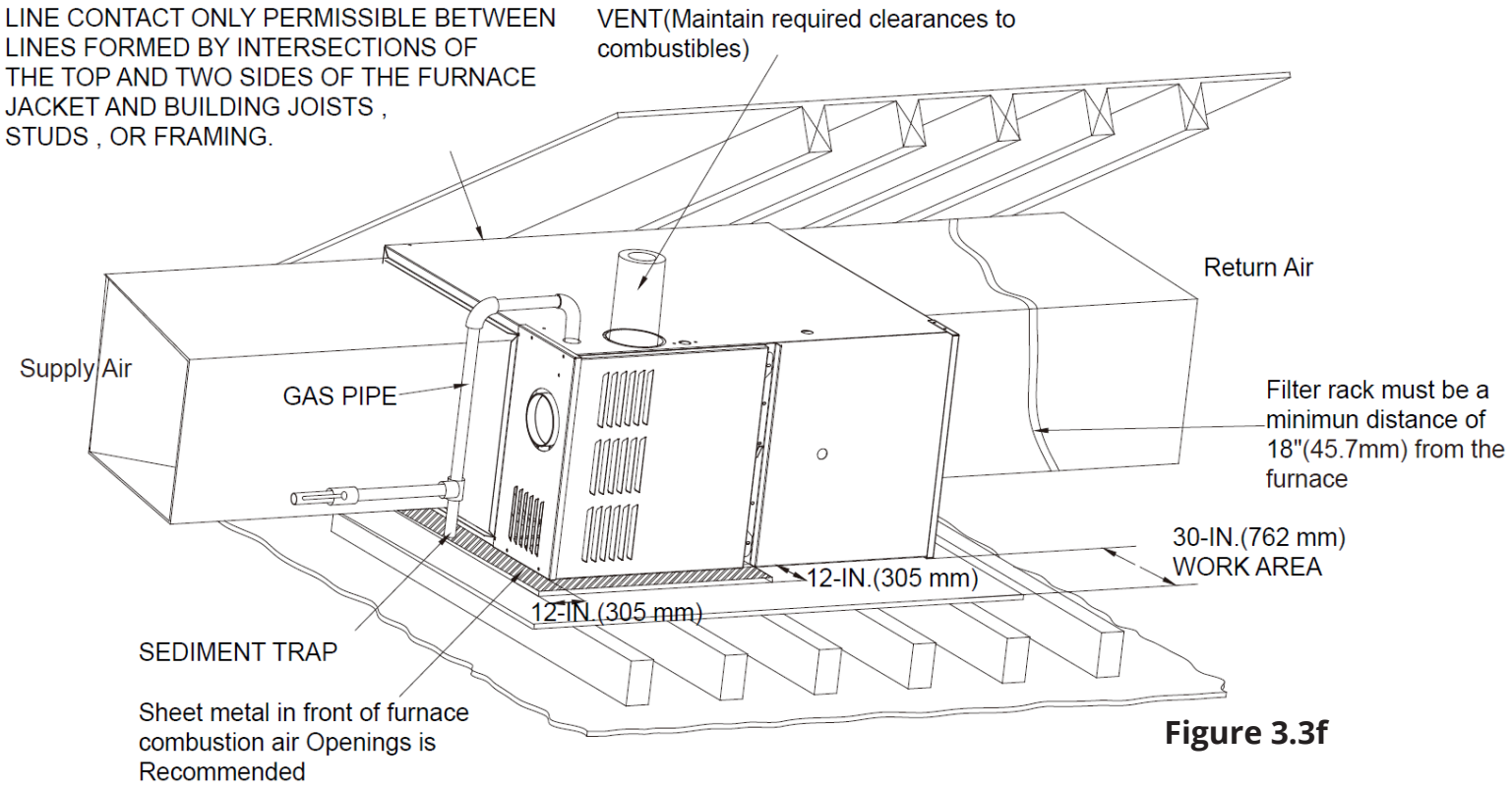


Figure 3.3f

3.4 Horizontal Installation

FIRE, EXPLOSION, & CARBON MONOXIDE POISONING HAZARD

- **Failure to follow this warning could result in personal injury, death, and/or property damage.**
- **Do not install the furnace on its back or hang furnace with control compartment facing downward.**
- **Safety control operation will be adversely affected. Never connect return-air ducts to the back of the furnace.**

The furnace can be installed horizontally in an attic or crawl space on bottom or either the left-hand (LH) or right-hand (RH) side. The furnace can be hung from floor joists, rafters, or trusses, or installed on a non-combustible platform, blocks, bricks, or pad.

Suspended Furnace Support

The furnace may be supported under each end with threaded rod, angle iron, or metal plumber's strap as shown in Figure 3.3d and 3.3e.

Secure angle iron to bottom of furnace as shown. Heavy-gauge sheet metal straps (plumber's straps) may be used to suspend the furnace from each bottom corner. To prevent screws from pulling out, use 2 #8 x 3/4-in screws into the side and 2 #8 x 3/4-in screws in the bottom of the furnace casing for each strap. (See Figure 3.3d & 3.3e)

If the screws are attached to ONLY the furnace sides and not the bottom, the straps must be vertical against the furnace sides and not pull away from the furnace sides, so that the strap attachment screws are not in tension (are loaded in shear) for reliable support.

Construct working platform at a location where all required furnace clearances are met. For furnaces with 1-in. clearance requirement on the side, set furnace on noncombustible blocks, bricks, or angle iron. For crawl space installations, if the furnace is not suspended from the floor joists, the ground underneath the furnace must be level and the furnace set on blocks or bricks.

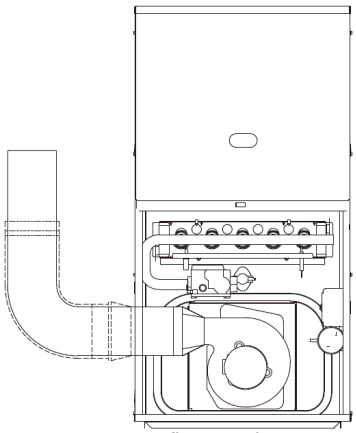
Roll-Out Protection

Provide a piece of sheet metal for flame roll-out protection in front of burner area for furnaces closer than 12 in. (305 mm) above the combustible deck or suspended furnaces closer than 12 in. (305 mm) to joists. The sheet metal MUST extend underneath the furnace casing by 1 in. (25 mm) with the door removed.

The bottom closure panel on furnaces of widths 12 in (305 mm) and larger may be used for flame roll-out protection when the bottom of the furnace is used for return air connection. See Figure 3.3 for proper orientation of roll-out shield.

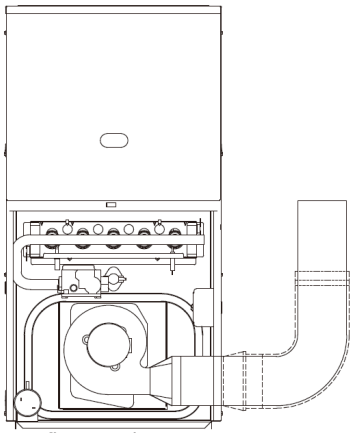
Vent the furnace with the appropriate connector as shown in Figures 3.4a-g.

Figure 3.4a



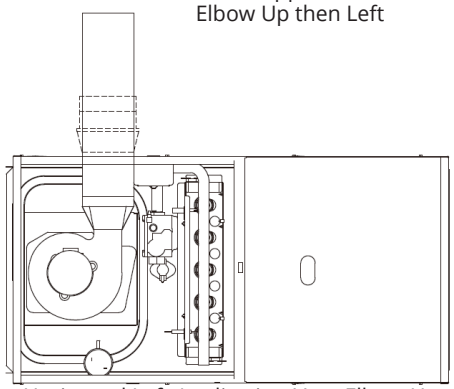
Downflow Application-Vent Elbow Up then Left

Figure 3.4b



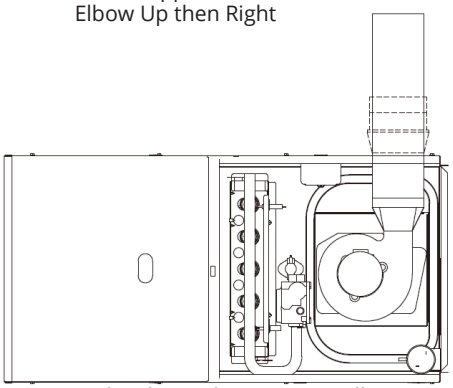
Downflow Application-Vent Elbow Up then Right

Figure 3.4c



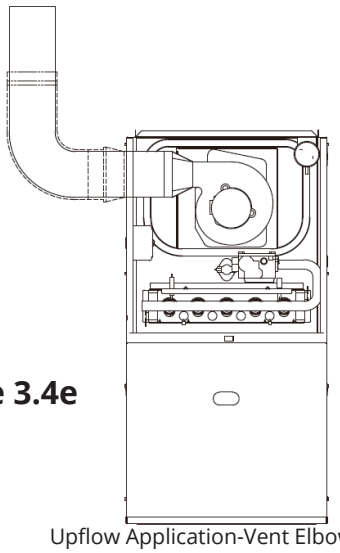
Horizontal Left Application-Vent Elbow Up

Figure 3.4d



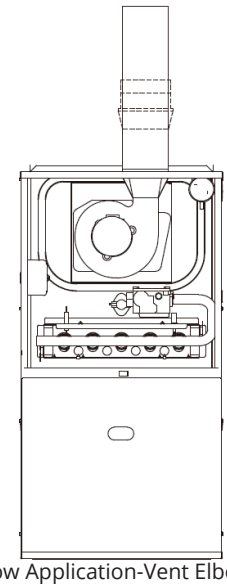
Horizontal Right Application-Vent Elbow Up

Figure 3.4e



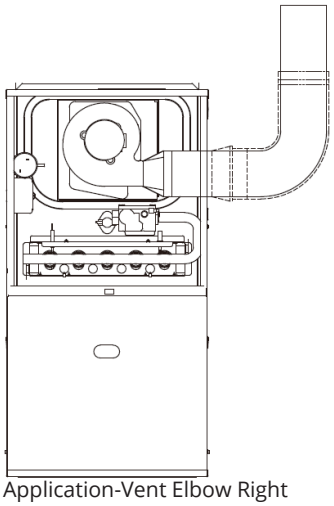
Upflow Application-Vent Elbow Right

Figure 3.4f



Upflow Application-Vent Elbow Up

Figure 3.4g



Upflow Application-Vent Elbow Right

3.5 Filter Arrangement

CARBON MONOXIDE & POISONING HAZARD

- **Failure to follow this warning could result in personal injury or death.**
- **Never operate a furnace without a filter or with the filter access door removed.**

Filter Size

See recommended filter size and type in Table 3.6b.

One of the most common problems in furnaces is a blocked or dirty filter. The filter must be inspected monthly for dirt accumulation and replace it if necessary.

Filter Type

Air velocity through throwaway filters may not exceed 300 feet per minute (91.4m/min). All velocities over this require the use of height velocity filters. If a normal speed disposable filter is used and air speed exceeds 300 feet per minute (FPM), two side returns or one side return and the bottom return may be needed. For airflow, refer to Table 3.6a.

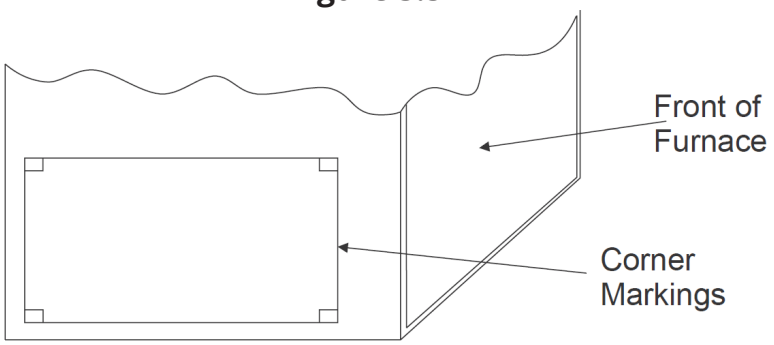
Side Return

Locate the 4 cutout locations. These indicate the size of the cut-out to be made in the furnace side panel. Refer to FIG ___ "Side Return Cutout Markings".

Install the side filter rack following the instructions provided with the accessory. If a filter is provided at another location in the return air system, the ductwork may be directly attached to the furnace side panel.

IMPORTANT: Some accessories such as electronic air cleaners and pleated media may require a larger side opening. Follow the instructions supplied with that accessory for side opening instructions.

Figure 3.5



Downflow Filters

Downflow furnaces typically are installed with the filters located above the furnace, extending into the return air plenum or duct. Any branch duct (rectangular or round duct) attached to the plenum must attach to the vertical plenum above the filter height.

Filter(s) may be located in the duct system external to the furnace using an external duct filter box attached to the furnace plenum or at the end of the duct in a return filter grille. The use of straps and/or supports is required to support the weight of the external filter box.

3.6 Air Ducts

General Requirements

The duct system should be designed and sized according to accepted national standards such as those published by Air Conditioning Contractors Association (ACCA), Sheet Metal and Air Conditioning Contractors National Association (SMACNA) or American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) or consult The Air Systems Design Guidelines reference tables available from your local distributor. The duct system should be sized to handle the required system design CFM at the design external static pressure. The furnace airflow rates are provided in Table 3.6a AIR DELIVERY-CFM (Without Filter).

When a furnace is installed so that the supply ducts carry air circulated by the furnace to areas outside 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.

Secure ductwork with proper fasteners for type of ductwork used.

Seal supply and return-duct connections to furnace with code approved tape or duct sealer.

NOTE

Flexible connections should be used between ductwork and furnace to prevent transmission of vibration. Ductwork passing through unconditioned space should be insulated and sealed to enhance system performance. When air conditioning is used, a vapor barrier is recommended.

Maintain a 1 in (25mm) clearance from combustible materials to supply air ductwork for a distance of 36 in (914mm) horizontally from the furnace. See NFPA 90B or local code for further requirements.

Ductwork Acoustical Treatment

NOTE

Metal duct systems that do not have a 90 degree elbow and 10 ft (3m) of main duct to the first branch take-off may require internal acoustical lining. As an alternative, fibrous ductwork may be used if constructed and installed in according with the latest edition of SMACNA construction standard on fibrous glass ducts. Both acoustical lining and fibrous ductwork shall comply with NFPA 90B as tested by UL Standard 181 for Class 1 Rigid air ducts.

Supply Air Connections

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. The cover attachment shall prevent leaks.

Upflow & Horizontal Furnaces

Connect supply-air duct to flanges on furnace supply-air outlet. Bend flange upward to 90° with wide-duct pliers. The supply-air duct must be connected to ONLY the furnace supply-outlet-air duct flanges or air conditioning coil casing (when used). Do not cut the main furnace casing side to attach supply air duct, humidifier, or other accessories. All accessories MUST be connect to a duct external to the furnace's main casing.

NOTE

For horizontal applications, the top-most flange may be bent past 90 degrees to allow the evaporator coil to hang on the flange temporarily while the remaining attachment and sealing of the coil are performed.

Downflow Furnaces

Connect supply-air outlet on furnace. Bend flange inward past 90° with wide-duct pliers. The supply-air duct must be connected to ONLY the furnace supply outlet or air conditioning coil casing (when used). When installed on combustible material, supply-air duct must be connect to ONLY the accessory subbase or a factory approved air conditioning coil casing. DO NOT cut main furnace casing to attach supply side air duct, humidifier, or other accessories. All accessories MUST be connected to a duct that is external to the furnace casing.

Table 3.6a Air Delivery CFM (Without Filter)

Furnace Size	Speed	Static Pressure	0	0.2	0.4	0.6	0.8	1
40A3B	H	[SCFM]	1149	1121	1160	1153	1143	1169
		Temp Rise °F (°C)	26	27	26	26	26	26
	MH	[SCFM]	999	1008	994	1030	990	972
		Temp Rise °F (°C)	30	30	30	29	30	31
	M	[SCFM]	799	777	797	782	828	809
		Temp Rise °F (°C)	37	38	37	38	36	37
	ML	[SCFM]	600	611	622	611	577	632
		Temp Rise °F (°C)	/	/	/	/	/	/
	L	[SCFM]	450	483	460	469	437	454
		Temp Rise °F (°C)	/	/	/	/	/	/
60B4B	H	[SCFM]	1301	1294	1313	1325	1301	1288
		Temp Rise °F (°C)	34	35	34	34	34	35
	MH	[SCFM]	1101	1106	1103	1106	1077	1142
		Temp Rise °F (°C)	41	40	41	40	42	39
	M	[SCFM]	901	899	889	886	879	918
		Temp Rise °F (°C)	50	50	50	50	51	49
	ML	[SCFM]	800	816	841	783	824	813
		Temp Rise °F (°C)	/	/	/	/	/	/
	L	[SCFM]	600	631	635	612	601	610
		Temp Rise °F (°C)	/	/	/	/	/	/
80B4B	H	[SCFM]	1301	1294	1313	1325	1301	1288
		Temp Rise °F (°C)	46	46	45	45	46	46
	MH	[SCFM]	1101	1106	1103	1106	1077	1142
		Temp Rise °F (°C)	54	54	54	54	55	52
	M	[SCFM]	901	899	889	886	879	918
		Temp Rise °F (°C)	/	/	/	/	/	/
	ML	[SCFM]	800	816	841	783	824	813
		Temp Rise °F (°C)	/	/	/	/	/	/
	L	[SCFM]	600	631	635	612	601	610
		Temp Rise °F (°C)	/	/	/	/	/	/

Furnace Size	Speed	Static Pressure	0	0.2	0.4	0.6	0.8	1
80C4B	H	[SCFM]	1301	1297	1271	1251	1343	1240
		Temp Rise °F (°C)	46	46	47	48	44	48
	MH	[SCFM]	1101	1113	1142	1141	1060	1168
		Temp Rise °F (°C)	54	54	52	52	56	51
	M	[SCFM]	901	855	905	938	874	924
		Temp Rise °F (°C)	/	/	/	/	/	/
	ML	[SCFM]	800	785	815	823	798	863
		Temp Rise °F (°C)	/	/	/	/	/	/
	L	[SCFM]	600	606	593	549	571	549
		Temp Rise °F (°C)	/	/	/	/	/	/
100C5B	H	[SCFM]	1751	1739	1742	1739	1736	1733
		Temp Rise °F (°C)	43	43	43	43	43	43
	MH	[SCFM]	1501	1516	1492	1500	1499	1505
		Temp Rise °F (°C)	50	49	50	50	50	50
	M	[SCFM]	1351	1351	1364	1356	1347	1336
		Temp Rise °F (°C)	55	55	55	55	55	56
	ML	[SCFM]	1151	1154	1152	1132	1154	1142
		Temp Rise °F (°C)	/	/	/	/	/	/
	L	[SCFM]	1001	995	996	982	981	1013
		Temp Rise °F (°C)	/	/	/	/	/	/
120D5B	H	[SCFM]	1951	1910	1896	1929	1981	1917
		Temp Rise °F (°C)	38	39	39	39	38	39
	MH	[SCFM]	1751	1775	1749	1772	1786	1771
		Temp Rise °F (°C)	43	42	43	42	42	42
	M	[SCFM]	1501	1570	1575	1569	1543	1544
		Temp Rise °F (°C)	50	48	47	48	48	48
	ML	[SCFM]	1348	1420	1410	1416	1412	1400
		Temp Rise °F (°C)	55	53	53	53	53	53
	L	[SCFM]	1148	1210	1196	1174	1179	1175
		Temp Rise °F (°C)	/	/	/	/	/	/

Table 3.6b Filter Size Information - in. (mm)

Furnace Casing Width	Filter Size		Filter Type
	Side Return	Bottom Return	
14-1/2 (368)	16X25 (406X635)	14X25 (356X365)	High Velocity (600 FPM)
17-1/2 (445)	16X25 (406X635)	16X25 (406X635)	
21 (533)	16X25 (406X635)	20X25 (508X635)	
24.5 (622)	16X25 (406X635)	24X25 (610X635)	

4.1 Vent Connections

Fig. ___ "Combustion Air Inducer" shows the furnace as it is shipped from the factory. To convert to a horizontal or downflow position, remove the four screws that secure the inducer assembly and rotate 90° being careful not to damage the gasket. Reinstall screws. Remove cap from appropriate vent outlet location on the cabinet. Cut the insulation in cabinet to the same size as the hole provided and reinstall cap in the hole in the top panel.

IMPORTANT: In downflow applications, do not block the combustion air inlet. The furnace must be installed on a coil cabinet or subbase to allow combustion air to enter the burner compartment.

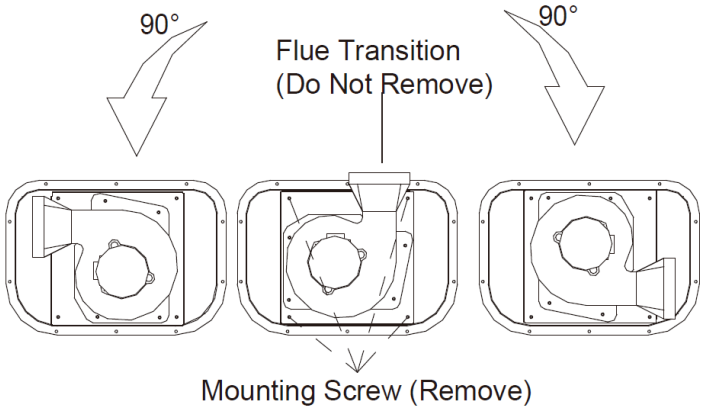


Figure 4.1a

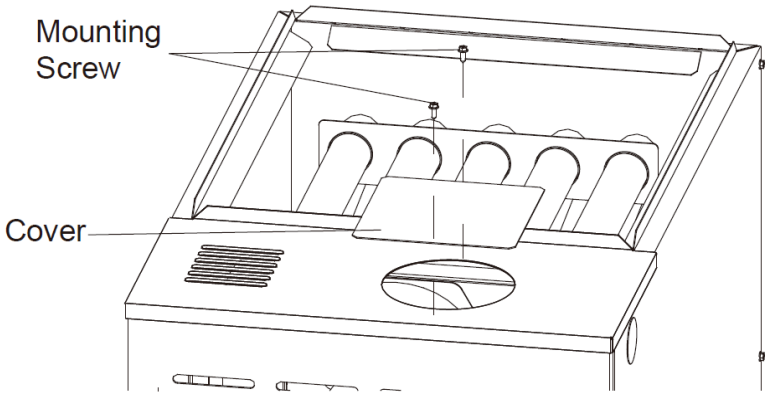


Figure 4.1b

Category 1 - 450°F Max. Vent Temp

The venting system must be installed in accordance with Section 5.3 Air for Combustion and Ventilation, of the National Fuel Gas Code Z223.1/NFPA 54 (latest edition), or Sections 7.2, 7.3, or 7.4 of CSA B149.1, National Gas and Propane Codes (latest edition), or applicable provisions of the local building code and these instructions.

The furnace should be connected to a type B vent connector. The furnace should not be connected to a chimney flue serving a separate appliance designed to burn solid fuel. Single-wall vent pipe is not allowed.

It is recommended that the appliance is installed in a location where the space temperature is 32°F (0°C) or higher. If the appliance is installed in a location where the temperature is below 32°F (0°C), the combustion byproducts could condense causing damage to the appliance heat exchanger.

This appliance may be common vented with another gas appliance for residential installations as allowed by the codes and standards listed in these instructions.

4.2 Venting System Requirements

Category I venting consists of vertically venting one or more appliances in B-vent or B-vent connectors. Type B-vent system extends in a general vertical direction and does not contain offsets exceeding 45° . A vent system having not more than one 60° offset is permitted.

4.3 Venting into Existing Chimney

This furnace may not be connected to any masonry chimney. However, an existing masonry chimney may be used as a chase through which the metal vent pipe passes.

4.4 Air for Combustion & Ventilation

Ambient Combustion Air Supply

This type of installation will draw the air required for combustion from within the space surrounding the appliance and from areas or rooms adjacent to the space surrounding the furnace. This may be from within the space in a non-confined location or it may be brought into the furnace area from outdoors through permanent openings or ducts.

A single, properly sized pipe from the furnace vent connector to the outdoors must be provided. For upflow models, combustion air is brought into the furnace through the unit's top panel opening.

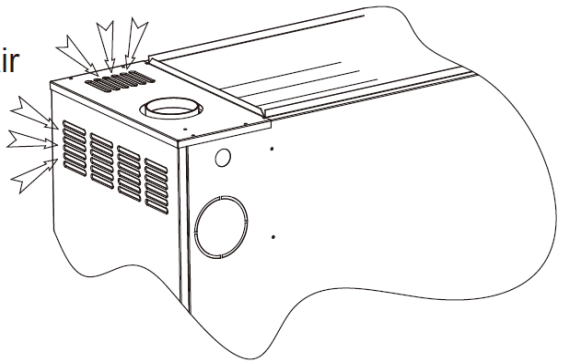


Figure 4.4a

WARNING

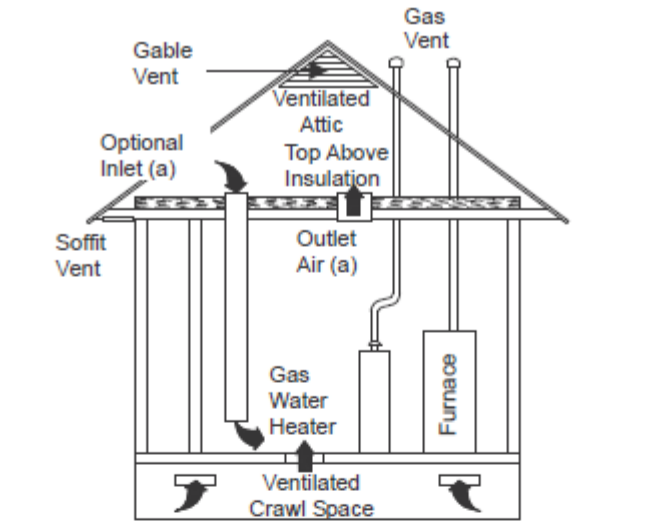
This type of installation requires that the supply air to the appliance(s) be of an amount sufficient enough to support all of the appliance(s) in the area. Operation of a mechanical exhaust, such as an exhaust fan, kitchen ventilation system, clothes dryer or fireplace may create conditions requiring special attention to avoid unsatisfactory operation of gas appliances. A venting problem or a lack of supply air will result in hazardous conditions, which can cause the appliance to soot and generate dangerous levels of carbon monoxide, which can lead to serious injury, property damage and/or death.

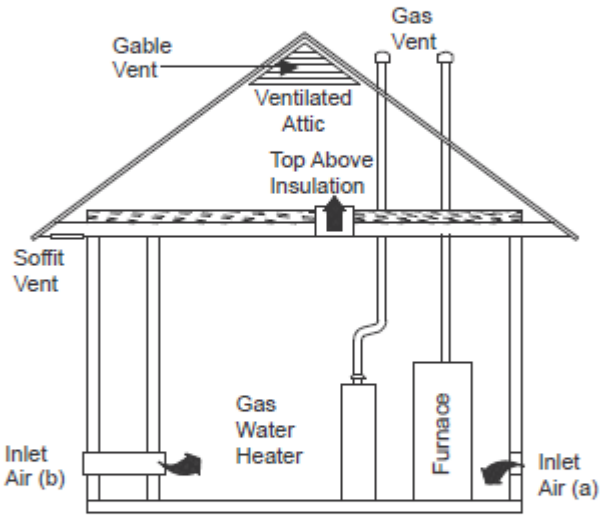
An unconfined space is not less than 50 cu.ft (1.42m3) per 1,000Btu/hr (0.2928 kW) input rating for all of the appliances installed in that area.

Rooms communicating directly with the space containing the appliances through openings not furnished with doors, are considered a part of the unconfined space.

In unconfined spaces (see definition below) in buildings, infiltration may be adequate to provide air for combustion ventilation and dilution of flue gases. However, in buildings of tight construction (for example, weather stripping, heavily insulated, caulked, vapor barrier, etc.), additional air may need to be provided using the methods described in the "confined space" section on page 25.

A **confined space** is an area with less than 50 cu.ft (1.42m3) per 1,000 Btu/hr (0.2928 kW) input rating for all of the appliances installed in that area. The following must be considered to obtain proper air for combustion and ventilation in confined spaces.





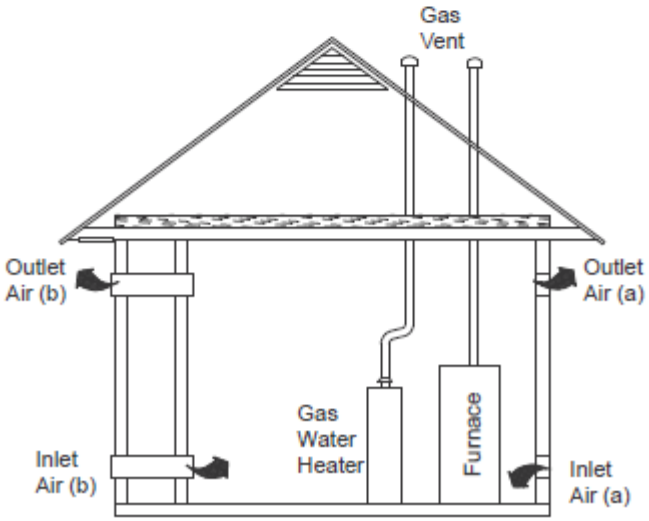


Figure 4.4b

WARNING

When a Category I furnace is removed or replaced, the original venting system may no longer be correctly sized to properly vent the attached appliances.
An improperly sized vent system can cause carbon monoxide to spill into the living space causing personal injury, and or death.

Equipment Located in Confined Spaces:

a) All air from inside the building:

The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria. The total input of all gas utilization equipment installed in the combined space shall be considered in making this determination. Each opening shall have a minimum free area of 1 square inch per 1,000BTU per hour of the total input rating of all gas utilization equipment in the confined space. One opening shall be within 12 inches of the top and one within 12 inches of the bottom of the enclosure (See Table 4.4a).

Table 4.4a

BTUH Input Rating	Minimum Free Area Required per Opening in² (cm²)
40,000	40 in² (322 cm²)
60,000	60 in² (450 cm²)
80,000	80 in² (516 cm²)
100,000	100 in² (645 cm²)
120,000	120 in² (742 cm²)

b) All air from outdoors:

Table 4.4b

BTUH Input Rating	Minimum Free Area Required per Opening		
	Horizontal Duct (2,000 BTUH)	Vertical Duct or Opening to Outside (4,000 BTUH)	Round Duct (4,000 BTUH)
40,000	20 in² (129 cm²)	10 in² (65 cm²)	4" (10 cm)
60,000	30 in² (226 cm²)	15 in² (96.8 cm²)	5" (13 cm)
80,000	40 in² (258 cm²)	20 in² (129 cm²)	5" (13 cm)
100,000	50 in² (323 cm²)	25 in² (161 cm²)	6" (15 cm)
120,000	60 in² (387 cm²)	30 in² (194 cm²)	7" (18 cm)

EXAMPLE: Determining Free Area

Appliance 1 Appliance 2 Total Input
100,000 + 30,000 = (130,000 / 4,000) = 32.5 in² Vertical

Appliance 1 Appliance 2 Total Input
100,000 + 30,000 = (130,000 / 2,000) = 65 in² Horizontal

4.5 Air Supply Openings & Ducts

1. Two permanent openings, one within 12 in (305 mm) of the top and one within 12 in (305 mm) of bottom of the confined space, should communicate directly or by means of ducts with the outdoors, crawl spaces or attic spaces.

2. One permanent opening, commencing within 12 in (305 mm) of the top of the enclosure shall be permitted where the equipment has clearances of at least 1 in (25.4 mm) from the sides and back and 6 in (152.4 mm) from the front of the appliance. The opening should communicate directly with the outdoors and shall have a minimum free area of:

a. 1 square inch per 3000 Btu per hour (734 mm2/kW) of the total input rating of all equipment located in the enclosure.

b. Not less than the sum of all vent connectors in the confined space.

3. The duct should be least the same cross-sectional area as the free area of the air supply inlet opening to which it connects.

4. The blocking effects of louvers, grilles and screens must be given consideration in calculating free area. If the free area of a specific louver or grille is not known, refer to “Estimated Free Area” table to estimated free area.

Wood or Metal Louvers or Grilles	Wood 20-25% Metal 60-70%
Screens +	1/4" (0.635cm) mesh or larger 100%

5. An opening may be used in lieu of a duct to provide the outside air supply to an appliance unless otherwise permitted by the authority having jurisdiction. The opening should be located within 12" (30.5 cm) horizontally from the burner level of the appliance.

4.6 Ventilated Combustion Air

The ventilated attic space or a crawl space from which the combustion air is taken must comply with the requirements specified in this manual and the Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 (latest edition). This type of installation requires two properly sized pipes. One brings combustion air from a properly ventilated attic space or crawl space and a second pipe that extends from the furnace vent connection (top right of unit) to the exterior of the building.

4.7 Vent & Outside Supply Air Safety Check Procedure

For Category I furnaces, vent installations shall be in accordance with Parts 7 and 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and or Section 7 and Appendix B of the CAS B 149.1, Natural Gas and Propane Installation Codes, the local building codes, and furnace and vent manufacturer’s instructions.

Multi-story or common venting systems are permitted and must be installed in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and / or the CSA B 149.1, Natural Gas and Propane Installation Codes, and the manufacturer’s instructions.

Vent connectors serving Category I furnaces shall not be connected into any portion of mechanical draft systems operating under positive pressure.

Horizontal portions of the venting system shall be supported to prevent sagging using hangers or perforated straps and must slope upwards not less than 1/4" per foot (0.635 cm/m) from the furnace to the vent terminal.

It is recommended that you follow the venting safety procedure. This procedure is designed to detect an inadequate ventilation system that can cause the appliances in the area to operate improperly causing unsafe levels of carbon monoxide or create unsafe conditions.

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. Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion or other deficiencies, which could cause an unsafe conditions.

2. Close all building doors and windows and all doors.

3. Turn on clothes dryers and any exhaust fans, such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Open the fireplace damper. Do not operate a summer exhaust fan.

4. Follow the lighting instructions. Place the appliance being inspected into operation. Adjust thermostat so the appliance shall operate continuously.

5. Test each appliance (such as a water heater) equipped with a draft hood for spillage (down-draft or no draft) at the draft hood relief opening after 5 minutes of main burner operation. Appliances that do not have draft hoods need to be checked at the vent pipe as close to the appliance as possible. Use a combustion analyzer to check the CO2 and CO levels of each appliance. Use a draft gauge to check for a downdraft or inadequate draft condition.

6. After it has been determined that each appliance properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their normal condition.

7. If improper venting is observed during any of the above tests, a problem exists with either the venting system or the appliance does not have enough combustion air (supply air from outside) to complete combustion. This condition must be corrected before the appliance can function safely.

NOTE: An unsafe condition exists when the CO reading exceeds 40 ppm and the draft reading is not in excess of -0.1 in. W.W.(-25 kPa) with all of the appliance(s) operating at the same time.

8. Any corrections to the venting system and/or to the supply (outside) air system must be in accordance with the National Fuel Gas Code Z223.1 or CAN/CGA B149.1 Natural Gas and Propane Installation Code (latest editions). If the vent system must be resized, follow the appropriate tables in Appendix G of the above codes or for this appliance.

WARNING-FIRE & EXPLOSION HAZARDS

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

- **Never purge a gas line into a combustion chamber. 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.**
- **Use proper length of pipe to avoid stress on the gas control manifold and a gas leak.**
- **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. Black iron pipe shall be installed at the furnace gas control valve and extend a minimum of 2 in. (51 mm) outside the unit.**

CAUTION-FURNACE OVERHEAT HAZARD

Failure to follow this caution may result in property damage.

- **Connect gas pipe to gas valve using a backup wrench to avoid damaging gas controls and causing burner misalignment.**

5.1 General Overview

The furnace rating plate includes the approved furnace gas input rating and gas types. The furnace must be equipped to operate on the type of gas applied. This includes any conversion kits required for alternate fuels and/or high altitude.

Inlet gas supply pressures must be maintained within the ranges specified. The supply pressure must be constant and available with all other household gas-fired appliances operating. The minimum gas supply pressure must be maintained to prevent unreliable ignition. The maximum must not be exceeded to prevent unit over-firing.

Inlet Gas Supply Pressure		
Natural Gas	Minimum: 5.0" W.C.	Maximum: 10.5" W.C.
Propane Gas	Minimum: 11.0" W.C.	Maximum: 13.0" W.C.

NOTE

Adjusting the minimum supply pressure below the limits in the above table could lead to unreliable ignition. Gas input to the burners must not exceed the rated input shown on the rating plate. Over-firing of the furnace can result in premature heat exchanger failure. Gas pressures in excess of 13 inches water column can also cause permanent damage to the gas valve.

At all altitudes and with either fuel, the air temperature rise must be within the range listed on the furnace nameplate. If the furnace needs to be converted to LP, refer to the instructions included in the factory authorized LP conversion kit.

5.2 High Altitude Derate

Alternate standard derate for altitude from National Fuel Gas Code ANSI Z223.1 of 4% per 1000' may be taken. Refer to the most recent version of ASNI Z223.1 for correct gas orifice. The orifices must be selected using the table below. The furnace derate is 4% for each 1,000 feet above sea level. This table is based upon a heating value of approximately 1,000 Btu/ft3.

In Canada, the input rating must be derated by 10% for altitudes of 2,000 ft. (610m) to 4,500 feet (1370m) above sea level by an authorized Gas Conversion Station or Dealer.

When an appliance is installed at elevations above 4500ft (1350m), the certified high-altitude input rating shall be reduced at the rate of 4% for each additional 1000ft (300m).

In some areas the gas supplier may artificially derate the gas in an effort to compensate for the effects of altitude. If the gas is artificially derated, the appropriate orifice size must be determined based upon the BTU/ft3 content of the derated gas and the altitude. Refer to the latest version of NFPA54/ANSI Z223.1 for US and the latest version of CSA B149.1 for Canada., and information provided by the gas supplier to determine the proper orifice size.

Table 5.2a **US Installation**

Input Rate KBTU/H	Number of Burners	Elevation (ft)									
		0-2000		2000-4000		4000-6000		6000-8000		8000-10000	
		Nat	LP	Nat	LP	Nat	LP	Nat	LP	Nat	LP
40A3B	3	50	59	51	61	52	62	53	64	54	65
60B4B	3	45	55	47	56	48	56	49	57	51	57
80B4B	5	49	56	50	57	51	58	52	59	53	61
80C4B	5	49	56	50	57	51	58	52	59	53	61
100C5B	6	49	56	50	57	51	58	52	59	53	61
120D5B	7	49	56	50	57	51	58	52	59	53	61

*LP Orifice based on 10 in. W.C. manifold pressure
The input to the furnace must be checked AFTER re-orificing.

Table 5.2b **Canada Installation**

Input Rate KBTU/H	Number of Burners	Elevation (ft)									
		0-2000		2000-4000		4000-6000		6000-8000		8000-10000	
		Nat	LP	Nat	LP	Nat	LP	Nat	LP	Nat	LP
40A3B	3	50	59	51	61	52	62	53	64	54	65
60B4B	3	45	55	47	56	48	56	49	57	51	57
80B4B	5	49	56	50	57	51	58	52	59	53	61
80C4B	5	49	56	50	57	51	58	52	59	53	61
100C5B	6	49	56	50	57	51	58	52	59	53	61
120D5B	7	49	56	50	57	51	58	52	59	53	61

*LP Orifice based on 10 in. W.C. manifold pressure
The input to the furnace must be checked AFTER re-orificing.

5.3 Propane Gas Conversion

Possible property damage, personal injury or death may occur if the correct conversion kits are not installed. The appropriate kits must be applied to ensure safe and proper furnace operation. All conversions must be performed by a qualified installer or service agency.

This unit is configured for natural gas. The appropriate manufacturer's propane gas conversion kit must be applied for propane gas installations. For high altitude Installations refer to the "High Altitude Derate" section on page 28 for details.

Contact your distributor for a tabular listing of appropriate manufacturer's kits for propane gas and/or high altitude installations. The indicated kits must be used to insure safe and proper furnace operation. All conversions must be performed by a qualified installer, or service agency.

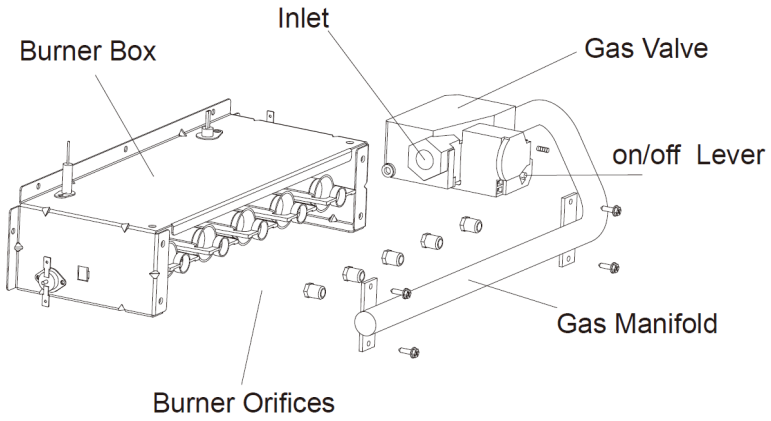
The gas supply shall be shut off prior to disconnecting the electrical power before proceeding with conversion.

1.Make sure all utilities (gas and electricity) are turned off
2.Remove the furnace front panel
3.Disconnect the gas line from the gas valve
4.Disconnect the wires at gas control.

To Replace Orifices with LP Orifices from Gas Manifold

1.Disconnect all control wires
2.Remove 4 screws holding gas manifold to supporting burner assembly bracket
3.Slide the manifold (with valve and orifices) out of burners. Be careful not to damage the assembly.
4.Replace the natural gas orifices with the LP orifices or appropriate high altitude orifices
5.Re-assemble the gas manifold and re-connect all wires.

Figure 5.3



To Convert from Natural to LP Gas on Gas Valve

1.Remove regulator (gas valve) cover screw.
2.Remove regulator adjustment screw (beneath the cover screw).
3.Remove natural gas spring from regulator sleeve.
4.Insert the LP spring included in the conversion kit into sleeve.
5.Replace the adjustment screw and adjust the outlet pressure to manufacturer's specified outlet pressure.
6.Replace the regulator cover screw.
7.Attach the WARNING label (provided in the kit) to the gas valve, attach small round LP label to the top of regulator cover screw.
8.Fill required blanks in provided conversion label and attach it to appropriate location on furnace case.

5.4 Gas Piping Connections

To avoid possible unsatisfactory operation or equipment damage due to under-firing of equipment, use the proper size of naturaupropane gas piping needed when running pipe from the meter/tank to the furnace.

When sizing a trunk line, be sure to include all appliances which will operate simultaneously.

The gas piping supplying the furnace must be properly sized based on the gas flow required, specific gravity of the gas, and length of the run. The gas line installation must comply with local codes, or in their absence, refer to the latest version of NFPA54/ANSI Z223.1 for US and the latest version of CSA B149.1 for Canada.

Table 5.4

Nominal Iron Pipe Size in. (mm)	Internal DIA. in. (mm)	Length of Pipe - ft(m)				
		10 (3.0)	20 (6.0)	30 (9.1)	40 (12.1)	50 (15.2)
1/2 (12.7)	0.622 (15.8)	175	120	97	82	73
3/4 (19.0)	0.824 (20.9)	360	250	200	170	151
1 (25.4)	1.049 (26.6)	680	465	375	320	285
1-1/4 (31.8)	1.380 (35.0)	1400	950	770	660	580
1-1/2 (38.1)	1.610 (40.9)	2100	1460	1180	990	900

(Pressure 0.5 psig or less and pressure drop of 0.3" W.C.; Based on 0.60 Specific Gravity Gas)

$$CFH = \frac{\text{BTUH Furnace input}}{\text{Heating Value of Gas (BTU/Cubic Foot)}}$$

To connect the furnace to the building's gas piping, the installer must supply a ground joint union, drip leg, manual shutoff valve, and line and fittings to connect to the gas valve. In some cases, the installer may also need to supply a transition piece from 1/2" pipe to a larger pipe size.

The following stipulations apply when connecting gas piping:

- Use black iron or steel pipe and fittings for the building piping.
- Use pipe joint compound on male threads only. Pipe joint compound must be resistant to the action of the fuel used.
- Use ground joint unions.
- Install a drip leg to trap dirt and moisture before it can enter the gas valve. The drip leg must be a minimum of three inches long.
- Install a 1/8" NPT pipe plug fitting, accessible for test gage connection, immediately upstream of the gas supply connection to the furnace.
- Use two pipe wrenches when making connection to the gas valve to keep it from turning. The orientation of the gas valve on the manifold must be maintained as shipped from the factory.
- Install a manual shutoff valve between the gas meter and unit within six feet of the unit. If a union is installed, the union must be downstream of the manual shutoff valve, between the shutoff valve and the furnace.
- Tighten all joints securely.

Connect the furnace to the building piping using rigid metallic pipe and fittings or semi-rigid metallic tubing and metallic fittings. Aluminum alloy tubing must not be used in exterior locations.

Use listed gas appliance connectors in accordance with their instructions. Connectors must be fully in the same room as the furnace.

Protect connectors and semi-rigid tubing against physical and thermal damage when installed. Ensure aluminum-alloy tubing and connectors are coated to protect against external corrosion when in contact with masonry, plaster, or insulation, or subjected to becoming wet by liquids such as water (except rain water), detergents, or sewage.

When the gas piping enters through the right side of the furnace, the installer must supply the following fittings (starting from the gas valve):

- 90° elbows (2)
- Close nipple
- Straight pipe to reach the exterior of the furnace

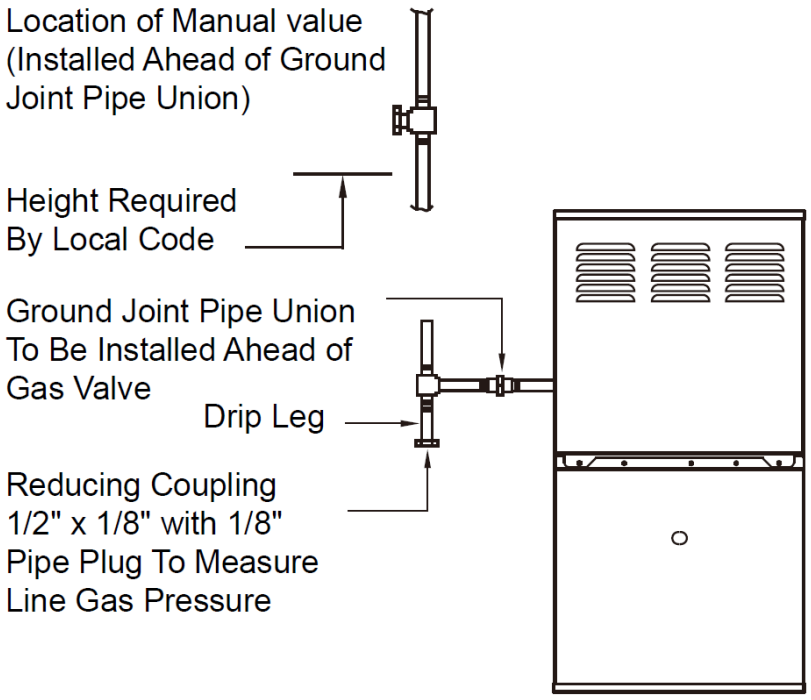


Figure 5.4

- A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2" to another pipe size.
- When the gas piping enters through the left side of the furnace, the installer must supply the following fittings (starting from the gas valve):
- Straight pipe to reach the exterior of the furnace.
- A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2 inch to another pipe size.

5.5 Gas Piping Checks

Before placing the unit in operation, leak test the unit and gas connections.

WARNING-FIRE & EXPLOSION HAZARDS

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

Check for leaks using an approved chloride-free soap and water solution, an electronic combustible gas detector, or other approved testing methods.

NOTE

Never exceed specified pressures for testing. Higher pressure may damage the gas valve and cause subsequent over-firing, resulting in heat exchanger failure.

Disconnect this unit and shutoff valve from the gas supply piping system before pressure testing the supply piping system with pressures in excess of 1/2 psig (3.48 kPa).

This unit must be isolated from the gas supply system by closing its manual shutoff valve before pressure testing of gas supply piping system with test pressures equal to or less than 1/2 psig (3.48 kPa).

6 ELECTRICAL CONNECTIONS

WARNING-ELECTRICAL SHOCK & FIRE HAZARDS

Failure to follow these warnings could result in personal injury or death.

- **Blower access panel door switch opens 115V power to control. No component operation can occur. Do not bypass or close switch with panel removed.**
- **The cabinet MUST have an uninterrupted or unbroken ground according to NEC ANSI/NFPA 70-2008 and Canadian Electrical Code CSA C22.1 or local codes to minimize personal injury if an electrical fault should occur.**
- **This may consist of electrical wire, conduit approved for electrical ground or a listed, grounded power cord (where permitted by local code) when installed in accordance with existing electrical codes. Refer to the power cord manufacturer's ratings for proper wire gauge. Do not use gas piping as an electrical ground.**
- **Do not connect aluminum wire disconnect switch and furnace. Use only copper wire.**

CAUTION-FURNACE NON-OPERATIONAL

- **Failure to follow this caution may result in intermittent furnace operation.**
- **Furnace control must be grounded for proper operation or else control will lock out. Control must remain grounded through green/yellow wire routed to gas valve and manifold bracket screw.**

6.1 115V Wiring

Verify that the voltage, frequency, and phase correspond to that specified on unit rating plate. Also, check to be sure that service provided by utility is sufficient to handle load imposed by this equipment. Refer to rating plate for equipment electrical specifications.

U.S. installations: Make all electrical connections in accordance with National Electrical Code (NEC) ANSI/NFPA 70-2008 and any local codes or ordinances that might apply. Canadian installations: Make all electrical connections in accordance with Canadian Electrical Code CSA C22.1 or authorities having jurisdiction.

Use a separate, fused branch electrical circuit with a properly sized fuse or circuit breaker for this furnace. See table for wire size and fuse specifications. A readily accessible means of electrical disconnect must be located within sight of the furnace.

NOTE

Proper polarity must be maintained for 115V wiring. If polarity is incorrect, control LED status indicator light will flash rapidly and furnace will NOT operate.

Junction Box Relocation

NOTE

If factory location of J-Box is acceptable, go to next section.
On 14" wide casing models, the J-Box shall not be relocated to other side of furnace casing when the vent pipe is routed within the casing.

1. Remove and save two screws holding J-Box.

NOTE

The J-Box cover does not need to be removed from the J-Box in order to move the J-Box. Do NOT remove the green ground screw inside J-Box. The ground screw is not threaded into the casing flange and can be lifted out of the clearance hole in casing while swinging the front edge of the J-Box outboard of the casing.

2. Cut wire tie on loop in furnace wires attached to J-box.
3. Move J-Box to desired location.
4. Fasten J-Box to casing with two screws removed in Step 1.
5. Route J-Box wires within furnace away from sharp edges, rotating parts and hot surfaces.

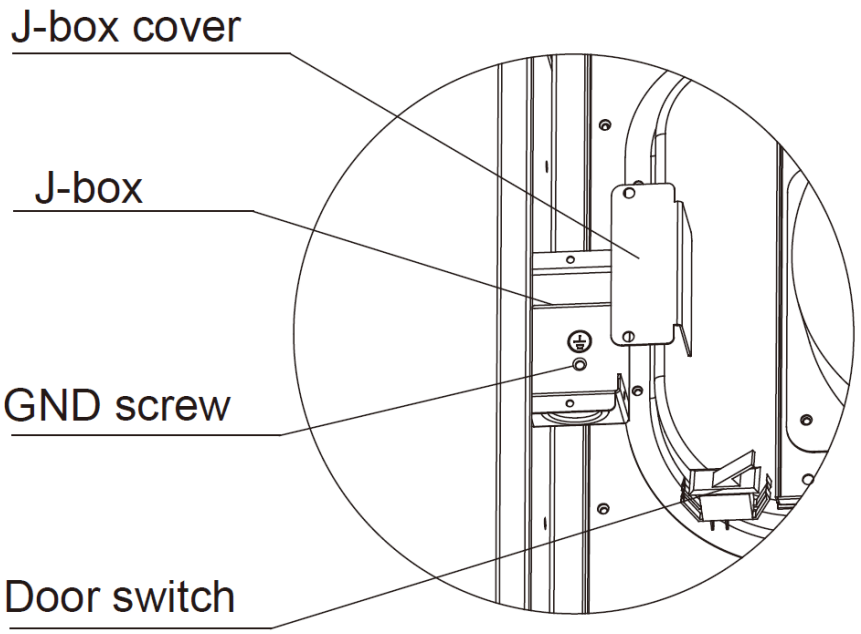


Figure 6.1

6.2 Electrical Connection to J-Box

Field-Supplied Electrical Box on Furnace J-Box Bracket

1. Remove cover from furnace J-Box.
2. Attach electrical box to furnace J-Box bracket with at least two field-supplied screws through holes in electrical box into holes in bracket. Use blunt-nose screws that will not pierce wire insulation.
3. Route furnace power wires through holes in electrical box and J-Box bracket, and make field-wire connections in electrical box. Use best practices (NEC in U.S. and CSA C22.1 in Canada) for wire bushings, strain relief, etc.
4. Route and secure field ground wire to green ground screw on J-Box bracket, or the furnace will fail to operate.
5. Connect line voltage leads as shown in Fig. 9-3.
6. Reinstall cover to J-Box. Do not pinch wires between cover and bracket.

Electrical Box on Furnace Casing Side

WARNING-ELECTRICAL SHOCK & FIRE HAZARD

Failure to follow this warning could result in personal injury, death, or property damage.
If field-supplied manual disconnect switch is to be mounted on furnace casing side, select a location where a drill or fastener cannot damage electrical or gas components.

1. Select and remove a hole knockout in the casing where the electrical box is to be installed.

NOTE

Check that the duct on the side of the furnace will not interfere with installed electrical box.

2. Remove the desired electrical box hole knockout and position the hole in the electrical box over the hole in the furnace casing.
3. Fasten the electrical box to casing by driving two field-supplied screws from inside electrical box into casing steel.
4. Remove and save two screws holding J-Box. (See Fig. 6.1.)
5. Pull furnace power wires out of l/2-in. (13 mm) diameter hole in J-Box. Do not loosen wires from strain-relief wire-tie on outside of J-Box.
6. Route furnace power wires through holes in casing and electrical box and into electrical box.
7. Pull field power wires into electrical box.
8. Remove cover from furnace J-Box.
9. Route field ground wire through holes in electrical box and casing, and into furnace J-Box.
10. Reattach furnace J-Box to furnace casing with screws removed in Step 4.
11. Secure field ground wire to J-Box green ground screw.
12. Complete electrical box wiring and installation.
13 Connect line voltage leads as shown in Fig. 6.7c. Use best practices (NEC in U.S. and CSA C22.1 in Canada) for wire bushings, strain relief, etc.
14. Reinstall cover to J-Box. Do not pinch wires between cover and bracket.

6.3 Power Cord Installation in Furnace J-Box

NOTE

Power cords must be able to handle the electrical requirements listed in the table. Refer to the power cord manufacturer's literature.

1. Remove cover from J-Box.
2. Route listed power cord through 7/8-in. (22 mm) diameter hole in J-Box.
3. Secure power cord to J-Box bracket with a strain relief bushing or a connector approved for the type of cord used.
4. Secure field ground wire to green ground screw on J-Box bracket.
5. Connect line voltage leads as shown in Figure 6.7c.
6. Reinstall cover to J-Box. Do not pinch wires between cover and bracket.

Table 6.3

Input		Output		Nominal Airflow	MAX. Unit	AFUE	Air Temp Rise		Max Over-Current Protection Amps	Min. Wire Size (awg) @ 75ft	Max. Outlet Air Temp	
MBH	KW	MBH	KW	CFM	Amps		°F	°C			°F	°C
40A3B	11.7	32	9.4	850	8.0	80	35	19.4	15	14	150	65.6
60B4B	17.6	48	14.1	1100	8.0	80	40	22.2	15	14	155	68.3
80B4B	23.4	64	18.8	1300	8.0	80	45	25.0	15	14	160	71.1
80C4A	23.4	64	18.8	1300	8.0	80	45	25.0	15	14	160	71.1
100C5A	29.3	80	23.4	1680	14.0	80	45	25.0	15	14	160	71.1
120D5B	35.2	96	28.1	1800	14.0	80	50	27.8	15	14	165	73.9

Annual Fuel Utilization Efficiency (AFUE) numbers are determined in accordance with DOE test procedures, National Electrical Code (NFPA-70-latest edition) and all local codes.

The furnace should be installed so that the electrical components are protected from water.

6.4 Bx Cable Installation in Furnace J-Box

1. Remove cover from J-Box.
2. Route BX cable into 7/8-in. (22 mm) diameter hole in J-Box.
3. Secure BX cable to J-Box bracket with connectors approved for the type of cable used.
4. Secure field ground wire to green ground screw on J-Box bracket.
5. Connect line voltage leads as shown.
6. Reinstall cover to J-Box. Do not pinch wires between cover and bracket.

6.5 24-V Wiring

Make field 24V connections at the 24V terminal strip.

Connect terminal Y as shown for proper cooling operation.

Use only AWG No. 18, color-coded, copper thermostat wire.

The 24V circuit contains an automotive-type, 3-amp. fuse located on the control. Any direct shorts during installation, service, or maintenance could cause this fuse to blow. If fuse replacement is required, use ONLY a

3-amp.. fuse of identical size.

6.6 Accessories (Field Supplied)

1. Electronic Air Cleaner (EAC)

Connect an accessory Electronic Air Cleaner (if used) using l/4-in female quick connect terminals to the two male 1/4-in quick-connect terminals on the control board marked EAC-H and NEUTRALS. The terminals are rated for 115V AC, 1.0 amps maximum and are energized during blower motor operation.

2. Humidifier (HUM)

Connect an accessory 115V AC, 0.5 amp. maximum humidifier (if used) to the 1/4-in male quick-connect HUM-H terminal and NEUTRALS terminal on the control board. The HUM terminal is energized when gas valve relay is energized.

6.7 Grounding

The furnace must be electrically grounded in accordance with local codes or, in the absence of local codes, with the National Electrical Code, ANSI/NFPA 70, and /or the Canadian Electrical Code, CSA C22.1, Part 1, if an external electrical source is utilized.

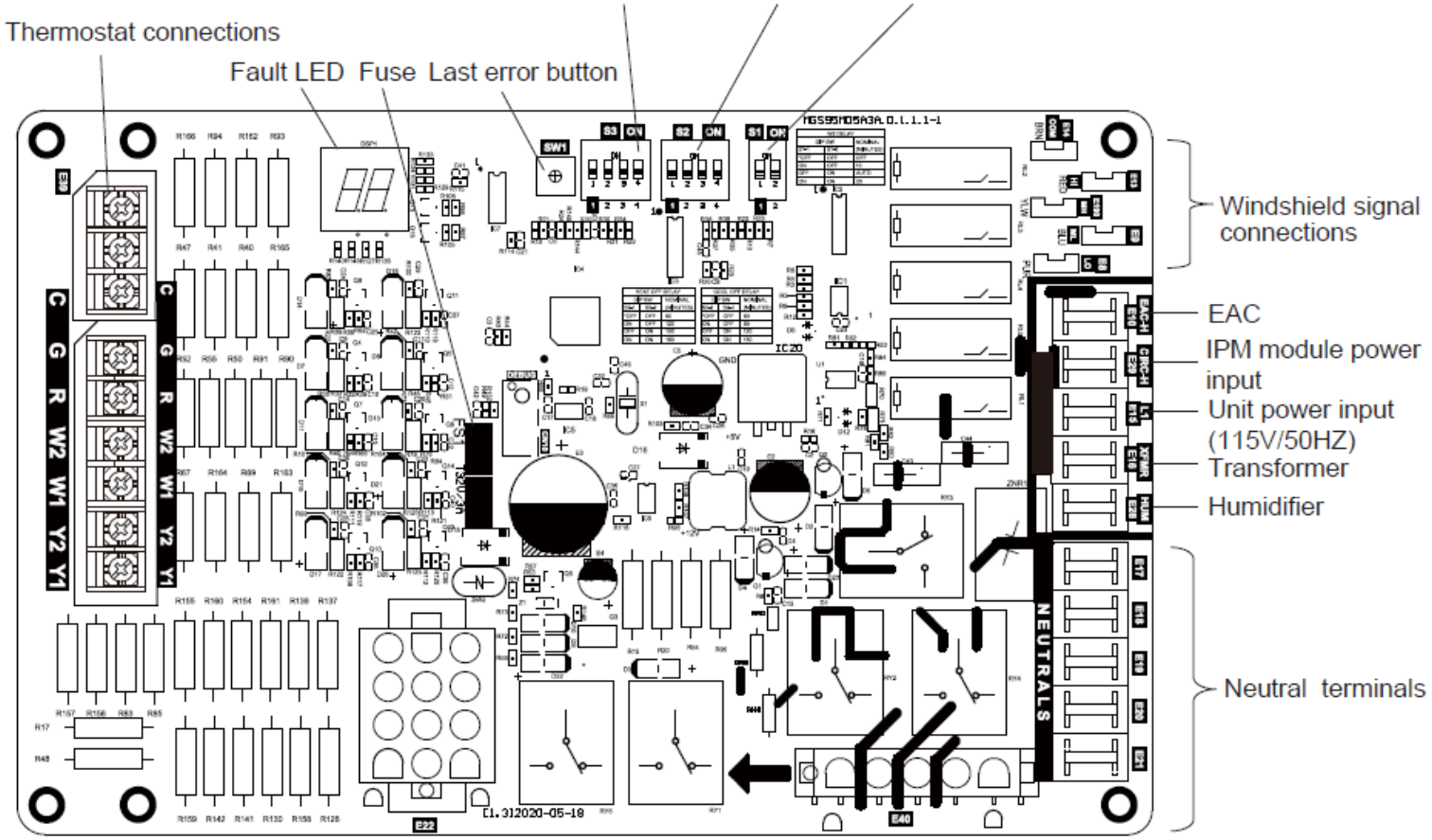
6.8 Furnace Control Diagram

80% machine windshield setting	FAN SPEED							
	DIP SW				NOMINAL SPEED			
	S3-1	S3-2	S3-3	S3-4	H-heat	L-heat	H-cool	L-cool
100C/120D	* OFF	ON	OFF	OFF	4	3	3	2
	OFF	ON	ON	OFF	4	3	5	3
	OFF	ON	ON	ON	5	4	4	4
	OFF	ON	OFF	ON	4	3	4	3
60A/80B/ 80C	* ON	OFF	OFF	ON	5	5	5	4
	OFF	ON	OFF	ON	4	3	4	3
	OFF	ON	OFF	OFF	4	3	3	2
60B	OFF	ON	OFF	OFF	4	3	3	2
	*OFF	ON	ON	OFF	4	3	5	3
	OFF	ON	ON	ON	5	4	4	4
	OFF	ON	OFF	ON	4	3	4	3
40A	* ON	OFF	ON	ON	5	3	5	4
	OFF	OFF	ON	OFF	4	2	3	2
	ON	ON	OFF	ON	4	2	4	3

HEAT OFF DELAY		
DIP SW		NOMINAL (MINUTES)
S2-1	S2-2	
*OFF	OFF	90
ON	OFF	120
OFF	ON	150
ON	ON	180

COOL OFF DELAY		
DIP SW		NOMINAL (MINUTES)
S2-3	S2-4	
*OFF	OFF	60
ON	OFF	90
OFF	ON	120
ON	ON	150

W2 DELAY		
DIP SW		NOMINAL (MINUTES)
S1-1	S1-2	
OFF	OFF	*OFF
ON	OFF	RESERVE
OFF	ON	RESERVE
ON	ON	RESERVE



[ ]: means reserved

Figure 6.7a

SERIES OF PRODUCTS		
SW2-4	OFF	80% GAS FURNACE
	ON	96% GAS FURNACE

80% MACHINE TYPE			
DIP SW			TYPE
SW2-1	SW2-2	SW2-3	
OFF	OFF	OFF	*
OFF	OFF	ON	40A,60A
OFF	ON	OFF	60B,80B
OFF	ON	ON	80C
ON	OFF	OFF	100C
ON	OFF	ON	120D

FAN SPEED		
SW1-1	OFF	NORMAL SPEED
	ON	SLOW SPEED
SW1-2	OFF	RESERVE
	ON	RESERVE

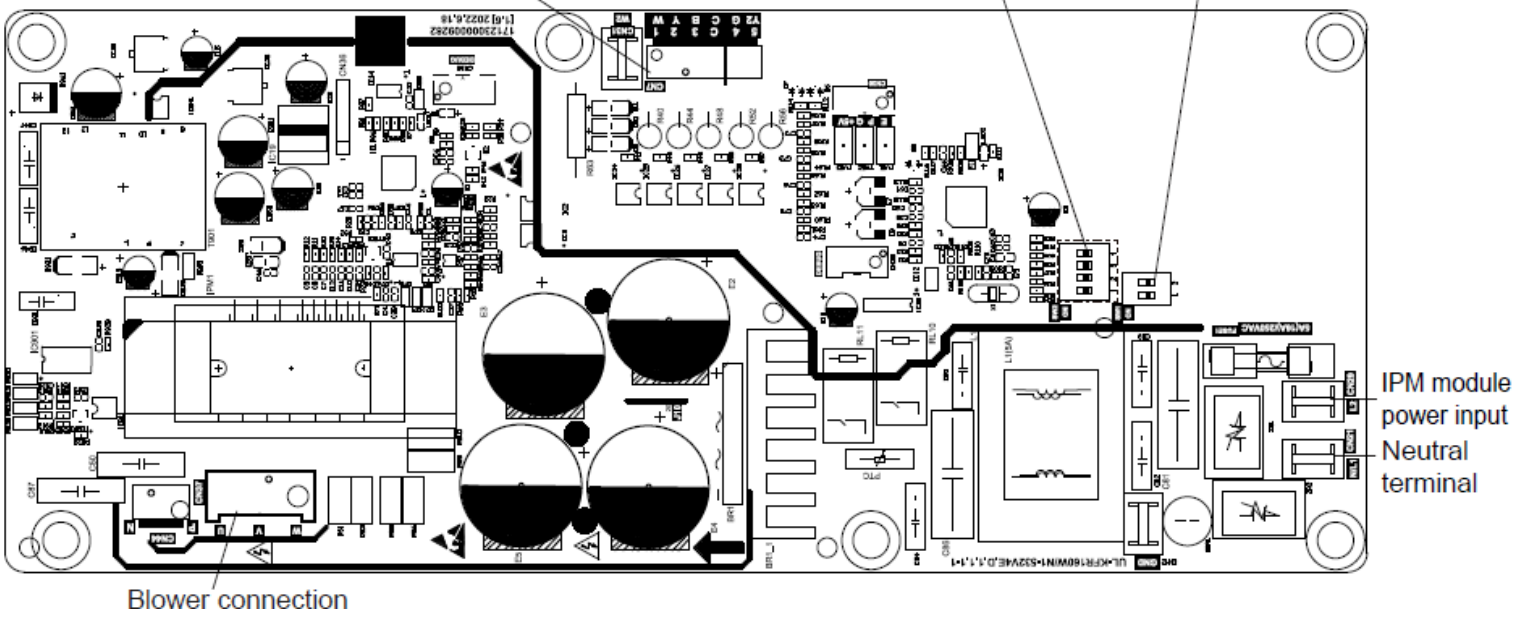


Figure 6.7b

6.9 Wiring Diagram with I-Stage Thermostat

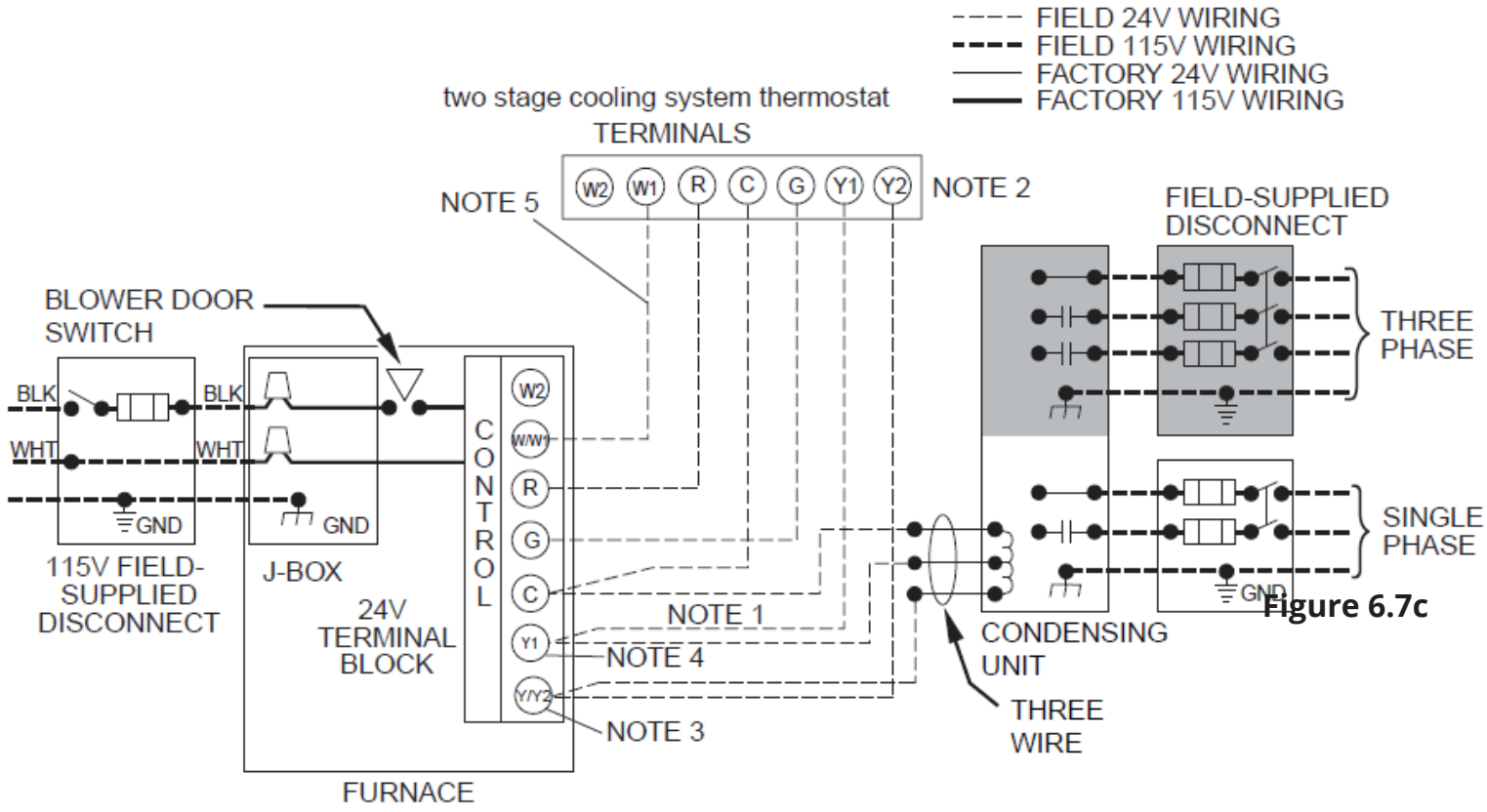


Figure 6.7c

Notes:

1. Connect Y1/Y2-terminal in furnace as shown for proper blower operation.
2. Some thermostats require a "C" terminal connection as shown.
3. Y1 connect two-stage cooling thermostat Y1 (first stage cool) terminal. Y/Y2 connect two-stage cooling thermostat Y2 (second stage cool) terminal.
4. Y1 connect single stage cooling system thermostat Y terminal.
5. Please connect W/W1 with single stage heat system thermostat terminal W and W2 reserved.
6. If any of the original wire, as supplied, must be replaced, use the same type or equivalent wire.

7 START-UP, ADJUSTMENT, & SAFETY CHECK

7.1 General Overview

WARNING-FIRE HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage. This furnace is equipped with manual reset limit switches in the gas control area. The switches open and shut off power to the gas valve if a flame rollout or overheating condition occurs in the gas control area. DO NOT bypass the switches. Correct inadequate combustion air supply problem before resetting the switches.

CAUTION-CUT HAZARD

- **Failure to follow this caution may result in intermittent furnace operation.**
- **Furnace control must be grounded for proper operation or else control will lock out. Control must remain grounded through green/yellow wire routed to gas valve and manifold bracket screw.**

1. Maintain 115V wiring and ground. Improper polarity will result in rapid flashing LED and no furnace operation.
2. Make thermostat wire connections at the 24-V terminal block on the furnace control. Failure to make proper connections will result in improper operation.
3. Gas supply pressure to the furnace must be greater than 4.5-in. W.C. (0.16 psig) but not exceed 14-in. W.C. (0.5 psig).
4. Check all manual-reset switches for continuity.
5. Install blower compartment door. Door must be in place to operate furnace.
6. Replace outer door.

7.2 Start-Up Procedures

WARNING-FIRE & EXPLOSION HAZARD

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

1. Purge gas lines after all connections have been made.
2. Check gas lines for leaks.

WARNING-ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, or death. Blower access door switch opens 115V power to control. No component operation can occur unless switch is closed. Caution must be taken when manually closing this switch for service purposes.

3. This furnace is also equipped with a self-diagnosing electronic control module. In the event a furnace component is not operating properly, the control module LED will flash on and off in a factory-programmed sequence, depending on the problem encountered.

This light can be viewed through the observation window in the blower access door. Refer to the Troubleshooting Chart for further explanation of the lighting codes.

Follow the start-up and adjustment items, refer to further information in Operational Checks.

7.3 Furnace Start-up

1. Close the manual gas shutoff valve external to the furnace.
2. Turn off the electrical power to the furnace.
3. Set the room thermostat to the lowest possible setting.
4. Remove the burner compartment door.

NOTE

This furnace is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

5. Gas Valve: Push the switch to the OFF position.
6. Wait five minutes to clear out any gas. Then smell for gas, including near the floor.
7. If you do not smell gas after five minutes. Push the switch to the ON position.

⚠ WARNING-FIRE & EXPLOSION HAZARD

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

8. Replace the door on the front of the furnace.
9. Open the manual gas valve external to the furnace.
10. Turn on the electrical power supply to the furnace.
11. Set the room thermostat to the desired temperature.

NOTE

There is an approximate 37 second delay between thermostat energizing and burner firing.

FURNACE SHUTDOWN

1. Set the thermostat to lowest setting.
2. Turn off the electrical power supply to the furnace.
3. Gas Valve : Push switch to the OFF position.
4. Close manual gas shutoff valve external to the furnace.
5. Replace the door on the unit.

7.4 Sequence of Operation

NOTE

Furnace control must be grounded for proper operation or control will lock out. Control is grounded through green wire routed to gas valve and manifold bracket screw. Follow the sequence of operation through the different modes.

Read and follow the wiring diagram very carefully.

The blower door must be installed for power to be conducted through the blower door interlock switch ILK to the furnace control CPU, transformer TRAN, inducer motor IDM, blower motor BLWM, hot--surface igniter HSI, and gas valve GV.

1. Heating mode

The wall thermostat "calls for heat," closing the R--to--W1 circuit. The furnace control performs a self-check, verifies the pressure switch contacts PRS are open, and starts the inducer motor IDM.

a. Inducer Pre-purge Period- The inducer blower and optional humidifier are energized and the igniter is powered within one second. The pressure switch contacts PRS close to begin a 15-second pre-purge period.

b. Igniter Warm-Up- At the end of the pre-purge period, the Hot-Surface igniter HSI is energized for a 17-second igniter warm-up period.

This controller has an adaptive algorithm that adjusts the duration of the igniter warm-up, to extend igniter life. Upon initial application of power, the warm-up time is 17 seconds. The igniter on-time will then be increased or decreased depending on whether or not flame is achieved. The warm-up time is limited to a maximum of 27 seconds.

Upon a call for heat, if the warm-up time has not been locked, it will be decreased by one second. This reduction of the igniter one time will continue until flame fails to be achieved (resulting in a retry).

c. Trial-for-Ignition Sequence-- When the igniter warm-up period is completed, the main gas valve relay contacts GVR close to energize the gas valve GV, the gas valve opens for 4 seconds. The gas valve GV permits gas flow to the burners where it is ignited by the HSI. a 4-second flame proving period begins.

d. Flame-Proving--When the burner flame is proved at the flame-proving sensor electrode FSE, the furnace control CPU begins the blower-ON delay period and continues to hold the gas valve GV open.

If flame is not detected, the gas valves is de-energized, the igniter is turned off, and the furnace control goes into the "retry" sequence. The "retry" sequence provides a 60-second wait following an unsuccessful ignition attempt (flame not detected). After this wait, the ignition sequence is restarted with an additional 10 seconds of igniter warm-up time. If this ignition attempt is unsuccessful, one more retry will be made before the control goes into system lockout.

If flame is detected, then lost, the furnace control will repeat the initial ignition sequence for a total of two "recycles". After two unsuccessful "recycle" attempts, the control will go into system lockout.

If flame is established for more than 10 seconds after ignition, the furnace controller will clear the ignition attempt (or retry) counter. If flame is lost after 10 seconds, it will restart the ignition sequence. This can occur a maximum of five times before system lockout.

e. Blower-On Delay- If the burner flame is proven, the blower motor is energized on high speed 30 seconds after the gas valve GV is energized. Simultaneously, the electronic air cleaner terminal EAC is energized and remains energized as long as the blower motor BLWM is energized.

f. Blower-Off Delay -When the thermostat is satisfied, the R--to--W1 circuit is opened, de-energizing the gas valve G V, stopping gas flow to the burners, The inducer motor IDM will remain energized for a 15-second post--purge period. Humidifier is de-energized. The blower motor BLWM and air cleaner terminal EAC will remain energized for 90, 120, 150, or 180 seconds (depending on the HEAT-OFF delay selection). The furnace control CPU is factory-set for a 90-second HEAT-OFF delay.

Timing Specifications

(All times are in seconds, unless noted otherwise)
* These times will vary depending on option switch position. The control is factory-set at 30 seconds heat delay-to-fan-on, 90 seconds heat delay-to-fan-off and 60 seconds cool delay-to-fan-off.

Table 7.4

Event	Definition	
Pre-Purge Time	The period of time intended to allow for the dissipation of any unburned gas or residual products of combustion at the beginning of a furnace operating cycle prior to initiating ignition.	15
Igniter Warm-Up Time	The length of time allowed for the igniter to heat up prior to the initiation of gas flow.	17
Trial for Ignition Period (TFI)	The period of time between initiation of gas flow and the action to shut off the gas flow in the event of failure to establish proof of the supervised ignition source or the supervised main burner flame.	4
Ignition Activation Period (IAP)	The period of time between energizing the main gas valve and deactivation of the ignition means prior to the end of TFI.	3
Retries	The additional attempts within the same thermostat cycle for ignition when the supervised main burner flame is not proven within the first trial for ignition period.	2 times
Valve Sequence Period	Valve sequence period equals 4 seconds trial for ignition period x (1 initial try + 2 retries) + 12 seconds.	12
Inter-purge	The period of time intended to allow for the dissipation of nay unburned gas or residual products of combustion between the failed trial for ignition and the retry period.	60
Post-Purge Time	The period of time intended to allow for the dissipation of any unburned gas for residual products of combustion at the end of a furnace burner operating cycle. Post-purge begins at the loss of flame sense.	15
Lock-Out Time	ANSI standard rated module timing.	300
Heat Delay-To-Fan-On	The period of time between proof of the supervised main burner flame and the activation of the blower motor at Heat speed.	30
Heat Delay-To-Fan-Off*	The period of time between the loss of a call for heat and the deactivation of the blower motor at Heat speed.	90/120/150/180
Cool Delay-To-Fan-On	The period of time after a thermostat demand for cool before energizing the circulator blower motor at Cool speed.	1
Cool Delay-To-Fan-Off	The period of time between the loss of a call for cool and the deactivation of the blower motor at Cool speed.	60/90/120/150
Automatic Reset Time	After one (1) hour of internal or external lockout, the control will automatically reset itself and go into an auto restart purge for 60 seconds.	60 Minutes

2. Cooling Mode

In a typical single stage cooling system (Y connection), a call for cool is initiated by closing the thermostat contacts. This energizes the compressor and the electronic air cleaner (optional).

The circulator will be energized at cool speed after the COOL delay-to-fan-on period. After the thermostat is satisfied, the compressor is de-energized and the COOL delay-to-fan-off period begins. After the COOL delay-to-fan-off period ends, the circulator and the electronic air cleaner are de-energized.

3. Fan Mode

If the thermostat fan switch is moved to the ON position, the circulator fan (low heat speed) and the electronic air cleaner (optional) are energized. When the fan switch is returned to the AUTO position, the circulator and electronic air cleaner are de-energized.

7.5 Gas Manifold Pressure Measurement & Adjustment

CAUTION

To prevent unreliable operation or equipment damage, the gas manifold pressure must be as specified on the unit rating plate. Only minor adjustments should be made by adjusting the gas valve pressure regulator.

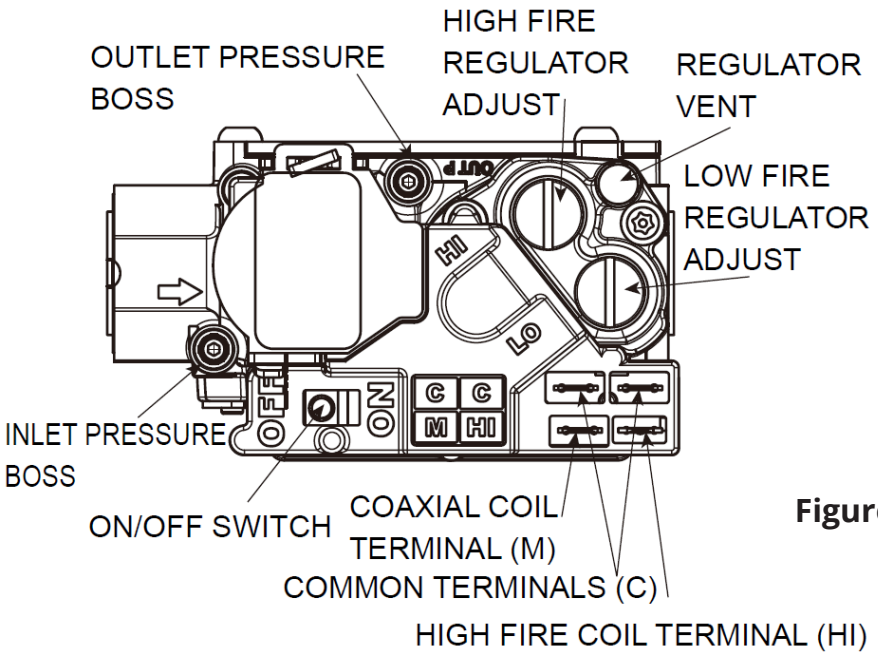
This valve is shipped from the factory with the regulator preset.

Consult the appliance rating plate to ensure burner manifold pressure is as specified. If another outlet pressure is required, follow these steps.

1. Turn OFF all electrical power to the system.
2. Using a 3/32 inch hex wrench, loosen outlet pressure tap (boss) screw one turn. Do not remove screw.
3. Attach a hose and manometer to the potlet pressure boss of valve to over lap at least 3/8”
4. Turn ON system power and set thermostat to a call for heat.
5. Using a leak detection solution or non-chlorine soap suds, check for leaks at hose connection. Bubbles forming indicate a leak. SHUT OFF GAS AND FIX ALL LEAKS IMMEDIATELY!
6. Remove regulator screw cover. Turn regulator screw either clockwise to increase pressure or counter clockwise to decrease.

Always adjust regulator to provide the correct pressure according to the original equipment manufacturer specifications listed on the appliance rating plate.

7. Replace regulator screw cover and finger-tighten securely.
8. Turn OFF all electrical power to the system.
9. Remove manometer and hose from outlet pressure tap.
10. Tighten outlet pressure tap clockwise 7 in-lbs minimum to seal port.
11. Turn ON system power and set thermostat to call for heat.
12. Using a leak detection solution or non-chlorine soap suds, check for leaks at hose connection. Bubbles forming indicate a leak. SHUT OFF GAS AND FIX ALL LEAKS IMMEDIATELY!



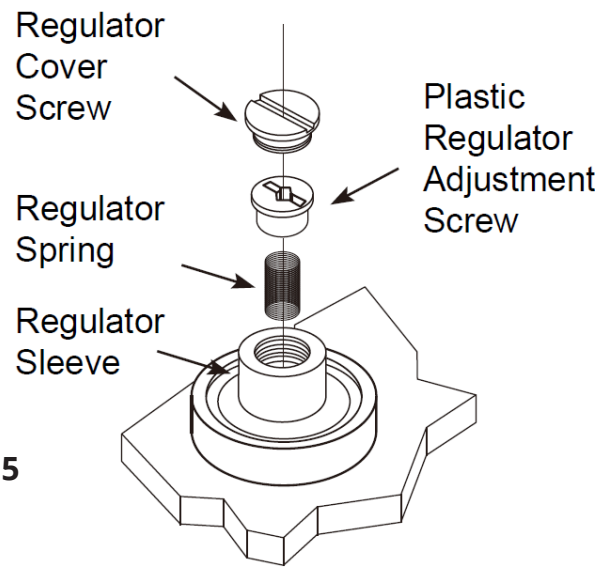


Figure 7.5

Measure gas manifold pressure with burners firing. Adjust manifold pressure per the Manifold Gas Pressure table.

Table 7.5

Manifold Gas Pressure		
Input Rating KBTU/H	**Natural Gas**	**Propane Gas**
40A	3.0" W.C.	10.5" W.C.
60B	3.5" W.C.	10" W.C.
80B	3.8" W.C.	10" W.C.
80C	3.9" W.C.	10" W.C.
100C	3.8" W.C.	10" W.C.
120D	3.8" W.C.	10.5" W.C.

The final manifold pressure must not vary more than ±0.3 w.c. from specified manifold pressure.

Any necessary major changes in gas flow rate should be made by changing the size of the burner orifice.

7.6 Gas Input Rate Measurement (Natural Gas Only)

The gas input rate to the furnace must never be greater than that specified on the unit rating plate. To measure natural gas input using the gas meter, use the following procedure.

1. Turn OFF the gas supply to all other gas-burning appliances except the furnace.

2. While the furnace is operating, time and record one complete revolution of the smallest gas meter dial.

3. Calculate the number of seconds per cubic foot (sec/ft3) of gas being delivered to the furnace. If the dial is one cubic foot dial, divide the number of seconds recorded in step 2 by one. If the dial is a two cubic foot dial, divide the number of seconds recorded in step 2 by two.

4. Calculate the furnace input in BTUs per hour (BTU/hr). Input equals the installation's gas heating value multiplied by a conversion factor (hours to seconds) divided by the number of seconds per cubic foot. The measured input must not be greater than the input indicated on the unit rating plate.

EXAMPLE:

Installation's gas heating (HTG) value: 1,000 BTU/ft3 (Obtained from gas supplier)

Installation's seconds per cubic foot: 34 sec/ft3

Conversion Factor (hours to seconds): 3600 sec/hr

Input = (Htg. value x 3600) + seconds per cubic foot

Input = (1,000 BTU/ft3 x 3600 sec/hr) + 34 sec/ft3

Input = 106,000 BTU/hr

This measured input must not be greater than the input indicated on the unit rating plate.

5. Turn ON gas and relight appliances turned off in step 1.Ensure all the appliances are functioning properly and that all pilot burners are operating.

7.7 Temperature Rise Adjustment

Air temperature rise is the temperature difference between supply and return air. The proper amount of temperature rise is usually obtained when the unit is operated at the rated input with the "as shipped" blower speed. If the correct amount of temperature rise is not obtained, it may be necessary to change the blower speed.

An incorrect temperature rise can cause condensing in or overheating of the heat exchanger. Determine and adjust the temperature rise as follows. The temperature rise must be within the range specified on the rating plate.

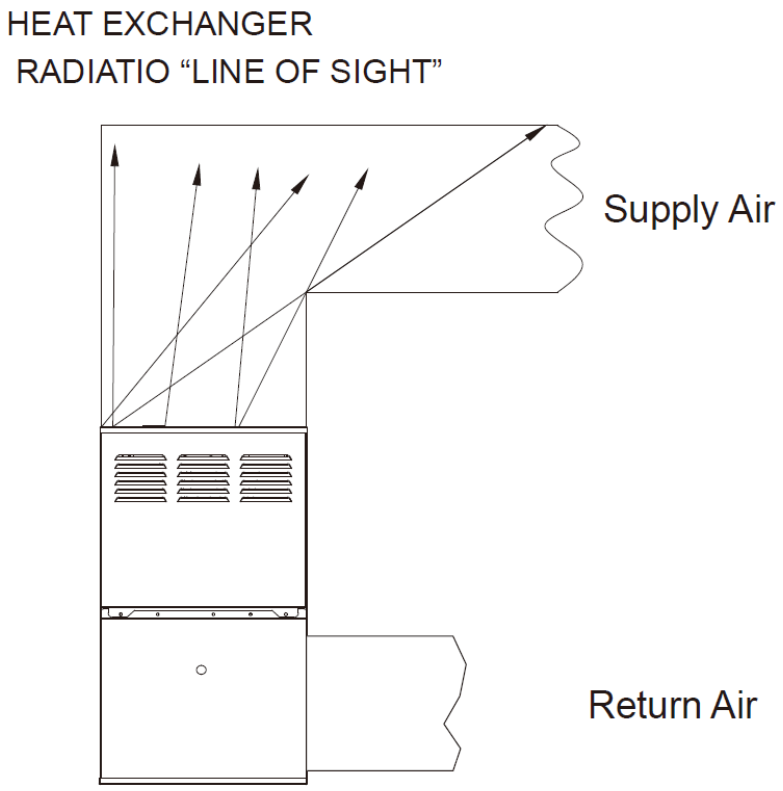


Figure 7.7

Temperature Rise Adjustment

1. Operate furnace with burners firing approximately 15 minutes. Ensure all registers are open and all duct dampers are in their final (fully or partially open) position.

2. Place thermometers in the return and supply ducts as close to the furnace as possible. Thermometers must not be influenced by radiant heat by being able to "see" the heat exchanger.

3. Subtract the return air temperature from the supply air temperature to determine the air temperature rise. Allow adequate time for thermometer readings to stabilize.

4. Adjust temperature rise by adjusting the circulator blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise.

7.8 Circulator Blower Speed Adjustment

WARNING-ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, or death. Turn OFF power to the furnace before changing speed taps.

This furnace is equipped with a ECM circulator blower motor. This blower provides ease in adjusting blower speeds. The cooling blower speed is shipped set on 5(4). High heat ships on 4(3).These blower speeds should be adjusted by the installer to match the installation requirements so as to provide the correct heating temperature rise and the correct cooling CFM.

To adjust the circulator blower speed, proceed as follows:

1. Turn off power to the furnace.

2. Select the heating and cooling blower speeds that match the installation requirements from the Air Delivery-CFM (Without Filter) table.

3. Relocate desired motor leads to the circulator blower heat and cool speed terminals on the integrated control module. (Terminals are identified as HEAT and COOL (hot)). If heating and cooling blower speeds are the same, a jumper wire must be used between the heat and cool terminals.

4. Turn ON power to furnace.

5. Verify proper temperature rise as outlined in Temperature Rise section.

Circulator Blower Fan Timing Adjustment

NOTE

Items in this section refer to the air circulator blower fan, NOT to the induced draft blower. The induced draft blower timing sequence is not adjustable. The circulator blower fan timing is adjustable.

As shipped, the circulator blower fan will remain on for 180 seconds after the gas valve closes. When a call for cooling occurs, the circulator fan comes on and remains on for 90 seconds after the call for cooling ends. During normal heating operation, the circulator fan will come on approximately 30 seconds after the gas valve opens.

Table 7.8b

Heat Off Delay		
DIP SW		Nominal (Minutes)
S2-1	S2-2	
*OFF	OFF	90
ON	OFF	120
OFF	ON	150
ON	ON	180

Cool Off Delay		
DIP SW		Nominal (Minutes)
S2-3	S2-4	
*OFF	OFF	60
ON	OFF	90
OFF	ON	120
ON	ON	150

8.1 Burner Flame

WARNING-FIRE, EXPLOSION, ELECTRICAL SHOCK, & CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury, or death. Do not remove any internal compartment covers or attempt any adjustment. Electrical compartments are contained in both compartments. Contact a qualified service agent at once if an abnormal flame appearance should develop.

The burner flames should be inspected with the burner compartment door installed. Flames should be stable, quiet, soft, and blue (dust may cause orange tips but they must not be yellow). Flames should extend directly outward from the burners without curling, floating, or lifting off, and should enter heat-exchanger tube.

Flames must not impinge on the sides of the heat exchanger firing tubes.

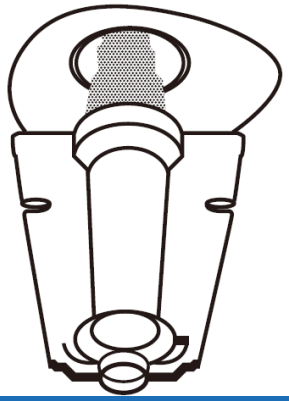


Figure 8.1

Check the burner flames for
1. Good adjustment
2. Stable, soft and blue
3. Not curling, floating, or lifting off

9.1 General

A number of safety circuits are employed to ensure safe and proper furnace operation. These circuits serve to control any potential safety hazards and serve as inputs in the monitoring and diagnosis of abnormal function. These circuits are continuously monitored during furnace operation by the integrated control module.

9.2 Integrated Control Model

The integrated control module is an electronic device which controls all furnace operations. Responding to the thermostat, the module initiates and controls normal furnace operation, and monitors and addresses all safety circuits. If a potential safety concern is detected, the module will take the necessary precautions and provide diagnostic information through an LED display.

9.3 Primary Limit

The primary limit control is located on the partition panel and monitors heat exchanger compartment temperature. It is an automatic reset temperature sensor. The limit guards against the overheating resulting from insufficient air passing over the heat exchanger.

9.4 Reverse Flow Switch

The reverse flow switch is located on the air circulating blower housing. It is an automatic reset temperature sensor. The reverse flow switch shuts off the furnace when the air circulating blower fails on downflow or horizontal installations to prevent air filter or other parts from overheating by hot air.

9.5 Rollout Limits

The rollout limit controls are mounted on the burner/manifold assembly and monitor the burner flame. They are manual-reset temperature sensors. This limit guards against burner flames not being properly drawn into the heat exchanger.

9.6 Pressure Switches

The pressure switches are normally-open, negative air pressure activated switches. They monitor the airflow (combustion air and flue products) through the heat exchanger via pressure taps located on the induced draft blower. These switches guard against insufficient airflow (combustion air and flue products) through the heat exchanger.

9.7 Flame Sensor

The flame sensor is a probe mounted to the burner/manifold assembly which uses the principle of flame rectification to determine the presence or absence of flame.

WARNING-FIRE, EXPLOSION, OR CARBON MONOXIDE POISONING HAZARD

Failure to replace with proper control could result in fire, explosion or carbon monoxide poisoning.
This appliance uses a NEGATIVE PRESSURE REGULATED gas control.
Replace ONLY with the same model number or as specified by the manufacturer.

10 TROUBLESHOOTING

10.1 Electrostatic Discharge (Eso) Precautions

NOTE

Discharge body's static electricity before touching unit. An electrostatic discharge can adversely affect electrical components.
Use the following precautions during furnace installation and servicing to protect the integrated control module from damage.
By putting the furnace, the control, and the person at the same electrostatic potential, these steps will help avoid exposing the integrated control module to electrostatic discharge. This procedure is applicable to both installed and uninstalled (ungrounded) furnaces.

1. Disconnect all power to the furnace. Do not touch the integrated control module or any wire connected to the control prior to discharging your body's electrostatic charge to ground.

2. Firmly touch a clean, unpainted, metal surface of the furnace away from the control. Any tools held in a person's hand during grounding will be discharged.

3. Service integrated control module or connecting wiring following the discharge process in step 2. Use caution not to recharge your body with static electricity; (i.e. do not move or shuffle your feet, do not touch ungrounded objects, etc.). If you come in contact with an ungrounded object, repeat step 2 before touching control or wires.

4. Discharge your body to ground before removing a new control from its container. Follow steps 1 through 3 if installing the control on a furnace. Return any old or new controls to their containers before touching any ungrounded object. The primary limit control is located on the partition panel.

10.2 Diagnostic Chart

Refer to the troubleshooting chart on the following pages for assistance in determining the source of unit operational problems.

The red diagnostic LED blinks to assist in troubleshooting the unit.

The number of blinks refer to a specific code.

10.3 Resetting From Lockout

Furnace lockout results when a furnace is unable to achieve ignition after three attempts. It is characterized by a non-functioning furnace and a one flash diagnostic LED code from the red LED. If the furnace is in "lockout", it will (or can be) reset in any of the following ways.

1. Automatic reset: The integrated control module will automatically reset itself and attempt to resume normal operations following a one hour lockout period.

2. Manual power interruption: Interrupt 115 volt power to the furnace for 1 - 20 seconds.

3. Manual thermostat cycle: Lower the thermostat so that there is no longer a call for heat for 1 - 20 sec.

NOTE

If the condition which originally caused the lockout still exists, the control will return to lockout. Refer to the diagnostic chart for help in determining the cause.

⚠ WARNING-FIRE, EXPLOSION, AND ASPHYXIATION HAZARD

Failure to replace with proper control could result in fire, explosion or carbon monoxide poisoning.
This appliance uses a NEGATIVE PRESSURE REGULATED gas control.
Replace ONLY with the same model number or as specified by the manufacturer.

Table 10.3

Troubleshooting Chart		
Error Code	**Error/Condition**	**Comments/Troubleshooting**
FE	Gas valve relay stuck closed	Verify the gas valve is operating and shutting down properly. Flame in burner assembly should extinguish promptly at the end of the cycle. Check orifices and gas pressure
E1	Shorted Pressure	Pressure switch is stuck closed. Check switch function, verify inducer is turning off.
E2	Open Pressure	Check pressure switch function and tubing. Verify inducer is turning on the pulling-sufficient vacuum to engage switch.
E4	Open-Pressure Switch Locked	If the pressure switch cycles 15 times (open, closed) during one call for heat from the thermostat the control will lockout. Check pressure switch for fluttering, inconsistent closure, or poor vacuum pressure.
E5	Open thermal limit, rollout switch	Verify continuity through rollout switch, primary limit, reverse flow limit circuit.
E6	Open thermal limit, rollout switch (after 5 times)	
E7	Ignition failure locked	Failure to sense flame is often caused by carbon deposits on the flame sensor, a disconnected or shorted flame sensor lead, or a poorly grounded furnace. Carbon deposits can be cleaned with emery cloth. Verify sensor is not contacting the burner and is located in a good position to sense flame. Check sensor lead for shorting and verify furnace is grounded properly.
E8	Flame loss locked	Check items for exceeded retries listed above and verify valve is not dropping out allowing flame to be established and then lost.
FL	Flame Low	Low flame sense current is often caused by carbon deposits on the flame sensor, a poorly grounded furnace or a misaligned flame-sense probe. Carbon deposits can be cleaned with emery cloth. Check for improve furnace and module ground. Verify sensor is located in or very near flame as specified by the appliance manufacturer.
Pr	Power reversed	Verify the control and furnace are properly grounded. Check and reverse polarity (primary) if incorrect.
Fo	Fuse open	Replace fuse of electric control board.
bE	Board error	Replace electric control board.
nL	Signal error	Ensure the wire control signal refer to user manual.

1. Integrated control module will automatically attempt to reset from lockout after one hour.
2. LED Flash code will cease if power to the control module is interrupted through the disconnect or door switch.

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.**

WARNING-FIRE, EXPLOSION, OR CARBON MONOXIDE HAZARD

Failure to replace with proper control could result in fire,explosion or carbon monoxide poisoning.
This appliance uses a NEGATIVE PRESSURE REGULATED gas control.
Replace ONLY with the same model number or as specified by the manufacturer.

11.1 Annual Inspection

The furnace should be inspected by a qualified installer or service agency at least once per year. This check should be performed at the beginning of the heating season. This will ensure that all furnace components are in proper working order and that the heating system functions appropriately. Pay particular attention to the following items. Repair or service as necessary.

(a) All flue gas carrying areas external to the furnace (i.e. chimney, vent connector) are clear and free of obstructions.

(b) The vent connector is in place, slopes upward, and is physically sound without holes or excessive corrosion.

(c) The return-air duct connection(s) is physically sound, is sealed to the furnace casing, and terminates outside the space containing the furnace.

(d) The physical support of the furnace is sound without sagging, cracks, gaps, etc, around the base so as to provide a seal between the support and the base.

(e) There are no obvious signs of deterioration of the furnace.

(f) The pilot and burner flames are in good adjustment (by comparison with pictorial sketches or drawings of the main burner flame and, if applicable, the pilot burner flame).

11.2 Filters

A return air filter is not supplied with this furnace; however, there must be a means of filtering all of the return air. The installer will supply filter(s) at the time of installation.

Filter Maintenance

Improper filter maintenance is the most common cause of inadequate heating or cooling performance. Filters should be cleaned (permanent) or replaced (disposable) every one month or as required.

When replacing a filter, it must be replaced with a filter of the same type and size.

Become familiar with filter location and procedures for removal, cleaning and replacing them. If help is needed, contact the installer of the furnace or a qualified servicer.

Filter Removal

Depending on the installation, differing filter arrangements can be applied. A media air filter or electronic air cleaner can be used as an alternate filter.

Follow the filter sizes given in the Recommended Minimum Filter size table to ensure proper unit performance.

For further details, see your distributor.

Upright Filter Removal

To remove filters from an external filter rack in an upright upflow installation, follow the directions provided with external filter rack kit.

Clean, wash and dry a permanent filter. When using a permanent filter, both sides should be sprayed with a dust adhesive as recommended on the adhesive container. Spray adhesives for use with permanent filters can be found at some hardware stores.

BE SURE AIRFLOW DIRECTION ARROW POINTS TOWARDS THE BLOWER.

Inspect filter. If your dirty filter is the disposable type, replace dirty filter with the same type and size filter. If your dirty filter is a permanent filter, clean as follows:

• Wash, rinse, and dry the permanent filters. Both sides should then be sprayed with a filter adhesive as is recommended on the adhesive container. Many hardware stores stock spray adhesives for use with permanent filters.

• If badly torn or uncleanable, these filters must be replaced by equal size permanent, high velocity filters. Throwaway filters must not be used as replacement for permanent filters. Under normal use, permanent filters should last for several years.

11.3 Induced Draft & Circulating Blower Motors

The bearings in the induced draft blower and ciretdator blower motors are permanently lubricated by the manufacturer. No further lubrication is required. Check motor windings for accumulation of dust which may cause overheating. Clean as necessary.

11.4 Flame Sensor

To be checked by a qualified servicer only

Under some conditions, the fuel or air supply can create a nearly invisible coating on the flame sensor. This coating acts as an insulator causing a drop in the flame sense signal. If the flame sense signal drops too low, the furnace will not sense flame and will lock out. The flame sensor should be carefully cleaned by a qualified servicer using emery cloth or steel wool. Following cleaning, the flame sense signal should be 1 to 6 microamps at 115 volts.

Igniter

To be checked by a qualified servicer only

If the igniter and the surrounding air are at about 70°F and the igniter wires are not connected to any other electrical components, the resistance of the igniter should not exceed 200 ohms. If it does, the igniter should be replaced.

11.5 Burners

WARNING-FIRE, EXPLOSION, ELECTRICAL SHOCK, AND CARBON MONOXIDE HAZARD

To avoid personal injury or death, do not remove any internal compartment covers or attempt any adjustment. Electrical compartments are contained in both compartments. Contact a qualified service agent at once if an abnormal flame appearance should develop.

Periodically during the heating season, make a visual check of the burner flames. Turn the furnace on at the thermostat. Wait a few minutes, since any dislodged dust will alter the normal flame appearance. Flames should be stable, quiet, soft and blue with slightly orange tips. They should not be yellow. They should extend directly outward from the burner ports without curling downward, floating or lifting off the ports.

NOTE

If the condition which originally caused the lockout still exists, the control will return to lockout. Refer to the diagnostic chart for help in determining the cause.

11.6 Cleaning Heat Exchanger

The following steps should be performed by a qualified service agency:

NOTE

If the heat exchangers get a heavy accumulation of soot and carbon, they should be replaced rather than trying to clean them thoroughly. A heavy build-up of soot and carbon indicates that a problem exists which needs to be corrected, such as improper adjustment of manifold pressure, insufficient or poor quality combustion air, incorrect size or damaged manifold orifice(s), improper gas, or a restricted heat exchanger. Action must be taken to correct the problem.

If it becomes necessary to clean the heat exchangers because of dust or corrosion, proceed as follows:

1. Turn OFF gas and electrical power to furnace.
2. Remove outer access door.
3. Disconnect vent connector from furnace vent elbow.
4. For downflow or horizontal furnace having an internal vent pipe, remove internal vent pipe within the casing.
5. Disconnect wires to the following components. Mark wires to aid in reconnection of (be careful when disconnecting wires from switches because damage may occur):
    a. Draft safeguard switch
    b. Inducer motor
    c. Pressure switch(es)
    d. Limit over-temperature switch
    e. Gas valve
    f. Hot surface igniter
    g. Flame-sensing electrode
    h. Flame rollout switches
6. Remove screws that fasten the collector box assembly to the cell panel. Be careful not to damage the collector box. Inducer assembly and elbow need not be removed from collector box.
7. Disconnect gas line from gas manifold.
8. Remove the 5 screws that attach the burner assembly to the cell panel. The gas valve and individual burners do not need to be removed from support assembly.

NOTE

Be very careful when removing burner assembly to avoid breaking igniter.

9. Using field-provided 25-caliber rifle cleaning brush, 36-in. (914 mm) long, 1/4" diameter steel spring cable, a variable speed, reversible electric drill, and vacuum cleaner, clean cells as follows:
    a. Remove metal screw fitting from wire brush to allow insertion into cable.
    b. Insert the twisted wire end of brush into end of spring cable, and crimp tight with crimping tool or crimp by striking with ball-peen hammer. TIGHTNESS IS VERY IMPORTANT.

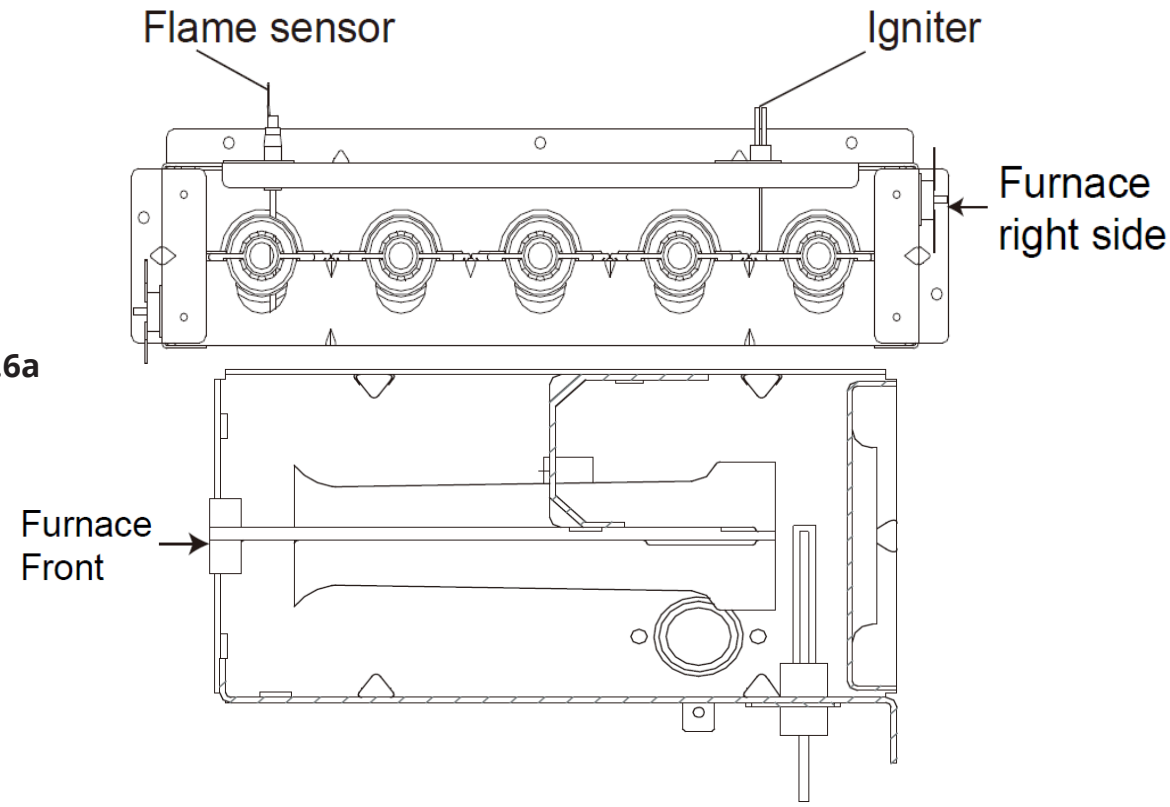


Figure 11.6a

NOTE

The materials needed in item 9 can usually be purchased at local hardware stores.

1. Attach variable-speed, reversible drill to the end of spring cable (end opposite brush).
2. Insert brush end of cable into the outlet opening of cell and slowly rotate with drill. DO NOT force cable. Gradually insert cable into upper pass of cell.
3. Work cable in and out of cell 3 or 4 times to obtain sufficient cleaning. DO NOT pull cable with great force. Reverse drill and gradually work cable out.
4. Insert brush end of cable in burner inlet opening of cell, and proceed to clean 2 lower passes of cell in same manner as upper pass.
5. Repeat foregoing procedures until each cell in furnace has been cleaned.
6. Using vacuum cleaner, remove residue from each cell.
7. Using vacuum cleaner with soft brush attachment, clean burner assembly.
8. Clean flame sensor with fine steel wool.
9. Reinstall burner assembly. Center burners in cell openings.
10. Remove old sealant from cell panel and collector box flange.
11. Spray releasing agent on the heat exchanger cell panel where collector box assembly contacts cell panel.

NOTE

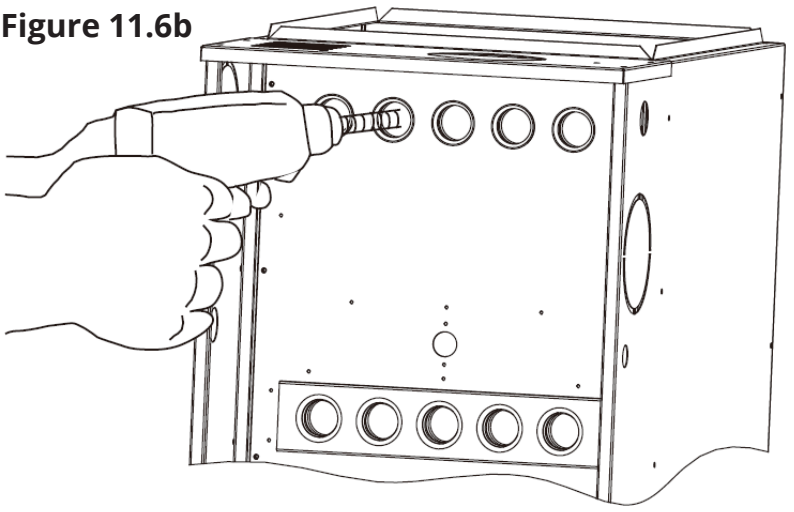
A releasing agent such as cooking spray or equivalent (must not contain corn or canola oil, aromatic or halogenated hydrocarbons or inadequate seal may occur) and RTV sealant (G.E. 162, 6702, or Dow-Corning 738) are needed before starting installation. DO NOT substitute any other type of RTV sealant. G.E. 162 (P771-9003) is available through RCD in 3-oz. tubes.

12. Apply new sealant to flange of collector box and attach to cell panel using existing screws, making sure all screws are secure.

13. Reconnect wires to the following components. (Use connection diagram on wiring label, if wires were not marked for reconnection locations.):

a. Draft safeguard switch.
b. Inducer motor.
c. Pressure switch(es).
d. Limit over-temperature switch.
e. Gas valve.
f. Hot surface igniter.
g. Flame-sensing electrode.
h. Flame rollout switches.

Figure 11.6b



14. Reinstall internal vent pipe, if applicable.

15. Reinstall vent connector on furnace vent elbow. Securely fasten vent connector to vent elbow with 2 field-supplied, corrosion-resistant, sheet metal screws located 1800 apart.

16. Replace blower access door only, if it was removed.

17. Set thermostat above room temperature and check furnace for proper operation.

18. Verify blower airflow and speed changes between heating and cooling.

19. Check for gas leaks

20. Replace outer access door.

⚠ WARNING-FIRE, OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.
Never use a match or other open flame to check for gas leaks.
Use a soap-and-water solution.

21. Turn on electric power and gas supply to the furnace.

22. Check furnace for proper operation. Refer to "Operational Checks" section to verify burner flame characteristics.

11.7 Before Leaving an Installation

- Cycle the furnace with the thermostat at least three times. Verify cooling and fan only operation.
- Review the Owner's Manual with the homeowner and discuss proper furnace operation and maintenance
- Leave literature packet near furnace.

11.8 Repair & Replacement Parts

- When ordering any of the listed functional parts, be sure to provide the furnace model, manufacturing, and serial numbers with the order.
- Although only functional parts are shown in the parts list, all sheet metal parts, doors, etc. may be ordered by description.
- Parts are available from your distributor.

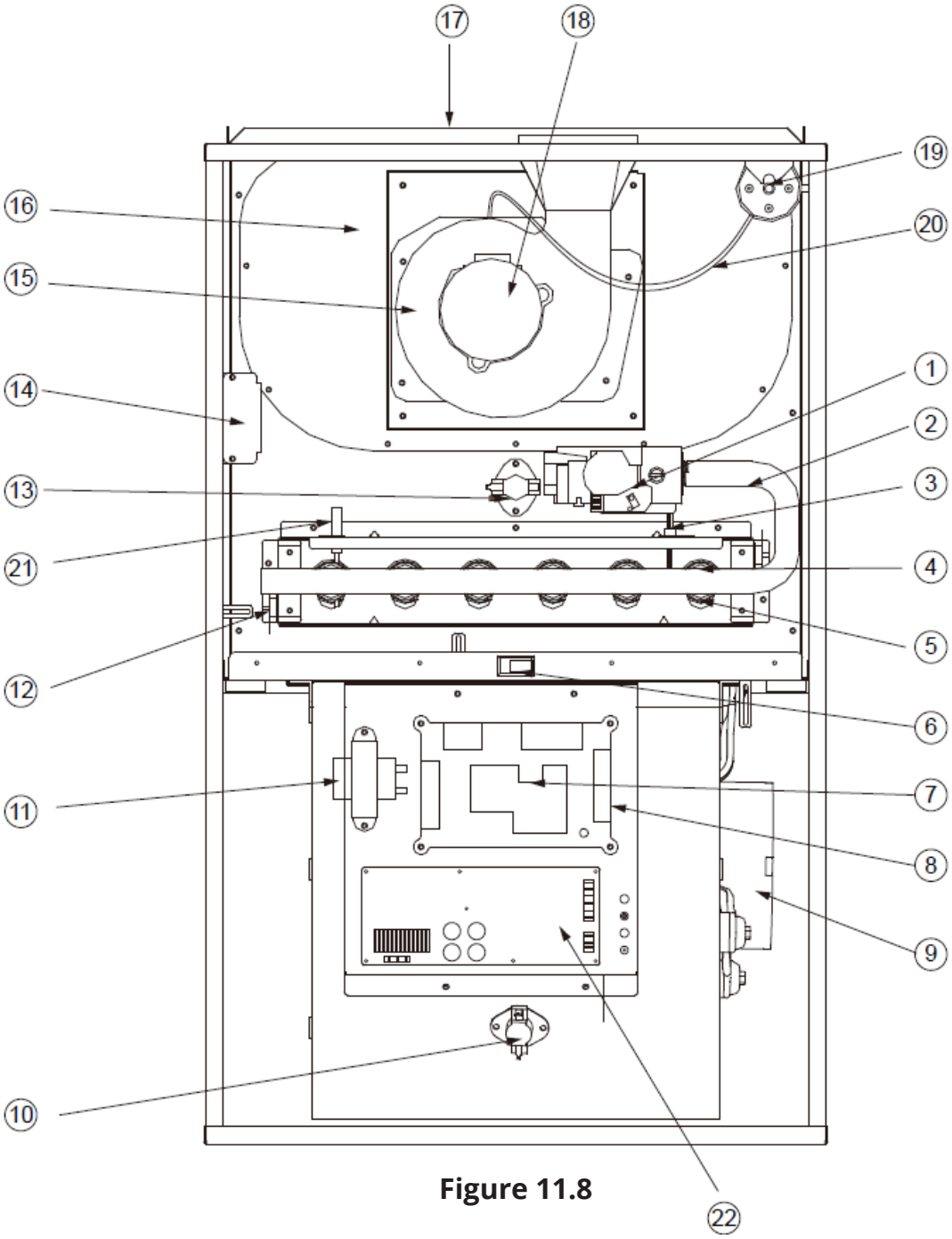


Figure 11.8

Component Identification					
1	Gas Valve	9	Circulator Blower	17	Heat Exchanger
2	Gas Manifold	10	Reverse Flow Switch	18	Blower Wheel
3	Mini Igniter	11	Transformer	19	Pressure Switch
4	Natural/Propane Gas Orifice	12	Rollout Limit Switch	20	Pressure Switch Hose
5	Burner	13	Primary Limit Switch	21	Flame Sensor
6	Door Switch	14	Junction Box	22	IPM Module
7	Integrated Control Module	15	Induced Draft Blower		
8	24 Volt Thermostat Connections	16	Flue Collector Box		

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The design and specifications of this product and/or manual are subject to change without prior notice.
Consult with the sales agency or manufacturer for details.