GAS FURNACES **80+ AFUE**

Installation Instructions

Single Stage High Efficiency Furnaces

*SA Upflow/Horizontal Model

*SK Downflow Model

⚠ WARNING:

- **PROPOSITION 65 WARNING: This product contains chemicals known to the state of California to cause cancer, birth defects or other reproductive harm.**
- **This furnace is not approved for installation in mobile homes. Installing this furnace in a mobile home could cause fire, property damage, and/or personal injury.**

ATTENTION INSTALLERS:

It is your responsibility to know this product better than your customer. This includes being able to install the product according to strict safety guidelines and instructing the customer on how to operate and maintain the equipment for the life of the product. Safety should always be the deciding factor when installing this product and using common sense plays an important role as well. Pay attention to all safety warnings and any other special notes highlighted in the manual. Improper installation of the furnace or failure to follow safety warnings could result in serious injury, death, or property damage.

These instructions are primarily intended to assist qualified individuals experienced in the proper installation of this appliance. Some local codes require licensed installation/service personnel for this type of equipment. Please read all instructions carefully before starting the installation. Return these instructions to the customer's package for future reference.

⚠ WARNING:

FIRE OR EXPLOSION HAZARD

- **Failure to follow safety warnings exactly could result in serious injury or property damage.**
- **Installation and service must be performed by a qualified installer, service agency or the gas supplier.**
- **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**

WHAT TO DO IF YOU SMELL GAS

- **Do not try to light any appliance.**
- **Do not touch any electrical switch; do not use any phone in your building.**
- **Leave the building immediately.**
- **Immediately call your gas supplier from a neighbors phone. Follow the gas suppliers instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

DO NOT DESTROY.
KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.

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SAFETY INFORMATION

Safety markings are used frequently throughout this manual to designate a degree or level of seriousness and should not be ignored. **WARNING** indicates a potentially hazardous situation that if not avoided, could result in personal injury or death. **CAUTION** indicates a potentially hazardous situation that if not avoided, may result in minor or moderate injury or property damage.

⚠ WARNING:

The safety information listed below must be followed during the installation, service, and operation of this furnace. Failure to follow safety recommendations could result in possible damage to the equipment, serious personal injury or death.

- Use only with type of gas approved for this furnace. Refer to the furnace rating plate.
- Install this furnace only in a location and position as specified in Table 1 (page 23).
- Provide adequate combustion and ventilation air to the furnace space as specified on Pages 6 - 8.
- Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified on Pages 12 - 13.
- Never test for gas leaks with an open flame. Use a commercially available soap solution to check all connections (Page 15).
- This furnace is designed to operate with a maximum external pressure rise of 0.5 inches of water column. Consult Tables 2 and 3 (pages 26 - 28), and the rating plate for the proper circulating air flow and temperature rise. It is important that the duct system be designed to handle the desired flow rate and temperature rise. An improperly designed duct system can result in nuisance shutdowns, and comfort or noise issues.
- When 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.
- This furnace may be used for temporary heating of buildings or structures under construction. See the guidelines listed on page 5.
- A gas-fired furnace for installation in a residential garage must be installed as specified on Page 6.

REQUIREMENTS and CODES

This furnace must be installed in accordance with these instructions, all applicable local building codes and the current revision of the National Fuel Gas Code (NFPA54/ANSI Z223.1) or the Natural Gas and Propane Installation Code, CAN/CGA B149.1.

Additional codes listed below are for reference purposes only and do not necessarily have jurisdiction over local or state codes. Always consult with local authorities before installing any gas appliance.

Combustion and Ventilation Air

- US: National Fuel Gas Code (NFGC), Air for Combustion and Ventilation
- CANADA: Natural Gas and Propane Installation Codes (NSCNGPIC), 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) Fundamentals Handbook

Electrical Connections

- US: National Electrical Code (NEC) ANSI/NFPA 70
- CANADA: Canadian Electrical Code CSA C22.1

Gas Piping and Gas Pipe Pressure Testing

- US: NFGC and National Plumbing Codes
- CANADA: NSCNGPIC

General Installation

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

Safety

- US: (NFGC) NFPA 54–1999/ANSI Z223.1 and the Installation Standards, Warm Air Heating and Air Conditioning Systems ANSI/NFPA 90B.
- CANADA: CAN/CGA-B149.1 and .2–M00 National Standard of Canada. (NSCNGPIC)

GENERAL INSTRUCTIONS

Combustion Air Quality

⚠ CAUTION:

Combustion air must not be drawn from a corrosive atmosphere.

To maximize heat exchanger life, the combustion air must be free of chemicals that can form corrosive acidic compounds in the combustion gases. The recommended source of combustion air is to use outdoor air. However, the use of indoor air in most applications is acceptable except as listed:

- If the furnace is installed in a confined space, it is required that the necessary combustion air come from the outdoors by way of attic, crawl space, air duct, or direct opening. See Installation in a Confined Space section (pages 7 - 8) for combustion air requirements.
- Installations in these locations may require outdoor air for combustion, due to chemical exposures:
  - Commercial buildings
  - Buildings with indoor pools
  - Furnaces installed in laundry rooms
  - Furnaces installed in hobby or craft rooms
  - Furnaces installed near chemical storage areas
- Exposure to the following substances in the combustion air supply may require outdoor air 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 (perchloroethylene)
  - Printing inks, paint removers, varnishes, etc.
  - Hydrochloric acid
  - Cements and glues
  - Antistatic fabric softeners
  - Masonry acid washing materials

Operation of Furnace During Construction

⚠ CAUTION:

Failure to follow these instructions will void the factory warranty and may significantly reduce the life or the performance of the furnace, and/or result in other unsafe conditions. It is the responsibility of the installing contractor to insure these provisions are met.

Operating gas furnaces in construction environments can cause a variety of problems with the furnace. Proper use of commercial portable space heating equipment during construction is recommended. This gas furnace may be used during construction if it is not in violation of any applicable codes and the following criteria are met:

- The installation must meet all applicable codes. The furnace must be permanently installed according to the instructions supplied with the furnace including electrical supply, gas supply, duct work and venting. The furnace must be controlled by a thermostat properly installed according to the instructions supplied with the furnace and thermostat. The installation must include a properly installed filter in the return air system with no by-pass air. The filter must be inspected frequently and replaced when necessary.
- Combustion air must be supplied from outside the structure and located such that dust and gases from construction activity are not introduced into the combustion system.
- Provisions must be made to insure that condensate does not freeze in the furnace or condensate drain lines during operation and during idle times; for example, overnight if turned off. (Condensing furnaces only)
- Before occupying the structure: The filter must be replaced or cleaned, the duct work must be inspected and cleaned of any construction debris, and the furnace must be cleaned and/or repaired if found to be dirty, damaged, or malfunctioning in any way by a qualified HVAC technician. The furnace shall be inspected and approved by applicable local authority even if this requires redundant inspections.
- Serial numbers for furnaces used during construction must be submitted in writing (fax and email also acceptable). This information will be used to track the long-term affects of the use during construction on furnaces. Proof of this submittal shall be available for the final inspection of the furnace prior to occupancy.
- This furnace is designed to operate with return air temperatures in ranges normally found in occupied residences, including setbacks. Minimum continuous return temperature must not be below 60° F (15° C). Occasionally a temporary return temperature of 55° F (12° C) is acceptable. However, operation with a return temperature below 55° F (12° C) is not allowed.

Installation in a Garage

⚠ WARNING:

Do not place combustible materials on or against the furnace cabinet or within 6 inches of the vent pipe. Do not place combustible materials, including gasoline or any other flammable vapors and liquids, in the vicinity of the furnace.

This Gas-fired furnace may be installed in a residential garage with the provision that the burners and igniter are located no less than 18 inches (457mm) above the floor. The furnace must be located or protected to prevent physical damage by vehicles**.**

Heating Load

The furnace should be sized to provide the design heating load requirement. Heating load estimates can be made using approved methods available from Air Conditioning Contractors of America (Manual J); American Society of Heating, Refrigerating, and Air Conditioning Engineers; or other approved engineering methods. **Excessive oversizing of the furnace could cause the furnace and/or vent to fail prematurely.** In addition, the ductwork should be appropriately sized to the capacity of the furnace to ensure its proper airflow rating. For installations above 2,000 ft., the furnace should have a sea level input rating large enough that it will meet the heating load after deration for altitude.

Clearances to Combustible Materials

This furnace is Design Certified in the U.S. and Canada by CSA International for the minimum clearances to combustible materials listed in Table 1 (page 23). To obtain model number and specific clearance information, refer to the furnace rating plate, located inside of the furnace cabinet.

Access for positioning and servicing the unit must be considered when locating unit. The minimum required clearance from the front of the unit for servicing is 24 inches. The minimum required clearance for positioning is 30 inches from the front of the unit. **The recommended clearance from the front of the unit is 36 inches.** The need to provide clearance for access to panels or doors may require clearance distances over and above the requirements.

COMBUSTION AIR REQUIREMENTS

General Information

⚠ WARNING:

Furnace installation using methods other than those described in the following sections must comply with the National Fuel Gas Code (NFGC) and all applicable local codes.

- Instructions for determining the adequacy of an installation can be found in the current revision of the NFGC (ANSI Z223.1 / NFPA54). **Consult local codes for special requirements**. These requirements are for US installations as found in the NFGC.
- The requirements in Canada (B149.1) are structured differently. Consult with B149.1 and local code officials for Canadian installations.
- Additional reference information for US and Canadian installations can be found in the Combustion and Ventilation Air section (page 4).

Provisions must be made during the installation of this furnace that provide an adequate supply of air for combustion.

⚠ CAUTION:

Exhaust fans, clothes dryers, fireplaces and other appliances that force air from the house to the outdoors can create a negative pressure inside the house, resulting in improper furnace operation or unsafe conditions such as flame roll out. It is imperative that sufficient air exchange with the outdoors is provided to prevent depressurization. Additional information about how to test for negative pressure problems can be found in the NFGC.

NOTE: Air openings on top of the furnace and openings in closet doors or walls must never be restricted. If the furnace is operated without adequate air for combustion, the flame roll-out switch will open, turning off the gas supply to the burners. This safety device is a manually reset switch. **DO NOT install jumper wires across these switches to defeat their function or reset a switch without identifying and correcting the fault condition.**

If a switch must be replaced, use only the correct sized part specified in the Replacement Parts List provided online.

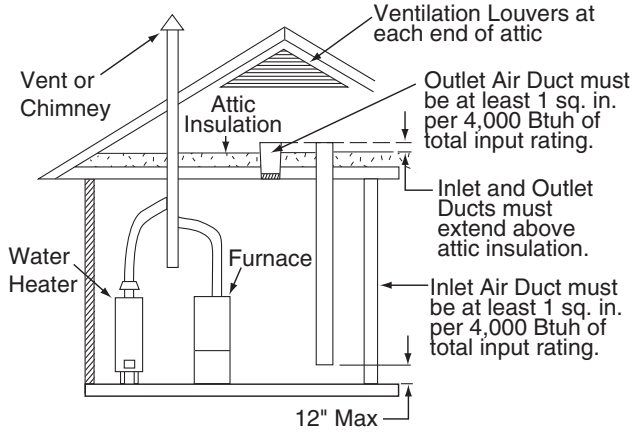
Installation In A Confined Space

A confined space is an area with volume less than 50 cubic feet per 1,000 Btuh of the combined input rates of all appliances drawing combustion air from that space. Furnace closets, small equipment rooms and garages are confined spaces. Furnaces installed in a confined space which supply heated air to areas outside the space must draw return air from outside the space and must have the return air ducts tightly sealed to the furnace.

The required sizing of these openings is determined by whether inside or outside air is used to support combustion, the method by which the air is brought to the space, and by the total input rate of all appliances in the space. In all cases, the minimum dimension of any combustion air opening is 3 inches.

Outdoor Air Using Vertical Ducts

If combustion air is taken from outdoors through vertical ducts, the openings and ducts must have a minimum free area of one square inch per 4,000 Btuh of total appliance input. In installations drawing combustion air from a ventilated attic, both air ducts must extend above the attic insulation (Figure 1).

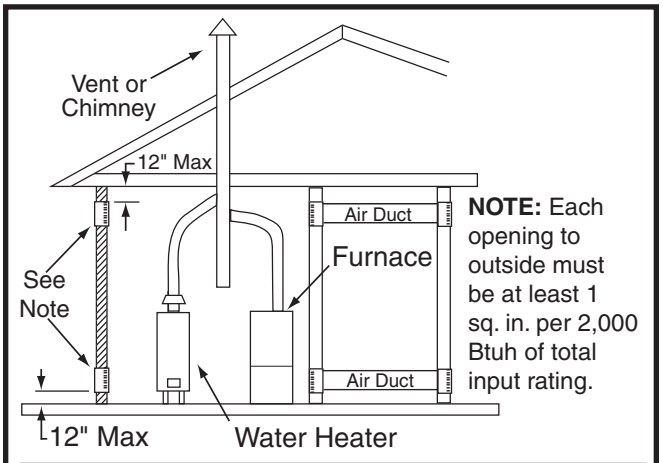


Total Input Rating (Btuh)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	100 sq. In	12 inches
60,000	100 sq. In	12 inches
80,000	100 sq. In	12 inches
100,000	100 sq. In	12 inches
120,000	120 sq. In	13 inches
140,000	140 sq. In	14 inches
160,000	160 sq. In	15 inches

Figure 1. Combustion Air Drawn from Outside Through Vertical Ducts

Outdoor Air Using Horizontal Ducts

If combustion air is taken from outdoors through horizontal ducts, the openings and ducts must have a minimum free area of one square inch per 2,000 Btuh of total appliance input (Figure 2).



Total Input Rating (Btuh)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	10 sq. In	5 inches
60,000	15 sq. In	6 inches
80,000	20 sq. In	7 inches
100,000	25 sq. In	8 inches
120,000	30 sq. In	9 inches
140,000	35 sq. In	10 inches
160,000	40 sq. In	10 inches

Figure 2. Combustion Air Drawn from Outside Through Horizontal Ducts

Outdoor Air from a Crawl Space or Vented Attic

When the openings can freely exchange air with the outdoors, each opening shall have a minimum free area of 1 square inch per 4,000 Btuh of total appliance input. The openings shall exchange directly, or by ducts, with the outdoor spaces (crawl or attic) that freely exchange with the outdoors (Figure 3).

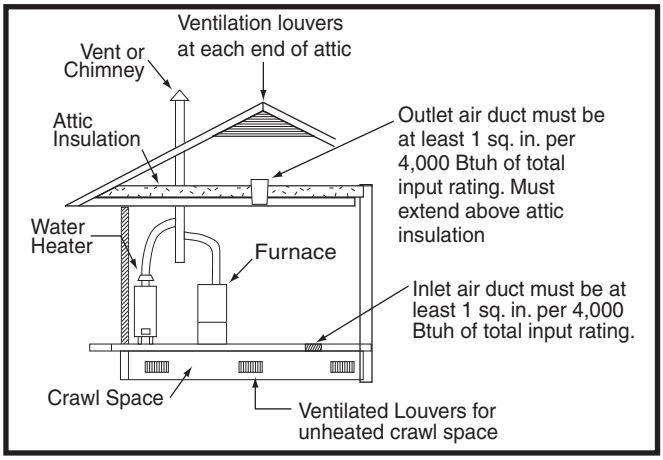
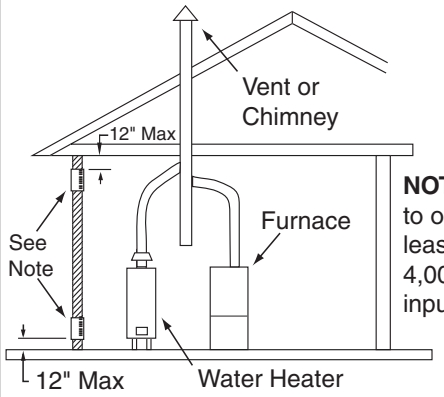


Figure 3. Combustion Air Drawn from a Crawl Space or Vented Attic

Air Directly Through An Exterior Wall

If combustion air is provided directly through an exterior wall, the two openings must each have free area of at least one square inch per 4,000 Btuh of total appliance input (Figure 4).



NOTE: Each opening to outside must be at least 1 sq. in. per 4,000 Btuh of total input rating.

Total Input Rating (Btuh)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	10 sq. In	4 inches
60,000	15 sq. In	5 inches
80,000	20 sq. In	5 inches
100,000	25 sq. In	6 inches
120,000	30 sq. In	6 inches
140,000	35 sq. In	7 inches
160,000	40 sq. In	8 inches

Figure 4. Combustion Air Drawn from Outside Through an Exterior Wall

Alternate Method of Providing Air from Outside:

If acceptable under local Codes, it is permitted to provide outside air using one opening (See NFGC).

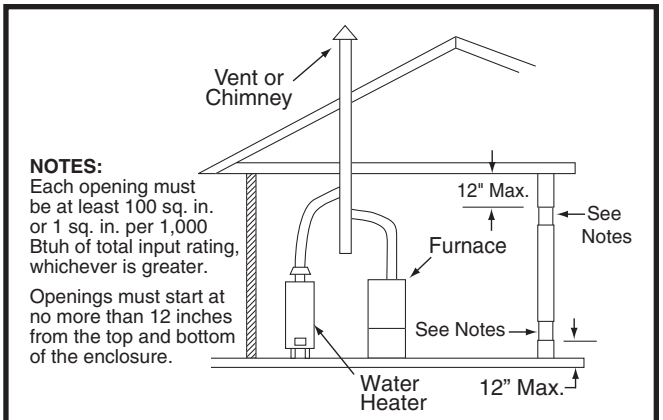
Generally, confined spaces must have two openings in the space for combustion air. One opening must be within 12 inches of the ceiling, and the other must be within 12 inches of the floor. However, an alternative method recently adopted by the NFGC uses one opening within 12 inches of the top of the space. This method may be used if it is acceptable to the local codes.

The following conditions must be met:

1. The opening must start within 12" of the top of the structure and connect with the out of doors through vertical or horizontal ducts or be ducted to a crawl or attic space that connects with the out of doors.
2. The opening must have a minimum free area of 1 sq. in. per 3,000 Btu per hour of the total input rating of all equipment located in the enclosure.
3. The free area must not be less than the sum of all the areas of the vent connectors in the enclosure.

Air From Inside

If combustion air is taken from the heated space, the two openings must each have a free area of at least one square inch per 1,000 Btuh of total input of all appliances in the confined space, but **not less than** 100 square inches of free area (Figure 5). For example, if the combined input rate of all appliances is less than or equal to 100,000 Btuh, each opening must have a free area of at least 100 square inches. If the combined input rate of all appliances is 120,000 Btuh, each opening must have a free area of at least 120 square inches.



Total Input Rating (Btuh)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	100 sq. In	12 inches
60,000	100 sq. In	12 inches
80,000	100 sq. In	12 inches
100,000	100 sq. In	12 inches
120,000	120 sq. In	13 inches
140,000	140 sq. In	14 inches
160,000	160 sq. In	15 inches

Figure 5. Combustion Air Drawn from Inside

Installation In An Unconfined Space

An unconfined space is an area including all rooms not separated by doors with a volume greater than 50 cubic feet per 1,000 Btuh of the combined input rates of all appliances which draw combustion air from that space.

In general, a furnace installed in an unconfined space will not require outside air for combustion. However, in homes built for energy efficiency (low air change rates), it may be necessary to provide outside air to ensure adequate combustion and venting, even though the furnace is located in an unconfined space. See example.

Example:

A space with a water heater rated at 45,000 Btuh input and a furnace rated at 75,000 Btuh requires a volume of 6,000 cubic feet [50 x (45 + 75) = 6,000] to be considered unconfined. If the space has an 8 foot ceiling, the floor area of the space must be 750 square feet (6,000 / 8 = 750).

FURNACE INSTALLATION

General Requirements

*SA series gas furnaces are shipped ready for installation in the upflow or horizontal right or left positions. Only the *SK series gas furnace may be used for downflow operation.

- The furnace must be leveled at installation and attached to a properly installed duct system. See Table 1 (page 23) for the required clearances needed to move the furnace to its installation point (hallways, doorways, stairs, etc).
- The furnace must be installed so that all electrical components are protected from water.
- The furnace must be installed upstream from a refrigeration system.
- Additional reference information for US and Canadian installations can be found in the General Installation section (page 4).

Upflow Installation

The *SA series gas furnace may be installed directly on combustible wood flooring or supports. **This furnace must not be installed directly on carpeting, tile, or any combustible material other than wood flooring.** For venting guidelines and specifications, see Venting Requirements section (pages 12 - 13).

Side Return Air Inlet

*SA series gas furnaces are shipped with the bottom panel installed (Figure 15, page 24). If the upflow furnace is installed with side return air, the bottom panel must not be removed.

Bottom Return Air Inlet

*SA series gas furnaces are shipped with the bottom panel installed. If the upflow furnace is installed with bottom return air, the bottom panel must be removed. See Bottom Panel Removal on page 10.

Horizontal Installation

The *SA series gas furnace can be installed horizontally in an attic, basement, crawl space or alcove (Figure 6). It can also be suspended from a ceiling in a basement or utility room in either a right to left airflow or left to right airflow as shown in Figure 7.

*SA series furnaces are shipped with the bottom panel installed. If the furnace is installed horizontally, remove the bottom panel from the furnace before attaching the duct system. See Bottom Panel Removal on page 10.

If the furnace is to be suspended from the ceiling, it will be necessary to use steel straps around each end of the furnace. The straps should be attached to the furnace with sheet metal screws and to the rafters with bolts. The furnace could also be suspended by an angle iron frame bolted to the rafters (Figure 7).

Access for positioning and servicing must be considered when locating the unit. See Table 1 (page 23) for clearance specifications.

If the furnace is to be installed in an attic, it is required that a drip pan be placed under the furnace. If the installation is on a combustible platform (Figure 6), it is recommended that the drip pan extend at least 12 inches past the top and front of the furnace.

⚠ WARNING:

The furnace must not be installed directly on carpeting, tile, or any combustible material other than wood flooring.

It is recommended for further reduction of fire hazard that cement board or sheet metal be placed between the furnace and the combustible floor and extend 12 inches beyond the front of the door and top of the furnace.

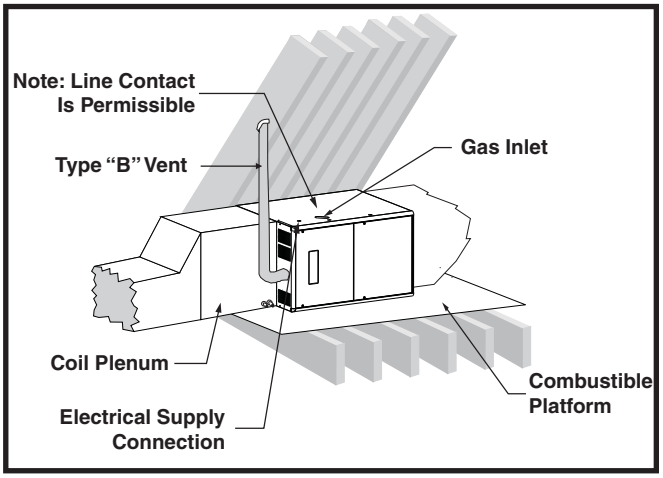


Figure 6. *SA Horizontal Installation on a Platform

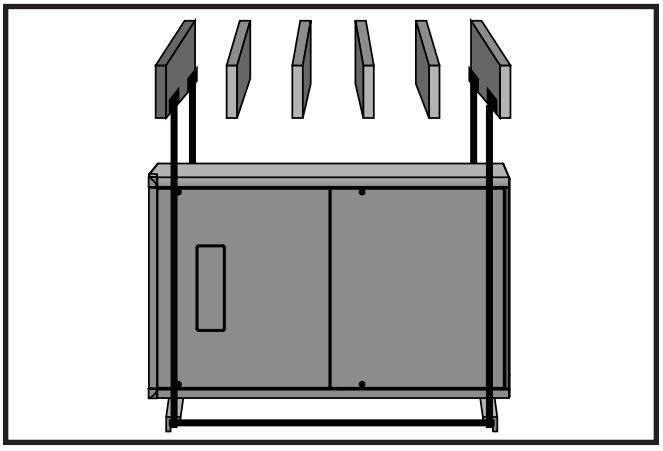


Figure 7. *SA Horizontal Installation Suspended in Attic or Crawl Space

Bottom Panel Removal

To remove the bottom panel (Figure 8) from the upflow furnace, perform the following steps:

1. Remove the blower door (1) from bottom of furnace.
2. Disconnect the wiring harness (2) from the connector.
3. Remove two screws (3) securing the blower assembly (4) to the furnace.
4. Carefully pull the blower assembly (4) out thru the front of the furnace.
5. Remove all screws (5) securing bottom panel (6) to bottom of furnace and front brace (7).
6. Lift up and slide bottom panel (6) out through front of furnace.
7. Reinstall the blower assembly (4) in reverse order it was removed.

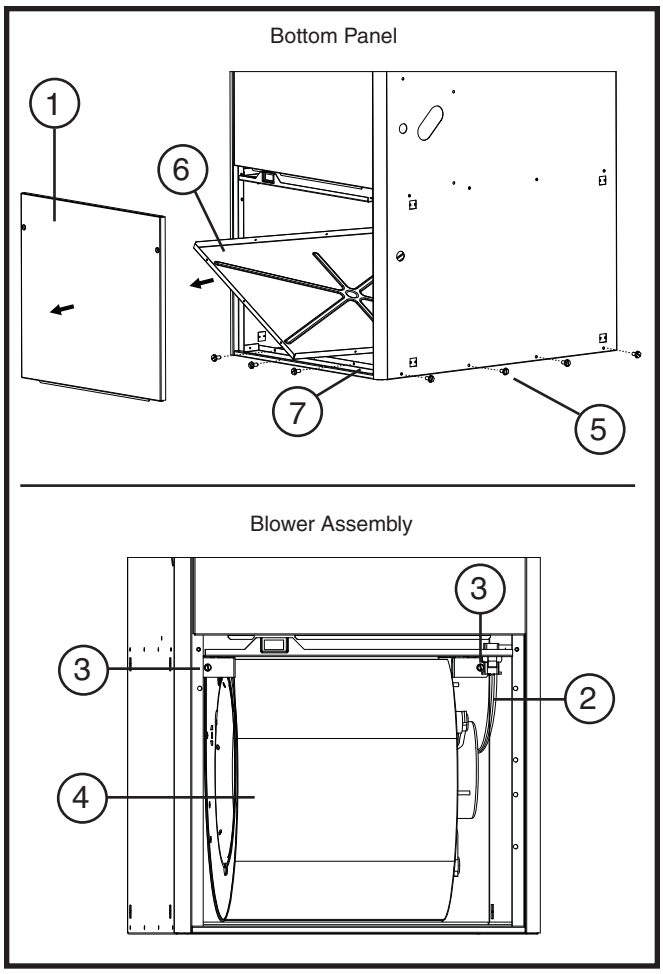


Figure 8. Removal of Bottom Panel

Downflow Installation

The *SK series gas furnace is certified for installation on combustible flooring. **This furnace must not be installed directly on carpeting, tile, or any combustible material other than wood flooring.** For venting guidelines and specifications, see Venting Requirements section (page 12).

⚠ WARNING:

Failure to install the downflow sub-base kit may result in fire, property damage or personal injury.

To install the furnace on combustible flooring, a special sub-base is required. Downflow sub-base kits are factory supplied accessories and are listed according to the cabinet letter of the furnace. For 'A' size cabinets use Sub-Base kit #902974 only. For 'B', 'C', and 'D' size cabinets use Kit #904911. **Please follow the instructions provided with the kit**.

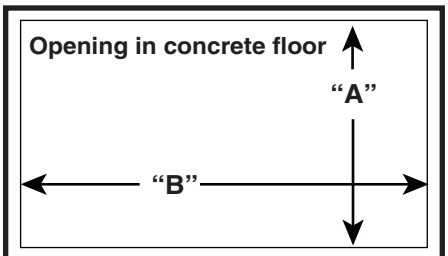
⚠ WARNING:

The downflow sub-base kit must not be installed directly on carpeting, tile, or any combustible material other than wood flooring.

A downflow sub-base kit is not necessary if the furnace is installed on a factory or site-built cased air conditioning coil. However, the plenum attached to the coil casing must be installed so that its surfaces are at least 1" from combustible construction.

Installation on a concrete slab.

1. Create an opening in the floor according to the dimensions in Figure 9.
2. Position the plenum and the furnace as shown in Figure 10 (page 11).



*SK MODEL NUMBERS:	Dimension "A"	Dimension "B"
054-23A	13 1/4	19 1/4
072-24B	16 5/8	19 1/4
090-24B	16 5/8	19 1/4
108-35C	20 1/8	19 1/4
126-45D	23 5/8	19 1/4

Figure 9. Cutout Dimensions

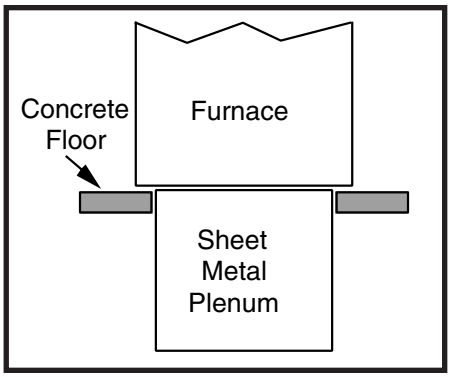


Figure 10. Furnace on a Concrete Slab

⚠ WARNING:

CARBON MONOXIDE POISONING HAZARD

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

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

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

VENTING REQUIREMENTS

⚠ WARNING:

Upon completion of the furnace installation, carefully inspect the entire flue system both inside and outside the furnace to assure it is properly sealed. Leaks in the flue system can result in serious personal injury or death due to exposure of flue products, including carbon monoxide.

- This furnace must be vented in compliance with the current revision of the National Fuel Gas Code (ANSI-Z223.1/NFPA54) and the instructions provided below. **Consult local codes for special requirements.**
- In Canada, venting shall conform to the requirements of the current (CAN/CGA B149.1 or .2) installation codes. **Consult local codes for special requirements.**
- Additional reference information for US and Canadian installations can be found in the Combustion and Ventilation Air section (page 4).

Category I Venting

This furnace is listed as a Category I vented appliance. Category I furnaces generally operate with a slight negative pressure (draft) and must be vented vertically or near vertical. Additionally it is important to guard against excessive condensation.

- Category I furnace installations must be connected to a factory built chimney or vent complying with a recognized standard, or a masonry or concrete chimney lined with a lining material acceptable to the authority having jurisdiction.

⚠ WARNING:

Venting into an unlined masonry chimney or concrete chimney is prohibited. This may result in improper draft and excess condensation forming in the chimney.

- This furnace may be vented with a dedicated venting system or common vented with other Category I appliances. The vent system dimensions and material must conform to the NFGC or local Codes. Generally, this means using Type B vent pipe or a lined masonry chimney. When consulting the vent sizing tables in the NFGC, the MAX capacity of the vent must be greater than the furnaces high fire rate. The MIN capacity must be lower than the low fire rate. If the venting system is inappropriate for the furnace, the venting system will need to be modified to comply with NFGC or local codes.
- The venting system should be designed to have the minimum number of elbows or turns. All horizontal runs shall slope upwards from the furnace at ¼ inch per running foot of vent. Supports for the vent pipe must be installed a minimum of every five feet along the vent run to ensure no displacement after installation. Under no circumstances shall any portion of the vent system extend into or pass through any return air duct, supply air duct, or plenum.
- Single wall vent connectors may be used under the limited capacity ranges found in the vent sizing tables. It is recommended that Type B double wall vent be used for the connector whenever possible. An existing masonry chimney should be inspected and relined if necessary.
- In the U.S., this furnace must never be vented to a chimney or flue that services a fireplace or other appliance designed to burn solid fuel. If the furnace vent is to be connected to a chimney serving a fireplace, the fireplace must be sealed off from the chimney. In Canada, common venting with a fireplace is permitted. Consult B149.1 and your local code authority.
- Single wall metal vertical vents shall not be used for Category I venting. The furnace vent, if metal, may be insulated if local codes allow. Any part of the vent system, metal vent only, not exposed to weather, but which are exposed to temperatures below 35° F (1°C) must be insulated to prevent condensation. All vent insulation shall be foil backed fiberglass of one inch minimum thickness.
- Sheet metal fasteners should be used to secure the vent pipe to the furnace flue. However, the NFGC lists that alternative vent products may be attached according to the vent manufacturers instructions.
- When an existing furnace is removed from a vent system serving other appliances, the existing vent system may no longer be sized to properly vent the remaining appliances. An improperly sized venting system can result in the formation of condensate, leakage, or spillage. The existing vent system should also be checked to make sure it remains in compliance with NFGC. If it isn't, the vent system must be brought into compliance before installing the furnace.

Horizontal Venting

⚠ WARNING:

Horizontal vent systems must be sealed with a high temperature sealant that can withstand temperatures of 450° F. Recommended sealants: Dow Corning Sealant 736 RTV; GE 106 RTV; High Tech Ind., High TEMP RED.

This furnace is not approved for horizontal venting without the use of an add-on power venter. Power venters establish negative pressure in the vent piping and the furnace operates as if connected to a Category I vertical vent. The power venter is only for use when exhausting through an exterior wall.

The power venter must be installed according to the instructions provided by the power venter manufacturer and applicable requirements of local codes. For Canadian installations please refer to the Canadian Installation Code (CAN/CGA-B149.1 or 2) and/or local codes.

The outlet of the vent must be at least 12 inches above the highest expected snow accumulation.

Flexible Vent Systems

Flexible venting systems are approved for use providing they are listed for the application and meet all local Code requirements. These systems are primarily used to line existing masonry chimneys. They must be sized to the application according to the sizing tables in the National Fuel Gas Code, including the required 20% reduction in maximum capacity.

Flexible venting systems are permitted to be used as the vent connector. However, great care must be taken to ensure that there are no sags in the venting system which could accumulate condensate. The flexible vent system must be supported at no more than 5 foot intervals and maintain a minimum slope of ¼ inch per foot of horizontal run.

CIRCULATING AIR REQUIREMENTS

⚠ WARNING:

Do not allow combustion products to enter the circulating air supply. Failure to prevent the circulation of combustion products into the living space can create potentially hazardous conditions including carbon monoxide poisoning that could result in personal injury or death.

All return ductwork must be secured to the furnace with sheet metal screws. For installations in confined spaces, all return ductwork must be adequately sealed. When return air is provided through the bottom of the furnace, the joint between the furnace and the return air plenum must be air tight.

The surface that the furnace is mounted on must provide sound physical support of the furnace with no gaps, cracks or sagging between the furnace and the floor or platform.

Return air and circulating air ductwork must not be connected to any other heat producing device such as a fireplace insert, stove, etc. This may result in fire, explosion, carbon monoxide poisoning, personal injury, or property damage.

Plenums and Air Ducts

- Plenums and air ducts must be installed in accordance with the Standard for the Installation of Air Conditioning and Ventilating Systems (NFPA No. 90A) or the Standard for the Installation of Warm Air Heating and Air Conditioning Systems (NFPA No. 90B). Additional reference information for US and Canadian installations can be found in the Duct Systems section (page 4).
- Table 2 and Table 3 (pages 26-28) contain the airflow and temperature rise data. If the maximum airflow is 1,600 CFM or more, it is recommended that two openings be used for return air on upflow furnaces. Downflow furnaces can only use one return opening.
- It is recommended that the outlet duct contain a removable access panel. The opening should be accessible when the furnace is installed in service and shall be of a size that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The cover for the opening shall be attached in such a manner as to prevent leaks.
- If outside air is used as return air to the furnace for ventilation or to improve indoor air quality, the system must be designed so that the return air is not less than 60° F (15° C) during operation. If a combination of indoor and outdoor air is used, the ducts and damper system

must be designed so that the return air supply to the furnace is equal to the return air supply under normal, indoor return air applications.
- When a cooling system is installed which uses the furnace blower to provide airflow over the indoor coil, the coil must be installed downstream (on the outlet side) of the furnace or in parallel with the furnace.
- If a cooling system is installed in parallel with the furnace, a damper must be installed to prevent chilled air from entering the furnace and condensing on the heat exchanger. If a manually operated damper is installed, it must be designed so that operation of the furnace is prevented when the damper is in the cooling position and operation of the cooling system is prevented when the damper is in the heating position.

Supply Air Connections

The supply air must be delivered to the heated space by duct(s) secured to the furnace casing, running full size and without interruption. It is good practice to seal all connections and joints with industrial grade sealing tape or liquid sealant. Requirements for sealing ductwork vary from region to region. Consult with local codes for requirements specific to your area.

Upflow and Horizontal Furnaces

To attach the supply air duct to the furnace, bend the furnace flanges (Figure 15, page 24) upward 90° with a pair of wide duct pliers. Position the duct on top of the furnace and secure together with sheet metal screws. The screws must penetrate the sheet metal casing and furnace flange. Tape or seal all seams if required by local code.

Downflow Furnaces

To attach the supply air duct to the downflow furnace, position the furnace over the duct and secure together with sheet metal screws. The screws must penetrate the duct and furnace casing.

Return Air Connections

In applications where the supply ducts carry heated air to areas outside the space where the furnace is installed, the return air must be delivered to the furnace by duct(s) secured to the furnace casing, running full size and without interruption. It is good practice to seal all connections and joints with industrial grade sealing tape or liquid sealant. Requirements for sealing ductwork vary from region to region. Consult with local codes for requirements specific to your area.

Upflow and Horizontal Furnaces

For upflow installations, the return air ductwork may be connected to the left side, right side, or bottom. The bottom panel (Figure 15, page 24) must be installed for left or right return air. **NOTE: Do not use the back of the furnace for return air.**

Side Return Installations

To attach the return air duct to the left or right side of the furnace, punch out the four knockouts (Figure 15) from the preferred side of the furnace. Using sharp metal cutters, cut an opening between all four knockouts to expose the blower assembly. Position the return air duct over the opening in the side and secure together with sheet metal screws. The screws must penetrate the duct and furnace casing.

⚠ WARNING:

The solid base of the furnace must be in place when the furnace is installed with side return air ducts. Removal of all or part of the base could cause circulation of combustible products into the living space and create potentially hazardous conditions, including carbon monoxide poisoning that could result in personal injury or death.

Bottom Return Installations

The bottom panel (Figure 15) must be removed from the bottom of the furnace for bottom return air. If bottom panel is still installed, go to page 9 for removal instructions. Position the furnace over the return air duct and secure together with sheet metal screws. The screws must penetrate the duct and furnace casing.

Downflow Furnaces

To attach the return air duct to the furnace, bend the furnace flanges (Figure 16, page 25) upward 90° with a pair of wide duct pliers. Position the duct on top of the furnace and secure together with sheet metal screws. The screws must penetrate the sheet metal casing and furnace flange. Tape or seal all seams if required by local code.

Acoustical Treatments

Damping ducts, flexible vibration isolators, or pleated media-style filters on the return air inlet of the furnace may be used to reduce the transmission of equipment noise eminating from the furnace. These treatments can produce a quieter installation, particularly in the heated space. However, they can increase the pressure drop in the duct system. Care must be taken to maintain the proper maximum pressure rise across the furnace, temperature rise and flow rate. This may mean increasing the duct size and/or reducing the blower speed. These treatments must be constructed and installed in accordance with NFPA and SMACNA construction standards. Consult with local codes for special requirements. For best sound performance, be sure to install all the needed gaskets and grommets around penetrations into the furnace, such as for electrical wiring.

GAS SUPPLY AND PIPING

All gas piping must be installed in compliance with local codes and utility regulations.

In the absence of local codes the gas line installation must comply with the latest edition of the National Fuel Gas Code (ANSI Z223.1) or (CAN/CGA B149.1 or .2) Installation Codes. Additional reference information for US and Canadian installations can be found in the Gas Piping and Gas Pipe Pressure Testing section (page 4).

IMPORTANT NOTES:

- Some local regulations require the installation of a manual main shut-off valve and ground joint union external to the furnace as depicted in Figure 11. The shut-off valve should be readily accessible for service and/or emergency use. Consult the local utility or gas supplier for additional requirements regarding placement of the manual main gas shut-off.
- Gas piping must never run in or through air ducts, chimneys, gas vents, or elevator shafts.
- Compounds used on threaded joints of gas piping must be resistant to the actions of LP propane gas.
- The main gas valve and main power disconnect to the furnace must be properly labeled by the installer in case emergency shutdown is required.
- Flexible gas connectors are not recommended for this type of furnace but may be used if allowed by local jurisdiction. The flexible gas connector must be agency approved and certified for the type of gas being used. Only new flexible connectors may be used. **Do not reuse old flexible gas connectors.**
- A drip leg should be installed in the vertical pipe run to the unit (Figure 11).

Table 7 (page 31) lists gas pipe capacities for standard pipe sizes as a function of length in typical applications based on nominal pressure drop in the line.

The furnace may be installed for either left or right side gas entry. When connecting the gas supply, provide clearance between the gas supply line and the entry hole in the furnace casing to avoid unwanted noise and/or damage to the furnace. A typical gas service hookup is shown in Figure 11.

Leak Check

⚠ WARNING:

FIRE OR EXPLOSION HAZARD

Never test for gas leaks with an open flame. Check all connections using a commercially available soap solution. A fire or explosion may result causing property damage, personal injury or loss of life. Failure to follow the safety warnings exactly could result in serious injury, death or property damage.

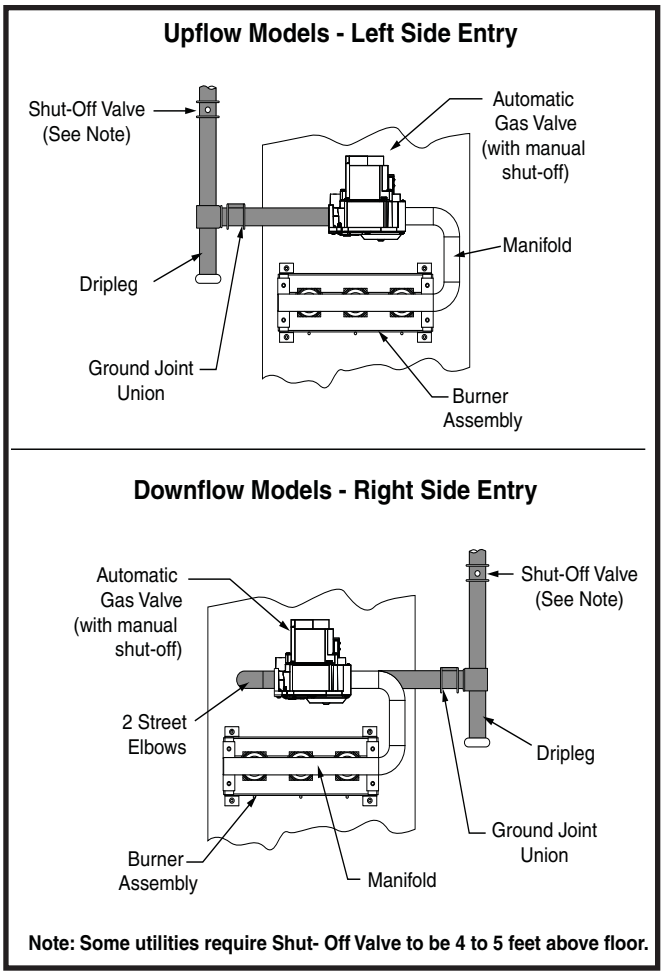


Figure 11. Typical Gas Connection

After the gas piping to the furnace is complete, all connections must be tested for gas leaks. This includes pipe connections at the main gas valve, emergency shutoff valve and flexible gas connectors (if applicable). The soap and water solution can be applied on each joint or union using a small paintbrush. If any bubbling is observed, the connection is not sealed adequately and must be retightened. Repeat the tightening and soap check process until bubbling ceases.

IMPORTANT NOTE: When pressure testing gas supply lines at pressures greater than 1/2 psig (14 inch W.C.), the gas supply piping system must be disconnected from the furnace to prevent damage to the gas control valve. If the test pressure is less than or equal to 1/2 psig (14 inch W.C.), close the manual shut-off valve.

High Altitude Application

High altitude conversion with this furnace depends on the installation altitude and the heating value of the gas. The installation of this furnace at altitudes above 2,000 feet must meet the requirements of the National Fuel Gas Code or local jurisdiction. In Canada, the requirements for high altitude are different and governed by CGA B149.1. Please consult your local code authority.

⚠ WARNING:

The reduction of input rating necessary for high altitude installation may only be accomplished with factory supplied orifices. Do not attempt to drill out orifices in the field. Improperly drilled orifices may cause fire, explosion, carbon monoxide poisoning, personal injury or death.

The furnaces are shipped from the factory with orifices and gas regulator settings for natural gas operation at sea level altitudes. At 2000 feet, the NFGC requires that this appliance be derated 4% for each 1,000 feet of altitude. For example, at 2,000 feet the input needs to be reduced 8% , at 3,000 feet (12%) and etc. This deration is in reference to the input rate and gas heating value at sea level.

To derate the furnace requires knowing the heating value of the gas at the installation site. Heating values at particular job sites vary for two reasons:

1. The chemical mixture of the gas varies from region to region and is expressed as the “sea level heating value”.
2. The heating value varies by altitude. For this reason, especially in high altitude areas, the local gas utility specifies the heating value at the residence’s gas meter as the “local value”.

For added flexibility, two tables have been provided for natural gas installations with HIGH or LOW heating values at sea level. Tables 10 and 11 (page 33) contain the orifice sizes and manifold pressure to use at various altitudes. Table 10 (High) is for natural gas installations with a heating value of more than 1,000 Btu per cubic foot and Table 11 (Low) is for less than 1,000 Btu per cubic foot. To determine which table to use:

1. Consult the local utility for the local heating value at your installation site.
2. From Table 9 (page 32), find your local heating value as supplied by the utility company. Follow down the column and stop at your altitude level.
3. If your sea level heating value is HIGH, use Table 10 or if it’s LOW, use Table 11 (page 33).

INSTALLATION EXAMPLE

Elevation: .....5,000 feet
Type of Gas:.....Natural Gas
Local Heating Value of Gas: 750

From Table 9, find 750 and follow down the column, stop at the 5,000 feet row. The heating value listed is LOW. Table 11 will be used to determine orifice size and manifold pressure.

After changing the regulator pressure or the orifices, it is required that you measure the gas input rate. This may be accomplished in the usual way, by clocking the gas meter and using the local gas heating value. See Verifying and Adjusting the Input Rate section (page 18).

IMPORTANT NOTE: Observe the action of the burners to make sure there is no yellowing, lifting or flashback of the flame.

Conversion to LP/Propane

⚠ WARNING:

The furnace was shipped from the factory equipped to operate on natural gas. Conversion to LP/propane gas must be performed by qualified service personnel using a factory supplied conversion kit. Failure to use the proper conversion kit can cause fire, explosion, property damage, carbon monoxide poisoning, personal injury, or death.

IMPORTANT NOTE: When converting a low NOx furnace from Natural gas to LP/propane gas, it is necessary to remove the NOx Baffles from the furnace.

Conversion to LP/propane is detailed in the installation instructions provided with the conversion kit. Generally, this will require the replacement of the burner orifices and the spring found under the cap screw on the pressure regulator. In the U.S. if installation is above 2,000 ft., refer to Table 8 (page 32) to determine the correct orifice size and manifold pressure. When conversion is complete, verify the manifold pressure and input rate are correct as listed in the Tables. Approved conversion kits are listed below:

- The United States LP/Propane Gas Sea Level and High Altitude Conversion Kit (P/N 904914) is for LP/propane conversion in the United States at altitudes between zero and 10,000 ft. above sea level. **Please follow the instructions provided with the kit**.
- The Canadian LP/Propane Gas Sea Level and High Altitude Conversion Kit (P/N 904915) is for LP/propane conversions in Canada at altitudes between zero and 4,500 ft. above sea level. **Please follow the instructions provided with the kit**.

ELECTRICAL WIRING

⚠ WARNING:

To avoid electric shock, personal injury, or death, turn off the electric power at the disconnect or the main service panel before making any electrical connections.

- Electrical connections must be in compliance with all applicable local codes and the current revision of the National Electric Code (ANSI/NFPA 70).
- For Canadian installations the electrical connections and grounding shall comply with the current Canadian Electrical Code (CSA C22.1 and/or local codes).
- Additional reference information for US and Canadian installations can be found in the Electrical Connections section (page 4).

IMPORTANT NOTE: If replacing any of the original wires supplied with the furnace, the replacement wire must be copper wiring and have a temperature rating of at least 105° F (40° C). For electrical requirements, refer to the furnace nameplate or Table 4 (page 29).

Low Voltage Wiring

The thermostat must be installed according to the instructions supplied by the thermostat manufacturer. Low voltage connections (24 VAC) from the thermostat are wired to the terminal strip on the integrated control in the furnace. See Figure 12 for proper connections for heating only (two-wire) and heating/cooling (four-wire) applications. Recommended minimum wire gauge for thermostat wiring is shown in Table 4.

The thermostat must not be installed on an outside wall or any other location where its operation may be adversely affected by radiant heat from fireplaces, sunlight, or lighting fixtures, and convective heat from warm air registers or electrical appliances.

The six pin terminal marked "Expansion Port" is not used in the single stage furnace as shipped from the factory. It is used for the furnace control board to communicate to a fixed speed or variable speed high efficiency motor that may be optionally installed. Please contact your distributor for the proper upgrade motor kit.

IMPORTANT NOTE: Set the heat anticipator according to the instructions supplied by the thermostat manufacturer.

To determine the heat anticipator setting:

1. Add the current draw of the system components; or
2. Measure the current flow on the thermostat **R-W** circuit after the circulating blower motor has started.

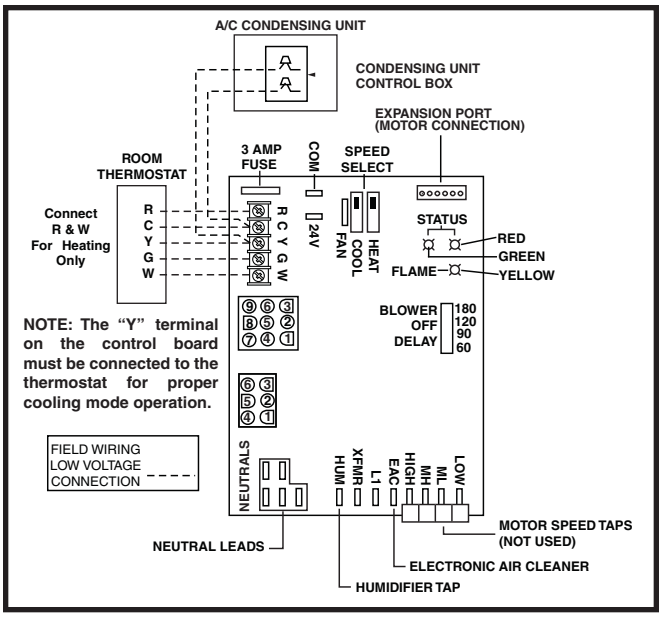


Figure 12. Low Voltage Field, Four-wire Heating/Cooling Applications

Line Voltage Wiring

It is recommended that the line voltage (115 VAC) to the furnace be supplied from a dedicated branch circuit containing the correct fuse or circuit breaker for the furnace (Table 4).

IMPORTANT NOTE: An electrical disconnect must be installed readily accessible from and located within sight of the furnace. See Figure 13 or the wiring diagram label inside of the control door. Any other wiring methods must be acceptable to authority having jurisdiction.

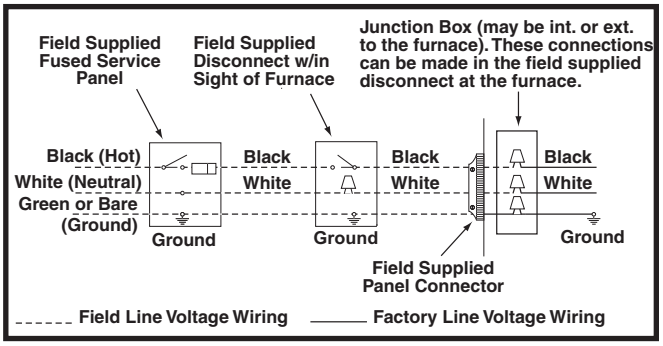


Figure 13. Line Voltage Field Wiring

⚠ CAUTION:

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

IMPORTANT NOTE: Proper line voltage polarity must be maintained in order for the control system to operate correctly. Verify the incoming neutral line is connected to the white wire and the incoming "hot" line is connected to the black wire. The furnace will not operate unless the polarity and ground are properly connected as shown in Figure 13 (page 17).

Grounding

⚠ WARNING:

To minimize personal injury, the furnace cabinet must have an uninterrupted or unbroken electrical ground. The controls used in this furnace require an earth ground to operate properly. Acceptable methods include electrical wire or conduit approved for ground service. Do not use gas piping as an electrical ground!

Twinning

Single stage G7 furnaces are not supplied with a built-in twinning capability. Other valuable features and enhancements were made to the new control that made it necessary to remove the twinning capability. All standard two-stage furnaces equipped with the fixed speed iSEER™ motor include a twinning terminal on the blower control board.

However, if both Single stage G7 furnaces are upgraded to the fixed speed iSEER ™ blower, the twin terminal on the blower control boards may be used. Alternately, off-the-shelf furnace twinning kits such as Johnson Controls (P/N 2TC03700124) may be used. Using this control also provides the additional feature of two-stage operation by individually controlling the heat section of each furnace. Contact your furnace distributor for technical details.

G7 furnaces equipped with <u>variable</u> speed iSEER ™ motors may not be twinned under any circumstances.

START-UP AND ADJUSTMENTS

Pre-Start Check List

- √ verify the polarity of the connections are correct, the line voltage power leads are securely connected and the furnace is properly grounded.
- √ verify the thermostat wires (**R**, **W**, **Y**, and **G**) are securely connected to the correct leads on the terminal strip of the circuit board.
- √ verify the gas line service pressure does not exceed 10.0 inches of W.C., and is not less than 4.5 inches W.C. for natural gas. For LP gas the line service pressure must not exceed 14 in. W.C., and must not be less than 11.0 in. W.C.
- √ verify the roll-out and manual reset switch is closed. If necessary, press the red button to reset a switch. **Note: DO NOT install a jumper wire across a switch to defeat its function.** If a switch reopens on startup, DO NOT reset the switch without identifying and correcting the fault condition.
- √ verify the blower door is in place, closing the door switch in the line voltage circuit.
- √ verify the gas line has been purged and all connections are leak free.

Start-up Procedures

Do not perform these steps until all of the checks in the previous steps have been completed:

1. Set the thermostat to the lowest setting.
2. Turn off all electrical power to the furnace.
3. Follow the Operating Instructions on the label attached to the furnace.
4. Set the thermostat above room temperature and verify the Operating Sequence (Page 20).
5. After 5 minutes of operation, set the thermostat below room temperature and verify steps 9-10 of the Operating Sequence (page 20).

Verifying and Adjusting Input Rate

IMPORTANT NOTE: The input rate must not exceed the rate shown on the furnace rating plate. At altitudes above 2,000 feet, it must not exceed that on the rating plate less 4% for each 1,000 feet.

The input rate must be verified for each installation to prevent over-firing of the furnace. To determine the exact input rate, perform the following procedures:

1. Shut off all other gas fired appliances.
2. Start the furnace and run it for at least 3 minutes.
3. Measure the time (in seconds) required for the gas meter to complete one revolution.
4. Convert the time per revolution to cubic feet of gas per hour using Table 6 (page 31).
5. Multiply the gas flow rate in cubic ft per hr by the heating value of the gas in Btu per cubic ft to obtain the input rate in Btuh or see the example (page 19).

Example:

- Time for 1 revolution of a gas meter with a 1 cubic ft dial = 40 seconds.
- From Table 6 read 90 cubic ft gas per hr.
- Local heating value of the gas (obtained from gas supplier) = 1,040 Btu per cubic ft.
- Input rate = 1,040 x 90 = 93,600 Btuh.

6. The manifold pressure must be set to the appropriate value for each installation by a qualified installer, service agency or the gas supplier.

⚠ WARNING:

Do not attempt to drill the gas orifices. Use only factory supplied orifices. Improperly drilled orifices may cause fire, explosion, carbon monoxide poisoning, personal injury or death.

a.) Obtain the manifold pressure setting required for this installation by referring to Table 8 for Propane or Tables 10 or 11 for Natural Gas (pages 32-33).

b.) Remove the regulator capscrew (Figure 14) from the INLET side of the regulator.

c.) Slowly turn the adjustment screw inside the regulator to obtain the appropriate manifold pressure. **NOTE: Turning the screw clockwise increases the pressure and turning the screw counter-clockwise decreases the pressure. To prevent backing the screw all the way out from the valve, turn the screw slowly.**

d.) Replace and tighten the regulator capscrew over the adjustment screw.

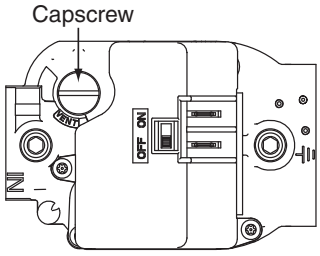


Figure 14. Regulator Capscrew

Verifying and Adjusting Temperature Rise

Confirm the temperature rise through the furnace is within the limits specified on the furnace rating plate. Any temperature rise outside the specified limits could result in premature failure of the heat exchanger.

⚠ WARNING:

To prevent electric shock, personal injury, or death, disconnect the electric power before performing any maintenance.

1. Place thermometers in the return and supply air stream as close to the furnace as possible. The thermometer on the supply air side must be shielded from direct radiation from the heat exchanger to avoid false readings.
2. Adjust all registers and duct dampers to the desired position and run the furnace for 10 to 15 minutes before taking any temperature readings. The temperature rise is the difference between the supply and return air temperatures.

For typical duct systems, the temperature rise will fall within the limits specified on the rating plate with the blower speed at the factory recommended setting. If the measured temperature rise is outside the specified limits, it may be necessary to change the speed of the blower. **NOTE:** Lowering the blower speed will increase the temperature rise and a higher blower speed will decrease the temperature rise.

The furnace is equipped with a multi-speed motor. Heating, cooling, and fan speed selection is made by moving the switch on the integrated control located in the furnace.

Verifying Burner Operation

⚠ CAUTION:

The door over the burners may only be open for inspection purposes only. The door must be installed during unattended operation.

1. Remove the burner compartment door.
2. Set the thermostat above room temperature and observe the ignition sequence. **NOTE:** The burner flame should carry over immediately between all burners without lifting off, curling, or floating. The flames should be blue, without yellow tips.
3. After validating the flame, change the thermostat setting to below room temperature.
4. Verify the burner flame is completely extinguished.
5. Replace the burner compartment door.

Verify Operation of the Supply Air Limit Switch

Note: A properly functioning limit switch should turn off the gas valve when the return is blocked (time depends on how well the return air is blocked). The circulating air and combustion blowers should continue to run when the limit switch opens.

1. Verify the blower door is securely mounted in place and that there is power to the furnace.
2. Block the return airflow to the furnace by installing a close-off plate in place of or upstream of the filter(s).
3. Set the thermostat above room temperature and observe the Operating Sequence.
4. Remove the close-off immediately after the limit switch opens. If the furnace continues to operate with no return air, set the thermostat below room temperature, shut off the power to the furnace, and replace the limit switch.

OPERATING SEQUENCE

The operating sequences for the heating, cooling, and fan modes are described below. Refer to the field and furnace wiring diagrams: (Figures 12-13, page 17) and (Figure 17, page 30).

Heating Cycle

1. The thermostat calls for heat by energizing the **W** terminal with 24VAC.
2. The control verifies the pressure switch is open.
3. If the pressure switch is open, the control energizes the inducer and waits for the pressure switch to close. The pressure switch must close within 10 seconds.
4. The control runs the inducer for a 30 second pre-purge.
5. The control energizes the igniter output for the appropriate warm-up time limit.
6. The control energizes the main gas valve for 3 seconds.
7. If the flame proved and ignites the gas, the control de-energizes the igniter. The gas valve and inducer remains energized. The control goes to blower on delay.
8. If flame is present, the control energizes the blower on the selected HEAT speed 30 seconds after the gas valve opened. The gas valve and inducer remain energized.
9. When the thermostat demand for heat is satisfied, the control de-energizes the gas valve. The inducer output remains on for a 30 second post-purge period.
10. Blower off timing begins when the thermostat is satisfied. The control will operate at the selected HEAT speed of 60, 90, 120, or 180 seconds. If the blower off delay jumper is not present, the fan should still operate for 120 seconds at the selected HEAT speed. The Indoor blower motor is de-energized after a blower off delay as selected by the movable jumper.

Cooling Cycle

1. The thermostat calls for cooling by energizing the **Y** terminal with 24VAC.
2. The control energizes the blower in the cooling speed and sends 24VAC to the contactor in the condensing unit.
3. When the thermostat removes the call for cooling, the contactor in the outdoor condensing unit is de-energized and the control continues to run the fan for a period of 60 seconds.

Fan Mode

- When the thermostat energizes the **G** terminal for continuous fan (without calling for heat or cooling), the indoor fan is energized on the selected FAN speed.
- If a call for cooling occurs during continuous fan, the blower will switch over to the selected COOL speed.
- If the **W** terminal receives a call for heat during continuous fan, the blower will de energize.
- A call for fan is ignored while in lockout.

MAINTENANCE

⚠ WARNING:

These maintenance instructions are primarily intended to assist qualified technicians experienced in the proper maintenance and operation of this appliance.

Proper maintenance is most important to achieve the best performance from a furnace. Follow these instructions for years of safe, trouble free operation.

- Always replace the doors on the furnace after servicing or cleaning/changing the filters. **Do not operate the furnace without all doors and covers in place.**
- Verify the thermostat is properly installed and is not being affected by drafts or heat from lamps or other appliances.
- To achieve the best performance and minimize equipment failure it is recommended that a yearly maintenance checkup be performed. At a minimum, this check should include the following items:

Air Filter(s)

⚠ WARNING:

Never operate the furnace without a filter in place. Dust and lint in the return air can build up on internal components, resulting in loss of efficiency, equipment damage, and possible fire.

Note: Air filter(s) are not supplied with the furnace as shipped from the factory. The installer must provide a high velocity filter and rack for a filter in the return air duct adjacent to the furnace, or in a return air grill to the furnace. It is recommended that filters be cleaned or replaced monthly. New or newly renovated homes may require more frequent changing until the construction dust has minimized.

Filters designed to remove smaller particles such as pollen, may require additional maintenance. Filters for side return and bottom return applications are available from most local distributors.

Blower Compartment
Dirt and lint can create excessive loads on the motor resulting in higher than normal operating temperatures and shortened service life. It is recommended that the blower compartment be cleaned of dirt or lint that may have accumulated in the compartment or on the blower and motor as part of the annual inspection.

Cleaning of Burners
If the burners must be cleaned, follow steps 1-12. See Figure 18 and 19 (page 35) for component location.

1. Shut off gas supply to the furnace at the meter or at a manual valve in the supply piping.
2. Turn off all power to the furnace and set the thermostat to its lowest setting.
3. Remove the burner door from the furnace.
4. Turn the gas control switch to the OFF position.
5. Disconnect the wires from the gas valve, igniter, flame sensor, and flame rollout switch.
6. Using two wrenches, separate the ground-joint union in the gas supply piping at the furnace.
7. Remove the piping between the gas valve and the ground-joint union. (If applicable).
8. Remove all screws securing the burner assembly to the furnace.
9. Carefully remove the burner assembly from the furnace. **DO NOT DAMAGE THE IGNITER WHILE REMOVING THE BURNER ASSEMBLY.**
10. Inspect the burners for accumulated dust or debris. If necessary carefully clean them with a soft wire brush and a vacuum cleaner. **DO NOT DAMAGE THE IGNITER WHILE CLEANING THE BURNER.**
11. Replace all the parts in reverse order that they were removed.
12. Follow the lighting instructions found on the furnace door to return the furnace to operation. Verify proper operation after servicing.

Cleaning Of Flue Passages
If the flue passages must be cleaned, follow the steps below. See Figures 18 and 19 for component location.

1. Shut off the gas supply to the furnace at the meter or at the manual valve in the gas supply piping.
2. Turn off all power to the furnace and set the thermostat to the lowest temperature setting.
3. Remove the blower door from the furnace.
4. Turn the gas control switch to the OFF position.

⚠ CAUTION:

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

5. Disconnect the wires from the gas valve, flame sensor, inducer, flame roll-out switch, limit switch, pressure switch and igniter.
6. Remove the silicone rubber tube from the inducer.
7. Using two wrenches, separate the ground-joint union in the gas supply piping at the furnace.
8. Remove the piping between the gas valve and the ground-joint union. (If applicable).
9. Remove all screws securing the burner assembly to the furnace.
10. Carefully remove the burner assembly from the furnace. **DO NOT DAMAGE THE IGNITER WHILE REMOVING THE BURNER ASSEMBLY.**

11a. Remove all screws securing the inducer assembly to the vent pipe running out of the furnace (*SA upflow/horizontal models only).

11b. Remove all screws securing the combustion air tube assembly to the vent pipe running out of the furnace. (*SK downflow models only).

12. Remove all screws securing the inducer assembly to the collector pan.

13a. Carefully remove the inducer assembly and combustion tube assembly from the furnace. **DO NOT BREAK THE SEALS AT EACH END OF THE COMBUSTION AIR TUBE.** (*SK downflow models only).

13b. Carefully remove the inducer assembly from the furnace (*SA upflow/horizontal models only).

14. Remove all screws securing the collector pan to the furnace.
15. Remove the collector pan and gasket from the furnace.
16. Attach a round wire brush to a length of high grade stainless steel cable. Attach the other end of the cable to a variable speed reversible drill. Slowly insert and rotate the cable into the top portion of the heat exchanger. Operate the drill alternating between

forward and reverse, working the cable in and out several times to obtain sufficient cleaning. Repeat this sequence for each heat exchanger tube.

17. Remove all loosened debris from the heat exchanger tubes using a vacuum cleaner.
18. Using a bright light, check the condition of the upper and lower sections of the heat exchanger tubes.
19. Inspect the burners for accumulated dust or debris. If burners must be cleaned, see Cleaning of Burners (page 22).
20. Replace all the parts in reverse order that they were removed.
21. Check gaskets for damage. Replace if needed.
22. Follow the lighting instructions found on the furnace door to return the furnace to operation. Verify proper operation after servicing.

Heat Exchanger and Burner Maintenance

The furnace should operate for many years without soot buildup in the flue passageways, however, the flue, vent system, and burners should be inspected and cleaned (if required) by a qualified service technician annually to ensure continued safe operation. Pay attention to any deterioration from corrosion or other sources.

Lubrication

The bearings in the blower motor and inducer blower used in these furnaces are pre-lubricated and sealed by the manufacturer. No further oiling of the bearings is required for the life of the motor.

Vent System

⚠ WARNING:

Holes in the vent pipe or heat exchanger can cause combustion products to enter the home. Replace the vent pipe or heat exchanger if leaks are found. Failure to prevent the circulation of combustion products into the living space can create potentially hazardous conditions including carbon monoxide poisoning that could result in personal injury or death.

Check the vent pipe and/or chimney to ensure that it is not corroded or blocked by debris. Any corroded section of vent pipe must be replaced, and any obstruction or blockage must be removed prior to operating the furnace.

TROUBLESHOOTING

If the furnace fails to operate check the following:

- Is the thermostat operating properly?
- Are the blower compartment door(s) in place?
- Is the furnace disconnect closed?
- Has the circuit breaker tripped or the control board fuse burned open?
- Is the gas turned on?
- Are any manual reset switches open?
- Is the filter dirty or plugged?
- Is the flame sensor coated? (Remove and clean with steel wool).
- Are all the LED's on the furnace control board constantly ON? If not, refer to Table 5 (page 29) or the wiring diagram (Figure 17, page 30) to determine fault condition.

IMPORTANT NOTE: The furnace will lock out after 5 failed attempts for ignition and will try again every hour if the call for heat remains.

- If the Inducer Blower is operating, and items above have been verified, check the Blower Limit Switch and reset if necessary. See Figure 18 or 19 (page 35) for component location.
- If the furnace operates when the Blower Limit Switch is reset, contact a qualified service technician to identify and repair the problem.
- If the furnace still doesn't operate, check the Flame Roll-out Switches and reset if necessary. See Figure 18 or 19 for component location.
- If the furnace operates when the Flame Rollout Switch is reset, contact a qualified service technician to identify and repair the problem.

DESCRIPTION OF COMPONENTS

The descriptions below are various functional components that affect the operation and shutting down of this furnace. Some of these components and their locations are shown in Figures 18 and 19. If any component of the furnace must be replaced, use only factory authorized replacement parts specified in the Replacement Parts List provided online.

Blower Limit Switch
Blower switches prevent operation when blower is not operational.

Flame Sensor
The flame sensor verifies when a flame has carried over from the igniter to the opposite end burner. If no flame is detected, the furnace will shut down within 4 seconds.

Flame Roll-Out Switch
The flame roll-out switch verifies that the burner flames are drawn into the heat exchanger tubes. If the burner flames are not properly drawn into the heat exchanger, the flame roll-out switch will close the gas valve and initiate the shutdown cycle.

Gas Valve
The gas valve controls the flow of gas to the burners. When the gas valve is energized it automatically opens and regulates the gas pressure in the manifold.

Inducer Assembly
The inducer assembly vents products of combustion to the outside.

Pressure Switch
The pressure switch verifies that the inducer is drawing the combustion gases through the heat exchanger. If the flame is not properly drawn into the heat exchanger tube, the rollout switch or the flame sensor will shut the furnace down.

Supply Air Limit Switch
The supply air limit switch prevents the air temperature leaving the furnace from exceeding the maximum allowable outlet air temperature.

FIGURES AND TABLES

UPFLOW, DOWNFLOW & HORIZONTAL INSTALLATION CLEARANCES*	
Left Side	0 In.
Right Side	0 In.
Vent	1 In.
Back	0 In.
Top	1 In.
Front	4 In.**
* These are the listed clearances to combustible materials.	
** Allow 24 in. minimum clearance for servicing. Recommended clearance is 36 in.	
The furnace is listed for installation on combustible or non-combustible flooring. However, wood is the only combustible flooring allowed for installation. Downflow models must use the appropriate subase kit when installing over a wood floor.	

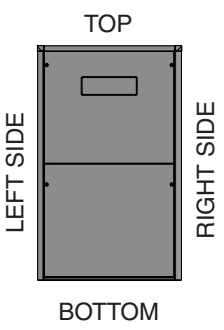
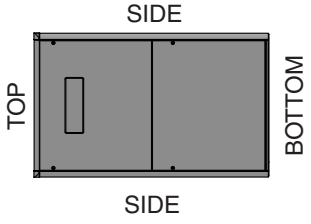
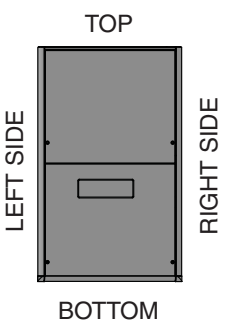
UPFLOW APPLICATION	HORIZONTAL APPLICATION	DOWNFLOW APPLICATION
		

Table 1. Minimum Clearances to Combustible Material

FURNACE DIMENSIONS

*SA Model #'s	Dimension "A"	Dimension "B"	Dimension "C"	Dimension "D"
045(†)-23A	14 ¼	10 ¾	12 5/8	12 7/8
054(†)-23A				
072(†)-24B	17 ½	11 ¾	15 7/8	16 1/8
090(†)-24B				
072(†)-35C	21	14	19 3/8	19 7/8
090(†)-35C				
108(†)-35C				
126(†)-45D	24 ½	15 ¼	22 7/8	23 1/8

NOTES:

(†) can be C or N

Dimensions shown in Inches.

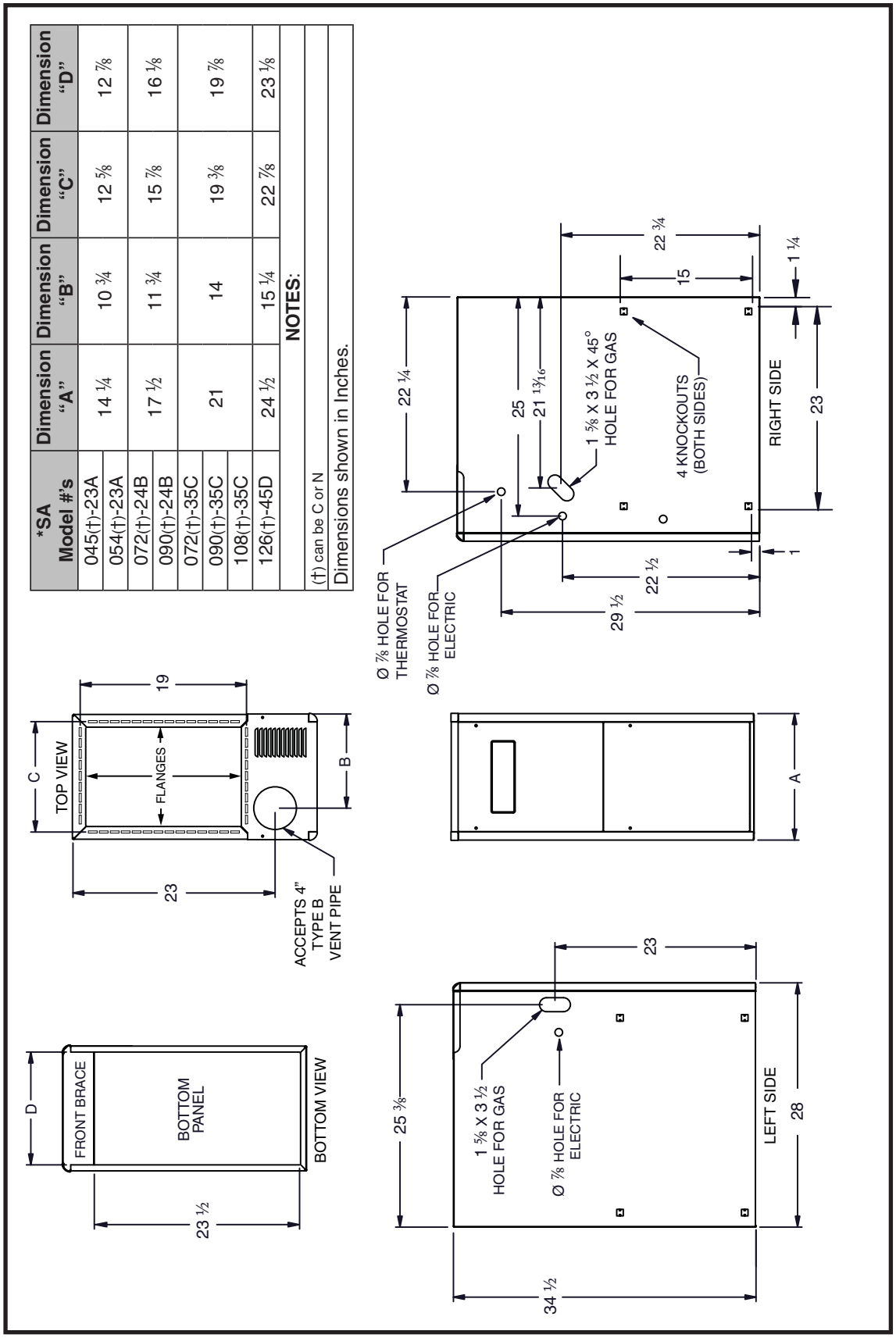


Figure 15. *SA 80+ High Efficiency Upflow/Horizontal Furnaces

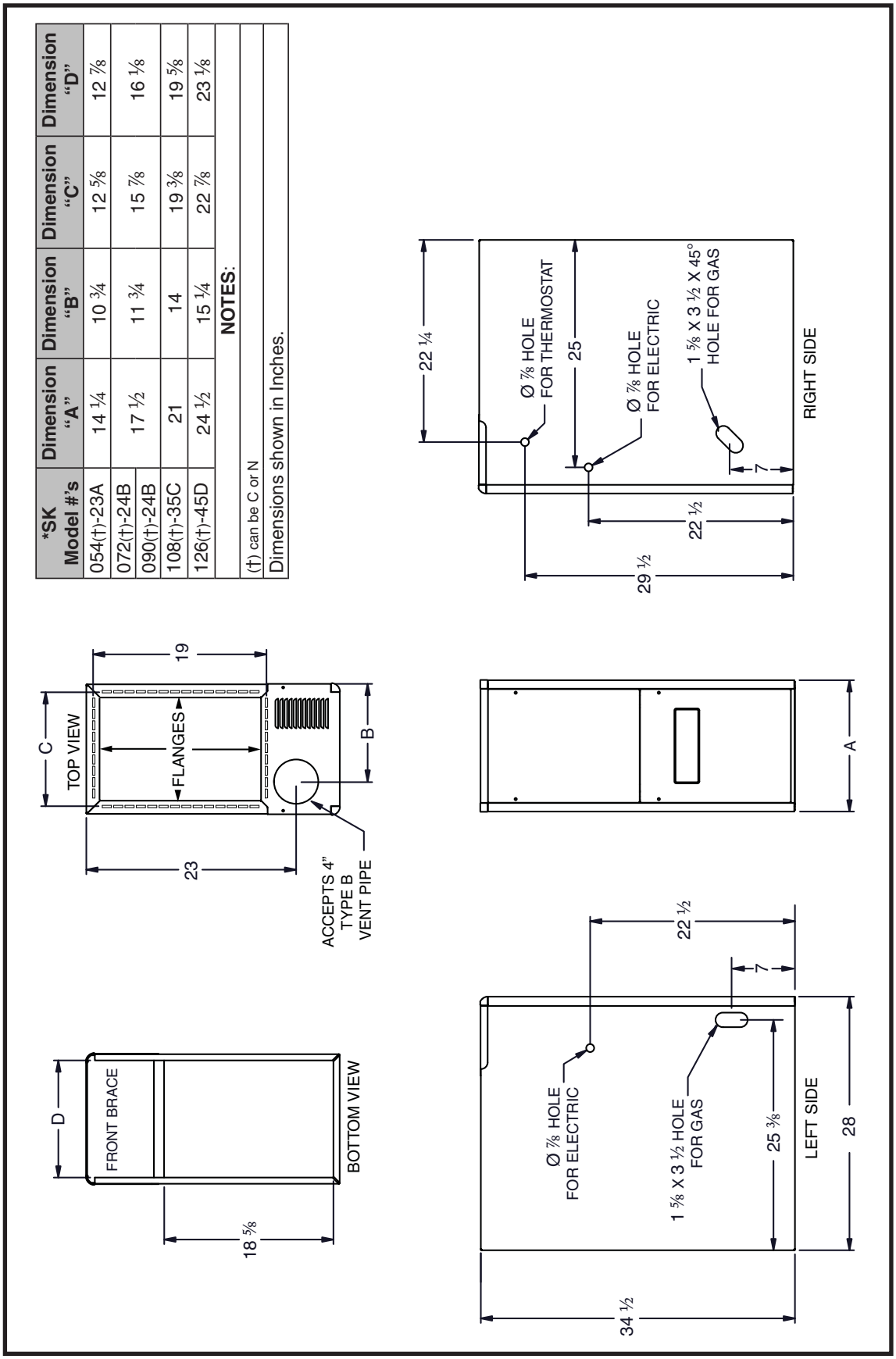


Figure 16. *SK 80+ High Efficiency Downflow Furnaces

AIRFLOW DATA

UPFLOW / HORIZONTAL GAS FURNACES																		
Model Number	Heating Input (Btuh)	Motor Speed	External Static Pressure (Inches Water Column)															
			0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8	
			CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise
SA045(†)-23A Bottom Return	45,000	High*	1,260	26	1,205	28	1,145	29	1,080	31	1,025	33	960	35	890	37	825	40
		Med-High	955	35	950	35	940	35	935	36	925	36	860	39	800	42	725	46
		Med-Low**	825	40	800	42	760	44	730	46	690	48	650	51	600	56	530	63
		Low	655	51	630	53	610	55	580	57	550	61	520	64	480	69	435	77
SA045(†)-23A Side Return	45,000	High*	1,350	25	1,290	26	1,225	27	1,155	29	1,100	30	1,025	33	950	35	885	38
		Med-High	1,025	33	1,015	33	1,005	33	1,000	33	990	34	920	36	855	39	775	43
		Med-Low**	885	38	855	39	815	41	780	43	740	45	695	48	640	52	565	59
		Low	700	48	675	49	655	51	620	54	590	56	555	60	515	65	465	72
SA054(†)-23A Bottom Return	54,000	High*	1,260	32	1,205	33	1,145	35	1,080	37	1,025	39	960	42	890	45	825	48
		Med-High**	955	42	950	42	940	43	935	43	925	43	860	47	800	50	725	55
		Med-Low	825	48	800	50	760	53	730	55	690	58	650	62	600	67	530	75
		Low	655	61	630	63	610	66	580	69	550	73	520	77	480	83	435	92
SA054(†)-23A Side Return	54,000	High*	1,350	30	1,290	31	1,225	33	1,155	35	1,100	36	1,025	39	950	42	885	45
		Med-High**	1,025	39	1,015	39	1,005	40	1,000	40	990	40	920	43	855	47	775	52
		Med-Low	885	45	855	47	815	49	780	51	740	54	695	58	640	63	565	71
		Low	700	57	675	59	655	61	620	65	590	68	555	72	515	78	465	86
SA072(†)-24B Bottom Return	72,000	High*	1,685	32	1,640	33	1,605	33	1,565	34	1,515	35	1,475	36	1,415	38	1,345	40
		Med-High	1,330	40	1,295	41	1,275	42	1,245	43	1,215	44	1,185	45	1,135	47	1,070	50
		Med-Low**	1,175	45	1,155	46	1,125	47	1,100	48	1,075	50	1,045	51	1,010	53	955	56
		Low	930	57	895	60	885	60	850	63	825	65	800	67	770	69	740	72
SA072(†)-24B Side Return	72,000	High*	1,770	30	1,720	31	1,685	32	1,645	32	1,590	34	1,550	34	1,485	36	1,415	38
		Med-High	1,400	38	1,360	39	1,340	40	1,310	41	1,275	42	1,245	43	1,190	45	1,125	47
		Med-Low**	1,235	43	1,215	44	1,180	45	1,155	46	1,130	47	1,100	48	1,060	50	1,005	53
		Low	975	55	940	57	930	57	890	60	865	62	840	63	810	66	775	69
SA090(†)-24B Bottom Return	90,000	High*	1,610	41	1,575	42	1,530	44	1,485	45	1,440	46	1,385	48	1,340	50	1,275	52
		Med-High**	1,295	51	1,260	53	1,235	54	1,220	55	1,175	57	1,135	59	1,095	61	1,015	66
		Med-Low	1,155	58	1,130	59	1,100	61	1,070	62	1,035	64	1,015	66	965	69	920	72
		Low	880	76	860	78	830	80	800	83	765	87	740	90	675	99	660	101
SA090(†)-24B Side Return	90,000	High*	1,690	39	1,655	40	1,610	41	1,560	43	1,510	44	1,455	46	1,405	47	1,340	50
		Med-High**	1,360	49	1,325	50	1,300	51	1,280	52	1,235	54	1,190	56	1,150	58	1,065	63
		Med-Low	1,215	55	1,190	56	1,155	58	1,125	59	1,090	61	1,065	63	1,015	66	965	69
		Low	925	72	900	74	870	77	840	79	800	83	775	86	710	94	695	96
SA072(†)-35C Bottom Return	72,000	High*	1,950	27	1,865	29	1,790	30	1,715	31	1,630	33	1,550	34	1,475	36	1,390	38
		Med-High	1,860	29	1,780	30	1,710	31	1,635	33	1,575	34	1,500	36	1,415	38	1,325	40
		Med-Low**	1,300	41	1,240	43	1,200	44	1,160	46	1,120	48	1,065	50	995	54	910	59
		Low	1,165	46	1,115	48	1,060	50	1,025	52	985	54	940	57	890	60	825	65
SA072(†)-35C Side Return	72,000	High*	2,030	26	1,940	27	1,860	29	1,785	30	1,695	31	1,615	33	1,535	35	1,445	37
		Med-High	1,935	28	1,850	29	1,780	30	1,700	31	1,340	40	1,560	34	1,470	36	1,380	39
		Med-Low**	1,350	40	1,290	41	1,250	43	1,205	44	1,165	46	1,110	48	1,035	52	945	56
		Low	1,215	44	1,160	46	1,105	48	1,065	50	1,025	52	980	54	925	58	860	62
SA072(†)-35C Side + Bottom or 2 Sides	72,000	High*	2,050	26	1,960	27	1,880	28	1,800	30	1,710	31	1,630	33	1,550	34	1,460	37
		Med-High	1,955	27	1,870	29	1,800	30	1,715	31	1,655	32	1,575	34	1,485	36	1,390	38
		Med-Low**	1,365	39	1,300	41	1,260	42	1,220	44	1,175	45	1,120	48	1,045	51	955	56
		Low	1,225	44	1,170	46	1,115	48	1,075	50	1,035	52	985	54	935	57	865	62

Table 2. *SA - 80% AFUE, Single Stage, Upflow/Horizontal Gas Furnaces

UPFLOW / HORIZONTAL GAS FURNACES																		
Model Number	Heating Input (Btuh)	Motor Speed	External Static Pressure (Inches Water Column)															
			0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8	
			CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise
SA090(†)-35C Bottom Return	90,000	High*	1,940	34	1,860	36	1,790	37	1,710	39	1,625	41	1,540	43	1,450	46	1,355	49
		Med-High**	1,820	37	1,760	38	1,695	39	1,620	41	1,545	43	1,466	45	1,380	48	1,280	52
		Med-Low	1,290	52	1,245	54	1,200	56	1,155	58	1,110	60	1,060	63	995	67	915	73
		Low	1,145	58	1,110	60	1,070	62	1,035	64	1,000	67	950	70	905	74	835	80
SA090(†)-35C Side Return	90,000	High*	2,020	33	1,935	34	1,860	36	1,780	37	1,690	39	1,600	42	1,510	44	1,410	47
		Med-High**	1,895	35	1,830	36	1,765	38	1,685	40	1,610	41	1,525	44	1,435	46	1,330	50
		Med-Low	1,345	50	1,295	51	1,250	53	1,200	56	1,155	58	1,100	61	1,035	64	950	70
		Low	1,190	56	1,155	58	1,115	60	1,075	62	1,040	64	980	68	940	71	870	77
SA090(†)-35C Side + Bottom or 2 Sides	90,000	High*	2,040	33	1,955	34	1,880	35	1,795	37	1,705	39	1,620	41	1,525	44	1,425	47
		Med-High**	1,910	35	1,850	36	1,780	37	1,700	39	1,625	41	1,540	43	1,450	46	1,345	50
		Med-Low	1,355	49	1,310	51	1,260	53	1,215	55	1,165	57	1,115	60	1,050	63	960	69
		Low	1,205	55	1,165	57	1,125	59	1,085	61	1,050	63	1,000	67	950	70	875	76
SA108(†)-35C Bottom Return	108,000	High*	2,205	36	2,150	37	2,095	38	2,030	39	1,970	41	1,900	42	1,830	44	1,740	46
		Med-High**	2,050	39	1,995	40	1,955	41	1,895	42	1,840	43	1,775	45	1,700	47	1,610	50
		Med-Low	1,700	47	1,680	48	1,645	49	1,610	50	1,565	51	1,525	52	1,460	55	1,375	58
		Low	1,390	58	1,370	58	1,355	59	1,320	61	1,300	62	1,270	63	1,225	65	1,175	68
SA108(†)-35C Side Return	108,000	High*	2,295	35	2,235	36	2,180	37	2,110	38	2,050	39	1,975	41	1,900	42	1,810	44
		Med-High**	2,130	38	2,075	39	2,035	39	1,970	41	1,915	42	1,845	43	1,765	45	1,675	48
		Med-Low	1,770	45	1,750	46	1,710	47	1,675	48	1,630	49	1,585	50	1,520	53	1,430	56
		Low	1,445	55	1,425	56	1,410	57	1,375	58	1,350	59	1,320	61	1,275	63	1,225	65
SA108(†)-35C Side + Bottom or 2 Sides	108,000	High*	2,315	35	2,260	35	2,200	36	2,130	38	2,070	39	1,995	40	1,925	42	1,825	44
		Med-High**	2,155	37	2,095	38	2,055	39	1,990	40	1,930	41	1,865	43	1,785	45	1,690	47
		Med-Low	1,785	45	1,765	45	1,725	46	1,690	47	1,645	49	1,600	50	1,535	52	1,445	55
		Low	1,460	55	1,440	56	1,425	56	1,385	58	1,365	59	1,335	60	1,285	62	1,235	65
SA126(†)-45D Bottom only or 2 openings	126,000	High*	2,255	41	2,200	42	2,125	44	2,065	45	2,010	46	1,935	48	1,855	50	1,755	53
		Med-High**	2,075	45	2,025	46	1,970	47	1,940	48	1,875	50	1,810	52	1,750	53	1,680	56
		Med-Low	1,720	54	1,695	55	1,655	56	1,630	57	1,580	59	1,520	61	1,455	64	1,390	67
		Low	1,360	69	1,375	68	1,365	68	1,315	71	1,310	71	1,300	72	1,260	74	1,230	76
SA126(†)-45D Side Return	126,000	High*	2,230	42	2,180	43	2,105	44	2,045	46	1,990	47	1,915	49	1,835	51	1,740	54
		Med-High**	2,055	45	2,005	47	1,950	48	1,920	49	1,855	50	1,790	52	1,735	54	1,665	56
		Med-Low	1,705	55	1,680	56	1,640	57	1,615	58	1,565	60	1,505	62	1,440	65	1,375	68
		Low	1,345	69	1,360	69	1,350	69	1,300	72	1,230	76	1,290	72	1,250	75	1,220	77

NOTES:

(†) Can be C or N

* Factory Set Cooling Speed

** Factory Set Heating Speed

1. Two openings are recommended for airflows above 1,600 CFM if filter(s) is(are) adjacent to furnace
2. Temperature rises in the table are approximate. Actual temperature rises may vary.
3. Temperature rises shaded in gray are for reference only. These conditions are not recommended

Table 2. Continued

DOWNFLOW GAS FURNACES																	
Model Number	Heating Input (Btuh)	Motor Speed	External Static Pressure (Inches Water Column)														
			0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8	
			CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise
SK054(†)-23A	54,000	High*	1,375	29	1,340	30	1,300	31	1,270	31	1,225	33	1,175	34	1,115	36	1,035	39
		Med-High	1,155	35	1,130	35	1,110	36	1,085	37	1,055	38	1,015	39	975	41	910	44
		Med-Low**	790	51	775	52	765	52	750	53	730	55	700	57	665	60	610	66
		Low	650	62	640	63	630	63	610	66	590	68	565	71	530	75	480	83
SK072(†)-24B	72,000	High*	1,610	33	1,590	34	1,575	34	1,560	34	1,540	35	1,495	36	1,460	37	1,415	38
		Med-High	1,295	41	1,275	42	1,260	42	1,250	43	1,220	44	1,195	45	1,170	46	1,120	48
		Med-Low**	1,155	46	1,135	47	1,115	48	1,095	49	1,065	50	1,040	51	1,015	53	980	54
		Low	910	59	885	60	860	62	835	64	810	66	785	68	765	70	735	73
SK090(†)-24B	90,000	High*	1,675	40	1,655	40	1,640	41	1,620	41	1,590	42	1,560	43	1,520	44	1,475	45
		Med-High	1,330	50	1,315	51	1,300	51	1,280	52	1,255	53	1,230	54	1,200	56	1,150	58
		Med-Low**	1,180	56	1,165	57	1,150	58	1,135	59	1,115	60	1,090	61	1,060	63	1,010	66
		Low	940	71	925	72	900	74	880	76	850	78	825	81	795	84	760	88
SK108(†)-35C	108,000	High*	2,395	33	2,335	34	2,285	35	2,230	36	2,200	36	2,140	37	2,080	38	2,000	40
		Med-High	2,190	37	2,135	37	2,115	38	2,080	38	2,030	39	1,975	41	1,915	42	1,810	44
		Med-Low**	1,785	45	1,770	45	1,740	46	1,725	46	1,685	47	1,645	49	1,615	50	1,565	51
		Low	1,145	70	1,110	72	1,070	75	1,035	77	1,000	80	950	84	905	88	835	96
SK126(†)-45D	126,000	High*	2,445	38	2,395	39	2,385	39	2,330	40	2,275	41	2,225	42	2,130	44	2,015	46
		Med-High	2,195	43	2,170	43	2,140	44	2,120	44	2,090	45	2,030	46	1,975	47	1,855	50
		Med-Low**	1,795	52	1,780	52	1,770	53	1,760	53	1,725	54	1,690	55	1,655	56	1,610	58
		Low	1,480	63	1,475	63	1,450	64	1,440	65	1,440	65	1,415	66	1,405	66	1,375	68

Notes

(†) Can be C or N

* Factory Set Cooling Speed

** Factory Set Heating Speed

1. Temperature rises in the table are approximate. Actual temperature rises may vary.

2. Temperature rises shaded gray are for reference only. These conditions are not recommended.

Table 3. *SK - 80% AFUE, Single Stage, Downflow Gas Furnaces

ELECTRICAL INFORMATION

Furnace Model Number *SA/*SK	Furnace Input (Btuh)	Cabinet Width (in.)	Nominal Electrical Supply	Maximum Operating Voltage	Minimum Operating Voltage	Maximum Furnace Amperes	Minimum Wire Gauge	Maximum Fuse or Circuit Breaker Amps**
045(†)-23A	45,000	14 ¼	115-60-1	127	103	6.3	14	15
054(†)-23A	54,000	14 ¼	115-60-1	127	103	6.3	14	15
072(†)-24B	72,000	17 ½	115-60-1	127	103	9.7	14	20
072(†)-35C	72,000	21	115-60-1	127	103	9.0	14	15
090(†)-24B	90,000	17 ½	115-60-1	127	103	9.7	14	20
090(†)-35C	90,000	21	115-60-1	127	103	9.0	14	15
108(†)-35C	108,000	21	115-60-1	127	103	9.0	14	15
126(†)-45D	126,000	24 ½	115-60-1	127	103	15.2	12	30

NOTES:

(†) can be “C” or “N”

** Time-delay fuses or HACR-type circuit breakers are required.

Thermostat Wire Gauge	Recommended Thermostat Wire Length	
	2 - wire (Heating)	4 or 5 wire (Cooling)
24	55 ft.	25 ft.
22	90 ft.	45 ft.
20	140 ft.	70 ft.
18	225 ft.	110 ft.

Table 4. Wire Length and Voltage Specifications

Diagnostic Description	Green LED	Red LED
Control Fault (No Power)	Off	Off
L1/Neutral Polarity Fault	Flash	Flash
1 Hour Lockout	Alternating Flash	
Normal Operation	On	On
Pressure Switch Closed Fault	On	Flash
Pressure Switch Open Fault	Flash	On
Open Limit Switch Fault	Flash	Off
Diagnostic Description	**Yellow LED**	
Low Flame Sensor Signal	Continuous Flash	
Flame Present	On	

Table 5. Control Board Fault Conditions

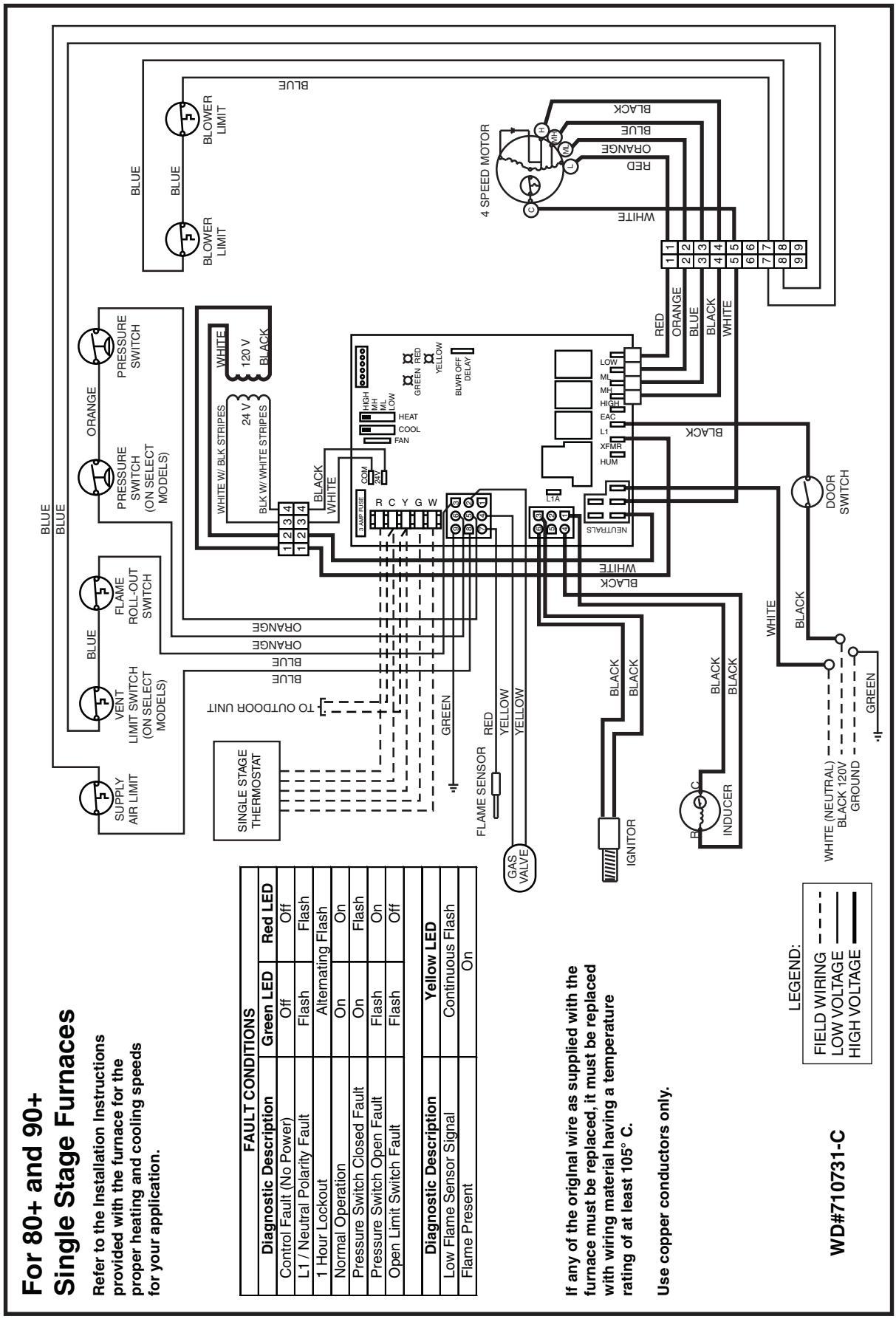


Figure 17. Wiring Diagram for Upflow and Downflow Furnaces

GAS INFORMATION

GAS FLOW RATES (CUBIC FEET PER HOUR)							
TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF GAS METER			TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF GAS METER		
	1	5	10		1	5	10
10	360	1,800	3,600	66	55	273	545
12	300	1,500	3,000	68	53	265	529
14	257	1,286	2,571	70	51	257	514
16	225	1,125	2,250	72	50	250	500
18	200	1,000	2,000	74	49	243	486
20	180	900	1,800	76	47	237	474
22	164	818	1,636	78	46	231	462
24	150	750	1,500	80	45	225	450
26	138	692	1,385	82	44	220	439
28	129	643	1,286	84	43	214	429
30	120	600	1,200	86	42	209	419
32	113	563	1,125	88	41	205	409
34	106	529	1,059	90	40	200	400
36	100	500	1,000	92	39	196	391
38	95	474	947	94	38	191	383
40	90	450	900	96	38	188	375
42	86	429	857	98	37	184	367
44	82	409	818	100	36	180	360
46	78	391	783	102	35	176	353
48	75	375	750	104	35	173	346
50	72	360	720	106	34	170	340
52	69	346	692	108	33	167	333
54	67	333	667	110	33	164	327
56	64	321	643	112	32	161	321
58	62	310	621	114	32	158	316
60	60	300	600	116	31	155	310
62	58	290	581	118	31	153	305
64	56	281	563	120	30	150	300

Table 6. Gas Flow Rates

CAPACITY OF BLACK IRON GAS PIPE (CU. FT. PER HOUR) FOR NATURAL GAS (SPECIFIC GRAVITY - 0.60)								
NOMINAL BLACK IRON PIPE DIAMETER (IN.)	LENGTH OF PIPE RUN (FT)							
	10	20	30	40	50	60	70	80
½	130	90	75	65	55	50	45	40
¾	280	190	150	130	115	105	95	90
1	520	350	285	245	215	195	180	170
1 ¼	1,050	730	590	500	440	400	370	350
1 ½	1,600	1,100	890	760	670	610		

NOTES

The cubic feet per hour listed in the table above must be greater than the cubic feet per hour of gas flow required by the furnace. To determine the cubic feet per hour of gas flow required by the furnace, divide the input rate of the furnace by the heating value (from gas supplier) of the gas.

$$\text{Cubic Feet Per Hour Required} = \frac{\text{Input To Furnace (Btu/hr)}}{\text{Heating Value of Gas (Btu/Cu. Ft.)}}$$

Table 7. Black Iron Gas Pipe Capacities

PROPANE GAS							
ALTITUDE ABOVE SEA LEVEL	INPUT (BTU)						
	45,000	54,000	72,000	90,000	108,000	126,000	
0 to 1,999 FT	57	56	56	56	56	56	ORIFICE SIZE
	10.0	10.0	10.0	10.0	10.0	10.0	MANIFOLD PRESSURE
2,000 to 2,999 FT	57	56	56	56	56	56	ORIFICE SIZE
	9.0	9.0	9.0	9.0	9.0	9.0	MANIFOLD PRESSURE
3,000 to 4,999 FT	57	56	56	56	56	56	ORIFICE SIZE
	8.5	8.5	8.5	8.5	8.5	8.5	MANIFOLD PRESSURE
5,000 to 5,999 FT	59	57	57	57	57	57	ORIFICE SIZE
	10.0	10.0	10.0	10.0	10.0	10.0	MANIFOLD PRESSURE
6,000 to 7,999 FT	59	57	57	57	57	57	ORIFICE SIZE
	9.0	9.0	9.0	9.0	9.0	9.0	MANIFOLD PRESSURE
8,000 to 10,000 FT	59	57	57	57	57	57	ORIFICE SIZE
	8.5	8.5	8.5	8.5	8.5	8.5	MANIFOLD PRESSURE

Table 8. High Altitude Deration Chart for Propane Gas

ALTITUDE ABOVE SEA LEVEL	LOCAL HEATING VALUE (BTU PER CUBIC FOOT)								
	650	700	750	800	850	900	950	1,000	1,050
2,000 FT	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH
3,000 FT	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH
4,000 FT	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH
5,000 FT	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH
6,000 FT	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH
7,000 FT	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH
8,000 FT	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
9,000 FT	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
10,000 FT	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH

Table 9. Natural Gas Heating Values

NATURAL GAS - HIGH HEATING VALUE							
ALTITUDE ABOVE SEA LEVEL	INPUT (BTU)						
	45,000	54,000	72,000	90,000	108,000	126,000	
0 to 1,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	3.5	3.5	3.5	3.5	3.5	3.5	MANIFOLD PRESSURE
2,000 to 2,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	2.9	3.2	3.2	3.2	3.2	3.2	MANIFOLD PRESSURE
3,000 to 3,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	2.8	3.0	3.0	3.0	3.0	3.0	MANIFOLD PRESSURE
4,000 to 4,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	2.6	2.8	2.8	2.8	2.8	2.8	MANIFOLD PRESSURE
5,000 to 5,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	2.5	2.7	2.7	2.7	2.7	2.7	MANIFOLD PRESSURE
6,000 to 6,999 FT	51	49	49	49	49	49	ORIFICE SIZE
	3.3	3.5	3.5	3.5	3.5	3.5	MANIFOLD PRESSURE
7,000 to 7,999 FT	51	49	49	49	49	49	ORIFICE SIZE
	3.0	3.3	3.3	3.3	3.3	3.3	MANIFOLD PRESSURE
8,000 to 8,999 FT	51	49	49	49	49	49	ORIFICE SIZE
	2.8	3.0	3.0	3.0	3.0	3.0	MANIFOLD PRESSURE
9,000 to 9,999 FT	51	49	49	49	49	49	ORIFICE SIZE
	2.6	2.8	2.8	2.8	2.8	2.8	MANIFOLD PRESSURE

Table 10. High Altitude Deration Chart for Natural Gas - High Heating Value

NATURAL GAS - LOW HEATING VALUE							
ALTITUDE ABOVE SEA LEVEL	INPUT (BTU)						
	45,000	54,000	72,000	90,000	108,000	126,000	
0 to 1,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	3.5	3.5	3.5	3.5	3.5	3.5	MANIFOLD PRESSURE
2,000 to 2,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	3.5	3.5	3.5	3.5	3.5	3.5	MANIFOLD PRESSURE
3,000 to 3,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	3.1	3.3	3.3	3.3	3.3	3.3	MANIFOLD PRESSURE
4,000 to 4,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	2.9	3.1	3.1	3.1	3.1	3.1	MANIFOLD PRESSURE
5,000 to 5,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	2.7	2.9	2.9	2.9	2.9	2.9	MANIFOLD PRESSURE
6,000 to 6,999 FT	49	47	47	47	47	47	ORIFICE SIZE
	2.6	2.8	2.8	2.8	2.8	2.8	MANIFOLD PRESSURE
7,000 to 7,999 FT	51	49	49	49	49	49	ORIFICE SIZE
	3.4	3.4	3.4	3.4	3.4	3.4	MANIFOLD PRESSURE
8,000 to 8,999 FT	51	49	49	49	49	49	ORIFICE SIZE
	3.1	3.2	3.2	3.2	3.2	3.2	MANIFOLD PRESSURE
9,000 to 9,999 FT	51	49	49	49	49	49	ORIFICE SIZE
	2.9	2.9	2.9	2.9	2.9	2.9	MANIFOLD PRESSURE

Table 11. High Altitude Deration Chart for Natural Gas - Low Heating Value

LOCATION OF FURNACE COMPONENTS

ITEM	COMPONENT NAME
1.	Blower Assembly
2.	Blower Door Switch
3.	Burner Assembly
4.	Control Board
5.	Flame Sensor
6.	Gas Manifold
7.	Gas Valve
8.	Igniter
9.	Inducer Assembly
10.	Limit Switch
11.	Pressure Switch
12.	Roll-Out Switch
13.	Transformer

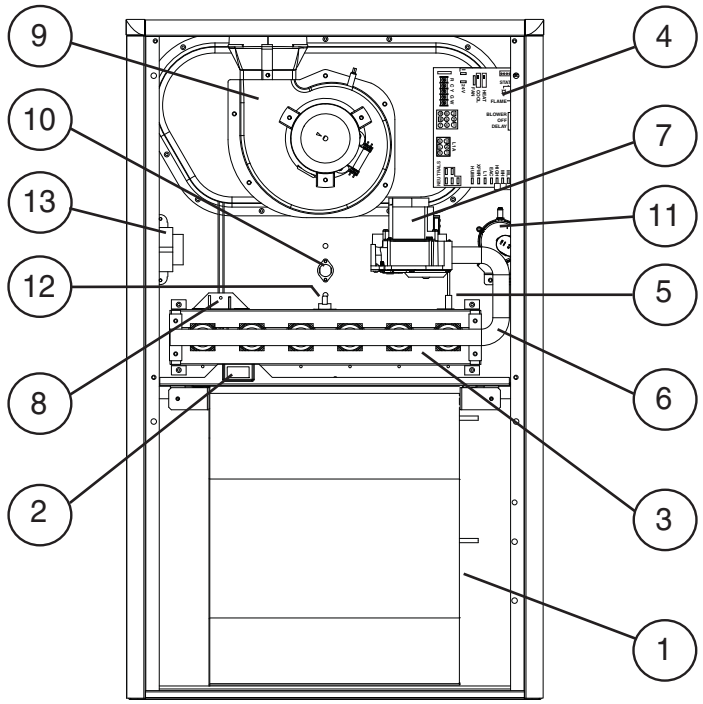


Figure 18. Upflow/Horizontal Gas Furnace

ITEM	COMPONENT NAME
1.	Blower Assembly
2.	Blower Door Switch
3.	Burner Assembly
4.	Combustion Tube
5.	Control Board
6.	Flame Sensor
7.	Gas Manifold
8.	Gas Valve
9.	Igniter
10.	Inducer Assembly
11.	Limit Switch
12.	Pressure Switch
13.	Roll-Out Switch
14.	Transformer

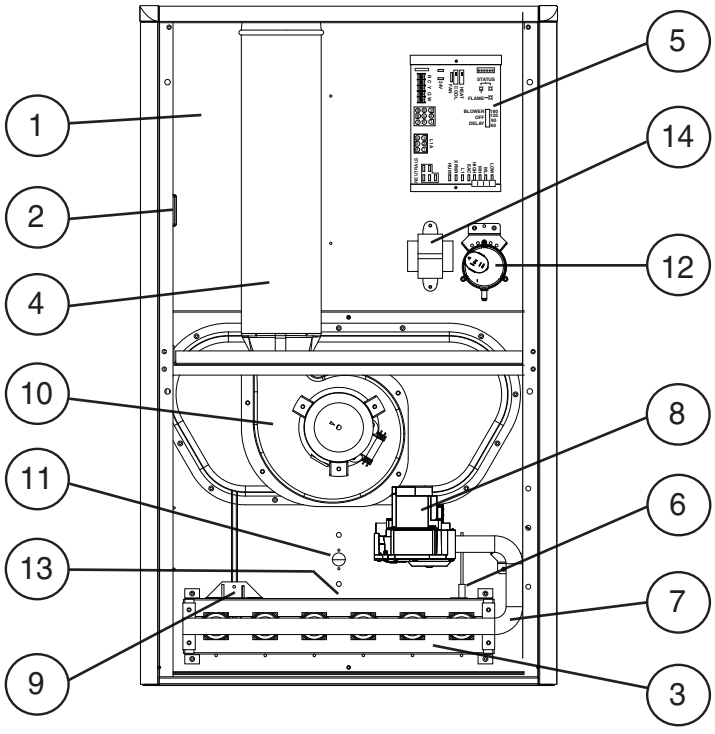


Figure 19. Downflow Gas Furnace

INSTALLATION/PERFORMANCE CHECK LIST

INSTALLER NAME:	
CITY _____	STATE _____

INSTALLATION ADDRESS:	
CITY _____	STATE _____

UNIT MODEL #_____
UNIT SERIAL # _____

Minimum clearances per Table 1 (page 23)?	YES	NO

Has the owner's information been reviewed with the home-owner?	YES	NO

Has the literature package been left near the furnace?	YES	NO

ELECTRICAL SYSTEM:		
Electrical connections tight?	YES	NO
Line voltage polarity correct?	YES	NO
Supply Voltage: _____ VOLTS		
Has the thermostat been calibrated?	YES	NO
Is the thermostat level?	YES	NO
Is the heat anticipator setting correct?	YES	NO

GAS SYSTEM:		
Gas Type: (circle one)	Natural Gas	Propane
Gas pipe connections leak tested?	YES	NO
Gas Line Pressure: _____ (in - W.C.)		
Is there adequate fresh air supply for combustion and ventilation?	YES	NO
Installation Altitude: _____ (FT.)		
Deration Percentage: _____ (%)		
Furnace Input:_____ (Btuh)		
Supply Air Temperature: _____ (° F)		
Return Air Temperature: _____ (° F)		
Temperature Rise: _____ (° F)		

VENTING SYSTEM:		
Vent free from restrictions?	YES	NO
Filter(s) secured in place?	YES	NO
Filter(s) clean?	YES	NO
Flue connections tight?	YES	NO
Is there proper draft?	YES	NO

NORDYNE
O'Fallon, MO

708807D

708807D (Replaces 708807C)