SINGLE STAGE HIGH EFFICIENCY GAS FURNACES **80+ AFUE**

INSTALLATION INSTRUCTIONS



*SA UPFLOW / HORIZONTAL FURNACE



*SK DOWNFLOW FURNACE

⚠ 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. PLEASE READ CAREFULLY & KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.

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IMPORTANT SAFETY INFORMATION

INSTALLER: Please read all instructions before servicing this equipment. Pay attention to all safety warnings and any other special notes highlighted in the manual. 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 in this manual must be followed during the installation, service, and operation of this unit. Unqualified individuals should not attempt to interpret these instructions or install this equipment. Failure to follow safety recommendations could result in possible damage to the equipment, serious personal injury or death.

⚠ WARNING:

Improper installation, service, adjustment, or maintenance may cause explosion, fire, electrical shock or other hazardous conditions which may result in personal injury or property damage. Unless otherwise noted in these instructions, only factory authorized kits or accessories may be used with this product.

⚠ WARNING:

Unless otherwise noted in these instructions, only factory authorized kits or accessories may be used with or when modifying this product.

⚠ WARNING:

Do not install this furnace if any part has been submerged under water. A flood damaged furnace is extremely dangerous. Attempts to use the furnace may result in fire or explosion. A qualified service agency should be contacted to inspect the furnace and to replace any electrical or control system parts that have been wet or under water.

- To minimize equipment failure or personal injury, it is essential that only qualified individuals install, service, or maintain this equipment. If you do not posses mechanical skills or tools, call your local dealer for assistance.
- Follow all precautions in the literature, on tags, and on labels provided with the equipment. Read and thoroughly understand the instructions provided with the equipment prior to performing the installation and operational checkout of the equipment.
- Use caution when handling this appliance or removing components. Personal injury can occur from sharp metal edges present in all sheet metal constructed equipment.
- Do not store any of the following on, or in contact with, the unit: Rags, brooms, vacuum cleaners, or other cleaning tools, spray or aerosol cans, soap powders, bleaches, waxes, cleaning compounds, plastics or plastic containers, paper bags or other paper products, gasoline, kerosene, cigarette lighter fluid, dry cleaning fluids, paint thinners, or other volatile fluids.
- The installer should become familiar with the units wiring diagram before making any electrical connections to the unit. See Figure 19, (page 27) or the unit wiring label.
- Always reinstall the doors on the furnace after servicing. Do not operate the furnace without all doors and covers in place.

REQUIREMENTS & 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/CSA B149.1.
- 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 on page 5.
- Provide adequate combustion and ventilation air to the furnace space as specified on page 5, page 6, page 7, & page 8.
- Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified on page 8 & page 9.
- Never test for gas leaks with an open flame. Use a commercially available soap solution to check all connections. See page 14.
- This furnace is designed to operate with a maximum external pressure rise of 0.5 inches of water column. Consult Table 3, (page 24) & Table 4, (page 26), 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. See page 9 & page 10.
- A gas-fired furnace for installation in a residential garage must be installed as specified on page 5.
- 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.

The information listed below is for reference purposes only and does not necessarily have jurisdiction over local or state codes. Always consult with local authorities before installing any gas appliance.

Combustion & 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 & 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/CSA-B149.1 and .2–M00 National Standard of Canada. (NSCNGPIC)

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. For Installations in confined spaces, see page 6 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

Clearances to Combustible Materials

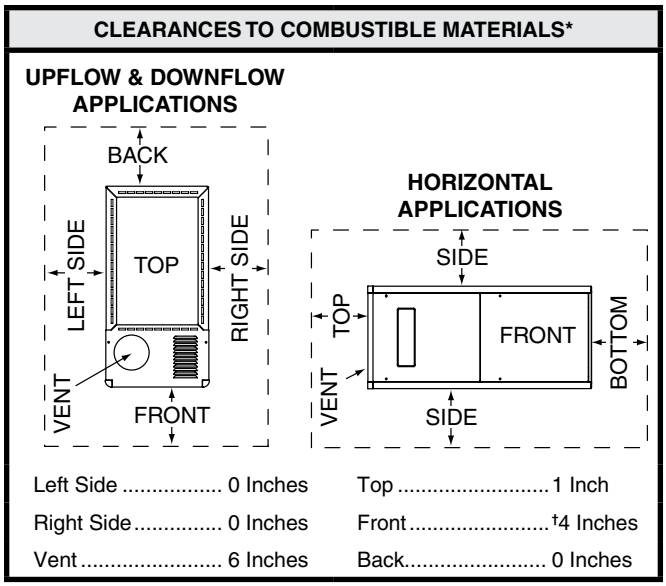
This furnace is Design Certified in the U.S. and Canada by CSA International for the minimum clearances to combustible materials. **NOTE:** The furnace is listed for installation on combustible or non-combustible flooring. However, wood is the only combustible flooring allowed for installation. Downflow models must use the appropriate subase kit when installing over a wood floor. 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 need to provide clearance for access to panels or doors may require clearance distances over and above the requirements. **Allow 24 inches minimum clearance from the front of the unit. However 36 inches is strongly recommended.** See Figure 1, (page 5) for minimum clearance requirements.

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.**

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.



†Allow 24 in. minimum clearance for servicing. Recommended clearance is 36 in.

Figure 1. Minimum Clearances to Combustible Materials

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.

Operation of Furnace During Construction

⚠ CAUTION:

Operating gas furnaces in construction environments can cause a variety of problems within the furnace and may significantly reduce the life or the performance of the furnace. Therefore operating the furnace during construction is not permitted and will void the warranty.

COMBUSTION AIR & VENTING REQUIREMENTS

⚠ 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.**

IMPORTANT INFORMATION:

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

⚠ 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.

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.

IMPORTANT NOTE

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.

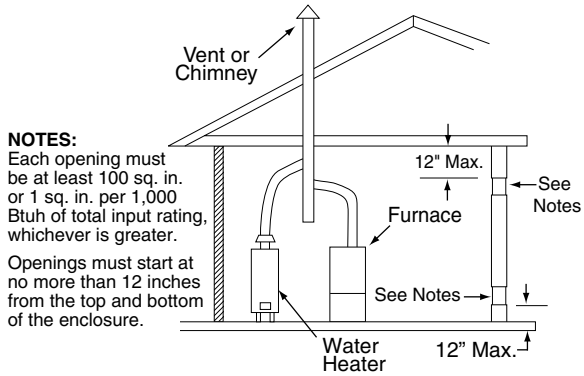
The required sizing of these openings is determined by whether inside or outside air is used to support combustion, the method by which the air is brought to the space, and by the total input rate of all appliances in the space. In all cases, the minimum dimension of any combustion air opening is 3 inches.

Air From Inside

If combustion air is taken from the heated space, the two openings must each have a free area of at least 1 in^2 per 1,000 Btuh of total input of all appliances in the confined space, but **not less than** 100 in^2 of free area. See Figure 2 and the Example below.

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 in^2. If the combined input rate of all appliances is 120,000 Btuh, each opening must have a free area of at least 120 in^2.



TOTAL INPUT RATING (BTUH)	MINIMUM FREE AREA (EACH OPENING)	ROUND DUCT DIAMETER
40,000	100 in^2	12 inches
60,000	100 in^2	12 inches
80,000	100 in^2	12 inches
100,000	100 in^2	12 inches
120,000	120 in^2	13 inches
140,000	140 in^2	14 inches
160,000	160 in^2	15 inches

Figure 2. Combustion Air Drawn from Inside

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 in^2 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. See Figure 3, (page 7).

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 1in^2 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. See Figure 4, (page 7).

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 1in^2 per 2,000 Btuh of total appliance input. See Figure 5, (page 7).

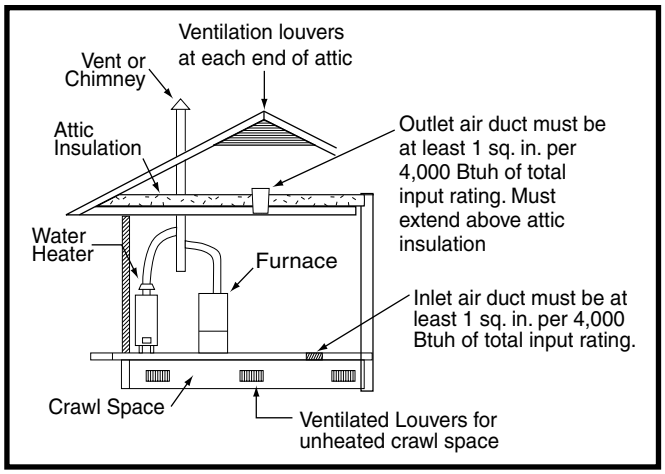
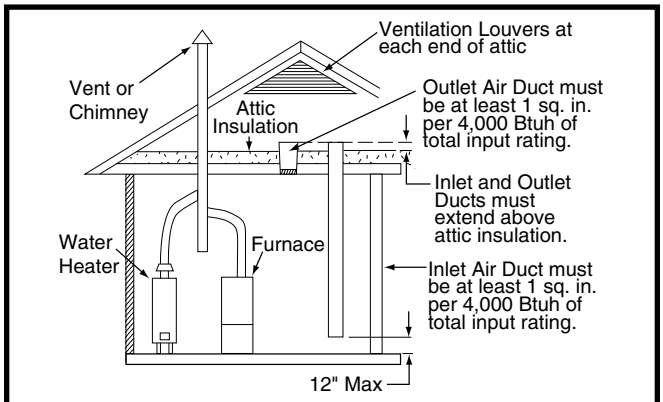
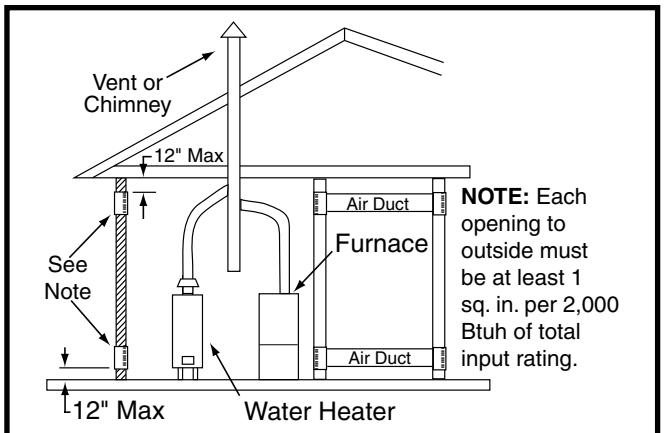


Figure 3. Combustion Air Drawn from a Crawl Space or Vented Attic



TOTAL INPUT RATING (BTUH)	MINIMUM FREE AREA (EACH OPENING)	ROUND DUCT DIAMETER
40,000	100 in^2	12 inches
60,000	100 in^2	12 inches
80,000	100 in^2	12 inches
100,000	100 in^2	12 inches
120,000	120 in^2	13 inches
140,000	140 in^2	14 inches
160,000	160 in^2	15 inches

Figure 4. Combustion Air Drawn from Outside Through Vertical Ducts

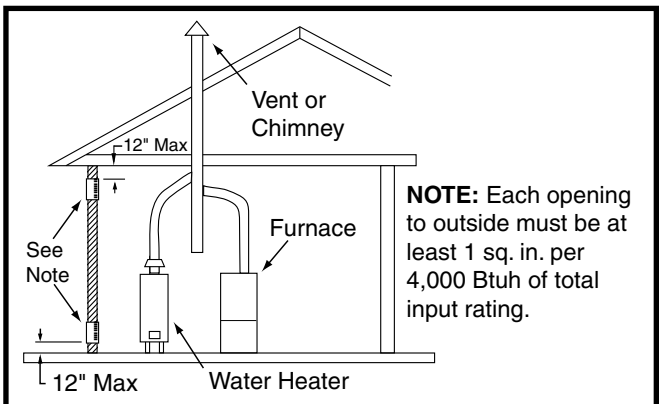


TOTAL INPUT RATING (BTUH)	MINIMUM FREE AREA (EACH OPENING)	ROUND DUCT DIAMETER
40,000	10 in^2	5 inches
60,000	15 sin^2	6 inches
80,000	20 in^2	7 inches
100,000	25 in^2	8 inches
120,000	30 in^2	9 inches
140,000	35 in^2	10 inches
160,000	40 in^2	10 inches

Figure 5. Combustion Air Drawn from Outside Through Horizontal Ducts

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 1in^2 per 4,000 Btuh of total appliance input. See Figure 6.



TOTAL INPUT RATING (BTUH)	MINIMUM FREE AREA (EACH OPENING)	ROUND DUCT DIAMETER
40,000	10 in^2	4 inches
60,000	15 in^2	5 inches
80,000	20 in^2	5 inches
100,000	25 in^2	6 inches
120,000	30 in^2	6 inches
140,000	35 in^2	7 inches
160,000	40 in^2	8 inches

Figure 6. 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 2 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 in^2. 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.

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 sq. ft. (6,000 / 8 = 750).

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.

⚠ 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.

⚠ 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 must be vented in compliance with the current revision of the National Fuel Gas Code (ANSI-Z223.1/NFPA54) and the instructions provided below. Refer to the NFGC for approved vent tables. Consult local codes for special requirements.**
- **In Canada, venting shall conform to the requirements of the current (CAN/CSA B149.1) installation codes. Consult local codes for special requirements.**
- **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.**
- **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.**
- 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 minimum diameter of any vent pipe is 4 inches.**
- 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.
- 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 states 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

- 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/CSA-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 & 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).
- Table 3, (page 24) & Table 4, (page 26) contain the maximum airflow and temperature rise data for each furnace input rate. 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.
- 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.

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. **Do not use the back of the furnace for return air.**
- Position the furnace with the return air ductwork ensuring even alignment of furnace (or coil casing) air opening and return air duct. **NOTE:** The ductwork must have an opening equal to that of the return air opening of the furnace (or coil casing). See Figure 18, (page 23) for return air opening size.

Upflow & Horizontal Furnaces

- The return air ductwork may be connected to the left side, right side, or bottom of the furnace. **NOTE:** If using only the left or right side of the furnace for return air, the bottom panel (Figure 18) must not be removed from the bottom of the furnace.

⚠ WARNING:

The bottom panel 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.

- **Side Return Installations:** To attach the return air duct to the left or right side of the furnace, punch out the 4 knockouts from the side of the furnace (Figure 18). Using sharp metal cutters, cut an opening between all 4 knockouts to expose the blower assembly. Position the return air duct over the opening and secure to the side with sheet metal screws.
- **Bottom Return Installations:** If using the bottom of the furnace for return air, the bottom panel (Figure 18) must be removed from the bottom of the furnace. See page 13 for removal instructions. Position the furnace over the return air duct and secure together with sheet metal screws. Make sure the screws penetrate the duct and furnace casing.

Downflow Furnaces

- To attach the return air duct to the downflow furnace, bend the flanges on the furnace upward 90° with wide duct pliers. See Figure 18, (page 23) for furnace flange locations. **NOTE:** If system installation includes AC coil casing, bend the flanges on the coil casing upward 90° before attaching the return air duct.
- Secure the return air ductwork to the furnace or coil casing (if installed) with sheet metal screws. Make sure the screws penetrate the sheet metal casing and flanges.

Supply Air Connections

- The supply air must be delivered to the heated space by duct(s) secured to the furnace or coil box casing, running full size and without interruption.
- To attach the supply air duct to upflow & horizontal furnaces, bend the flanges on the furnace upward 90° with wide duct pliers. See Figure 18, (page 23) for furnace flange locations. **NOTE:** If system installation includes AC coil casing, bend the flanges on the coil casing upward 90° before attaching the supply air duct.
- Position the supply air ductwork onto the furnace ensuring even alignment of furnace air opening and supply air duct. **NOTE**: The ductwork must have an opening equal to that of the supply air opening of the furnace. See Figure 18 for supply air opening size.

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.

FURNACE INSTALLATION

These Installation procedures are suggested for typical furnace installations. Since each installation is different, the sequence of instructions may differ from the actual installation. **Only qualified HVAC technicians should install this furnace.**

The installer must be familiar with and comply with all codes and regulations applicable to the installation of these heating appliances and related equipment. In the absence of local codes, the installation must be in accordance with the current provisions of one or more of the following standards.

- American National Standard (ANSI-Z223.1/NFPA-54) and/or CAN/CSA B149 for all gas-fired furnace models.
- American National Standard (ANSI-C1/NFPA-70) and/or CSA 22.1 Canadian Electric Code Part 1 for all electrical field wiring.

About The Furnace

The *SA / *SK series furnace is designed only for indoor installations and can be readily connected to the high static duct system of a home. *SA series gas furnaces are shipped ready for installation in the upflow or horizontal right or left positions. *SK series gas furnace may only be used for downflow operation. Units are approved for single / multistory residential structures in freestanding /closet / alcove configurations.

This appliance will provide many years of safe and dependable comfort, providing it is properly installed and maintained. Abuse, improper use, and/or improper maintenance can shorten the life of the appliance and create unsafe hazards. Please read all instructions before installing the unit.

Approved installation, operation, and maintenance of this appliance must be in accordance with the listed specifications contained in these instructions and other documents supplied with the furnace and/or optional air conditioning equipment. Unless it is noted differently in this manual, only use factory authorized kits and accessories on this appliance. Refer to local authorities having jurisdiction for further information.

Before You Install the Furnace

√ This equipment is securely packaged at the time of shipment and upon arrival should be carefully inspected for damage prior to installing the equipment at the job site. Claims for damage (apparent or concealed) should be filed immediately with the carrier.

√ Check the electrical supply and verify the power supply is adequate for unit operation. The system must be wired and provided with circuit protection in accordance with local building codes. If there is any question concerning the power supply, contact the local power company.

√ Verify the air delivery of the furnace is adequate to handle the static pressure drop of the coil, filter, and duct work.

Locating the Furnace

- The dimensions of the room or alcove must be able to accommodate the overall size of the furnace and required clearances to combustible materials listed in Figure 1, (page 5). Access for positioning and servicing must also be considered when locating the unit. To determine the required clearances needed for installation, refer to Figure 18, (page 23) for overall dimensions.
- The furnace must be installed on a solid surface and must be level front-to-back and side-to-side at installation. The surface that the furnace is mounted on must provide sound physical support of the unit. Secure the furnace to the floor.
- The furnace should be installed as close to the center of the air distribution system as possible and attached to a properly installed duct system. **Do not use the back of the furnace for return air.** See page 9 & page 10 for circulating requirements.
- The furnace must be installed so that all electrical components are protected from water.
- The plenum attached to the A/C coil box and ductwork within 3 ft. of the furnace must be installed so that surfaces are at least 1" from combustible construction.
- When installed in a residential garage, the furnace must be positioned so the burners and the source of the ignition are located no less than 18 inches above the floor and protected from physical damage by vehicles.
- The furnace must be installed upstream from a refrigeration system.
- The furnace requires special venting materials and installation procedures. See page 8 & page 9 for venting guidelines and specifications.

Upflow Furnaces

⚠ WARNING:

The furnace must not be installed directly on carpeting, tile, or any combustible material other than wood flooring. Failure to comply may result in fire, property damage or personal injury.

*SA series gas furnaces are shipped with the bottom panel installed as shown in Figure 18, (page 23). If the furnace is installed with only side return air, the bottom panel must not be removed. If the furnace is installed with bottom return air, the bottom panel must be removed. See Bottom Panel Removal on page 13.

Horizontal Furnaces

⚠ WARNING:

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

- The *SA series gas furnace can be installed horizontally (Figure 7) in an attic, basement, crawl space or alcove. 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 8, (page 12).
- *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 13.
- If installing the furnace with an evaporator coil (in an attic), it is required that a drip pan be placed under the furnace. If the installation is on a combustible platform (Figure 7), it is recommended that the drip pan extend at least 12 inches past the top and front of the furnace. **NOTE:** Although it is not required to use a drip pan for heat only applications, state and local codes may require it.
- If suspending the furnace from the ceiling, assemble a support frame (Figure 8) using slotted iron channel and full

threaded rod. Fasten the frame together with nuts, washers, and lockwashers. Secure the support frame to the rafters with lag bolts. The furnace can also be suspended using 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.

- 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.

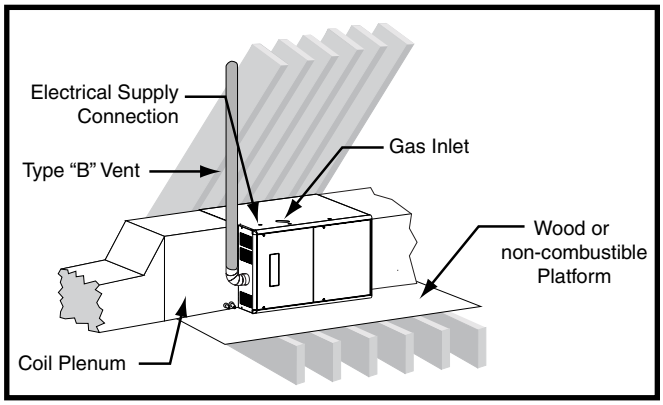


Figure 7. *SA Horizontal Installed on a Platform

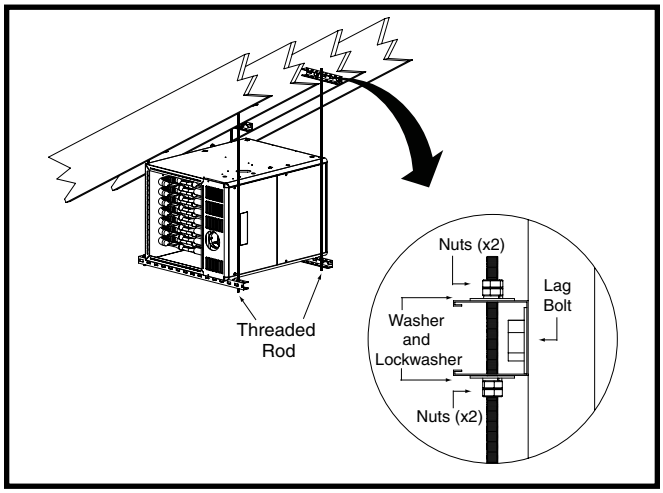


Figure 8. *SA Horizontally Suspended in Attic

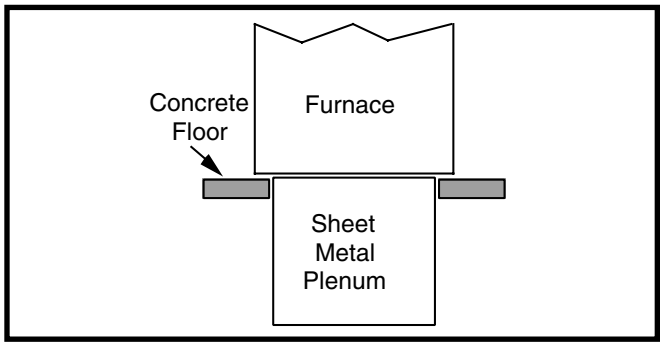


Figure 9. Furnace on a Concrete Slab

Downflow Installation

The furnace must not be installed directly on carpeting, tile, or any combustible material other than wood flooring. To install the furnace on combustible flooring, a special sub-base is required.

⚠ WARNING:

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

⚠ WARNING:

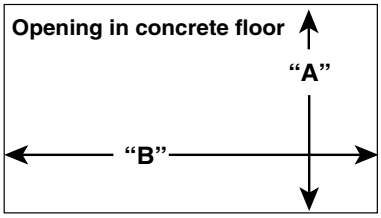
The downflow sub-base kit must not be installed directly on carpeting, tile, or any combustible material other than wood flooring. Failure to comply may result in fire, property damage or personal injury.

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**.

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 Table 1.
2. Position the plenum and the furnace as shown in Figure 9.



*SK MODELS	DIM. "A"	DIM. "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

NOTE: Dimensions shown in Inches.

Table 1. Cutout Dimensions

Pressure Switch Tubing

Figure 10 displays the proper routing of pressure switch tubing for *SA & *SK furnaces. On both furnaces, the tubing connects at one end of the pressure switch and is routed directly onto the static tap of the inducer assembly.

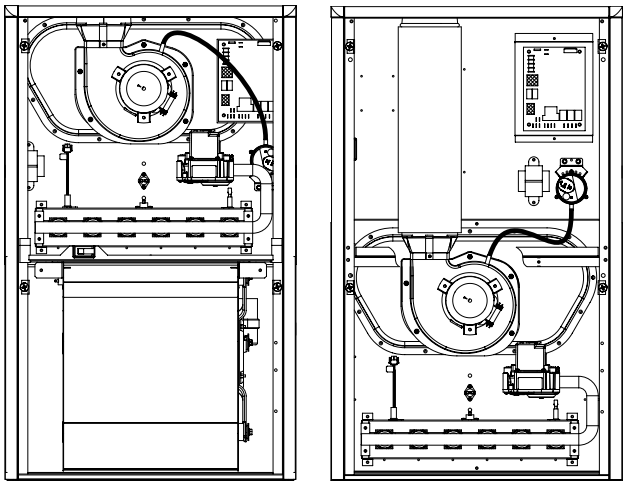


Figure 10. Pressure Switch Tubing for *SA & *SK Furnaces

Bottom Panel Removal

The steps listed below explain the proper method for removing the bottom panel from the furnace. See Figure 11.

1. Remove the door (1) from the blower compartment.
2. Disconnect the blower motor wiring harness (2) from the control board.
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.

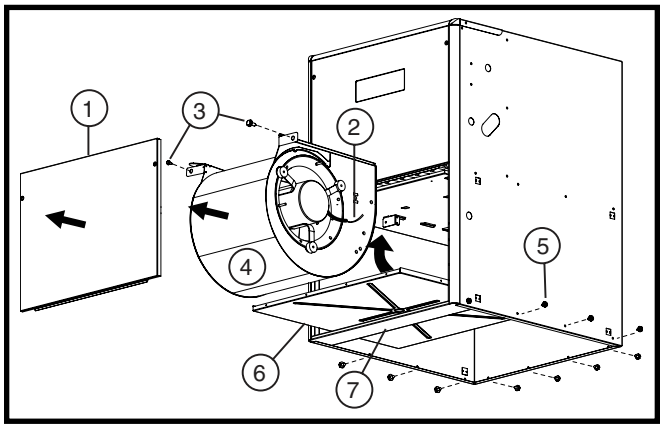


Figure 11. Bottom Panel Removal

Alternate Bottom Panel Removal

If the bottom panel cannot be removed using the previous instructions, the steps below are an alternate method for removing the bottom panel. See Figure 12.

1. Remove the door (1) from the blower compartment .
2. Remove all screws securing the bottom panel (2) to the front brace (3).
3. Remove two screws (4) securing the furnace cabinet to the blower deck (5).
4. Remove all screws (6) securing the furnace cabinet to the bottom panel (2).
5. Remove the screw (7) securing the bottom corner of the furnace cabinet to the front brace (3).
6. Carefully spread the bottom corner of the furnace cabinet outwards while sliding the bottom panel (2) out through the front of the furnace.
7. Reassemble the furnace in reverse order.

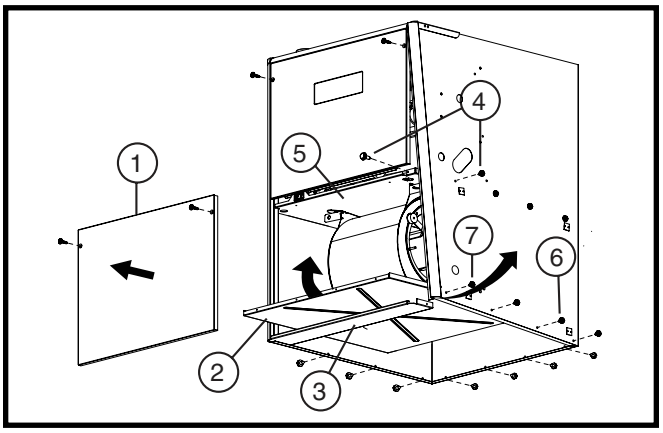


Figure 12. Alternate Removal Method

GAS SUPPLY & PIPING

⚠ 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 neighbor's phone. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

- **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/CSA B149.1) Installation Codes.**
- **Some local regulations require the installation of a manual main shut-off valve and ground joint union external to the furnace as shown in Figure 13, (page 15). 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.**
- **Per ANSI 21.47, A 1/8-inch NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the furnace external to the cabinet. If local codes allow the use of a flexible gas appliance connector, always use a new listed connector. Do not use a connector that has previously serviced another gas appliance.**
- **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. Only new flexible connectors may be used. Do not use a connector which has previously serviced another gas appliance.**
- **A drip leg should be installed in the vertical pipe run to the unit (Figure 13).**

Table 6, (page 28) 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. Typical gas hookups are shown in Figure 13.

Leak Check

⚠ WARNING:

FIRE OR EXPLOSION HAZARD

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

Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

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

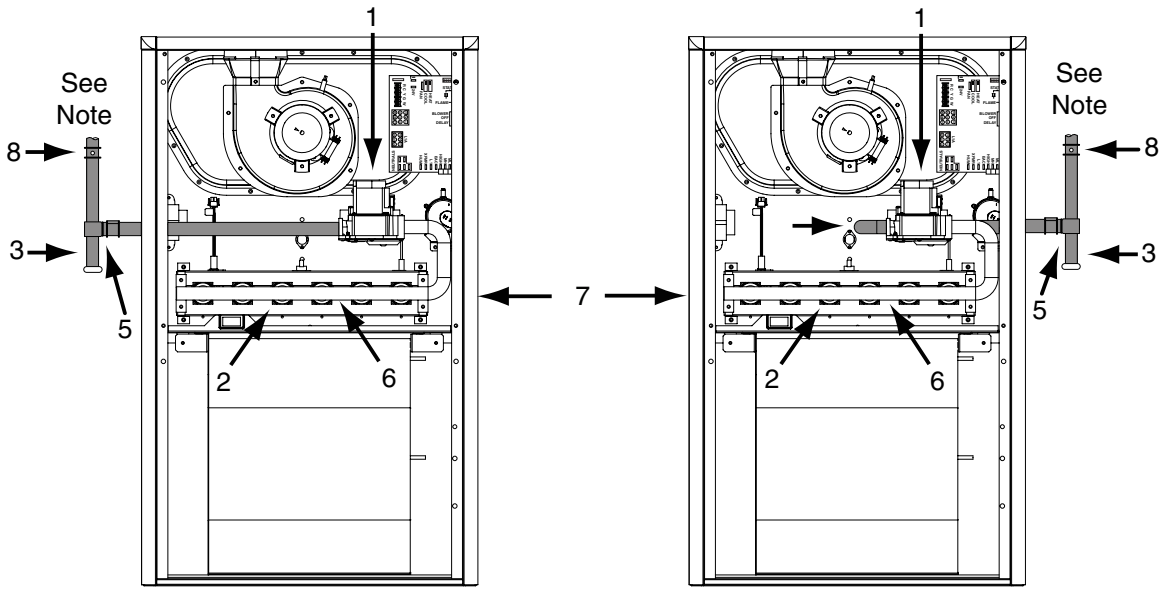
High altitude conversion with this furnace depends on the installation altitude and the heating value of the gas. Installation of this furnace at altitudes above 2,000 feet shall be in accordance with local codes, or in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1/ NFPA 54 or National Standard of Canada, Natural Gas & Propane Installation Code CSA 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.

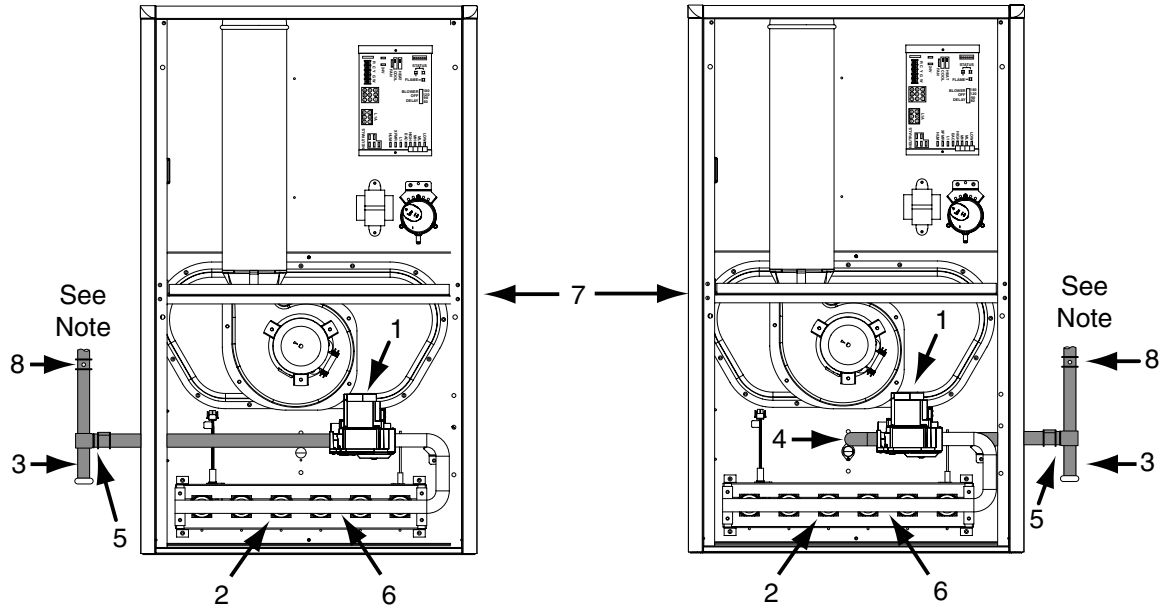
The furnaces are shipped from the factory with orifices and gas regulator settings for natural gas operation at sea level altitudes. At 2,000 feet, the NFGC requires that this appliance be derated 4% for each 1,000 feet of altitude. For example, at 2,000 feet the input needs to be reduced 8%, at 3,000

UPFLOW MODELS



Left Side Entry **Right Side Entry**

DOWNFLOW MODELS



Left Side Entry **Right Side Entry**

COMPONENTS:

(1) Automatic Gas Valve (w/ manual shut-off)	(2) Burner Assembly	(3) Dripleg	(4) Elbow
(5) Ground Joint Union	(6) Manifold	(7) Plug	(8) Shut - Off Valve

NOTE: Some utilities require Shut- Off Valve to be 4 - 5 feet above floor.

Figure 13. Typical Gas Connections

feet (12%), 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 across regions 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. Table 9 & Table 10, (page 30) contain the orifice sizes and manifold pressure to use at various altitudes. Table 9 (High) is for natural gas installations with a heating value of more than 1,000 Btu per cubic foot and Table 10 (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 8, (page 29), 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 9 or if it’s LOW, use Table 10.

EXAMPLE

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

From Table 8, find 750 and follow down the column, stop at the 5,000 feet row. The heating value listed is LOW. Table 10 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 19).

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

For US installations only: To avoid nuisance tripping at altitudes from 7500 to 10,000 feet, a pressure switch conversion may be required. Consult the tables in the LP and High altitude and LP gas conversion kit for installations in the US.

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.

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 7, (page 29) to determine the correct orifice size and manifold pressure. See example below.

EXAMPLE

Elevation: .....5,000 feet
Type of Gas:..... Propane Gas
Input BTUH of Furnace: 72,000

From Table 7, find 5,000 and follow across the row, stop at the 72,000 BTU column. The manifold pressure listed is 10.0 and the orifice size is 57.

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 905028) 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 905029) 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:

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

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

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

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

- 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).

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. See Table 2.

IMPORTANT NOTES:

- **An electrical disconnect must be installed readily accessible from and located within sight of the furnace. See Figure 14 or the wiring diagram label inside of the control door. Any other wiring methods must be acceptable to authority having jurisdiction.**
- **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 14.**
- **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 specifications, refer to the furnace nameplate or Table 2.**

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!

Thermostat / Low Voltage Connections

- The furnace is designed to be controlled by a 24 VAC thermostat. The thermostat's wiring must comply with the current provisions of the NEC (ANSI/NFPA 70) and with applicable local codes having jurisdiction.
- 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. Figure 15 contains the proper connections for heating only (two-wire) and heating/cooling (four-wire) applications. Recommended minimum wire gauge for thermostat wiring is shown in Table 2, (page 18).
- The thermostat should be mounted about 5 feet above the floor on an inside wall. DO NOT install the thermostat 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. Refer to the thermostat manufacturer's instruction sheet for detailed mounting information.
- The six pin terminal marked "Expansion Port" (Figure 15) 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.

Heat Anticipator

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.

Twinning

Single stage 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. For twinning of single stage furnaces with PSC motors, a twinning kit (1010035) is available for purchase. **Please follow the instructions provided with the kit.**

If both single stage furnaces are upgraded to the fixed speed iSEER™ blower, the twin terminal on both blower control boards (Figure 16, (page 19)) may be used to twin the single stage furnaces. The twinning system requires a relay (P/N 624843) in the secondary furnace for proper twinning.

For proper twinning of fixed speed furnaces the following criteria must be met:

- Both furnaces and motors must be the same size.
- Both motors must be on the same speed for cooling and heating.
- Both furnaces must have a common return duct and common supply plenum.
- Both furnaces must be the same phase and on the same leg of power.

Furnaces equipped with variable speed iSEER™ motors may not be twinned under any circumstances.

FURNACE MODEL *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*
045C-23A	45,000	14 1/4	115-60-1	127	103	6.3	14	15
054C-23A	54,000	14 1/4	115-60-1	127	103	6.3	14	15
072C-24B	72,000	17 1/2	115-60-1	127	103	9.7	14	20
072C-35C	72,000	21	115-60-1	127	103	9.0	14	15
090C-24B	90,000	17 1/2	115-60-1	127	103	9.7	14	20
090C-35C	90,000	21	115-60-1	127	103	9.0	14	15
108C-35C	108,000	21	115-60-1	127	103	15.2	12	30
126C-45D	126,000	24 1/2	115-60-1	127	103	15.2	12	30

* Time-delay fuses or 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 2. Wire Length & Voltage Specifications

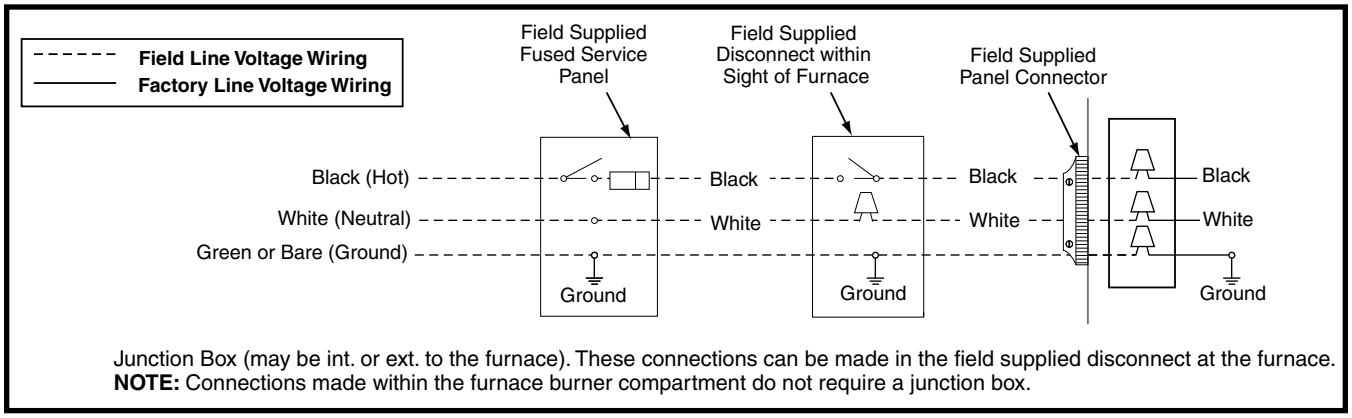


Figure 14. Line Voltage Field Wiring

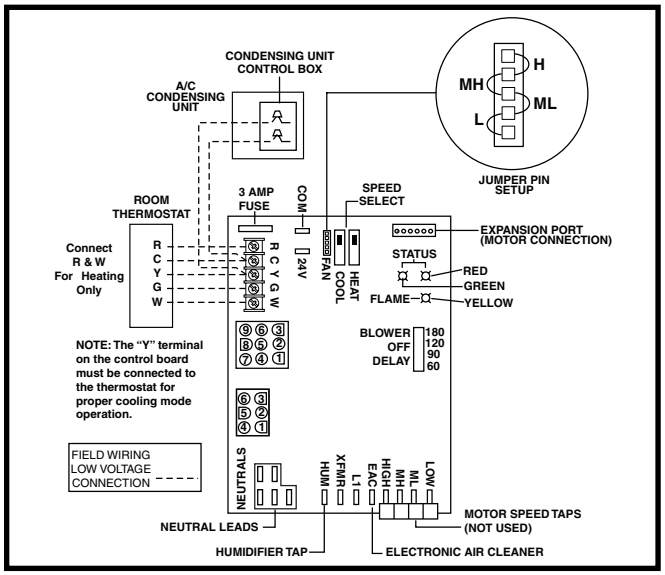


Figure 15. Low Voltage Field, Four-wire Heating/ Cooling Applications

⚠ WARNING:

When servicing either twinned furnace, power must be turned off on both furnaces. Failure to comply may result in improper operation leading to damage to the furnaces or personal injury!

1. Turn off all power to both furnaces.
2. Attach a wire between the two twin terminals on the blower control boards. Use field supplied wire and 3/16" wire terminals.

NOTE: One furnace can be used for one stage of heating and the other furnace can be used for the second stage of heating. The installer also has the choice of running one furnace only or both furnaces. In both cases the blowers will run at the same time and at the same speeds:

One stage heating

- Connect the thermostat wires to the primary furnace control board. Mount the relay on the bracket on the secondary furnace.

- Connect **W** from the primary furnace to the coil side of the relay (using field supplied wire and 3/16" terminals).
- Connect **C** from the primary furnace to the coil side of the relay (using field supplied wire and 3/16" terminals).

NOTE: Make sure connections are made on opposite sides of the coil.

- Connect **R** from the secondary furnace control board to the COM side of the relay (use included **red** wire).
- Connect **W** from the secondary furnace control board to **NO** side of the relay (use included **white** wire).

Two stage heating

- Connect the thermostat wires to the furnace control board (except **W2**). Mount the relay on the bracket on the secondary furnace.
- Connect **W1** from the thermostat control to **W** of the primary furnace.
- Connect **W2** from the thermostat to the coil side of the relay (using field supplied wire and 3/16" terminals).
- Connect **C** from the primary furnace to the coil side of the relay (using field supplied wire and 3/16" terminals).

NOTE: Make sure connections are made on opposite sides of the coil.

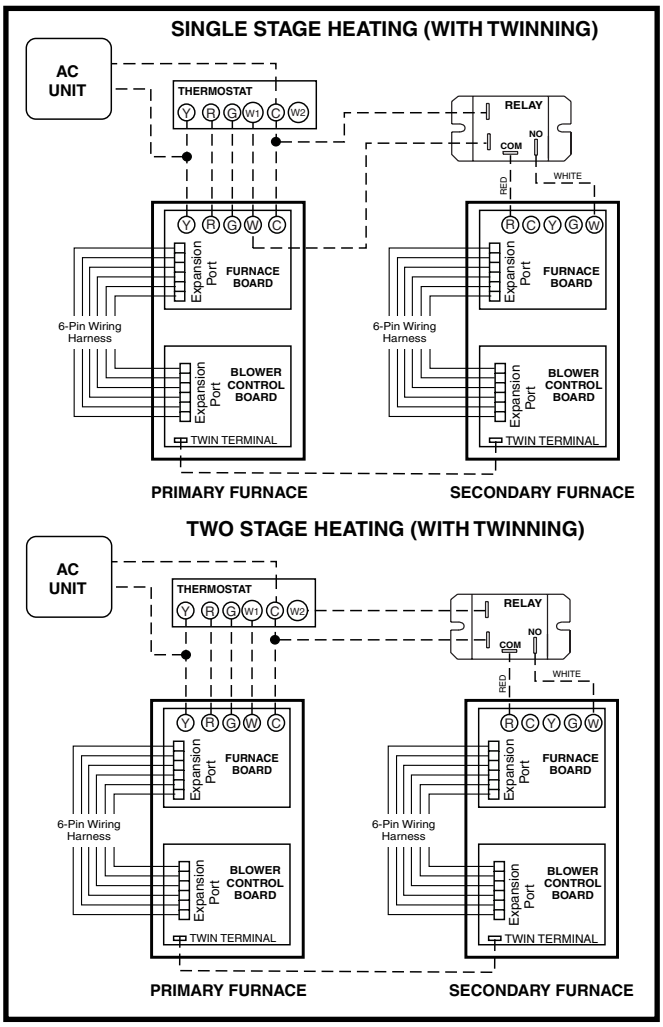


Figure 16. Single Stage Twinning

START-UP & 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**, & **G**) are securely connected to the correct leads on the terminal strip of the circuit board.

√ Verify the jumper setting (for fan speed) on the control board. See Figure 15, (page 18).

√ 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. 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 21).
5. After 5 minutes of operation, set the thermostat below room temperature and verify steps 9 - 10 of the Operating Sequence.

Verifying & Adjusting Input Rate

The input rate must be verified for each installation to prevent over-firing of the furnace. **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. 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 5, (page 28).
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. See Example.

EXAMPLE

- Time for 1 revolution of a gas meter with a 1 cubic ft dial = 40 seconds.
- From Table 5 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.

⚠ 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.

6. Obtain the manifold pressure setting required for this installation by referring to Table 7, (page 29) for Propane or Table 9 or Table 10, (page 30) for Natural Gas.

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

7. Remove the regulator capscrew from the INLET side of the regulator. See (Figure 17, (page 20).
8. 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.

9. Replace and tighten the regulator capscrew over the adjustment screw.

Verifying & Adjusting Temperature Rise

After installation of the furnace, confirm the temperature rise of the furnace is within the limits specified on the rating plate. Any temperature rise outside the specified limits could result in premature failure of the heat exchanger.

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.

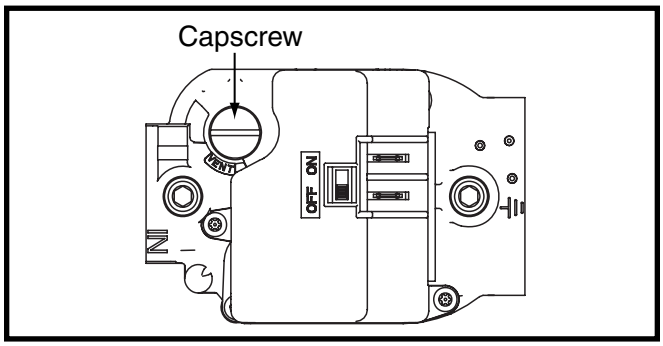


Figure 17. Regulator Capscrew

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

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 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:Figure 14, (page 18), Figure 15, (page 18) and Figure 19, (page 27).

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. See Figure 15, (page 18).
- 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.
- The blower will operate at 50% of the selected high cooling speed for continuous fan operation.

MAINTENANCE

⚠ WARNING:

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

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

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

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

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

- These maintenance instructions are primarily intended to assist qualified technicians experienced in the proper maintenance and operation of this appliance.
- Always reinstall 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 - An air filter is not supplied with the furnace as shipped from the factory. The installer must provide a high velocity filter that is appropriately sized to the return air duct opening or external filter rack.

⚠ WARNING:

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

It is recommended that filter(s) be 1" or 2" thick and 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 20, (page 32) 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.

⚠ CAUTION:

To prevent damage to the unit or internal components, it is recommended that two wrenches be used when loosening or tightening nuts. Do not over tighten!

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 Figure 20, (page 32) 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.
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.**
11. *SA models - Remove all screws securing the inducer assembly to the vent pipe running out of the furnace
    *SK models - Remove all screws securing the combustion air tube assembly to the vent pipe running out of the furnace.
12. Remove all screws securing the inducer assembly to the collector pan.
13. *SA models - Carefully remove the inducer assembly from the furnace.
    *SK models - 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.**
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 page 22.
20. Replace all the parts in reverse order that they were removed.
21. Check gaskets for damage and replace if needed.
22. Follow the lighting instructions found on the furnace door to return the furnace to operation. Verify proper operation after servicing.

Vent System - Check the vent pipe and/or chimney for corrosion or debris. Any corroded section of vent pipe must be replaced, and any obstruction or blockage must be removed prior to operating the furnace.

⚠ 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.

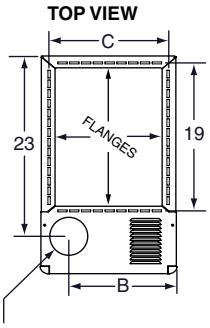
Heat Exchanger & Burner Maintenance - The furnace should operate for many years without soot buildup in the flue passageways, however, the flue, vent system, and burners should be inspected and cleaned (if required) by a qualified service technician annually to ensure continued safe operation. Pay attention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

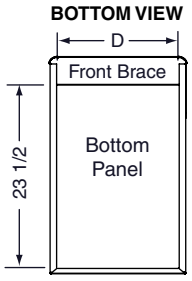
Lubrication - The bearings in the blower motor and inducer blower used in these furnaces are pre-lubricated and sealed by the manufacturer. No further oiling of the bearings is required for the life of the motor.

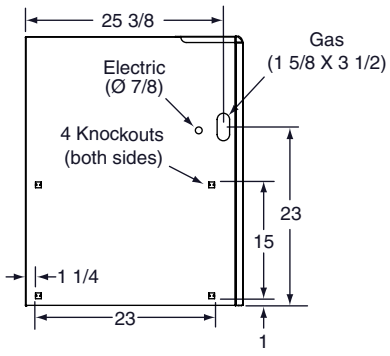
FIGURES & TABLES

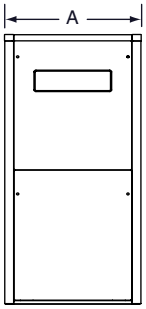
*SA 80+ UPFLOW FURNACE				
MODEL #'S	DIM. -A-	DIM. -B-	DIM. -C-	DIM. -D-
045C-23A	14 1/4	10 3/4	12 5/8	12 7/8
054C-23A				
072C-24B	17 1/2	11 3/4	15 7/8	16 1/8
090C-24B				
072C-35C	21	14	19 3/8	19 7/8
090C-35C				
108C-35C				
126C-45D	24 1/2	15 1/4	22 7/8	23 1/8

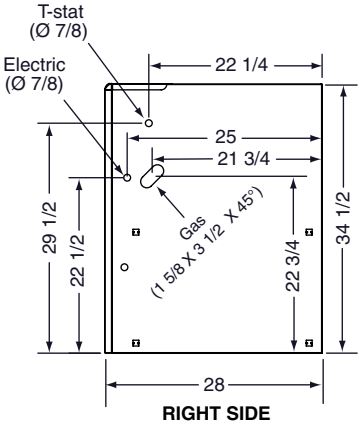
NOTE: Dimensions shown in Inches.





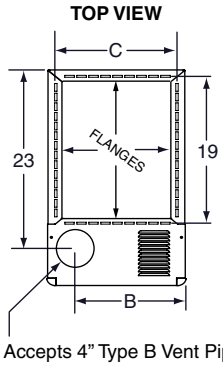


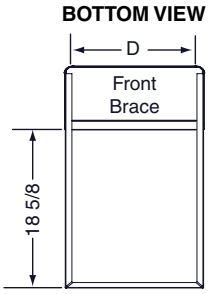


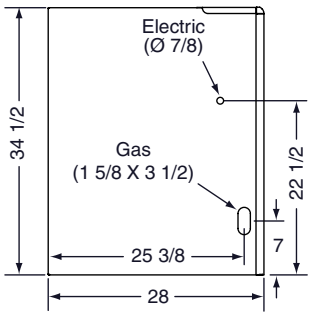


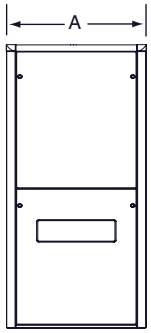
*SK 80+ DOWNFLOW FURNACE				
MODEL #'S	DIM. -A-	DIM. -B-	DIM. -C-	DIM. -D-
054C-23A	14 1/4	10 3/4	12 5/8	12 7/8
072C-24B	17 1/2	11 3/4	15 7/8	16 1/8
090C-24B				
108C-35C	21	14	19 3/8	19 5/8
126C-45D	24 1/2	15 1/4	22 7/8	23 1/8

NOTE: Dimensions shown in Inches.









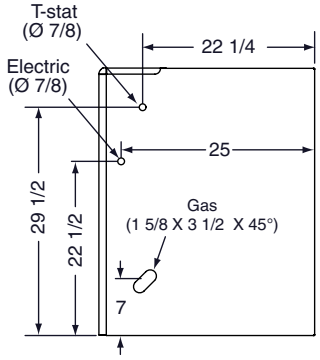


Figure 18. Furnace Dimensions

Airflow Data

MAXIMUM AIRFLOW & TEMPERATURE RISES (° F) *SA - UPFLOW / HORIZONTAL FURNACES - 80+ AFUE																	
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
SA045C-23A2 Bottom Return (45,000)	High*	1,368	24	1,318	25	1,261	26	1,216	27	1,168	29	1,116	30	1,060	31	997	33
	Med-High	1,090	31	1,070	31	1,035	32	1,004	33	971	34	925	36	888	38	831	40
	Med-Low**	854	39	816	41	797	42	772	43	725	46	696	48	661	50	607	55
	Low	727	46	698	48	669	50	629	53	597	56	559	60	523	64	480	69
SA045C-23A2 Side Return (45,000)	High*	1,337	25	1,301	26	1,268	26	1,239	27	1,200	28	1,157	29	1,100	30	1,037	32
	Med-High	1,078	31	1,053	32	1,014	33	987	34	959	35	927	36	888	38	839	40
	Med-Low**	823	41	799	42	772	43	751	44	722	46	686	49	640	52	599	56
	Low	702	47	673	50	650	51	623	54	589	57	547	61	511	65	462	72
SA054C-23A2 Bottom Return (54,000)	High*	1,368	29	1,318	30	1,261	32	1,216	33	1,168	34	1,116	36	1,060	38	997	40
	Med-High**	1,090	37	1,070	37	1,035	39	1,004	40	971	41	925	43	888	45	831	48
	Med-Low	854	47	816	49	797	50	772	52	725	55	696	57	661	61	607	66
	Low	727	55	698	57	669	60	629	64	597	67	559	72	523	76	480	83
SA054C-23A2 Side Return (54,000)	High*	1,337	30	1,301	31	1,268	32	1,239	32	1,200	33	1,157	35	1,100	36	1,037	39
	Med-High**	1,078	37	1,053	38	1,014	39	987	41	959	42	927	43	888	45	839	48
	Med-Low	823	49	799	50	772	52	751	53	722	55	686	58	640	63	599	67
	Low	702	57	673	59	650	62	623	64	589	68	547	73	511	78	462	87
SA072C)-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
SA072C-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
SA090C-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
SA090C-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
SA072C-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
SA072C-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
SA072C-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 3. *SA Upflow / Horizontal Blower Data

MAXIMUM AIRFLOW & TEMPERATURE RISES (° F)
*SA - UPFLOW / HORIZONTAL FURNACES - 80+ AFUE

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
SA090C-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
SA090C-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
SA090C-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
SA108C-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
SA108C-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
SA108C-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
SA126C-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
SA126C-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:

* 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 3. Continued

MAXIMUM AIRFLOW & TEMPERATURE RISES (° F) *SK - DOWNFLOW FURNACES - 80+ AFUE																	
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
SK054C-23A2 (54,000)	High*	1,346	30	1,309	31	1,285	31	1,257	32	1,224	33	1,183	34	1,133	35	1,076	37
	Med-High	1,060	38	1,034	39	1,010	40	985	41	960	42	926	43	890	45	843	47
	Med-Low**	815	49	778	51	755	53	727	55	698	57	665	60	633	63	587	68
	Low	692	58	662	60	631	63	600	67	569	70	536	75	511	78	473	85
SK072C-24B (72,000)	High*	1,675	32	1655	32	1640	33	1620	33	1590	34	1560	35	1520	35	1475	36
	Med-High	1,330	40	1315	41	1300	41	1280	42	1255	42	1230	44	1200	44	1150	46
	Med-Low**	1,180	45	1165	46	1150	46	1135	47	1115	48	1090	50	1060	50	1010	53
	Low	940	57	925	58	900	59	880	61	850	63	825	65	795	67	760	70
SK090C-24B (90,000)	High*	1,610	41	1590	42	1575	42	1560	43	1540	43	1495	46	1460	46	1415	47
	Med-High	1,295	51	1275	52	1260	53	1250	53	1220	55	1195	57	1170	57	1120	60
	Med-Low**	1,155	58	1235	54	1115	60	1095	61	1065	63	1040	66	1015	66	980	68
	Low	910	73	885	75	860	78	835	80	810	82	785	85	765	87	735	91
SK108C-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
SK126C-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:

* 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 4. *SK Downflow Blower Data

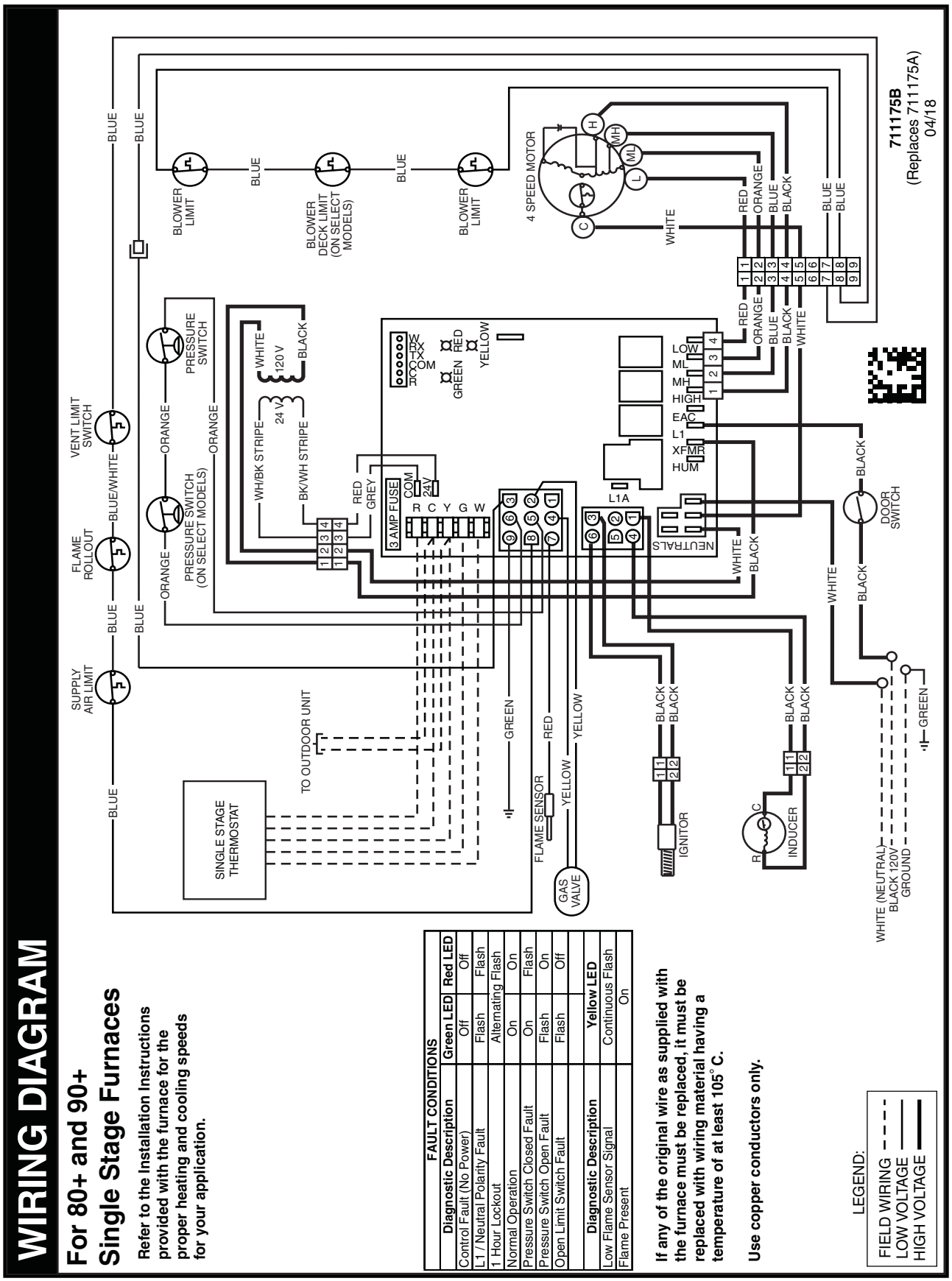


Figure 19. Wiring Diagram

Gas Information

GAS FLOW RATES (CUBIC FEET PER HOUR)			
TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF GAS METER		
	1	5	10
10	360	1,800	3,600
12	300	1,500	3,000
14	257	1,286	2,571
16	225	1,125	2,250
18	200	1,000	2,000
20	180	900	1,800
22	164	818	1,636
24	150	750	1,500
26	138	692	1,385
28	129	643	1,286
30	120	600	1,200
32	113	563	1,125
34	106	529	1,059
36	100	500	1,000
38	95	474	947
40	90	450	900
42	86	429	857
44	82	409	818
46	78	391	783
48	75	375	750
50	72	360	720
52	69	346	692
54	67	333	667
56	64	321	643
58	62	310	621
60	60	300	600
62	58	290	581
64	56	281	563

GAS FLOW RATES (CUBIC FEET PER HOUR)			
TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF GAS METER		
	1	5	10
66	55	273	545
68	53	265	529
70	51	257	514
72	50	250	500
74	49	243	486
76	47	237	474
78	46	231	462
80	45	225	450
82	44	220	439
84	43	214	429
86	42	209	419
88	41	205	409
90	40	200	400
92	39	196	391
94	38	191	383
96	38	188	375
98	37	184	367
100	36	180	360
102	35	176	353
104	35	173	346
106	34	170	340
108	33	167	333
110	33	164	327
112	32	161	321
114	32	158	316
116	31	155	310
118	31	153	305
120	30	150	300

Table 5. Gas Flow Rates

CAPACITY OF BLACK IRON GAS PIPE (CU. FT. PER HOUR) FOR NATURAL GAS (SPECIFIC GRAVITY - 0.60)								
NOMINAL PIPE DIAMETER (IN.)	LENGTH OF PIPE RUN (FEET)							
	10	20	30	40	50	60	70	80
1/2	130	90	75	65	55	50	45	40
3/4	280	190	150	130	115	105	95	90
1	520	350	285	245	215	195	180	170
1 1/4	1,050	730	590	500	440	400	370	350
1 1/2	1,600	1,100	890	760	670	610		

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

NOTE:

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.

Table 6. Gas Pipe Capacities

PROPANE DERATION CHART							
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 7. High Altitude Deration Chart for Propane Gas

LOCAL HEATING VALUES FOR NATURAL GAS									
ALTITUDE ABOVE SEA LEVEL	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 8. Natural Gas Heating Values

NATURAL GAS W/ 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 9. High Altitude Deration Chart for Natural Gas - High Heating Value

NATURAL GAS W/ 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 10. High Altitude Deration Chart for Natural Gas - Low Heating Value

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 11 or the wiring diagram (Figure 19, (page 27)) 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 20, (page 32) 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 switch and reset if necessary. See Figure 20 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.

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
Motor Fault	On	Off
DIAGNOSTIC DESCRIPTION	**YELLOW LED**	
Low Flame Sensor Signal	Continuous Flash	
Flame Present	On	

Table 11. Control Board Fault Conditions

FURNACE 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 Figure 20, (page 32). 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 - Prevents operation when blower is not operational.

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 - 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.

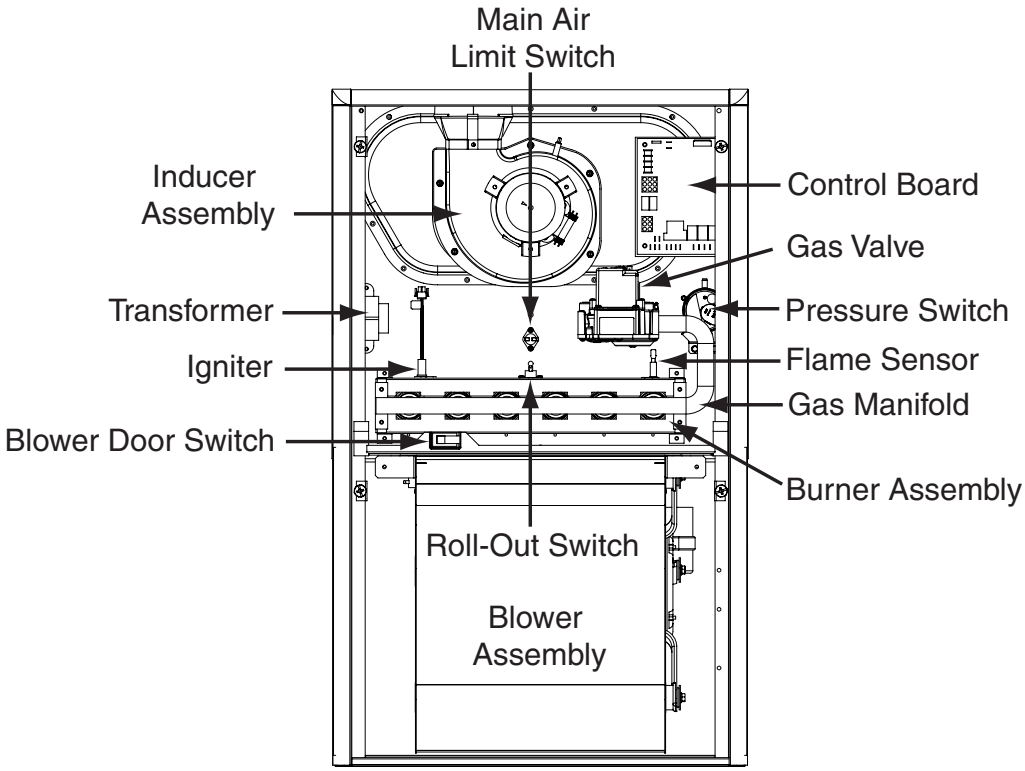
Gas Valve - Controls the flow of gas to the burners. When the gas valve is energized it automatically opens and regulates the gas pressure in the manifold.

Inducer Assembly - Vents products of combustion to the outside.

Pressure Switch - Verifies that the inducer is drawing the combustion gases through the heat exchanger. The pressure switch prevents furnace operation with excessive flue blockage or improper inducer operation.

Supply Air Limit Switch - Prevents the air temperature leaving the furnace from exceeding the maximum allowable outlet air temperature.

UPFLOW / HORIZONTAL FURNACE (*SA SERIES)



DOWNFLOW FURNACE (*SK SERIES)

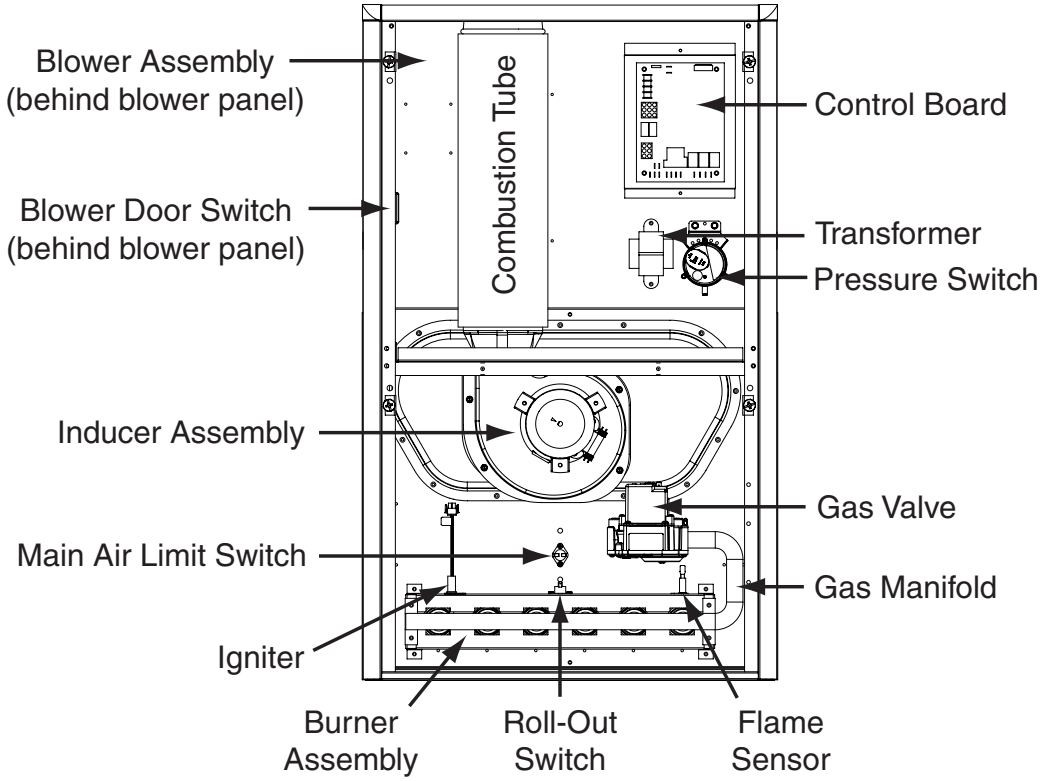


Figure 20. Component Locations

INSTALLATION CHECK LIST

INSTALLER NAME:		
CITY:	STATE:	
INSTALLATION ADDRESS:		
CITY:	STATE:	
UNIT MODEL #		
UNIT SERIAL #		
Minimum clearances as showni n Figure 1, (page 5)?	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

PROPOSITION 65 WARNING:

WARNING:This product contains chemicals known to the state of California to cause cancer.

WARNING:This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

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 unit 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.

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.)		
Installation Altitude:.....(FT.)		
Deration Percentage:.....(%)		
Furnace Input:.....(Btuh)		
Supply Air Temperature: .....(° F)		
Return Air Temperature: .....(° F)		
Temperature Rise: .....(° F)		

COMBUSTION AIR & VENTING SYSTEM		
Is there adequate fresh air supply for combustion and ventilation?	YES	NO
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

HRAI MEMBER COMPANY

AHRI CERTIFIED™ www.ahridirectory.org
Residential Furnaces
DOE 10 CFR Part 430

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