INSTALLATION INSTRUCTIONS

*TC Upflow / Horizontal 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:

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

⚠ 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:

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 30 (page 32) & Figure 31 (page 33) 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

⚠ WARNING:

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

- This furnace must be installed in accordance with these instructions, all applicable local building codes and the current revision of the National Fuel Gas Code (NFPA54/ ANSI Z223.1) or the Natural Gas and Propane Installation Code, CAN/CGA B149.1.
- 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 in the Combustion Air and Ventilation Requirements section (page 6).
- Provide adequate clearances around the vent air intake terminal as specified in Figure 7 (page 10), Figure 8 (page 10), Figure 9 (page 10), & Figure 10 (page 11).
- Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified on page 9.
- Never test for gas leaks with an open flame. Use a commercially available soap solution to check all connections. See page 19.
- This furnace is designed to operate with a maximum external pressure rise of 0.5 inches of water column. Consult the rating plate for the proper circulating air flow and temperature rise. It is important that the duct system be designed to provide the correct flow rates and external pressure 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 in the conditioned space. See page 12.

- 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 Commonwealth of Massachusetts requires compliance with regulation 248 CMR 4.00 and 5.00 for installation of through – the – wall vented gas appliances as follows:

1. For direct-vent appliances, mechanical-vent heating appliances or domestic hot water equipment, where the bottom of the vent terminal and the air intake is installed below four feet above grade the following requirements must be satisfied:
   a.) A carbon monoxide (CO) detector and alarm shall be placed on each floor level where there are bedrooms. The detector shall comply with NFPA 720 (2005 Edition) and be mounted in the living area outside the bedroom(s).
   b.) A (CO) detector shall be located in the room that houses the appliance or equipment and shall:
      • Be powered by the same electrical circuit as the appliance or equipment. Only one service switch shall power the appliance and the (CO) detector;
      • Have battery back-up power;
      • Meet ANSI/UL 2034 Standards and comply with NFPA 720 (2005 Edition); and Approved and listed by a Nationally Recognized Testing Laboratory as recognized under 527 CMR.
   c.) A Product-approved vent terminal must be used, and if applicable, a product-approved air intake must be used. Installation shall be in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the appliance or equipment at the completion of the installation.
   d.) A metal or plastic identification plate shall be mounted at the exterior of the building, four feet directly above the location of vent terminal. The plate shall be of sufficient size, easily read from a distance of eight feet away, and read "Gas Vent Directly Below".
2. For direct-vent appliances, mechanical-vent heating appliances or domestic hot water equipment where the bottom of the vent terminal and the air intake is installed above four feet above grade the following requirements must be satisfied:
   a.) A (CO) detector and alarm shall be placed on each floor level where there are bedrooms. The detector shall comply with NFPA 720 (2005 Edition) and be mounted in the living area outside the bedroom(s).
   b.) The (CO) detector shall:
      • Be located in the room that houses the appliance or equipment;
      • Be hard-wired or battery powered or both.
      • Shall comply with NFPA 720 (2005 Edition).
   c.) A product-approved vent terminal must be used, and if applicable, a product-approved air intake must be used. Installation shall be in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the appliance or equipment at the completion of the installation.

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/CGA-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 7.
- 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

Heating Load

This 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.

Two-stage furnaces operate at two input rates to better meet heating loads. The lower heating rate (low fire) is 65% of the high fire rate. The greatest degree of control over the furnace can be gained by controlling it with a two stage thermostat. This allows the thermostat to directly request either high or low fire. However, it is possible to operate the furnace using a single stage thermostat. In this application the furnace control can be set to increase from low to high fire, based on a timer. See Autostaging for Single Stage Thermostats (page 23).

Furnaces are properly sized to meet the expected maximum heating load. But this load occurs infrequently. So, during more moderate weather, the furnace is likely to use low fire a considerable part of the time. This is normal and has the benefit of quieter and more efficient operation.

Installation in a Garage

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.

⚠ WARNING:

Do not place combustible material 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.

Clearances to Combustible Materials

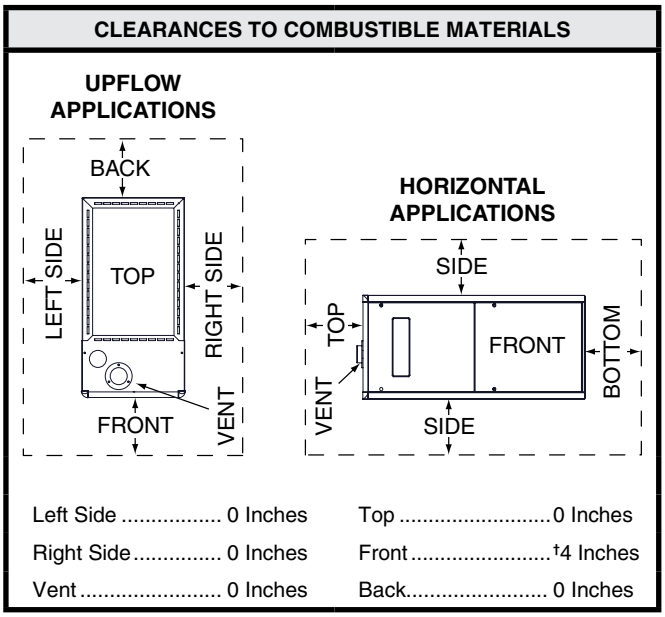
This furnace is Design Certified in the U.S. and Canada by CSA International for the minimum clearances to combustible materials. **NOTE:** The furnace is listed for installation on combustible or non-combustible flooring. However, wood is the only combustible flooring allowed for installation. To obtain 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 for minimum clearance requirements.

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.



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

Figure 1. Minimum Clearances to Combustible Materials

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:

- **This furnace must be vented in compliance with the current revision of the National Fuel Gas Code (ANSI-Z223.1/NFPA54). Instructions for determining the adequacy of an installation can be found in the current revision of the NFGC (ANSI Z223.1 / NFPA54). Consult local codes for special requirements. These requirements are for US installations as found in the NFGC.**
- **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.**
- **Requirements in Canada (B149.1) are structured differently. In Canada, venting shall conform to the requirements of the current (CAN/CGA B149.1) installation codes. Consult local codes for special requirements.**
- **Provisions must be made during the installation of this furnace that provide an adequate supply of air for combustion. The combustion air from the outside needs to be clear of chemicals that can cause corrosion. The inlet pipe should not be placed near corrosive chemicals such as those listed on page 5.**

⚠ 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:

This furnace must not be vented with other appliances, even if that appliance is of the condensing type. Common venting can result in severe corrosion of other appliances or their venting and can allow combustion gases to escape through such appliances or vents. Do not vent the furnace to a fireplace chimney or building chase.

This condensing furnace is certified for installation either as a Direct Vent (2-pipe) or Conventional (1-pipe) appliance. Direct Vent appliances draw combustion air from the outdoors and vent combustion products back outside. Installation with air taken from around the furnace is often referred to as Conventional installation - i.e. only the vent (exhaust) pipe is provided.

Another important consideration when selecting one or two pipe installation is the quality of the Indoor air which can sometimes be contaminated with various household chemicals . These chemicals can cause severe corrosion in the furnace combustion system. A 2-pipe installation has the additional advantage that it isolates the system from the effects of negative pressure in the house.

⚠ 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 testing negative pressure problems can be found in the National Fuel Gas Code.

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.

Direct Vent Systems

Direct vent appliances draw combustion air from the outdoors and vent combustion products back outside, isolating the entire system from the indoor space. It is important to make sure that the whole system is sealed and clearances to combustibles are maintained regardless of the installation being in a confined or unconfined space.

Conventional Vent Systems - Confined Spaces

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. Ducts must have cross - sectional area at least as large as the free area of their respective openings to the furnace space. Attics or crawl spaces must connect freely with the outdoors if they are the source of air for combustion and ventilation.

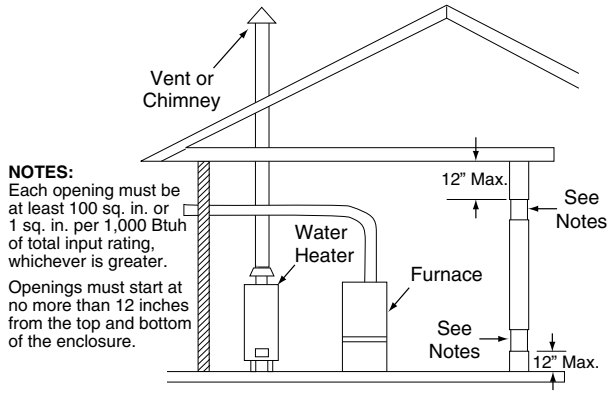
The required sizing of these openings is determined by whether inside or outside air is used to support combustion, the method by which the air is brought to the space, and by the total input rate of all appliances in the space. In all cases, the minimum dimension of any combustion air opening is 3 inches.

Air From Inside

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

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
38,000	100 sq. In	12 inches
60,000	100 sq. In	12 inches
80,000	100 sq. In	12 inches
100,000	100 sq. In	12 inches
120,000	120 sq. In	13 inches
140,000	140 sq. In	14 inches
160,000	160 sq. In	15 inches

Figure 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 square inch per 4,000 Btuh of total appliance input. The openings shall exchange directly, or by ducts, with the outdoor spaces (crawl or attic) that freely exchange with the outdoors. See Figure 3.

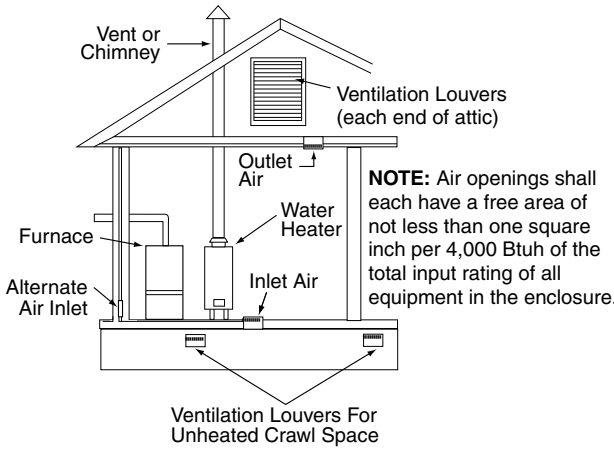
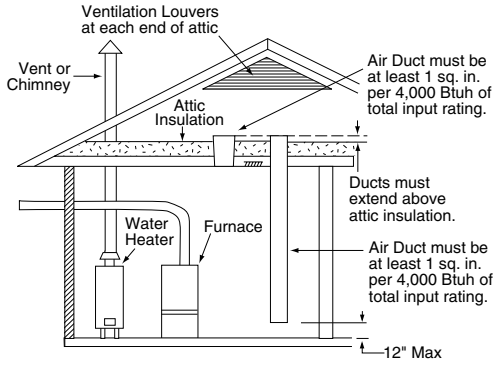


Figure 3. Combustion Air Drawn from a Crawl Space or Vented Attic

Outdoor Air Using Vertical Ducts

If combustion air is taken from outdoors through vertical ducts, the openings and ducts must have a minimum free area of one square inch per 4,000 Btuh of total appliance input. See Figure 4.



TOTAL INPUT RATING (BTUH)	MINIMUM FREE AREA (EACH OPENING)	ROUND DUCT DIAMETER
38,000	10 sq. In	4 inches
60,000	15 sq. In	5 inches
80,000	20 sq. In	5 inches
100,000	25 sq. In	6 inches
120,000	30 sq. In	6 inches
140,000	35 sq. In	7 inches
160,000	40 sq. In	8 inches

Figure 4. Combustion Air Drawn from Outside Through Vertical Ducts

Outdoor Air Using Horizontal Ducts

If combustion air is taken from outdoors through horizontal ducts, the openings and ducts must have a minimum free area of one square inch per 2,000 Btuh of total appliance input. Ducts must have cross - sectional area at least as large as the free area of their respective openings to the furnace space. See Figure 5.

Air Directly Through an Exterior Wall

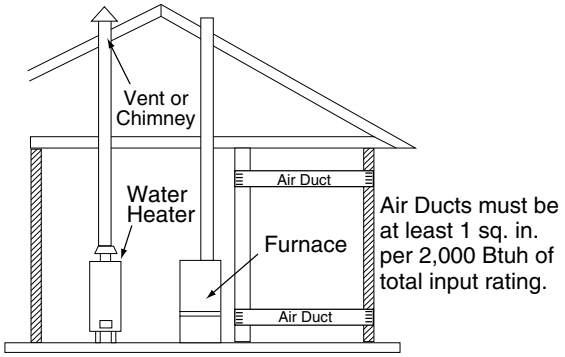
If combustion air is provided directly through an exterior wall, the two openings must each have free area of at least one square inch per 4,000 Btuh of total appliance input. See Figure 6.

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.

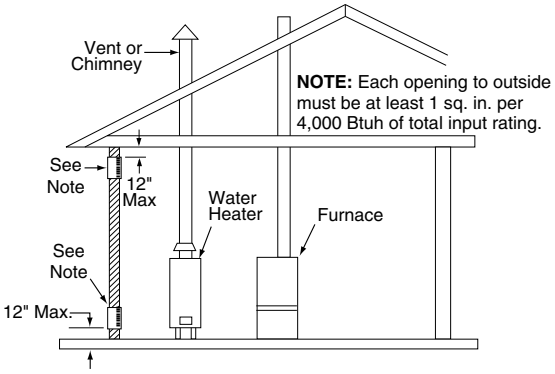
THE FOLLOWING CONDITIONS MUST BE MET:

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.



TOTAL INPUT RATING (BTUH)	MINIMUM FREE AREA (EACH OPENING)	ROUND DUCT DIAMETER
38,000	20 sq. In	5 inches
60,000	30 sq. In	6 inches
80,000	40 sq. In	7 inches
100,000	50 sq. In	8 inches
120,000	60 sq. In	9 inches
140,000	70 sq. In	10 inches
160,000	80 sq. In	10 inches

Figure 5. Combustion Air Drawn from Outside Through Horizontal Ducts



TOTAL INPUT RATING (BTUH)	MINIMUM FREE AREA (EACH OPENING)	ROUND DUCT DIAMETER
38,000	10 sq. In	4 inches
60,000	15 sq. In	5 inches
80,000	20 sq. In	5 inches
100,000	25 sq. In	6 inches
120,000	30 sq. In	6 inches
140,000	35 sq. In	7 inches
160,000	40 sq. In	8 inches

Figure 6. Combustion Air Drawn from Outside Through an Exterior Wall

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.

Conventional Vent Systems - Unconfined Spaces

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 below.

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 IV Venting

⚠ WARNING:

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

This furnace is classified as a "Category IV" appliance, which requires special venting materials and installation procedures. This section specifies installation requirements for Conventional (1-pipe) and Direct Vent (2-pipe) piping.

For 1- pipe installations, install vent piping as described in this section and provide air for combustion and ventilation according to the Combustion Air & Venting Requirements section (page 6). The length of vent and combustion air piping for either type of installation are shown in Table 1.

Category IV appliances operate with positive vent pressure and therefore require vent systems which are thoroughly sealed. They also produce liquid condensate, which is slightly acidic and can cause severe corrosion of ordinary venting materials. Furnace operation can be adversely affected by restrictive vent and combustion air piping.

The inducer assembly on this furnace can be rotated to vent the flue products out of the left or right side of the furnace. This increases the flexibility of which direction the vent pipe can exit the furnace.

Vent Pipe Material

Vent and combustion air pipe and fittings must be one of the following materials in the list and must conform to the indicated ANSI/ASTM standards.

MATERIALS	STANDARDS
Schedule 40PVC	D1785
PVC-DWV	D2665
SDR-21 & SDR-26	D2241
ABS-DWV	D2661
Schedule 40 ABS	F628
Foam / Cellular Core PVC	F891
*PolyPro® by DuraVent	ULC-S636
CPVC	D1784

*When using PolyPro®, all venting and fittings must be from the same manufacturer with no interchanging of other materials. Refer to specific instructions supplied with the PolyPro vent kits

When joining PVC to PVC, use cement that conforms to ASTM standard D2564. PVC primer must meet standard ASTM F656. When joining ABS to ABS, use cement that conforms to ASTM standard D2235. When joining PVC to ABS, use cement as specified in procedure from ASTM standard D3138

In Canada, all plastic vent pipes and fittings including any cement, cleaners, or primers must be certified as a system to ULC S636. However this requirement does not apply to the finish flanges or piping internal to the furnace.

FURNACE MODELS (BTU)	FURNACE INSTALLATION	SINGLE VENT PIPE LENGTH (FT.) WITH 1 LONG RADIUS ELBOW*		DUAL VENT PIPE LENGTH (FT.) WITH 1 LONG RADIUS ELBOW ON EACH PIPE*	
		OUTLET 2" DIAMETER	OUTLET 3" DIAMETER	INLET / OUTLET 2" DIAMETER	INLET / OUTLET 3" DIAMETER
38,000	Upflow	90	90	90	90
	Horizontal	50	90	50	90
60,000	Upflow	90	90	90	90
	Horizontal	50	90	50	90
80,000	Upflow	40	90	40	90
	Horizontal	30	90	30	90
100,000	Upflow	30	90	30	90
	Horizontal	30	90	30	90
120,000	Upflow	N/A	90	N/A	90
	Horizontal	N/A	90	N/A	90

***NOTES:**

1. Subtract 2.5 ft. for each additional 2 inch long radius elbow, 5 ft. for each additional 2 inch short radius elbow, 3.5 ft. for each additional 3 inch long radius elbow, and 7 ft. for each additional 3 inch short radius elbow. Subtract 5 ft for each 2" tee and 8 ft for each 3" tee. Two 45 degree elbows are equivalent to one 90 degree elbow.
2. This table applies for elevations from sea level to 2,000 ft. For higher elevations, decrease pipe lengths by 8% per 1,000 ft of altitude.

Table 1. Vent Pipe Lengths

Vent Pipe Length & Diameter

In order for the furnace to operate properly, the combustion air and vent piping must not be excessively restrictive.

- The venting system should be designed to have the minimum number of elbows or turns.
- Transition to the final vent diameter should be done as close to the furnace outlet as practical.
- Always use the same size or a larger pipe for combustion air that is used for the exhaust vent.

Table 1 indicates the maximum allowable pipe length for a furnace of known input rate, when installed with piping of selected diameter and number of elbows. To use the table, the furnace input rate, the centerline length and the number of elbows on each pipe must be known.

When estimating the length of vent runs, consideration must be made to the effect of elbows and other fittings. This is conveniently handled using the idea of “equivalent length”. This means the fittings are assigned a linear length that accounts for the pressure drop they will cause. For example: a 2” diameter, long radius elbow is worth the equivalent of 2.5 feet of linear run. A 90 degree tee is worth 7 ft.

The equivalent lengths of tees and various elbows are listed in Table 1 . Measure the linear length of the vent run and then add in the equivalent length of each fitting. The total length, including the equivalent fitting lengths, must be less than the maximum length specified in Table 1.

Vent Pipe Installation

⚠ CAUTION:

Combustion air must not be drawn from a corrosive atmosphere.

This furnace has been certified for installation with zero clearance between vent piping and combustible surfaces. However, it is good practice to allow space for convenience in installation and service.

- In the absence of local codes, the location of any combustion air inlet relative to any vent terminal must be at least 8 inches. This includes installations involving more than one furnace.
- The quality of outdoor air must also be considered. Be sure that the combustion air intake is not located near a source of solvent fumes or other chemicals which can cause corrosion of the furnace combustion system. (See list of substances on page 5).
- Route piping as direct as possible between the furnace and the outdoors. Horizontal piping from inducer to the flue pipe must be sloped 1/4” per foot to ensure condensate flows towards the drain tee or PVC trap. Longer vent runs require larger pipe diameters. Refer to the Inducer & Venting Options section on page 15 for additional information.
- If a Direct Vent (2-pipe) system is used, the combustion air intake and the vent exhaust must be located in the same atmospheric pressure zone. This means both pipes must exit the building through the same portion of exterior wall or roof as shown in Figure 7, Figure 8, Figure 9, & Figure 10 (page 11).
- Piping must be mechanically supported so that its weight does not bear on the furnace. Pipe supports must be installed a minimum of every 5 feet along the vent run to

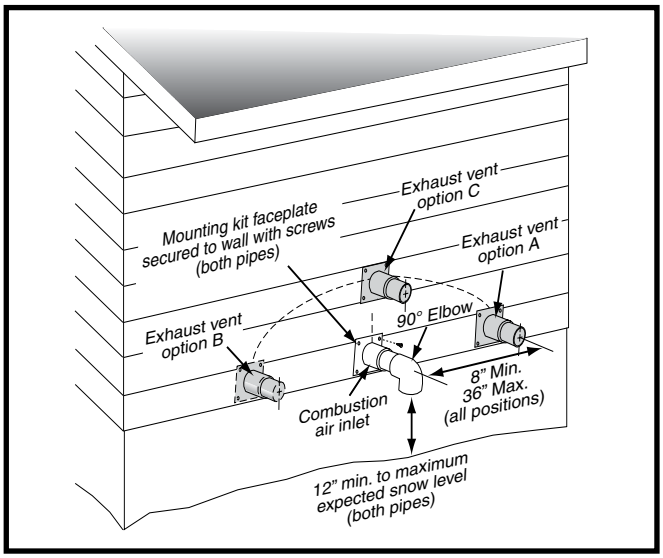


Figure 7. Inlet & Exhaust Pipe Clearances

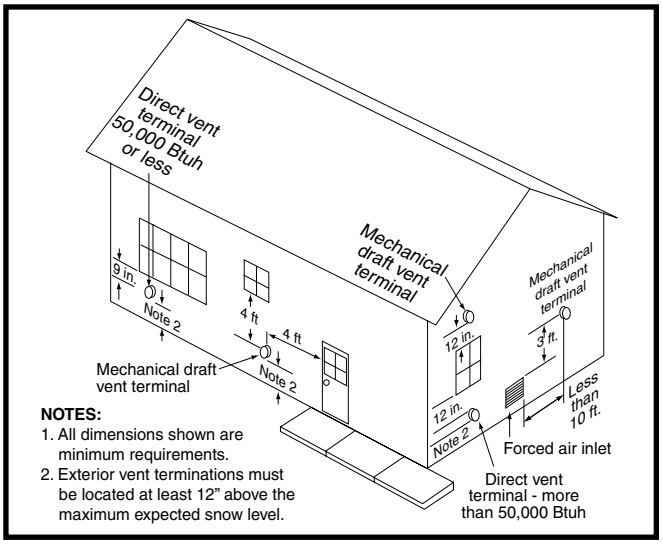


Figure 8. Vent Locations

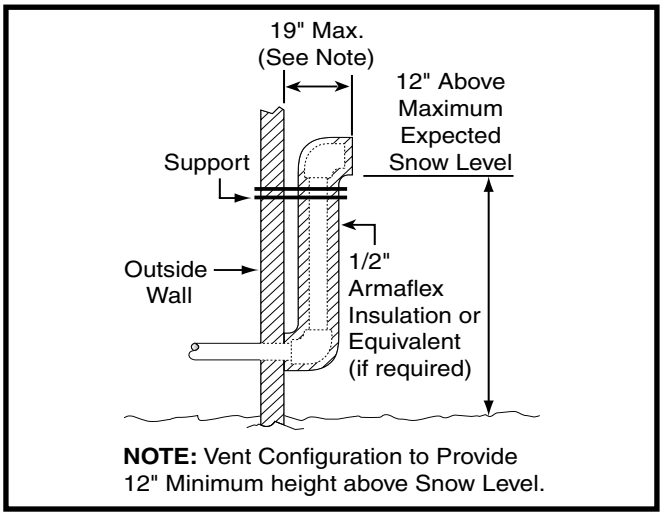


Figure 9. Alternate Horizontal Vent Installation

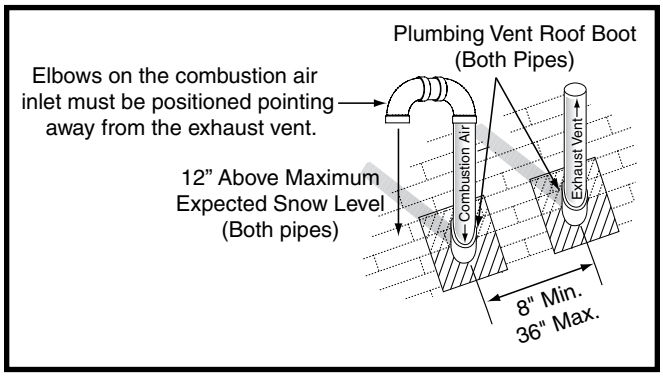


Figure 10. Vertical Vent Termination

ensure no displacement after installation. Supports may be at shorter intervals if necessary to ensure that there are no sagging sections that can trap condensate. See Figure 32 (page 35) and Figure 33 (page 36). It is recommended to install couplings along the vent pipe, on either side of the exterior wall. These couplings may be required by local code.

- If breakable connections are required in the combustion air inlet pipe (if present) and exhaust vent piping, then straight neoprene couplings for 2" or 3" piping with hose clamps can be used. These couplings can be ordered through your local furnace distributor. To install a coupling:

1. Slide the rubber coupling over the end of the pipe that is attached to the furnace and secure it with one of the hose clamps.
2. Slide the other end of the rubber coupling onto the other pipe from the vent.
3. Secure the coupling with the second hose clamp, ensuring that the connection is tight and leak free.

Outdoor Terminations - Horizontal Venting

- Vent and combustion air intake terminations shall be installed as depicted in Figure 7 & Figure 8 and in accordance with these instructions:
- Vent termination clearances must be consistent with the NFGC, ANSI 2223.1/NFPA 54 and/or the CSA B149.1, Natural Gas and Propane Installation Code. Table 11 (page 34) lists the necessary distances from the vent termination to windows and building air intakes.
- Vent and combustion air intake terminations must be located to ensure proper furnace operation and conformance to applicable codes. A vent terminal must be located at least 3 feet above any forced air inlet located within 10 feet. This does not apply to the combustion air inlet of a direct vent (two pipe) appliance. In Canada, CSA B149.1, takes precedence over these instructions. See Table 11.
- All minimum clearances must be maintained to protect building materials from degradation by flue gases. See Figure 7.
- For optimal performance, vent the furnace through a wall that experiences the least exposure to winter winds.
- The vent termination shall be located at least 3 ft. horizontally from any electric meter, gas meter, regulator and any relief equipment. These distances apply ONLY to U.S. installations. In Canada, CSA B149.1, takes precedence over these instructions.
- Do not install the vent terminal such that exhaust is directed into window wells, stairwells, under decks or into alcoves or similar recessed areas, and do not terminate above any public walkways.
- If venting horizontally, a side wall vent kit is available according to the pipe diameter size of the installation. For 2 inch pipe use side wall vent kit #904617, and for 3 inch pipe use kit #904347. **Please follow the instructions provided with the kit.**
- Concentric vent kits are available for both 2" and 3" applications. Each size has one that meets UL 1738 and one that meets ULC S636. Refer to the technical sales literature for kit numbers.
- When the vent pipe must exit an exterior wall close to the grade or expected snow level where it is not possible to obtain clearances shown in Figure 7 (page 10), a riser may be provided as shown in Figure 9 (page 10). Insulation is required to prevent freezing of this section of pipe. See Table 2 for vent freezing protection.

Outdoor Terminations - Vertical Venting

Termination spacing requirements from the roof and from each other are shown in Figure 10. The roof penetration must be properly flashed and waterproofed with a plumbing roof boot or equivalent flashing. Vent and combustion air piping may be installed in an existing chimney which is not in use provided that:

- Both the exhaust vent and air intake run the length of the chimney.
- The top of the chimney is sealed and weatherproofed.
- The termination clearances shown in Figure 10 are maintained.
- No other gas fired or fuel-burning equipment is vented through the chimney.

Vent Freezing Protection

⚠ CAUTION:

When the vent pipe is exposed to temperatures below freezing (i.e., when it passes through unheated spaces, chimneys, etc.) the pipe must be insulated with 1/2 inch thick sponge rubber insulation, Armaflex-type insulation or equivalent. Insulating pipe is important to avoid condensate icing.

- Table 2 lists the maximum length of flue pipe that can travel through an unconditioned space or an exterior space. The total vent length must not exceed the lengths noted in Table 1 (page 9). For Canadian installations, please refer to the Canadian Installation Code (CAN/CGA-B149.1) and/or local codes.
- For extremely cold climates or for conditions of short furnace cycles (i.e. set back thermostat conditions) the last

WINTER DESIGN TEMPERATURE	MAXIMUM FLUE PIPE LENGTH (FEET) IN UNCONDITIONED & EXTERIOR SPACES	
	WITHOUT INSULATION	WITH INSULATION*
20	45	70
0	20	70
-20	10	60

***NOTE:** Insulation thickness greater than 3/8 inch, based on an R value of 3.5 (ft x F x hr) / (BTU x in.)

Table 2. Vent Protection

18 inches of vent pipe can be reduced. It is acceptable to reduce from 3" to 2-1/2", 3" to 2", or 2" to 1-1/2" if the total vent length is at least 15 feet in length and the vent length is within the parameters specified in Table 1. The restriction should be counted as 3 equivalent feet. Smaller vent pipes are less susceptible to freezing, but must not be excessively restrictive. The length of the 2 inch pipe must not be longer than 18 inches.

- If furnace is installed horizontally, make sure the drainage port on the in-line drain assembly is pointed downward to ensure proper drainage of condensate. See Figure 36 (page 39) & Figure 37 (page 40).
- To prevent debris or creatures from entering the combustion system, a protective screen may be installed over the combustion air intake opening. The screens hole size must be large enough to prevent air restriction.

Existing Installations

When an existing furnace is removed from a vent system serving other appliances, the existing vent system may not be sized properly to vent the remaining appliances (For example: water heater). An improperly sized venting system can result in the formation of condensate, leakage, or spillage. The existing vent system should be checked to make sure it is in compliance with NFGC and must be brought into compliance before installing the furnace.

NOTE: If replacing an existing furnace, it is possible you will encounter an existing plastic venting system that is subject to a Consumer Product Safety Commission recall. The pipes involved in the recall are High Temperature Plastic Vent (HTPV). **If your venting system contains these pipes DO NOT reuse this venting system!** This recall does not apply to other plastic vent pipes, such as white PVC or CPVC. Check for details on the CPSC website or call their toll-free number (800) 758-3688.

Condensate Disposal

The method for disposing of condensate varies according to local codes. Consult your local code or authority having jurisdiction.

Each of the condensate drain lines must be J-trapped using field supplied parts. After the condensate lines are J-trapped, they may be combined together into a single run to the drain. The drain lines must be routed downward to ensure proper drainage from furnace.

Neutralizer kit P/N 902377 is available for use with this furnace. **Please follow the instructions provided with the kit.**

For Installations where there is limited clearance for the J-Trap (such as an attic where it may be installed between ceiling joists), either side of the J-Trap can be shortened to a minimum of 3 Inches. See Figure 11, (page 14).

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).
- If the maximum airflow is 1,600 CFM or more, it is required that two openings be used for return air on upflow furnaces.
- 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 way 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.
- It is good practice to seal all connections and joints with industrial grade sealing tape or liquid sealant. Requirements for sealing ductwork vary from region to region. Consult with local codes for requirements specific to your area.

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 26 (page 27) 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 the left or right side of the furnace for return air, the bottom panel (Figure 26) 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 26 (page 27)). 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 26) must be removed from the bottom of the furnace. See page 17 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.

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 26 (page 27) 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 26 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

*TC series gas furnaces offer a wide range of installation options, including installation in the upflow or horizontal positions with either right, left, or upflow return air.

General Requirements

- The furnace must be leveled at installation and attached to a properly installed duct system. See Figure 1 (page 5) for the required clearances needed to move the furnace to its installation point (hallways, doorways, stairs, etc).
- The furnace must be installed so that all electrical components are protected from water.
- The furnace must be installed upstream from a refrigeration system. (If applicable)
- The cabinet plug must always be used to close the hole in the side of the furnace when rotating the inducer.
- The furnace requires special venting materials and installation procedures. Refer to the Combustion Air & Venting Requirements section (page 6) 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.

*TC series gas furnaces are shipped with the bottom panel installed as shown in Figure 16 (page 18). 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 17.

Horizontal Furnaces

⚠ WARNING:

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

The *TC series gas furnace can be installed horizontally (Figure 11) 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 12.

*TC series furnaces are shipped with the bottom panel installed. If furnace is installed horizontally, remove the bottom panel from the furnace before attaching the duct system. See Bottom Panel Removal section (page 17).

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 11), 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 the furnace will be suspended from the ceiling, assemble a support frame (Figure 12) 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.

NOTE: 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.

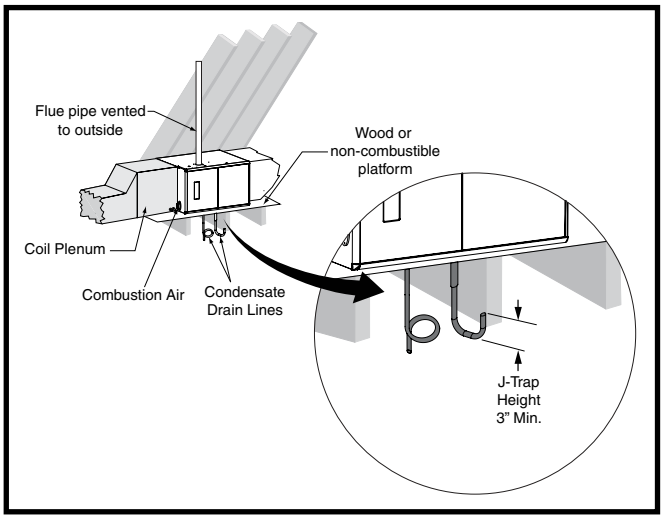


Figure 11. *TC Horizontally Installed on a Platform

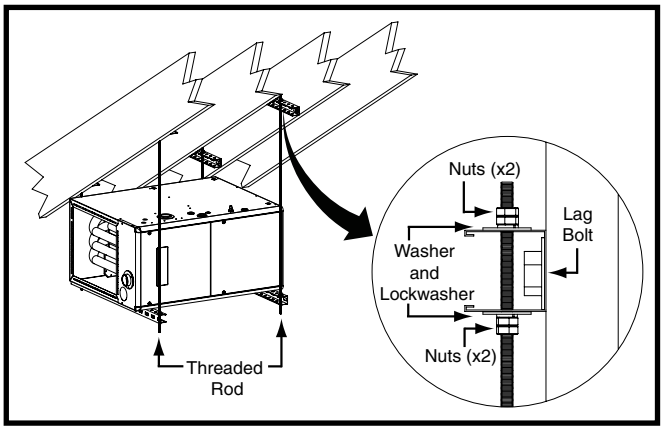


Figure 12. *TC Horizontally Suspended in Attic

Inducer & Venting Options

To increase installation flexibility, the inducer assembly can be rotated to 2 different positions **('B', 'C', & 'D' width cabinets only)**. Each variation has slightly different requirements with regard to condensate disposal and, in some cases, the need to seal the furnace cabinet.

IMPORTANT NOTES

- **For 'A' width cabinets, the vent pipe can only exit the cabinet through the top of the cabinet.**
- **The inducer assembly must never be positioned to vent downwards on horizontal installs.**

Before using Table 3, the number of pipes (1-pipe or 2-pipe) connected to the furnace must be known. Find the proper furnace style (upflow or horizontal) and then the side that the pipes will exit from the furnace. Finally select the option that properly matches your installation type from Figure 34 (page 37), Figure 35 (page 38), Figure 36 (page 39) & Figure 37 (page 40).

NOTE: It is important that Direct Vent (2-pipe) systems maintain an airtight flow path from the air inlet to the flue gas outlet. The furnace ships from the factory with two holes in the cabinet for the air inlet and flue gas outlet. In certain configurations, it is necessary to remove and relocate a plastic cap in the furnace cabinet. If changing the position of the air inlet and flue gas outlet, it is required that the previous hole be closed off with the plastic cap to maintain air tightness in the furnace. The hole locations are shown in Figure 26 (page 27).

'A' WIDTH CABINETS				
VENT		UPFLOW	HORIZ. RIGHT	HORIZ. LEFT
1-Pipe Options	Right	N/A	Option 7	N/A
	Up	Option 1	N/A	N/A
	Left	N/A	N/A	Option 8
2-pipe Options	Right	N/A	Option 9	N/A
	Up	Option 2	N/A	N/A
	Left	N/A	N/A	Option 10

B, C, & D, WIDTH CABINETS				
VENT		UPFLOW	HORIZ. RIGHT	HORIZ. LEFT
1-Pipe Options	Right	Option 3	N/A	N/A
	Up	N/A	Option 11	Option 12
	Left	Option 4	N/A	N/A
2-pipe Options	Right	Option 5	N/A	N/A
	Up	N/A	Option 13	Option 14
	Left	Option 6	N/A	N/A

Table 3. Vent & Inducer Blower Options

Inducer Assembly Rotation

⚠ WARNING:

Inducer rotation must be completed before the furnace is connected to gas and electric. If both utilities have been connected, follow the shutdown procedures printed on the furnace label and disconnect the electrical supply.

⚠ CAUTION:

It is good practice to label all wires prior to disconnection. Wiring errors can cause improper and dangerous operation.

1. Disconnect the electrical harness from the inducer assembly.
2. Remove the inducer assembly ground wire from the blower deck or door.
3. Remove 4 screws securing the inducer assembly to the header box.
4. Remove drain tube from inline drain assembly.
5. Rotate the inducer assembly to its new position.
6. Secure the inducer assembly to the header box by reinstalling the four screws.
7. Remove the cabinet plug from side of furnace and reinstall in hole on opposite side of cabinet.
8. Connect all condensate drains as required for your installation. See Table 3 and Figure 34 (page 37), Figure 35 (page 38), Figure 36 (page 39) or Figure 37 (page 40).
9. Reconnect the electrical harness to the inducer assembly.
10. Reconnect the inducer assembly ground wire to the blower deck or door.
11. Verify proper operation as detailed on the furnace label.

Pressure Switch Tubing

Figure 13 displays the proper routing of pressure switch tubing for *TC furnaces. All upflow / horizontal furnaces have two pairs of switches. One set is connected to the static tap on the inducer assembly and the other to the collector box.

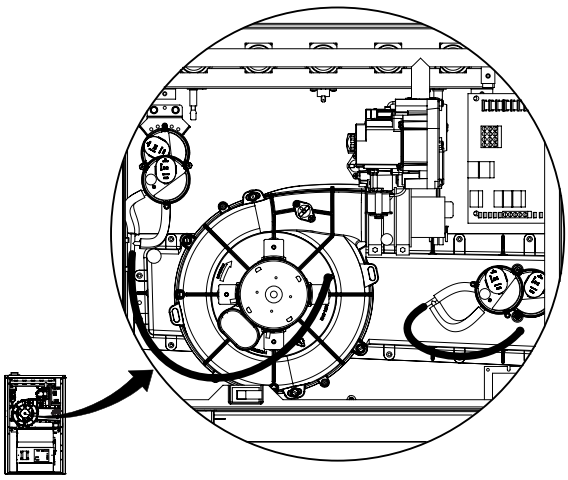


Figure 13. Pressure Switch Tubing for *TC Upflow / Horizontal Furnaces *Not applicable for 'A' Width Cabinets

Accessories

The components in Figure 14 & Figure 15 are included in the extra parts bag supplied with the purchase of *TC furnaces. Depending on your particular installation, some of these components are optional and may not be used. Please refer to the descriptions and accompanying figures when installing these items.

Finish Flange

The finish flange must be installed to vent the combustion air pipe through the top of the furnace. **NOTE:** For proper installation it is important that the pipe and screw holes in the finish flange, gasket, and cabinet are aligned.

1. Position flange gasket over hole in the furnace cabinet.
2. Position finish flange on top of the flange gasket. **NOTE**: Make sure the flange is properly oriented so that the FRONT lettering is located near the front of the furnace as shown in Figure 14.
3. Secure flange and gasket to cabinet with three field supplied sheet metal screws.

Rubber Grommets

The 2 1/4" rubber grommet is used to seal the opening between the furnace cabinet and the 2" PVC vent pipe. The rubber grommet should be installed in the 3" hole prior to running the vent pipe out of cabinet. No sealants are required. See Figure 14.

The 7/8" rubber grommet is used to seal the opening between the furnace cabinet and the gas pipe. The rubber grommet should be installed in the 1 5/8" hole prior to running the gas pipe into the cabinet. No sealants are required.

The 3/4" rubber grommet is used if venting out the left side of the cabinet and the drain tube is routed through the blower deck. Remove the plastic plug from the hole and install the grommet before routing the drain tube.

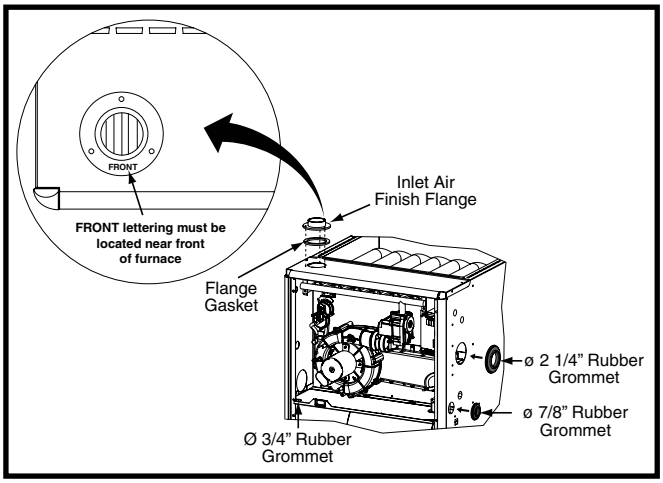


Figure 14. Finish Flange & Rubber Grommets

PVC Components

IMPORTANT NOTES:

- **Before permanently installing these components, it is recommended you dry-fit them first to ensure proper fit and alignment with other vent pipes.**
- **The 2" PVC pipe shown in Figure 15 is not provided in the extra parts bag.**

The 2" PVC Tee and Trap are used when the inducer is rotated to vent out thru the left or right side of the furnace cabinet. See Figure 15.

The 1/2" x 3/4" hose barb can be used to route the condensate drain to the outside of the cabinet. It must be installed from inside the cabinet with the threaded end inserted thru the 1 1/16" hole. See Figure 26 (page 27) for hole location. The condensate drain should be connected to the barbed end. Attach 1" PVC drain line to the threaded end.

Typical Orientation

1. Install the PVC Tee vertically on the 2" vent pipe that is extending out the side of the cabinet. Permanently bond them together using appropriate primer and cement. Refer to the typical orientation shown in Figure 15.
2. Install the reducer or PVC trap (if supplied) on the bottom end of the PVC Tee. Permanently bond them together using appropriate primer and cement.

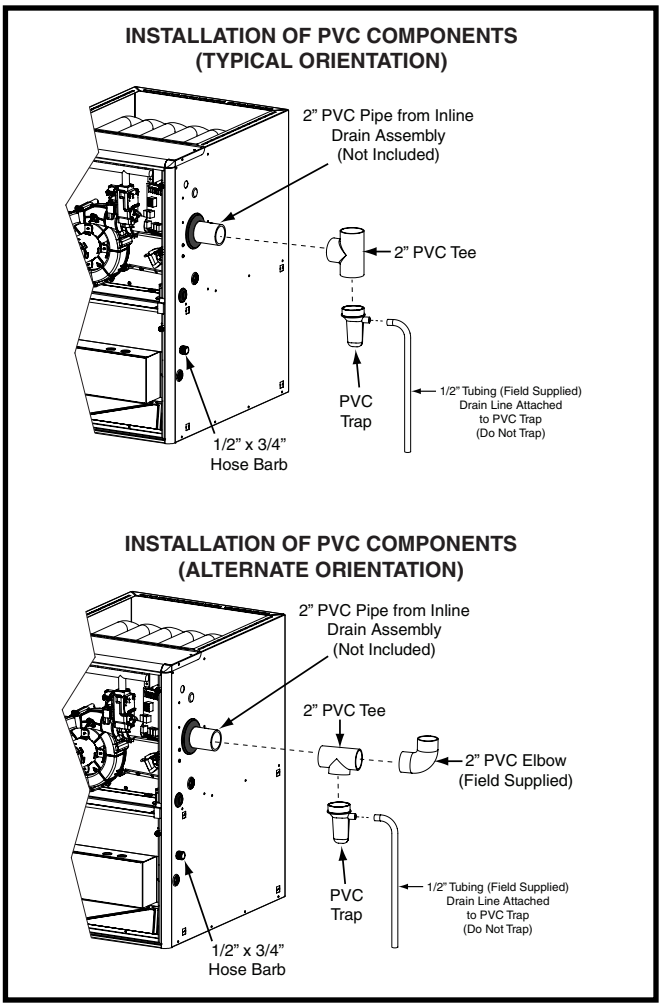


Figure 15. PVC Components

3. Install the 1/2” x 1/2” hose barb on the 2” PVC reducer. **NOTE:** Do not over tighten! Use an adequate amount of Teflon tape on the threads. Do not use liquid sealants.
4. Verify all connections and joints for tight fit and proper alignment with other vent pipes.

Alternate Orientation

1. Install the 2” PVC Tee horizontally on the 2” vent pipe that is extending out the side of the cabinet. Permanently bond them together using appropriate primer and cement. Refer to the alternate orientation shown in Figure 15.
2. Install the 2” PVC Elbow on the end of the 2” PVC Tee. Permanently bond them together using appropriate primer and cement.
3. Install the reducer or PVC trap (if supplied) on the bottom end of the PVC Tee. Permanently bond them together using appropriate primer and cement.
4. Install the 1/2” x 1/2” hose barb on the 2” PVC reducer. **NOTE:** Do not over tighten! Use an adequate amount of Teflon tape on the threads. Do not use liquid sealants.
5. Verify all connections and joints for tight fit and proper alignment with other vent pipes.

Condensate Drain Lines

IMPORTANT NOTE

If the furnace is installed in an area where temperatures fall below freezing, special precautions must be made for insulating condensate drain lines that drain to the outdoors. If condensate freezes in the lines, this will cause improper operation or damage to the furnace. It is recommended that all drain lines on the outside of the residence be wrapped with an industry approved insulation or material allowed by local code.

The placement of the condensate drain lines will depend on the configuration selected in Table 3 (page 15). The drain lines can be routed out the left or right side of the furnace, but must maintain a downward slope to ensure proper condensate drainage.

The J-trap may need to be rotated to the side that matches your setup in Figure 34 (page 37), Figure 35 (page 38), Figure 36 (page 39) & Figure 37 (page 40). To rotate the J-trap, loosen the clamp on the drain tube, rotate the J-trap to either side, and retighten the clamp.

It is permissible to locate the trap away from the furnace. The condensate drain system (J-trap and drain tube) should be no more than 30 equivalent feet while maintaining 1/4” per foot slope, and insulated if located in an unconditioned space.

THREE GENERAL RULES APPLY:

- Each condensate drain line must be separately trapped using a J-Trap or field supplied loop. After individually trapping the condensate lines, it is acceptable to combine the drains.
- There must always be a drain attached to the collector at the outlet of the secondary heat exchanger.
- There must always be a drain at the lowest point of the venting system. **NOTE:** If using a condensate pump, the furnace drain line must be installed above the pumps water line.

EXCEPTIONS AND CLARIFICATIONS TO THE GENERAL RULES:

- In some cases, the lowest point in the vent system is where it connects to the inducer (Option 12 & Option 14). In this case one drain at this location is sufficient.
- If the vent exits the furnace horizontally, the vent may be turned vertically with a tee. **The drip leg formed by the tee must include a drain** (Option 3, Option 4, Option 5, & Option 6).
- In certain cases, it is permitted to drain the inducer back into the top drain of the collector (Option 3, Option 5, Option 11, & Option 13). To ensure proper drainage of condensate, make sure the drain line does not sag or becomes twisted. The drain tube supplied with the furnace may need to be trimmed.

Bottom Panel Removal

The steps listed below describe how to remove the bottom panel from the furnace. See Figure 16 (page 18).

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

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 17 (page 18).

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

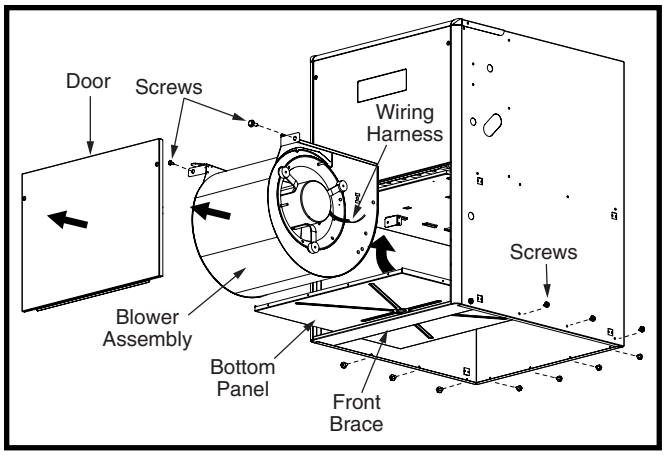


Figure 16. Bottom Panel Removal

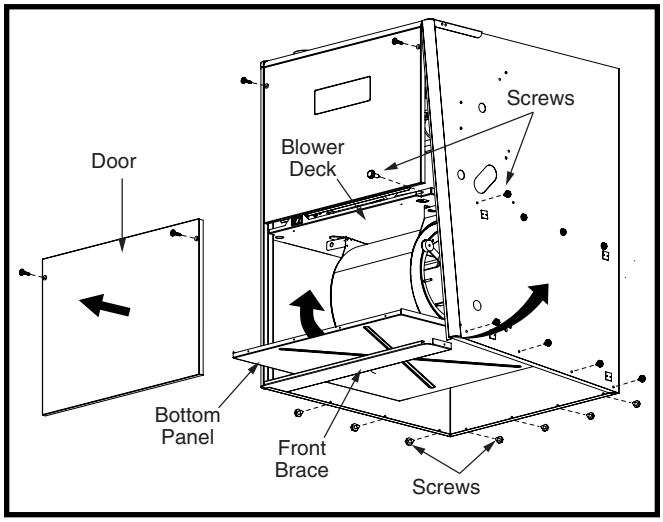


Figure 17. Alternate Removal Method

GAS SUPPLY & PIPING

⚠ WARNING:

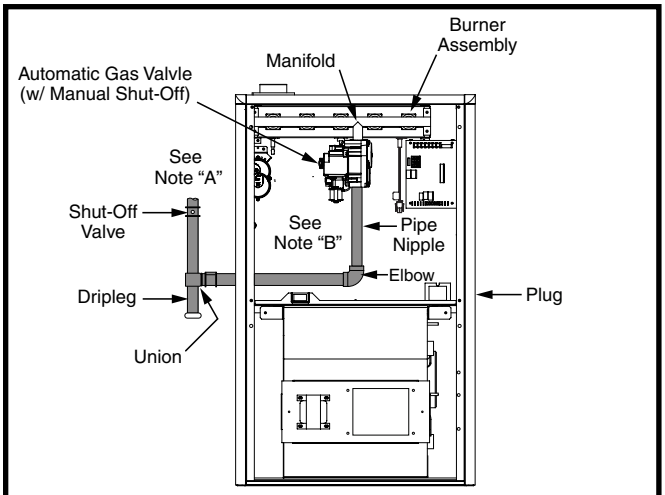
FIRE OR EXPLOSION HAZARD

- **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/CGA 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. 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. See Figure 18 (page 19).**
- **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 liquefied petroleum gases.**
- **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 reuse old flexible gas connectors.**
- **A drip leg should be installed in the vertical pipe run to the unit. See Figure 18.**

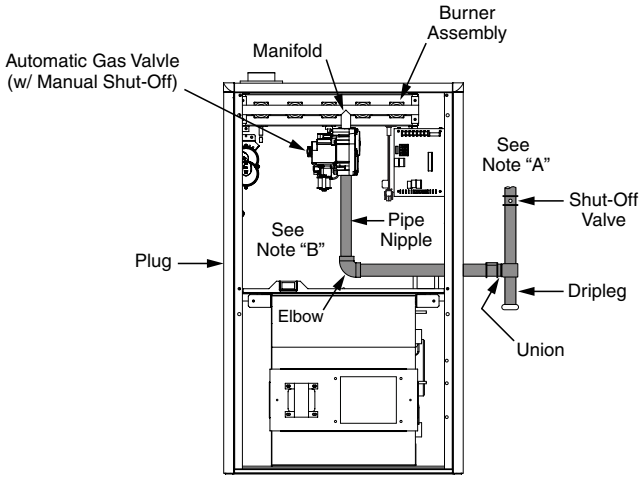


Left Side Entry
See Note “C”

NOTE A: Consult local codes for Shut- Off Valve location requirements.

NOTE B: Inducer assembly omitted for clarity of pipe installation.

NOTE C: Left side gas entry not available on ‘A’ width cabinets.



Right Side Entry

Figure 18. Typical Gas Connections

Table 6 (page 28) lists gas flow capacities for standard pipe sizes as a function of length in typical applications based on nominal pressure drop in the line.

NOTE: The ‘A’ width furnace can only be installed with right side gas entry. ‘B’, ‘C’, & ‘D’ width furnaces may be installed for either left or right side gas entry **(only)**.

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 18.

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 (Natural Gas Only)

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

⚠ WARNING:

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

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

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

1. The chemical mixture of the gas varies from region to region and is expressed as the “sea level heating value”.
2. The heating value varies by altitude. For this reason, particularly in high altitude areas, the local gas utility usually

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 (page 30) & 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 your local utility for the local heating value at your installation.
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. See example.

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 changing 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 & Adjusting the Input Rate section (page 24).

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 7,500 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.

Converting from Natural Gas 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 assembly in the pressure regulator. Approved conversion kits are listed below:

- Installations in the United States: For Propane (LP) conversion or for LP gas installations in altitudes between 2,000 ft. and 10,000 ft. above sea level, use the LP & High Altitude LP Gas Conversion Kit (P/N 905028) for Installations in the United States. **Please follow the instructions provided with the kit**.
- Installations in Canada: For Propane (LP) conversion or for LP Gas installations in altitudes between zero and 4,500 ft. above sea level, use the LP & High Altitude LP Gas Conversion Kit (P/N 905029) for Installations in Canada. **Please follow the instructions provided with the kit.**

If the installation is in the U.S. above 2,000 ft., refer to Table 7 (page 29) to determine the correct orifice size and regulator pressure. See Example below.

EXAMPLE

Elevation: .....5,000 feet
Type of Gas:..... Propane Gas
Input BTUH of Furnace: 80,000

From Table 7, find 5,000 and follow across the row; stop at the 80,000 btuh column. At first stage, the manifold pressure listed is 4.2, but at 2nd stage the pressure is 9.0. The listed orifice size is 56.

When conversion is complete, verify the manifold pressure and input rate are correct as listed in the Tables.

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).

IMPORTANT NOTE:

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

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 4 below.

IMPORTANT NOTES:

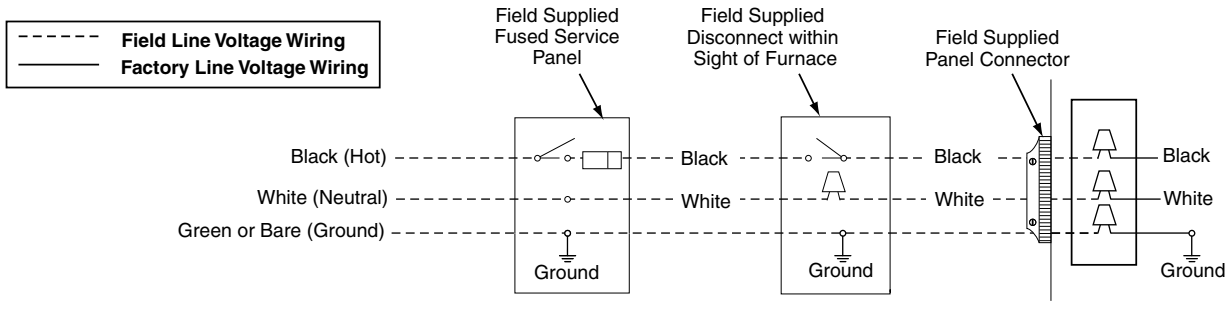
- **An electrical disconnect must be installed readily accessible from and located within sight of the furnace. See Figure 19 or the wiring diagram label inside of the control door. Any other wiring methods must be acceptable to authority having jurisdiction.**
- **Proper line voltage polarity must be 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 19.**

FURNACE INPUT (BTUH)	CABINET WIDTH (IN.)	NOMINAL ELECTRICAL SUPPLY	MAXIMUM OPERATING VOLTAGE	MINIMUM OPERATING VOLTAGE	MAXIMUM FURNACE AMPERES	MAXIMUM FUSE OR CIRCUIT BREAKER AMPS*
38,000	14 1/4	115-60-1	127	103	7.0	15
60,000	17 1/2	115-60-1	127	103	7.0	15
80,000	21	115-60-1	127	103	9.4	15
100,000	21	115-60-1	127	103	9.4	15
120,000	24 1/2	115-60-1	127	103	12.5	15

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.

* Time-delay fuses or circuit breakers are required.

Table 4. Wire Length & Voltage Specifications



Junction Box (may be int. or ext. to the furnace). These connections can be made in the field supplied disconnect at the furnace.
NOTE: Connections made within the furnace burner compartment do not require a junction box.

Figure 19. Line Voltage Field Wiring

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.
- Nortek no longer supports twinning of two stage furnaces. Please contact your furnace distributor for details.
- 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. Recommended minimum wire gauge for thermostat wiring is shown in Table 4 (page 21).
- 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.
- Depending on the type of air conditioning unit and thermostat used, both blower applications utilize three basic wiring configurations.

Single Stage AC & Single Stage Thermostat

This option does not use the full two-stage control capability of the furnace, but the possibility of timed autostaging is available. See also Autostaging for Single Stage Thermostats.

- Connect the thermostat's **W** output to the furnace control boards **W1** terminal. This allows the furnace to always run in low output mode. See Figure 20.
- Always connect the thermostat **C** & **R** to the furnace control board **C** & **R**.

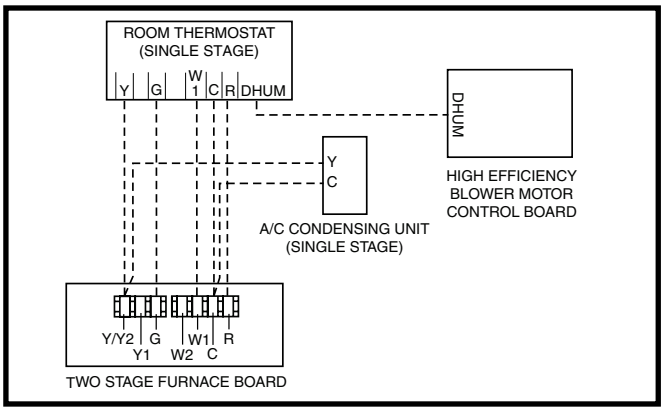


Figure 20. Wiring Configuration 1

- For cooling, connect the thermostats **Y** signal to the furnace control board **Y / Y2** terminal.
- Field supplied wires should also connect **Y / Y2** & **C** to the outdoor unit's **Y** & **C** terminals.

Single Stage AC & Two Stage Thermostat

This option uses the full two stage heating capability of the furnace with a single stage outdoor unit. See Figure 21.

- Connect the thermostat's **W1** & **W2** outputs to the furnace control board's **W1** & **W2** terminals.
- Always connect the thermostat **C** & **R** to the furnace control board **C** & **R**
- For cooling, connect the thermostats **Y** signal to the furnace control board **Y / Y2** terminal.
- Field supplied wires should also connect **Y / Y2** & **C** to the outdoor unit's **Y** & **C** terminals.

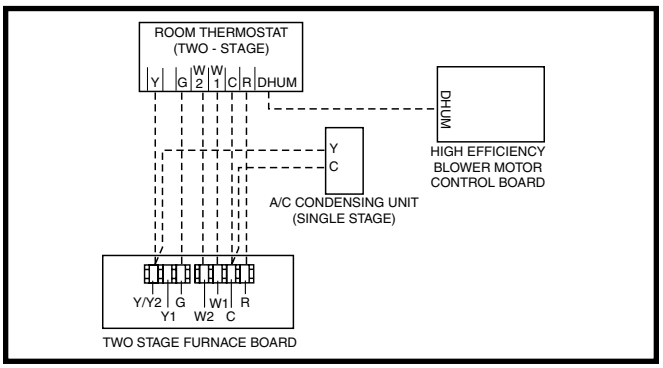


Figure 21. Wiring Configuration 2

Two-Stage AC & Two-Stage Thermostat

This option uses the full two stage heating capability of the furnace with a two stage outdoor unit. See Figure 22.

- Connect the thermostat's **W1** & **W2** outputs to the furnace control board's **W1** & **W2** terminals.
- Always connect the thermostat **C** & **R** to the furnace control board **C** & **R**.
- For cooling, connect the thermostat **Y** & **Y1** to the furnace control board's **Y / Y2** & **Y1** terminal's.
- Field supplied wires should also connect the **Y / Y2** & **Y1** signals to the outdoor unit's **Y** & **Y1** terminals.
- Connect terminal **C** to the outdoor unit's **C**.

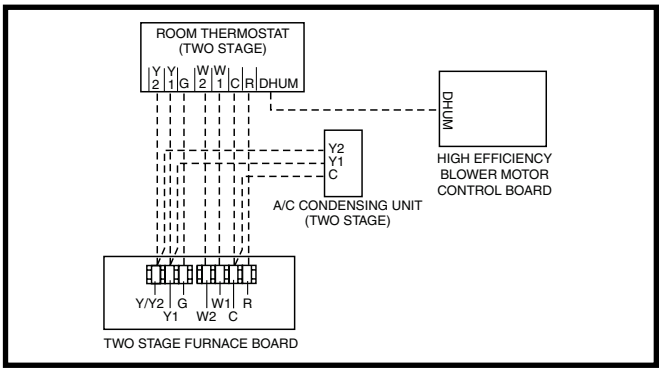


Figure 22. Wiring Configuration 3

Autostaging for Single Stage Thermostats

The Autostaging feature makes it possible to use a single stage thermostat and still receive some of the benefits of 2-stage furnace operation. If Autostage is enabled, the furnace will drop to **LOW** fire after initially starting in **HIGH** fire. After a period of 10 minutes, the furnace will then stage up to **HIGH** fire, until the heating load is met. See Figure 20 and the Low Voltage Connection section on page 22.

The autostaging option on the furnace control board is selected using the autostage jumper located near the thermostat terminal block. See Figure 29 (page 31). When the autostage jumper is moved from **OFF** to **ON**, the following occurs during a call for heat:

Setting the Autostage jumper in the **ON** position signals the control to utilize a 10 minute delay between **LOW** fire and **HIGH** fire when a call for heat is supplied via 24V signal to **W1**. This setting is the same as jumping **R** to **W2.**

NOTE: If the autostage jumper is in the **ON** position and a **W1** demand is present when power is applied to the furnace, the first heat cycle will run in second stage heat with no autostaging. After the first cycle, the furnace will resume normal autostaging operation. **DO NOT jump W1 & W2 together while the autostage jumper is in the ON position**.

Autostaging for Two-Stage Thermostats

The Autostage setting on the furnace control board Figure 29 (page 31) is disabled when shipped from the factory. This feature will be not used when paired with a two-stage thermostat. The autostage jumper setting (**P7**) must be kept on **OFF** to allow the thermostat to adjust stages.

Blower Speed Configuration

Two-stage furnaces use high efficiency circulating air motors that come in two variations, with each being controlled differently. The fixed speed motor control board maintains constant motor torque, while the variable speed motor control board maintains constant CFM airflow. Both boards use the same furnace control board.

Fixed Speed Blower Applications

NOTE: This section applies only to furnaces with fixed speed blowers. If your model has a variable speed blower, please consult the Variable Speed Blower Application section.

The fixed speed motor control board (Figure 27) contains a set of dip switches for setting the blower speed. Use pins 1 to 4 to set the blower speed for heating and pins 5 to 8 to set the speed for cooling.

For thermostats with a dehumidifier output, use a field supplied wire to connect the thermostat's dehumidifier output to the terminal marked **DEHUM**. The thermostat should be set so that the **DEHUM** output should be high (positive) when dehumidification is needed. See also Dehumidification Options section.

⚠ CAUTION:

The terminal marked "Y1_IN" on the variable speed motor control board is not an output to drive the outdoor unit. DO NOT connect Y1_IN on the motor control board to the outdoor unit.

Variable Speed Blower Applications

⚠ CAUTION:

The variable speed control board is used by other appliances. Many of the terminals and connections on the board are for other appliances and are not used in the two stage application. The only two-stage field connection to this board is the DHUM terminal, used to reduce the blower speed during cooling.

NOTE: This section applies only to furnaces with variable speed blowers. If your model has a fixed speed blower, please consult the Fixed Speed Blower Application section.

The variable speed motor control board shown in Figure 28 (page 31) has a set of dip switches for setting the base blower speed. Use pins 1 to 4 to set the blower speed for heating and pins 5 to 8 to set the speed for cooling.

Use field supplied wire to connect the thermostat's dehumidifier output to the terminal marked **DEHUM**. The thermostat should be set so that the **DEHUM** output is high (positive) when dehumidification is needed. See also Dehumidification Options section.

Dehumidification Options

Both motor control boards (Figure 27 & Figure 28) have a **DEHUM** connection that allows the system to increase the amount of humidity that is removed from the circulating air. This is accomplished by reducing the CFM and allowing the cooling coil to become colder. This will only occur when there is a call for cooling. There are many ways that this can be electrically wired:

- If the room thermostat incorporates a humidity sensor and **DEHUM** output, connect the **DEHUM** on the thermostat to the **DEHUM** terminal on the motor control board. See Figure 23 (page 24).
- If using a separate humidistat, connect the **DEHUM** & **R** terminals on the humidistat to the **DEHUM** & **R** terminals on the motor control board. See Figure 27 & Figure 28. In this option, the **DEHUM** output of the humidistat must be set to be normally open and closed when there is a call for humidification.
- If a humidistat is not available, it is an acceptable option to connect the **R** & **DEHUM** via a field supplied normally open relay. See Figure 24 (page 24). The **R** & **DEHUM** terminals should be connected across the normally open relay terminals. The **O** (**B**) & **C** terminals should then be connected across the relay coil. This option causes the blower to run at a reduced CFM for 10 minutes after a call for cooling.

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.

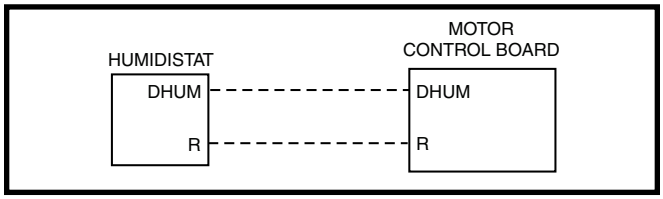


Figure 23. DEHUM Wiring Configuration with Humidistat

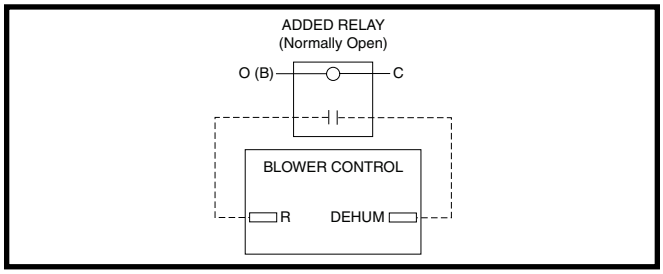


Figure 24. DEHUM Wiring Configuration without Humidistat

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 that all needed thermostat wires are securely connected to the correct leads on the terminal strip of the circuit board. See Figure 20 (page 22), Figure 21 (page 22), & Figure 22 (page 22).

√ Verify the gas line service pressure does not exceed 10.0 inches of water column, 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 button to reset the switch. **DO NOT install a jumper wire across a switch to defeat its function.** If a switch reopens on start-up, 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 furnace label.
4. Set the thermostat above room temperature and verify the Operating Sequence. See page 25.
5. After 5 minutes of operation, set the thermostat below room temperature and verify steps 11 & 12 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 and run the furnace in high fire 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 feet per hr by the heating value of the gas in Btu per cubic ft to obtain the input rate in Btuh. See example below.

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.

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

⚠ WARNING:

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

a. Remove plastic cap from pressure regulator.
b. Obtain the manifold pressure setting required for this installation by referring to Table 7 (page 29) for Propane or Table 9 & Table 10 (page 30) for Natural Gas.
c. Using an Allen wrench, turn the the LO Input Adjusting Screw on the LO side of the regulator to adjust the reduced input setting or turn the HI Input Adjusting Screw on the side of the regulator to adjust the full input setting. See Figure 25 (page 25). **NOTE**: Turning the adjusting screw clockwise increases the pressure and counterclockwise reduces the pressure.
d. Reinstall plastic cap after adjustment is complete.

Verifying & Adjusting Temperature Rise

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

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

For typical duct systems, the temperature rise will fall within the limits specified on the rating plate with the blower speed at the factory recommended setting. If the measured temperature

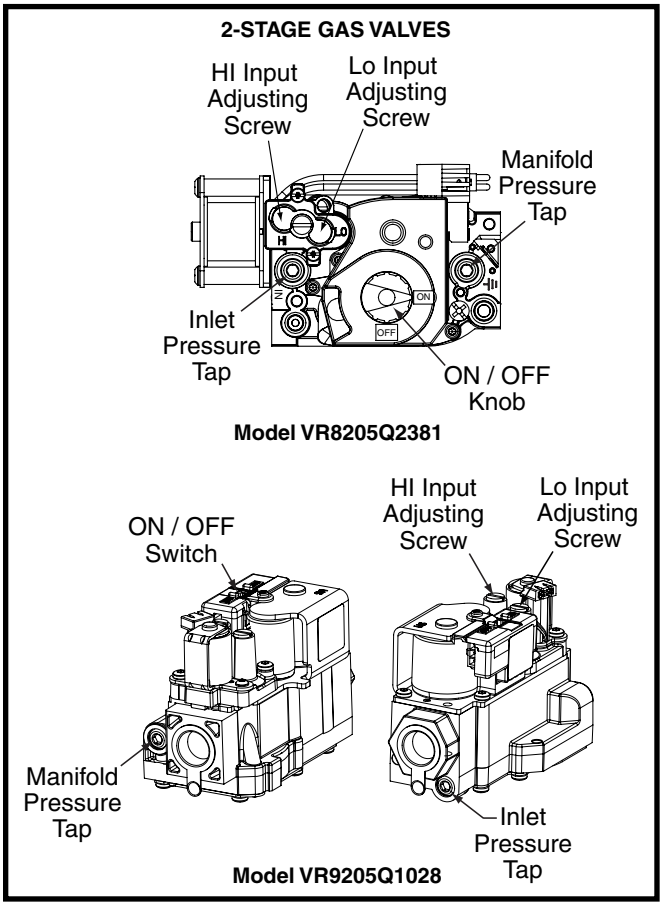


Figure 25. HI & LO Input Adjusting Screws

rise is outside the specified limits, it may be necessary to change the speed of the blower. **NOTE**: Lowering the blower speed increases the temperature rise and a higher blower speed will decrease the temperature rise.

The furnace is equipped with a multi-speed motor. Heating and cooling speed selection is made by moving the switches 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. 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 flame characteristics, change thermostat setting to below room temperature.
4. Verify burner flame is completely extinguished.
5. Replace the burner compartment door.

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

OPERATING SEQUENCE

The operating sequences for the heating, cooling, and fan modes are described below. Refer to the field and furnace wiring diagrams: Figure 19 (page 21), Figure 20 (page 22), Figure 21 (page 22), Figure 22 (page 22), Figure 30 (page 32), & Figure 31 (page 33).

Heating Cycle

1. The thermostat calls for heat by energizing the **W1** terminal with 24VAC.
2. The control checks to see the pressure switch is open. If the switch is closed, the furnace will shut down for 5 minutes before retrying
3. If the pressure switch is open, the control energizes the inducer motor and waits for the pressure switch to close. The pressure switch must close within 12 seconds.
4. The control runs the inducer for a 30 second pre-purge time.
5. The control energizes the igniter output for the appropriate adaptive warm-up time limit.
6. The furnace always ignites the burners in **high** fire. If the call for heat is for **low** rate, the furnace will move down to low fire after the flames stabilize.
7. If the flame is 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. The control energizes the blower on the selected HEAT speed 22 seconds after the gas valve opened. The gas valve and inducer remain energized.
9. If there is a call for **high** fire, the gas valve moves to the **high** fire position and the blower speeds are increased. The furnace will remain in **high** fire until the demand for heat is satisfied.
10. If autostaging is enabled (single stage thermostat) the demand for heat has lasted more than the selected time, the furnace automatically moves up to **high** fire. Autostage time is ON (10 minutes) or **OFF**, depending on the Jumper (**P7**) setting on the furnace control board.
11. 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.
12. The circulating air blower will continue to run for the selected Blower Off Delay(**P5**). This may be 60, 90, or 120 seconds depending on the jumper setting on the furnace control board.

Cooling Cycle

1. The thermostat calls for cooling by energizing the **Y / Y2** or **Y1** terminal with 24VAC.
2. The control energizes the blower in the cooling speed and sends 24VAC to the contactor in the condensing unit.
3. When the thermostat removes the call for cooling, the contactor in the outdoor condensing unit is de-energized and the control continues to run the fan for a period of 60 seconds.

Fan Mode

- When the thermostat energizes the **G** terminal for continuous fan (without calling for heat or cooling), the indoor fan is energized on the selected FAN speed.
- If a call for cooling occurs during continuous fan, the blower will switch over to the selected COOL speed.
- If the W terminal receives a call for heat during continuous fan, the blower will de energize.
- A call for fan is ignored while in lockout.
- For continuous fan operation, the blower motor will operate at 35% of the selected high-speed torque when equipped with a fixed speed motor control board. The blower motor will operate at 50% of the high-speed CMF when equipped with a variable speed motor control board.

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 that the thermostat is properly installed and is not affected by drafts or heat from lamps or other appliances.
- To achieve the best performance and minimize equipment failure it is recommended that a yearly maintenance checkup be performed. At a minimum, this check should include the following items:

Air Filter(s) - Air filter(s) are not supplied with the furnace as shipped from the factory. The installer must provide a high velocity filter and rack for a filter in the return air duct adjacent to the furnace, or in a return air grill to the furnace.

⚠ WARNING:

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

It is recommended that filters 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 the steps below and see Figure 38 (page 42) for component location.

1. Shut off gas supply to the furnace either 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 it's 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 Manifold Assembly to the Burner Box.
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 from which they were removed.

12. Follow the lighting instructions found on the furnace door to return the furnace to operation. Verify proper operation after servicing.

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.

⚠ 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.

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

Vent System - Check the inlet pipe (if applicable) and outlet pipe to ensure they are not blocked by debris. Any damaged section of vent pipe must be replaced, and any obstruction or blockage must be removed prior to operating the furnace.

FIGURES & TABLES

*TC 95.1% UPFLOW / HORIZONTAL FURNACE			
CABINET SIZE	**DIM. "A"**	**DIM. "B"**	**DIM. "C"**
'A' Cabinet	14 1/4	12 5/8	12 7/8
'B' Cabinet	17 1/2	15 7/8	16 1/8
'C' Cabinet	21	19 3/8	19 5/8
'D' Cabinet	24 1/2	22 7/8	23 1/8

NOTE: Dimensions shown in inches.

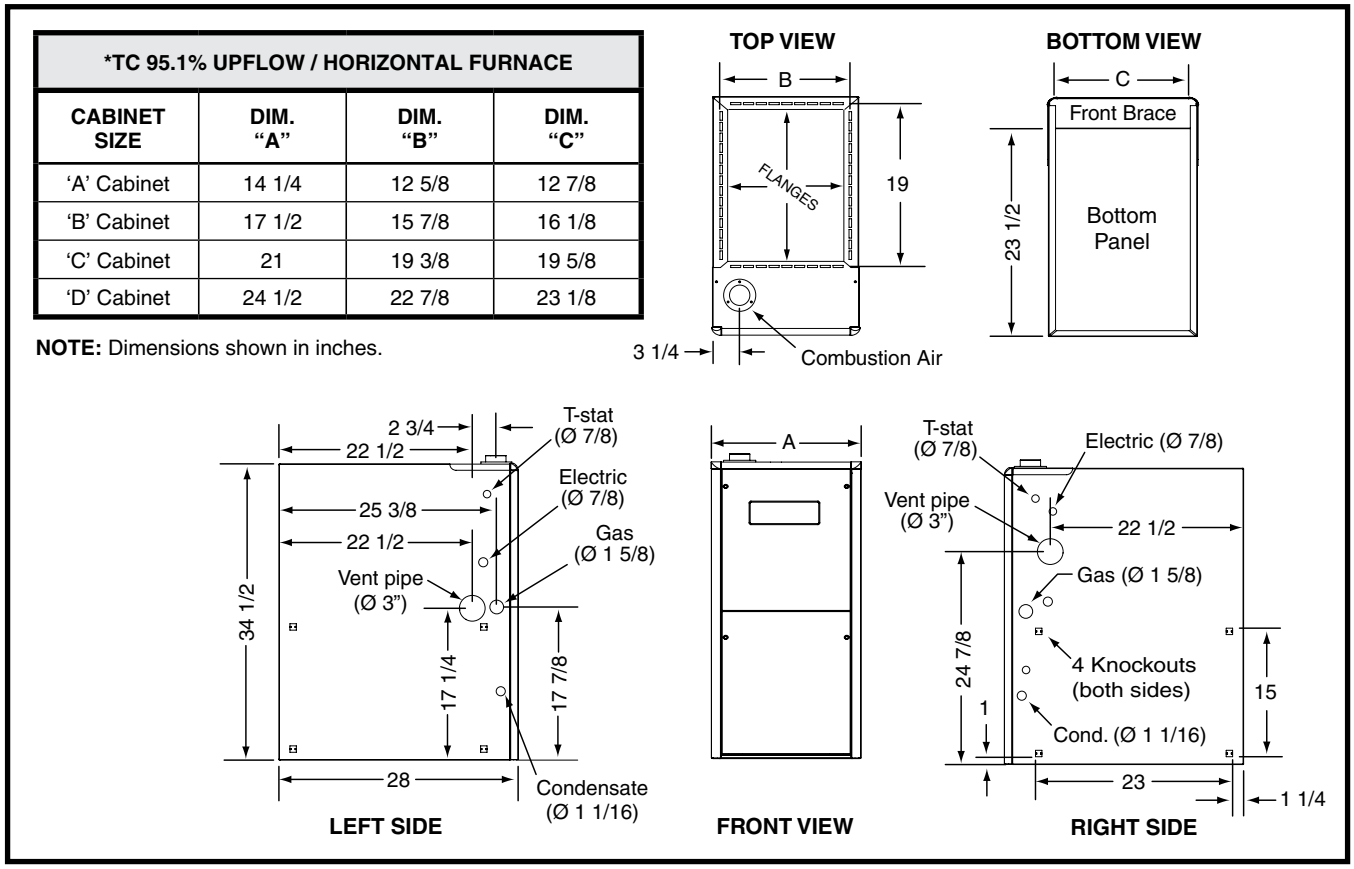


Figure 26. *TC Cabinet Dimensions

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 W/ 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

HIGH ALTITUDE DERATION – PROPANE GAS											
ALTITUDE ABOVE SEA LEVEL	INPUT (BTU) & STAGE										
	38,000		60,000		80,000		100,000		120,000		
	1ST	2ND	1ST	2ND	1ST	2ND	1ST	2ND	1ST	2ND	
0 to 1,999 FT	60		55		55		55		55		ORIFICE SIZE
	4.2	10.0	4.2	10.0	4.2	10.0	4.2	10.0	4.2	10.0	MANIFOLD PRESSURE
2,000 to 2,999 FT	60		55		55		55		55		ORIFICE SIZE
	4.2	9.0	4.2	9.0	4.2	9.0	4.2	9.0	4.2	9.0	MANIFOLD PRESSURE
3,000 to 4,999 FT	60		55		55		55		55		ORIFICE SIZE
	4.2	8.5	4.2	8.5	4.2	8.5	4.2	8.5	4.2	8.5	MANIFOLD PRESSURE
5,000 to 5,999 FT	61		56		56		56		56		ORIFICE SIZE
	4.2	10.0	4.2	10.0	4.2	10.0	4.2	10.0	4.2	10.0	MANIFOLD PRESSURE
6,000 to 7,999 FT	61		56		56		56		56		ORIFICE SIZE
	4.2	9.0	4.2	9.0	4.2	9.0	4.2	9.0	4.2	9.0	MANIFOLD PRESSURE
8,000 to 10,000 FT	61		56		56		56		56		ORIFICE SIZE
	4.2	8.5	4.2	8.5	4.2	8.5	4.2	8.5	4.2	8.5	MANIFOLD PRESSURE

Table 7. High Altitude Deration - 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

HIGH ALTITUDE DERATION – NATURAL GAS WITH HIGH HEATING VALUE											
ALTITUDE ABOVE SEA LEVEL	INPUT (BTU) & STAGE										
	38,000		60,000		80,000		100,000		120,000		
	1ST	2ND	1ST	2ND	1ST	2ND	1ST	2ND	1ST	2ND	
0 to 1,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	MANIFOLD PRESSURE
2,000 to 2,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	3.3	1.7	3.3	1.7	3.3	1.7	3.3	1.7	3.3	MANIFOLD PRESSURE
3,000 to 3,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	3.1	1.7	3.1	1.7	3.1	1.7	3.1	1.7	3.1	MANIFOLD PRESSURE
4,000 to 4,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	2.9	1.7	2.9	1.7	2.9	1.7	2.9	1.7	2.9	MANIFOLD PRESSURE
5,000 to 5,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	2.8	1.7	2.8	1.7	2.8	1.7	2.8	1.7	2.8	MANIFOLD PRESSURE
6,000 to 6,999 FT	55		48		48		48		48		ORIFICE SIZE
	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	MANIFOLD PRESSURE
7,000 to 7,999 FT	55		48		48		48		48		ORIFICE SIZE
	1.7	3.3	1.7	3.3	1.7	3.3	1.7	3.3	1.7	3.3	MANIFOLD PRESSURE
8,000 to 8,999 FT	55		48		48		48		48		ORIFICE SIZE
	1.7	3.0	1.7	3.0	1.7	3.0	1.7	3.0	1.7	3.0	MANIFOLD PRESSURE
9,000 to 9,999 FT	55		48		48		48		48		ORIFICE SIZE
	1.7	2.8	1.7	2.8	1.7	2.8	1.7	2.8	1.7	2.8	MANIFOLD PRESSURE

Table 9. High Altitude Deration - Natural Gas with HIGH Heating Value

HIGH ALTITUDE DERATION – NATURAL GAS WITH LOW HEATING VALUE)											
ALTITUDE ABOVE SEA LEVEL	INPUT (BTU) & STAGE										
	38,000		60,000		80,000		100,000		120,000		
	1ST	2ND	1ST	2ND	1ST	2ND	1ST	2ND	1ST	2ND	
0 to 1,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	MANIFOLD PRESSURE
2,000 to 2,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	MANIFOLD PRESSURE
3,000 to 3,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	3.4	1.7	3.4	1.7	3.4	1.7	3.4	1.7	3.4	MANIFOLD PRESSURE
4,000 to 4,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	3.2	1.7	3.2	1.7	3.2	1.7	3.2	1.7	3.2	MANIFOLD PRESSURE
5,000 to 5,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	3.1	1.7	3.1	1.7	3.1	1.7	3.1	1.7	3.1	MANIFOLD PRESSURE
6,000 to 6,999 FT	52		45		45		45		45		ORIFICE SIZE
	1.7	2.9	1.7	2.9	1.7	2.9	1.7	2.9	1.7	2.9	MANIFOLD PRESSURE
7,000 to 7,999 FT	55		48		48		48		48		ORIFICE SIZE
	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	MANIFOLD PRESSURE
8,000 to 8,999 FT	55		48		48		48		48		ORIFICE SIZE
	1.7	3.3	1.7	3.3	1.7	3.3	1.7	3.3	1.7	3.3	MANIFOLD PRESSURE
9,000 to 9,999 FT	55		48		48		48		48		ORIFICE SIZE
	1.7	3.1	1.7	3.1	1.7	3.1	1.7	3.1	1.7	3.1	MANIFOLD PRESSURE

Table 10. High Altitude Deration - Natural Gas with LOW Heating Value

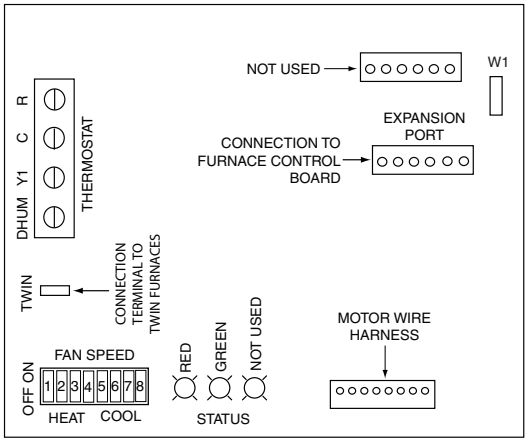


Figure 27. Two-Stage Fixed Speed Motor Control Board

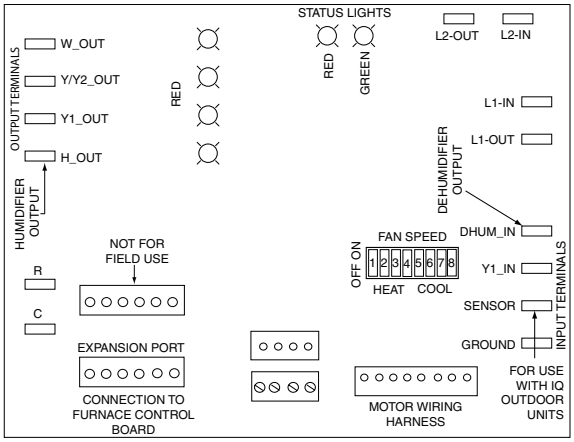


Figure 28. Two-Stage Variable Speed Motor Control Board

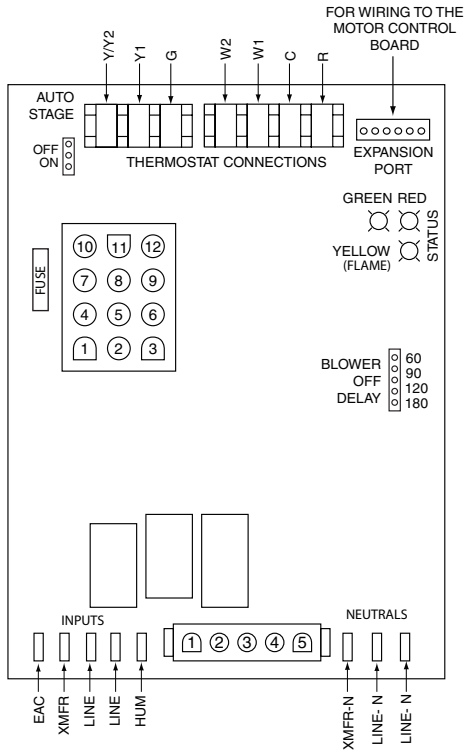


Figure 29. Two-Stage Furnace Control Board

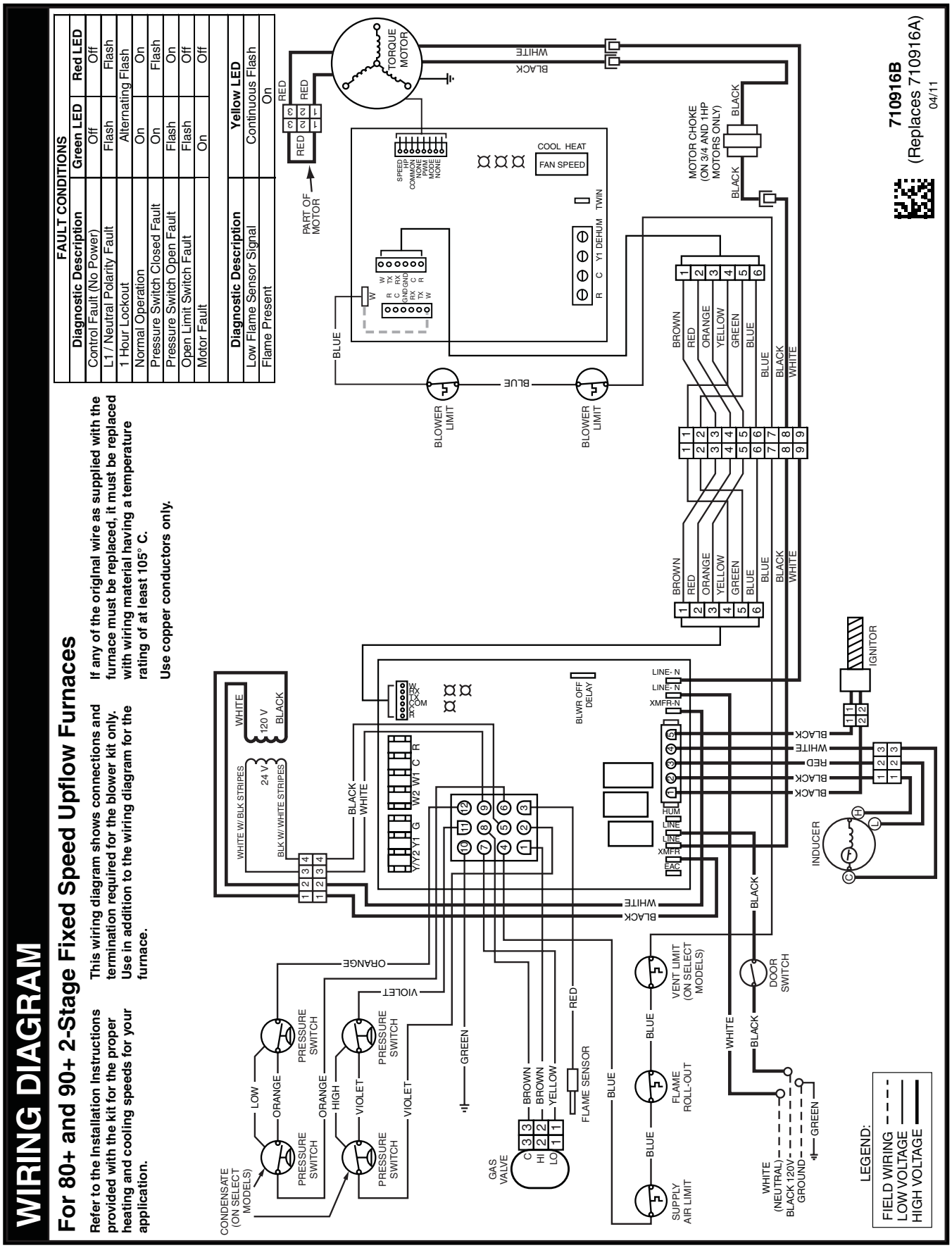


Figure 30. Wiring Diagram for Two-Stage, Fixed Speed Upflow Furnaces

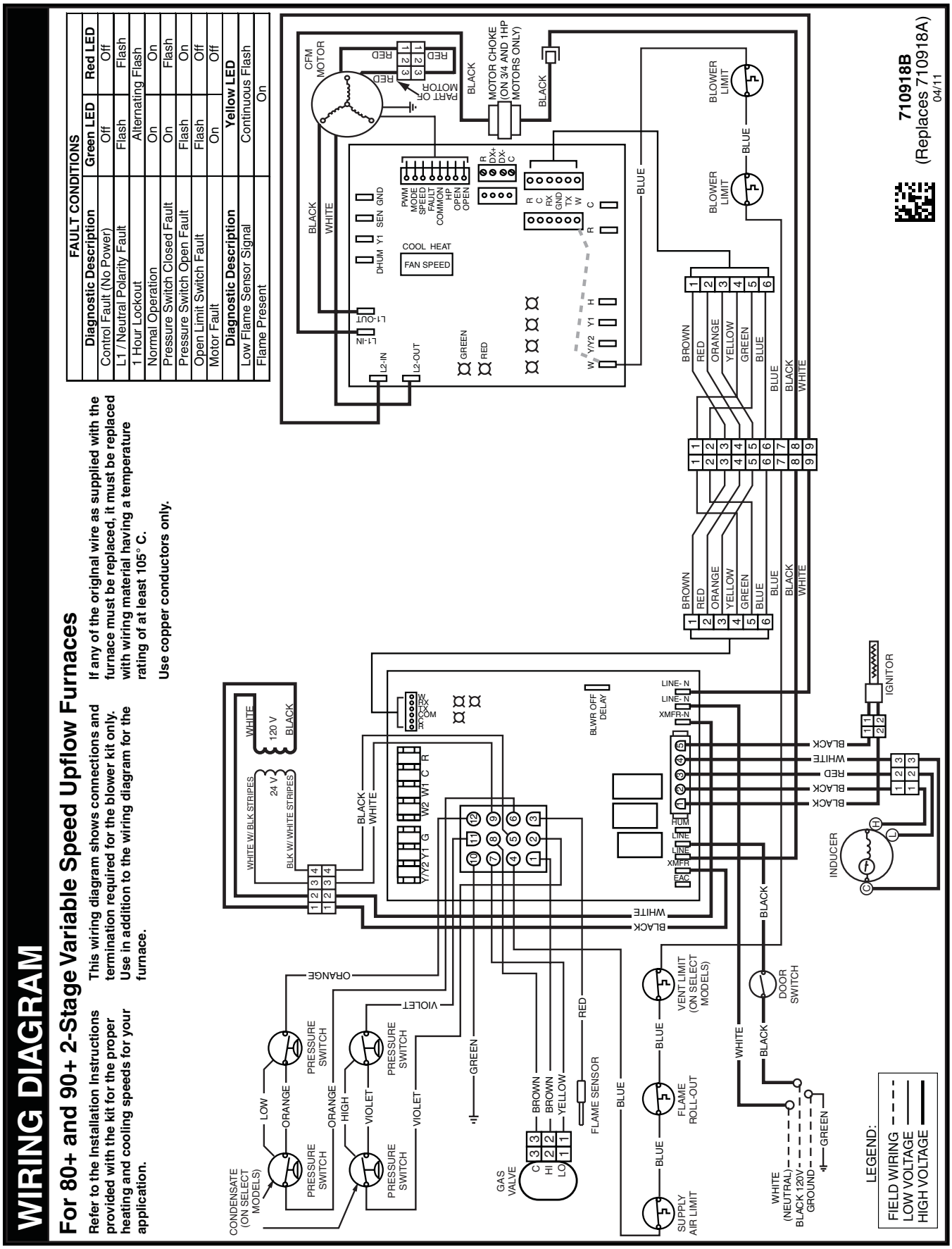
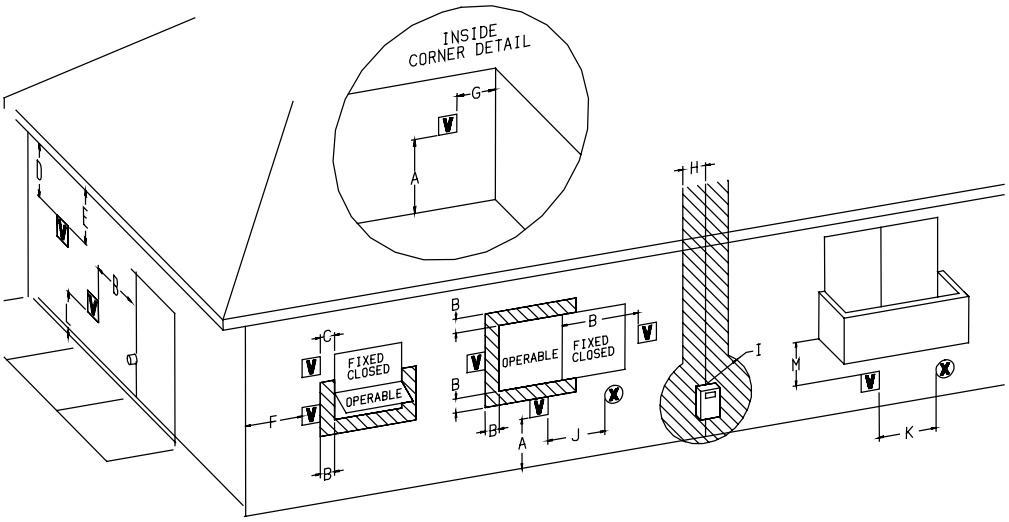


Figure 31. Wiring Diagram for Two-Stage, Variable Speed Upflow Furnaces

Venting Information



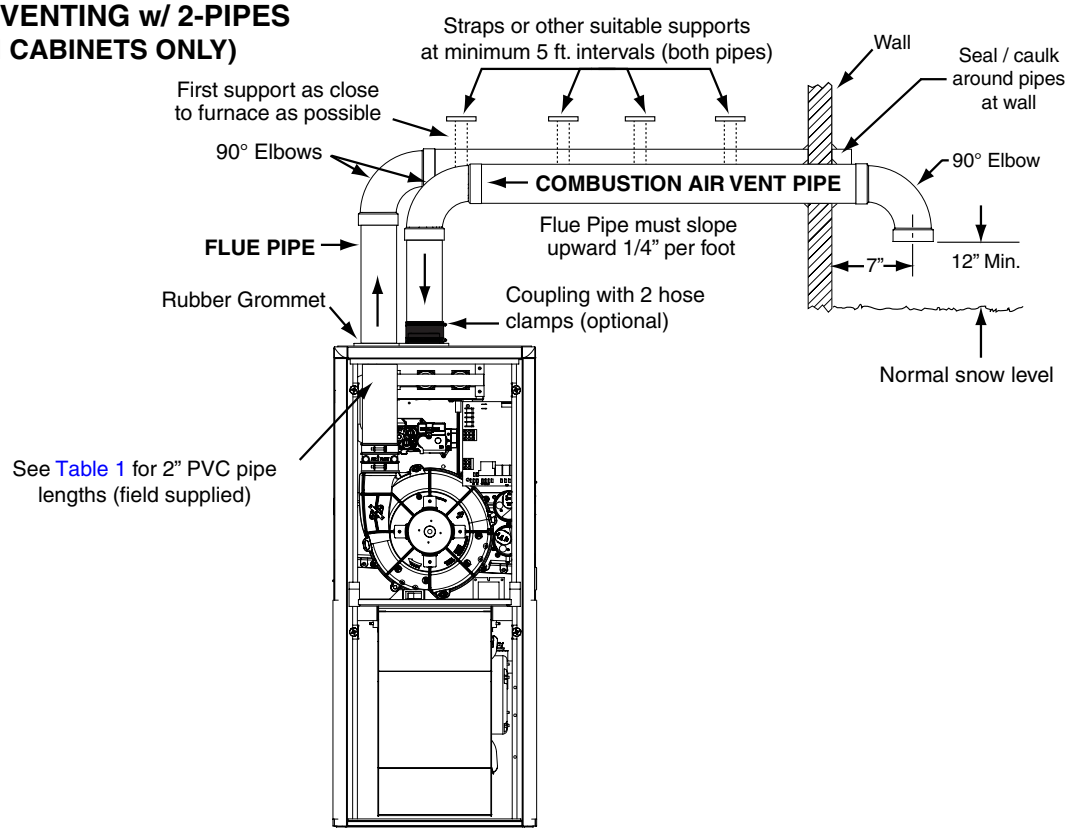
V VENT TERMINAL **X AIR SUPPLY INLET** **AREA WHERE TERMINAL IS NOT PERMITTED**

CLEARANCE LOCATION		CANADIAN INSTALLATIONS [A]	US INSTALLATIONS [B]	
		DIRECT VENT (2-PIPE) & CONVENTIONAL VENT (1-PIPE) FURNACES	DIRECT VENT (2-PIPE) FURNACES	CONVENTIONAL VENT (1-PIPE) FURNACES
A =	Clearance above grade, veranda, porch, deck, balcony, or maximum expected snow level.	12 inches (30cm)	12 inches (30cm)	12 inches (30cm)
B =	Clearance to window or door that may be opened.	6 inches (15cm) for appliances < 10,000 Btuh (3kW)	6 inches (15cm) for appliances < 10,000 Btuh (3kW)	4 ft. (1.2m) below or to side of opening; 1 ft. (300mm) above opening
		12 inches (30cm) for appliances 10,000 Btuh - 100,000 Btuh (30kW)	9 inches (23cm) for appliances 10,000 Btuh - 50,000 Btuh (30kW)	
		36 inches (91cm) for appliances > 100,000 Btuh (30Kw)	12 inches (30cm) for appliances > 50,000 Btuh (30Kw)	
C =	Clearance to permanently closed window	*	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61cm) from the center line of the terminal.	*	*	*
E =	Clearance to unventilated soffit.	*	*	*
F =	Clearance to outside corner.	*	*	*
G =	Clearance to inside corner.	*	*	*
H =	Clearance to each side of center line extended above meter/regulator assembly.	3 feet (91cm) within a height 15 feet above the meter/regulator assembly	*	*
I =	Clearance to service regulator vent outlet.	3 feet (1.83m)	*	*
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance.	6 inches (15cm) for appliances < 10,000 Btuh (3kW)	6 inches (15cm) for appliances < 10,000 Btuh (3kW)	4 ft. (1.2m) below or to side of opening; 1 ft. (300mm) above opening
		12 inches (30cm) for appliances 10,000 Btuh - 100,000 Btuh (30kW)	9 inches (23cm) for appliances 10,000 Btuh - 50,000 Btuh (30kW)	
		36 inches (91cm) for appliances > 100,000 Btuh (30Kw)	12 inches (30cm) for appliances > 50,000 Btuh (30Kw)	
K =	Clearance to mechanical air supply inlet.	6 feet (1.83m)	3 feet (91cm) above if within 10 feet (3m) horizontally	3 ft. (91cm) above if within 10 feet (3m) horizontally
L =	Clearance above paved sidewalk or driveway located on public property.	7 feet (2.13m) [c]	*	7 ft. (2.13m)
M =	Clearance under veranda, porch, deck, or balcony.	12 inches (30cm) [d]	*	*

a: In accordance with the current CSA B149.1 Natural Gas and Propane Installation Guide Code
b: In accordance with the current ANSI Z223.1 / NFPA 54 Natural Fuel Gas Code
c: A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
d: Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
* For clearances not specified in ANSI Z223.1 / NFPA 54 or CSA B149.1, the following statement shall be included: “Clearance in accordance with local installation codes, and the requirements of the gas supplier and the manufacturers installation instructions”

Table 11. Vent Termination Clearances

HORIZONTAL VENTING w/ 2-PIPES
('A' WIDTH CABINETS ONLY)



VERTICAL VENTING w/ 2-PIPES
('A' WIDTH CABINETS ONLY)

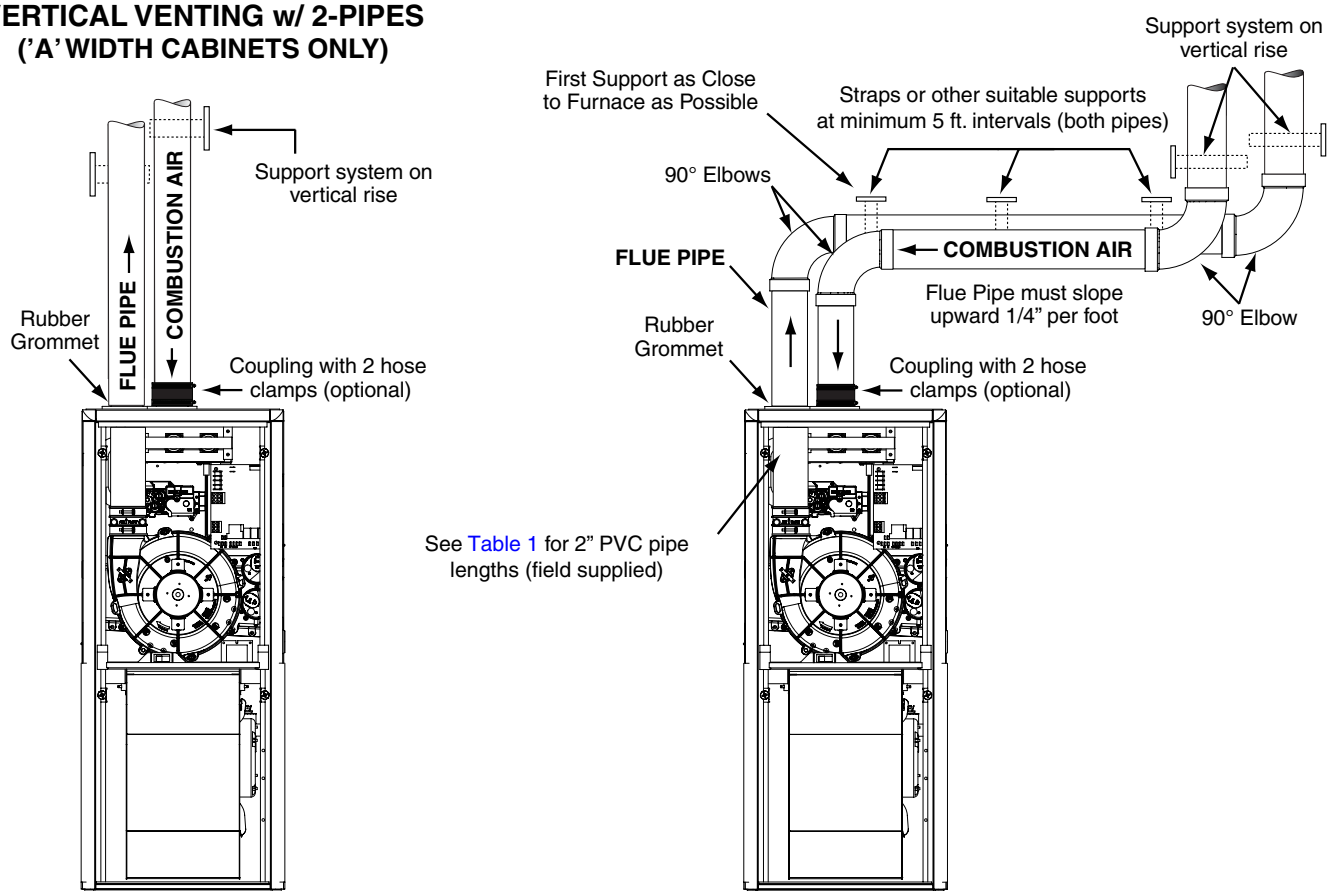
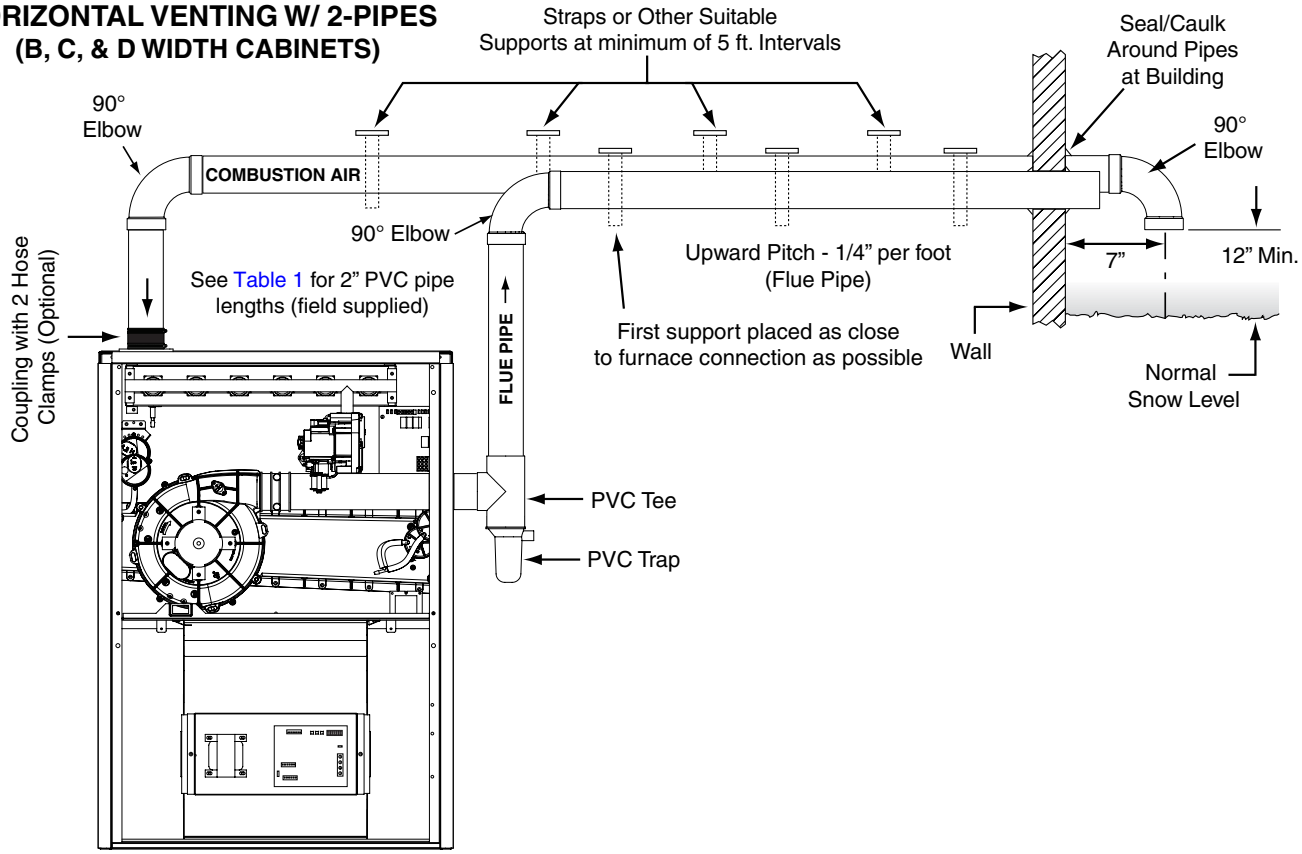


Figure 32. Horizontal & Vertical Venting (A Width Cabinets)

HORIZONTAL VENTING W/ 2-PIPES (B, C, & D WIDTH CABINETS)



VERTICAL VENTING W/ 2-PIPES (B, C, & D WIDTH CABINETS)

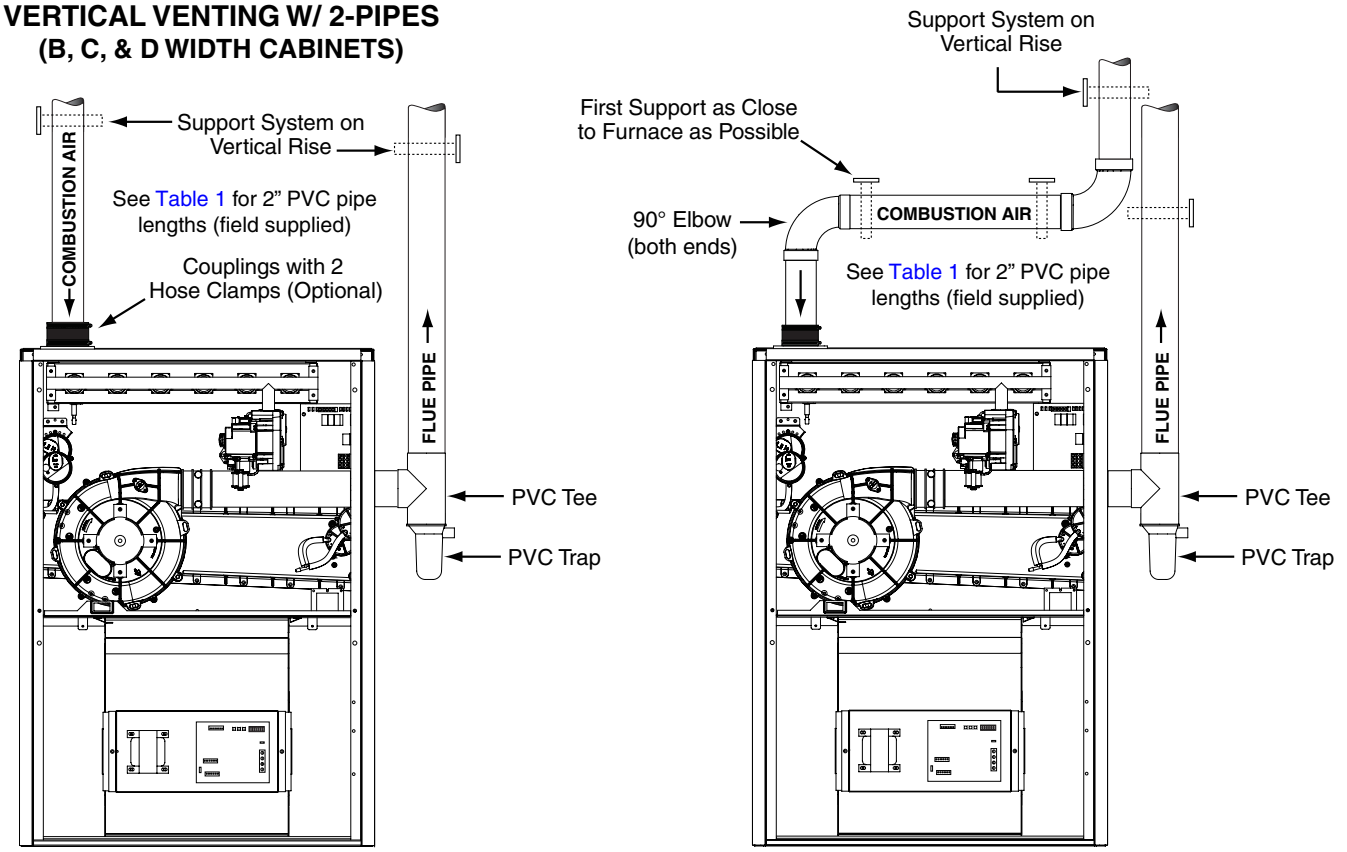
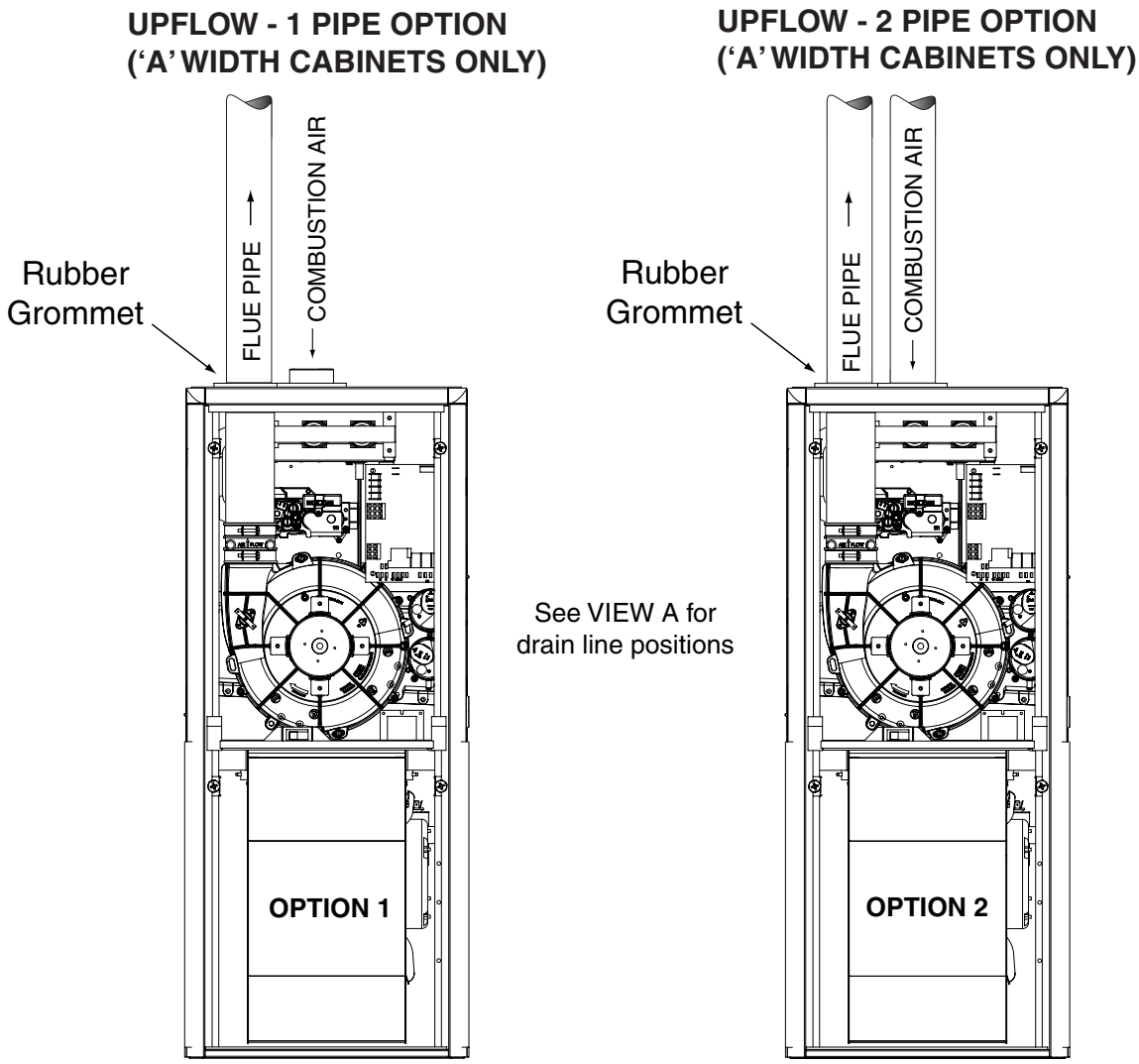
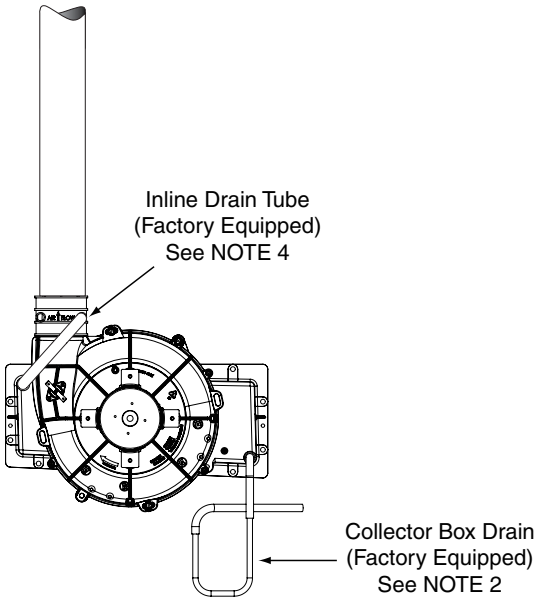


Figure 33. Horizontal & Vertical Venting (B, C, & D Width Cabinets)



VIEW -A-

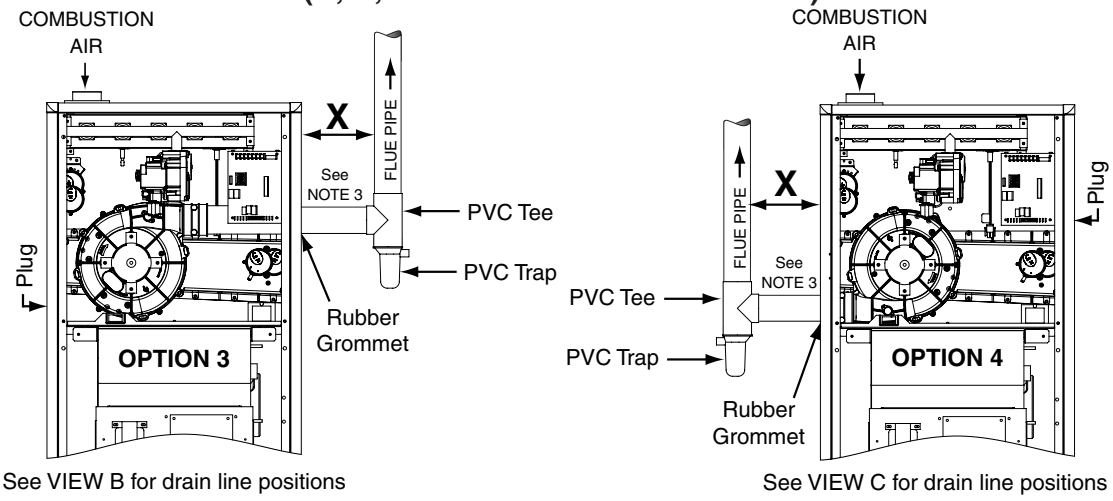


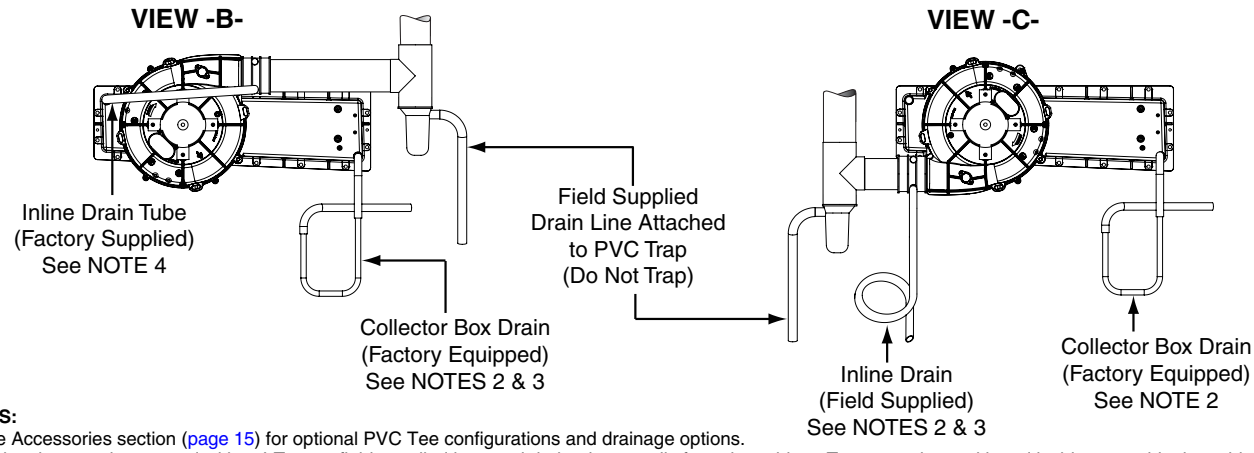
NOTES:

1. See Accessories section (page 15) for optional PVC Tee configurations and drainage options.
2. Drain tube must be trapped with a J-Trap or field supplied loop and drained externally from the cabinet. Traps may be positioned inside or outside the cabinet.
3. Tubing needs to be cut to length and attached during unit installation.

Figure 34. Upflow Venting Options (A Width Cabinets)

UPFLOW - 1 PIPE OPTIONS
(B, C, & D WIDTH CABINETS ONLY)





NOTES:

1. See Accessories section (page 15) for optional PVC Tee configurations and drainage options.
2. Drain tube must be trapped with a J-Trap or field supplied loop and drained externally from the cabinet. Traps may be positioned inside or outside the cabinet.
3. Inline drain is required only if "X" is greater than 6 feet.
4. Tubing needs to be cut to length and attached during unit installation.
5. Horizontal piping from inducer to flue pipe must be sloped 1/4" per foot to ensure drainage to PVC trap.

UPFLOW - 2 PIPE OPTIONS
(B, C, & D WIDTH CABINETS ONLY)

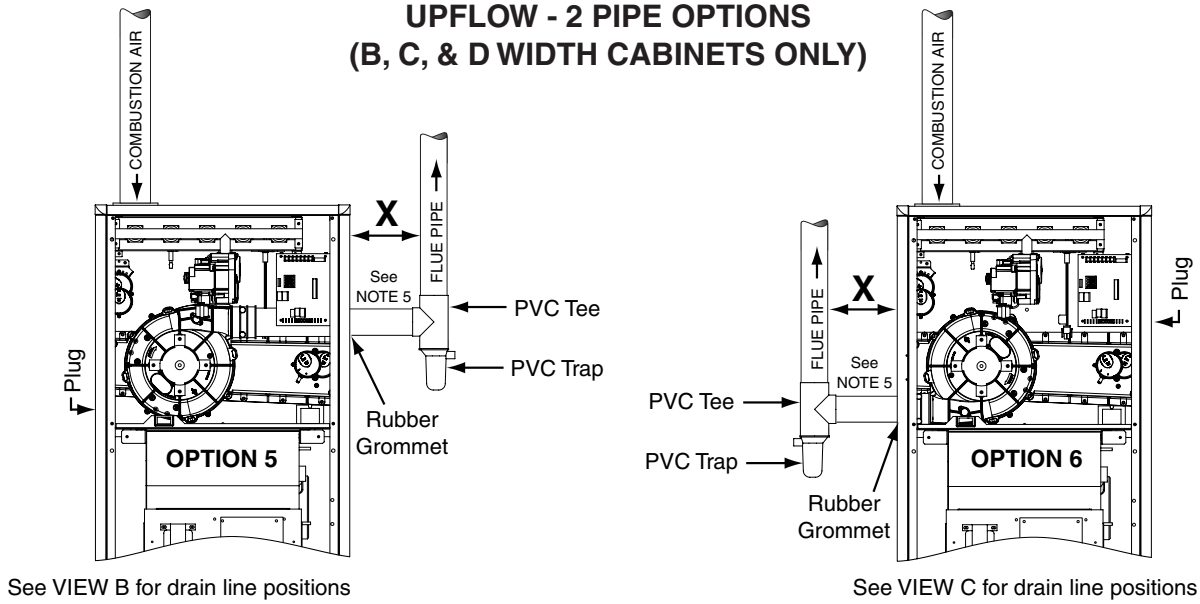
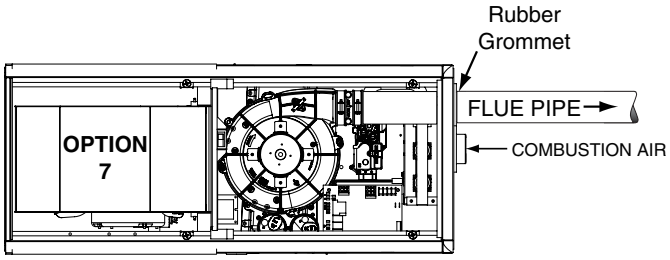


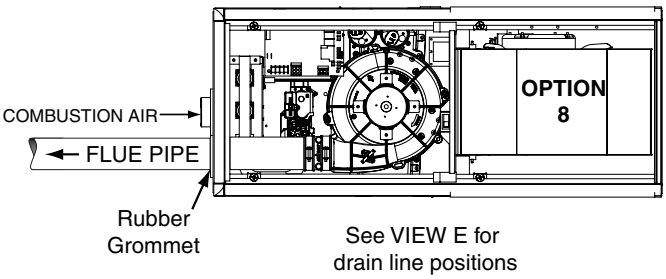
Figure 35. Upflow Venting Options (B, C, & D Width Cabinets)

HORIZONTAL RIGHT - 1 PIPE OPTION ('A' WIDTH CABINETS ONLY)



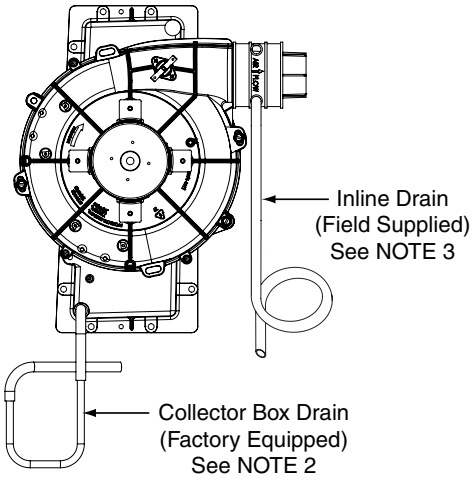
See VIEW D for
drain line positions

HORIZONTAL LEFT - 1 PIPE OPTION ('A' WIDTH CABINETS ONLY)

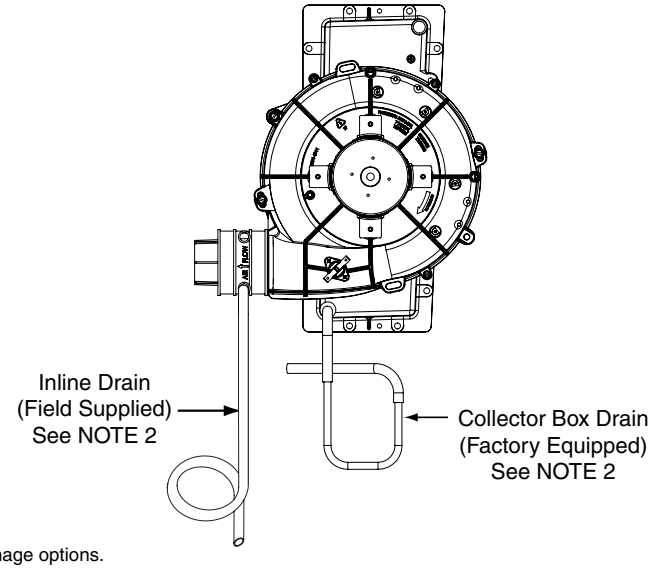


See VIEW E for
drain line positions

VIEW -D-

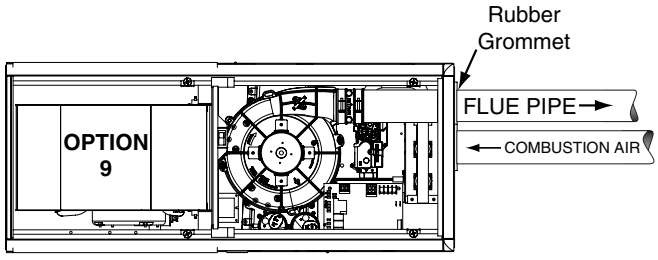


VIEW -E-



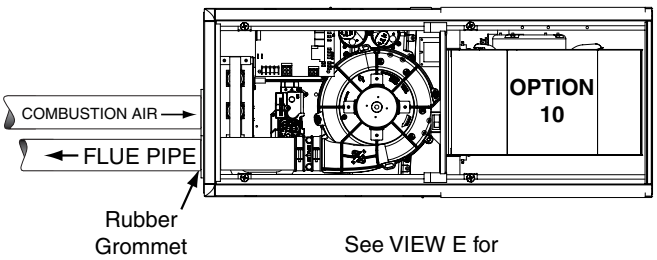
NOTES:
1. See Accessories section (page 15) for optional PVC Tee configurations and drainage options.
2. All drain lines must be trapped with J-Trap or field supplied loop and drained externally from the cabinet.
3. Tubing needs to be cut to length and attached during unit installation.

HORIZONTAL RIGHT - 2 PIPE OPTION ('A' WIDTH CABINETS ONLY)



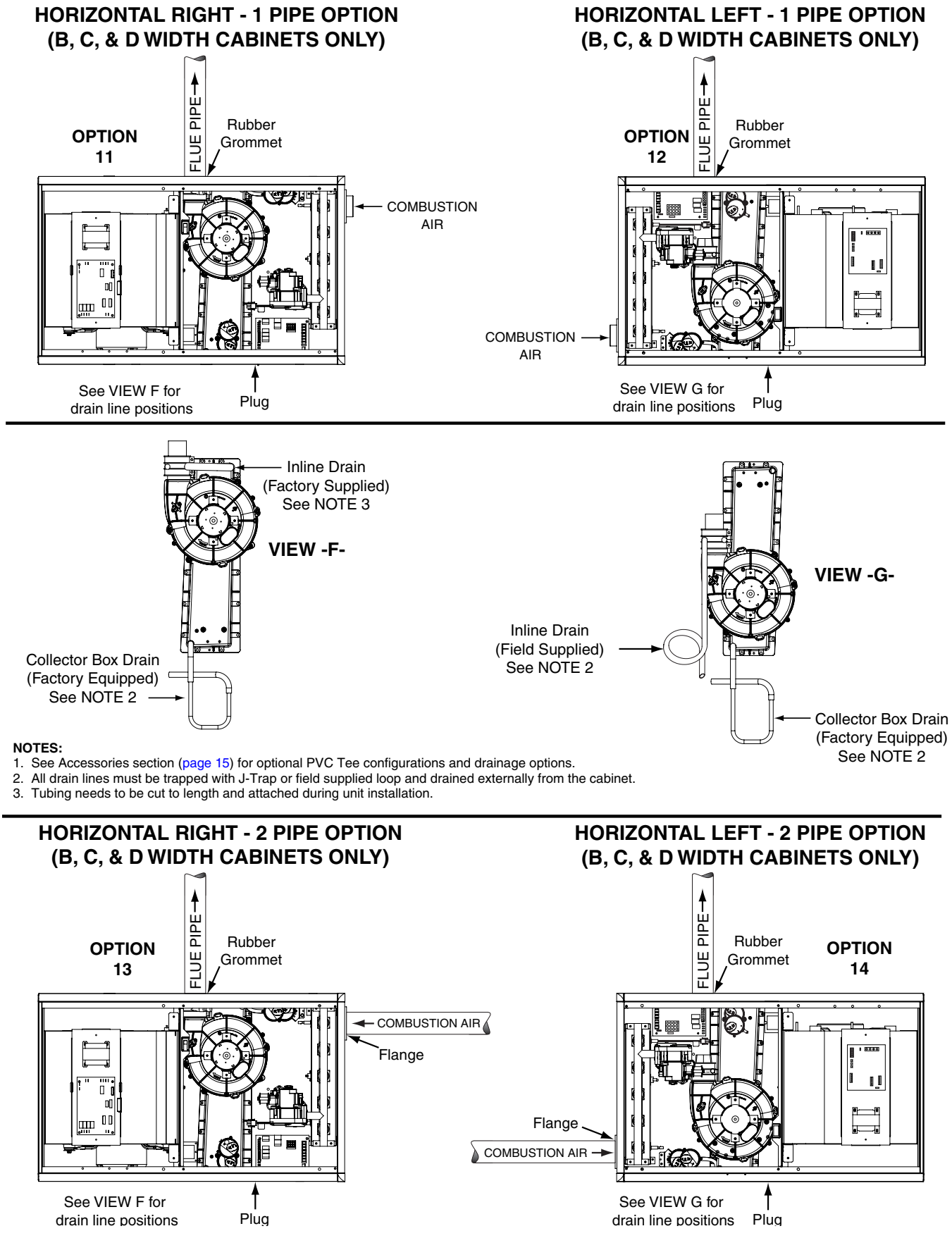
See VIEW D for
drain line positions

HORIZONTAL LEFT - 2 PIPE OPTION ('A' WIDTH CABINETS ONLY)



See VIEW E for
drain line positions

Figure 36. Horizontal Venting Options (A Width Cabinets)



NOTES:
1. See Accessories section (page 15) for optional PVC Tee configurations and drainage options.
2. All drain lines must be trapped with J-Trap or field supplied loop and drained externally from the cabinet.
3. Tubing needs to be cut to length and attached during unit installation.

Figure 37. Horizontal Venting Options (B, C, & D Width Cabinets)

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. **Do not use emery cloth or sandpaper!)**
- Are all the LED's on the furnace and motor control boards constantly ON? If not, refer to Table 12 & Table 13 or the wiring diagrams: (Figure 30 (page 32) & Figure 31 (page 33)) 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 38 (page 42).
- If the furnace operates when the Blower Limit 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 12. Furnace Control Board Fault Conditions

	DIAGNOSTIC DESCRIPTION	GREEN LED	RED LED
Fixed Speed Furnaces	Control Fault (No Power)	Off	Off
	Normal Operation	On	On
	Motor Fault	On	Flash
	Twin Fault (no motor fault)	Flash	On
	Communications Fault	Flash	Flash
Variable Speed Furnaces	Control Fault (No Power)	Off	Off
	Normal Operation	On	On
	Motor Fault	On	Flash
	Communications Fault	Flash	Flash

Table 13. Motor Control Board Fault Conditions

- If the furnace still doesn't operate, check the Flame Roll-out Switches (Figure 38) and reset if necessary.
- If the furnace operates when the Flame Rollout Switch is reset, contact a qualified service technician to identify and repair the problem.

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 38 (page 42). 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.

Condensate Drain Switch - The Condensate Drain Switch will shut down the furnace if the condensate drain from the Collector Pan becomes clogged.

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.

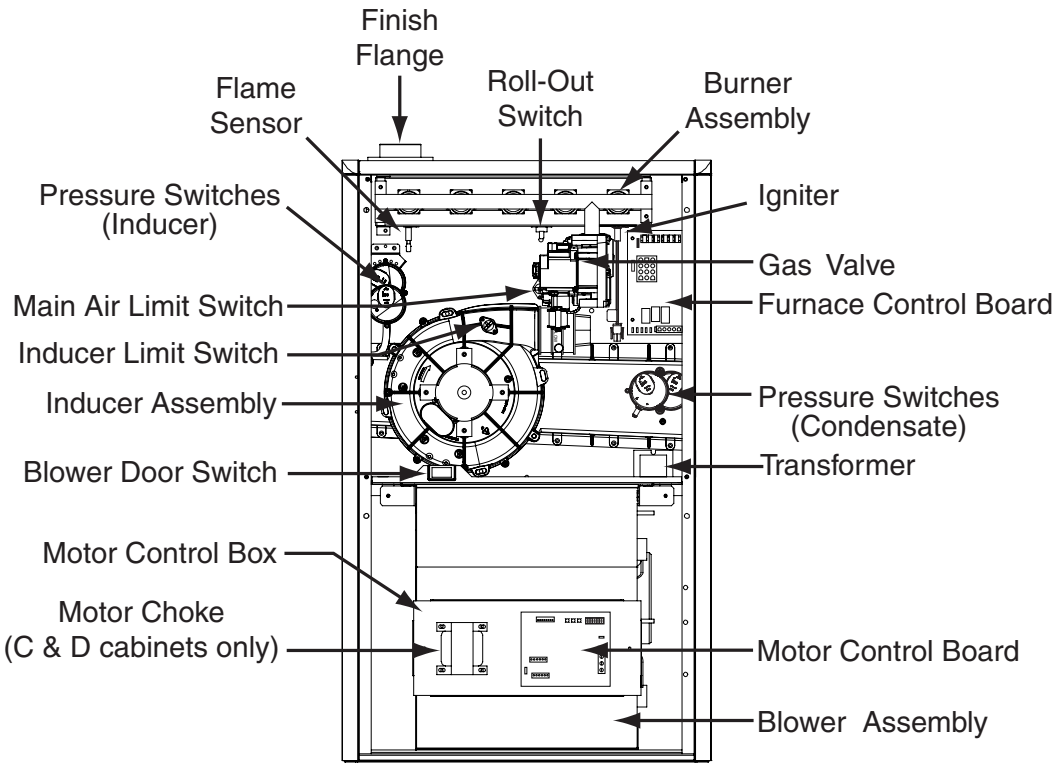
Gas Valve - Controls the flow of gas to the burners. When the gas valve is energized it automatically opens and regulates the gas pressure in the manifold.

Inducer Assembly - Vents products of combustion to the outside.

Pressure Switches - Verifies that the inducer is drawing the combustion gases through the heat exchanger. The pressure switch prevents furnace operation with excessive flue / condensate 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 (*TC SERIES)



NOTE: Component locations may be different in 'A' width cabinets.

Figure 38. Component Locations

INSTALLATION CHECKLIST

INSTALLER NAME:		
CITY:	STATE:	
INSTALLATION ADDRESS:		
CITY:	STATE:	
UNIT MODEL #		
UNIT SERIAL #		
Minimum clearances as shown in 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

ATTENTION INSTALLERS:

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

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

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

10258900
(Replaces 709368E)

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