INSTALLATION MANUAL

Two-Stage Variable Speed ECM Residential Gas Furnaces

Models: TM9V*C Series

(96% AFUE Multi-position)

Assembled at a facility with an ISO 9001:2015-certified Quality Management System

List of sections

List of figures

List of tables

These high efficiency, compact units employ induced combustion, reliable hot surface ignition and high heat transfer aluminized tubular heat exchangers. The units are factory shipped for installation in upflow or horizontal applications and may be converted for downflow applications.

These furnaces are designed for residential installation in a basement, closet, alcove, attic, recreation room or garage and are also ideal for commercial applications. All units are factory assembled, wired and tested to assure safe dependable and economical installation and operation.

These units are Category IV listed and may not be common vented with another gas appliance as allowed by the National Fuel Gas Code.

Section I: Safety

This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention to the signal words **DANGER**, **WARNING**, or **CAUTION**.

DANGER indicates an **imminently** hazardous situation, which, if not avoided, **will result in death or serious injury**.

WARNING indicates a **potentially** hazardous situation, which, if not avoided, **could result in death or serious injury**.

CAUTION indicates a potentially hazardous situation, which, if not avoided **may result in minor or moderate injury.** It is also used to alert against unsafe practices and hazards involving only property damage.

⚠ WARNING

Incorrect installation may create a condition where the operation of the product could cause personal injury or property damage.

Incorrect installation, adjustment, alteration, service or maintenance can cause injury or property damage. **Failure to carefully read and follow all instructions in this manual can result in furnace malfunction, death, personal injury and/or property damage.** Only a qualified contractor, installer or service agency must install this product.

Specific safety rules and precautions

1. Only Natural gas or Propane (LP) gas are approved for use with this furnace.
2. Install this furnace only in a location and position as specified in these instructions.
3. A gas-fired furnace for installation in a residential garage must be installed as specified in these instructions.
4. Provide adequate combustion and ventilation air to the furnace space as specified in these instructions.
5. Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in SECTION VII, "Combustion air and vent system" of these instructions.
6. Test for gas leaks as specified in these instructions.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

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

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

7. Always install the furnace to operate within the furnace's intended temperature rise range. Only connect the furnace to a duct system which has an external static pressure within the allowable range, as specified on the furnace rating plate.
8. When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air must also be handled by ducts sealed to the furnace casing and terminating outside the space containing the furnace.
9. It is permitted to use the furnace for heating of buildings or structures under construction where the application and use must comply with all manufacturer's installation instructions including:
   - Correct vent installation
   - Furnace operating under thermostatic control
   - Return air duct sealed to the furnace
   - Air filters in place
   - Set furnace input rate and temperature rise per rating plate marking
   - Means for providing outdoor air required for combustion
   - Return air temperature maintained between 55ºF (13ºC) and 80ºF (27ºC)
   - The **air filter must be replaced** upon substantial completion of the construction process.
   - Clean furnace, duct work and components upon substantial completion of the construction process, and verify furnace-operating conditions including ignition, input rate, temperature rise and venting, according to the manufacturer's instructions.
10. When installed in a non-HUD-Approved Modular Home or building constructed on-site, combustion air must not be supplied from occupied spaces.
11. The size of the unit must be based on an acceptable heat loss calculation for the structure. Use ACCA, Manual J, or other approved methods.
12. When moving or handling this furnace prior to installation, always leave the doors on the furnace to provide support and to prevent damage or warping of the cabinet. When lifting the furnace by the cabinet, support the ends of the furnace rather than lifting by the cabinet flanges at the return air openings (bottom or sides) or supply air opening.
13. When lifting the furnace, it is acceptable to use the primary heat exchanger tubes as a lifting point provided that the tubes are lifted at the front of the heat exchangers where attached to the vestibule panel. Do not use the top return bend of the heat exchangers as lifting points as the tubes may shift out of position or their location brackets/baffles.

Important: During installation, doors must remain on the furnace when moving or lifting.

Safety requirements

⚠ CAUTION

This product must be installed in strict compliance with the installation instructions and any applicable local, state, and national codes including, but not limited to building, electrical, and mechanical codes.

- Refer to the unit rating plate for the furnace model number, and then see Figure 8 in this manual for return air plenum dimensions. The plenum must be installed according to the instructions.
- Provide clearances from combustible materials as listed in Table 1.
- Provide clearances for servicing ensuring that service access is allowed for both the burners and blower.
- These models **are not** CSA listed or approved for installation into a **HUD Approved Modular Home** or a **Manufactured (Mobile) Home**.
- This furnace is not approved for installation in trailers or recreational vehicles.
- Furnaces for upflow installation on combustible flooring must not be installed directly on carpeting, tile, or other combustible materials other than wood flooring.
- Check the rating plate and power supply to be sure that the electrical characteristics match. All models use nominal 115 VAC, 1 Phase, 60 Hz power supply. **Do not connect this appliance to a 50 Hz power supply or a voltage above 130 V.**
- This furnace must be installed so the electrical components are protected from water.
- Installing and servicing heating equipment can be hazardous due to the electrical components and the gas fired components. Only trained and qualified personnel must install, repair, or service gas heating equipment. Untrained service personnel can perform basic maintenance functions such as cleaning and replacing the air filters. When working on heating equipment, observe precautions in the manuals and on the labels attached to the unit and other safety precautions that may apply.

Combustion air quality list of contaminants

⚠ WARNING

The furnace area must not be used as a broom closet or for any other storage purposes, as a fire hazard may be created. Never store items such as the following on, near or in contact with the furnace.

1. Spray or aerosol cans, rags, brooms, dust mops, vacuum cleaners or other cleaning tools.
2. Soap powders, bleaches, waxes or other cleaning compounds; plastic items or containers; gasoline, kerosene, cigarette lighter fluid, dry cleaning fluids or other volatile fluid.
3. Paint thinners and other painting compounds.
4. Paper bags, boxes or other paper products

Never operate the furnace with the blower door removed. To do so could result in serious personal injury and/or equipment damage.

The furnace requires **outdoor air** for combustion when the furnace is located in any of the following environments:

- Buildings with indoor pools
- Chemical exposure
- Commercial buildings
- Hobby or craft rooms
- Laundry rooms
- Near chemical storage areas
- Restricted Environments

The furnace requires **outdoor air** for combustion when the furnace is located in an area where the furnace is being exposed to the following substances or chemicals.

- Antistatic fabric softeners for clothes dryers
- Carbon tetrachloride
- Cements and glues
- Chlorine based swimming pool chemicals
- Chlorinated waxes and cleaners
- Cleaning solvents, such as perchloroethylene
- De-icing salts or chemicals
- Halogen type refrigerants
- Hydrochloric acid
- Masonry acid washing materials
- Permanent wave solutions
- Printing inks, paint removers, varnishes, or similar materials
- Water softening chemicals

When outdoor air is used for combustion, the combustion air intake duct system termination must be located external to the building and in an area where there is no exposure to the substances listed above.

Codes and standards

Follow all national and local codes and standards in addition to this installation manual. The installation must comply with regulations of the serving gas supplier, local building, heating, plumbing, and other codes. In absence of local codes, the installation must comply with the national codes listed below and all authorities having jurisdiction.

In the United States and Canada, follow all codes and standards for the following, using the latest edition available:

Safety

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

General installation

- US: Current edition of the NFGC and NFPA 90B. For copies, contact the

  National Fire Protection Association Inc.
  Batterymarch Park
  Quincy, MA 02269

  or for only the NFGC, contact the

  American Gas Association,
  400 N. Capital, 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 Canada M9W 1RS

Combustion and ventilation air

- US: Section 5.3 of the NFGC, air for Combustion and Ventilation
- CANADA: Part 7 of 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 Association National Association (SMACNA), or American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 1997 Fundamentals Handbook Chapter 32.

Acoustical lining and fibrous glass duct

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

Gas piping and gas pipe pressure testing

- US: NFGC; chapters 2, 3, 4, & 9 and National Plumbing Codes
- CANADA: NSCNGPIC Part 5

Electrical connections

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

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances these instructions exceed certain local codes and ordinances, especially those who have not kept up with changing residential and non-HUD modular home construction practices. These instructions are required as a minimum for a safe installation.

For furnaces installed in the Commonwealth of Massachusetts only

For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. **Installation of carbon monoxide detectors.** At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors
   a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
   b. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.
2. **Approved carbon monoxide detectors.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
3. **Signage.** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "**GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS**".
4. **Inspection.** The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

Inspection

As soon as a unit is received, it must be inspected for possible damage during transit. If damage is evident, the extent of the damage must be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent must be made in writing. Also, before installation, the unit must be checked for screws or bolts which may have loosened in transit. There are no shipping or spacer brackets which need to be removed from the interior of this unit.

Furnace location and clearances

Locate the furnace using the following guidelines:

1. Where a minimum amount of air intake/vent piping and elbows is required.
2. As centralized with the air distribution as possible.
3. Where adequate combustion air is available, particularly when the appliance is not using outdoor combustion air.
4. Where it does not interfere with correct air circulation in the confined space.
5. Where the outdoor vent terminal is not blocked or restricted. See "VENT CLEARANCES" located in SECTION VII of these instructions. These minimum clearances must be maintained in the installation.
6. Where the unit is installed in a level position with no more than 1/4 in. (6.4 mm) slope side-to-side and front-to-back to provide adequate condensate drainage.

Installation in freezing temperatures:

1. Furnace shall be installed in an area where ventilation facilities provide for safe limits of ambient temperature under normal operating conditions. Ambient temperatures must not fall below 32°F (0°C) unless the condensate system is protected from freezing.

⚠ WARNING

Incorrect installation in an ambient below 32ºF (0.0° C) could create a hazard, resulting in damage, injury or death.

2. Do not allow return air temperature to be below 55º F (13°C) for extended periods. To do so may cause condensation to occur in the main heat exchanger, leading to premature heat exchanger failure.
3. If this furnace is installed in an unconditioned space and an extended power failure occurs, there will be potential damage to the internal components. Following a power failure situation, do not operate the unit until inspection and repairs are performed.

⚠ WARNING

Liquid anti-freeze will cause damage to internal plastic parts of this furnace. **DO NOT attempt to winterize the furnace using liquid anti-freeze.**

Clearances for access/service:

Ample clearances must be provided to permit easy access to the unit. The following minimum clearances are recommended:

1. 24 in. (61 cm) between the front of the furnace and an adjacent wall or another appliance, when access is required for servicing and cleaning.
2. 18 in. (46 cm) at the side where access is required for passage to the front when servicing or for inspection or replacement of flue/vent connections.

In all cases, accessibility clearances shall take precedence over clearances for combustible materials where accessibility clearances are greater.

Installation in a residential garage:

A gas-fired furnace for installation in a residential garage must be installed so the burners and the ignition source are located not less than 18 in. (46 cm) above the floor, and the furnace must be located or protected to avoid physical damage by vehicles.

Note: All furnaces are approved for alcove and attic installation.

Table 1: Unit clearances to combustibles

Application	Upflow (in.)	Downflow (in.)	Horizontal (in.)
Top	1	0	0
Vent	0	0	0
Rear	0	0	0
Side	0	0	1
Front[1]	0	0	0
Floor	Combustible	Combustible[2]	Combustible
Closet	Yes	Yes	Yes
Line Contact	No	No	Yes

1. 24 in. clearance in front and 18 in. on side recommended for service access.
2. For combustible floors only when used with special sub-base.

Section II: Ductwork

Ductwork general information

The duct system's design and installation must:

1. Handle an air volume appropriate for the served space and within the operating parameters of the furnace specifications.
2. Be installed in accordance of National Fire Protection Association as outlined in NFPA standard 90B (latest editions) or applicable national, provincial, state, and local fire and safety codes.
3. Create a closed duct system. For residential and non-HUD Modular Home installations, when a furnace is installed so that the supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air must also be handled by ducts sealed to the furnace casing and terminating outside the space containing the furnace.
4. Complete a path for heated or cooled air to circulate through the air conditioning and heating equipment and to and from the conditioned space.

⚠ CAUTION

The indoor coil must be installed in the supply air duct, downstream of the furnace. Cooled air may not be passed over the heat exchanger.

When the furnace is used with an indoor coil, the coil must be installed parallel with or in the supply air side of the furnace to avoid condensation in the primary heat exchanger. When a parallel flow arrangement is used, dampers or other means used to control airflow must be adequate to prevent chilled air from entering the furnace. If manually operated, the damper must be equipped with means to prevent the furnace or the air conditioner from operating unless the damper is in full heat or cool position.

When replacing an existing furnace, if the existing plenum is not the same size as the new furnace, then the existing plenum must be removed and a new plenum installed that is the correct size for the new furnace. If the plenum is shorter than 12 in. (30.5 cm), the turbulent air flow may cause the limit controls not to operate as designed, or the limit controls may not operate at all.

The duct system is a very important part of the installation. **If the duct system is incorrectly sized, the furnace does not operate correctly.** The ducts attached to the furnace plenum must be of sufficient size so that the furnace operates at the specified external static pressure and within the air temperature rise specified on the nameplate.

Important: The minimum plenum height is 12 in. (30.5 cm). The furnace does not operate correctly on a shorter plenum height. The minimum rectangular duct height is 4 in. (10.2 cm) attached to the plenum.

⚠ WARNING

The duct system must be correctly sized to obtain the correct airflow for the furnace size that is being installed.

Refer to the furnace rating plate for the correct rise range and static pressures or see Table 6 for the correct rise range.

If the ducts are undersized, the result is high duct static pressures and/or high temperature rises, which can result in a heat exchanger **overheating condition**. This condition can result in premature heat exchanger failure, which can result in personal injury, property damage, or death.

If a matching cased indoor coil is used, it may be placed directly on the furnace outlet and sealed to prevent leakage. If an uncased indoor coil with a thermoplastic drain pan is to be installed in the upflow/horizontal configuration, then an extra 2 in. (5.1 cm) minimum spacing may be needed to ensure against drain pan distortion.

On all installations without a coil, use a removable access panel in the outlet duct, so that smoke or reflected light is observable inside the casing, indicating the presence of leaks in the heat exchanger. Attach this access cover in such a manner as to prevent leaks.

Duct flanges

Four flanges are provided to attach ductwork to the furnace. These flanges are rotated down for shipment. In order to use the flanges, remove the screw holding an individual flange, rotate the flange so it is in the upward position, and reinstall the screw. Repeat this for all four flanges.

If the flanges are not used, they must remain in the rotated down position as shipped.

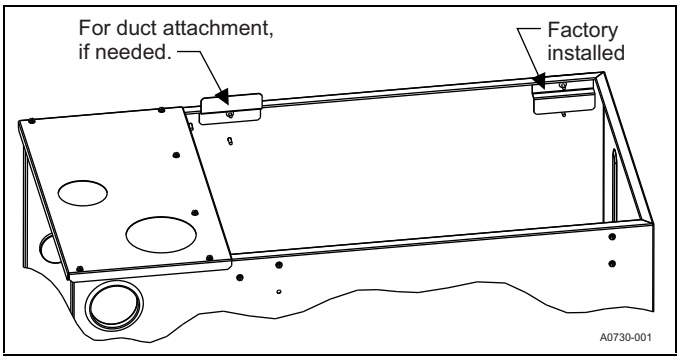
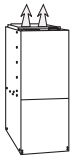


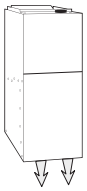
Figure 1: Duct attachment

Ductwork installation and supply plenum connection - upflow/horizontal



Attach the supply plenum to the furnace outlet. Use an approved flexible duct connector on all installations. This connection must be sealed to prevent air leakage. The sheet metal must be crosshatched to eliminate any popping of the sheet metal when the indoor fan is energized.

Floor base and ductwork installation - downflow



Installations on combustible material or directly on any floors must use a combustible floor base as shown in Figure 2. Follow the instructions supplied with the combustible floor base accessory. This combustible floor base can be replaced with a matching indoor coil, correctly sealed to prevent leaks. Follow the instructions supplied with the indoor coil cabinet for installing the cabinet to the duct connector. Plug intake and vent pipe holes in the bottom panel and move the grommet to the desired vent side exit.

Downflow air - indoor coil cabinet

The furnace must be installed with the coil cabinet part number specifically intended for downflow application. If a matching indoor coil is used, it may be placed directly on the furnace outlet and sealed to prevent leakage. For details of the coil cabinet dimensions and installation requirements, refer to the installation instructions supplied with the coil cabinet.

Attach the indoor coil cabinet to the duct connector, and then position the furnace on top of the coil cabinet. The connection to the furnace, air conditioning coil cabinet, duct connector, and supply air duct must be sealed to prevent air leakage.

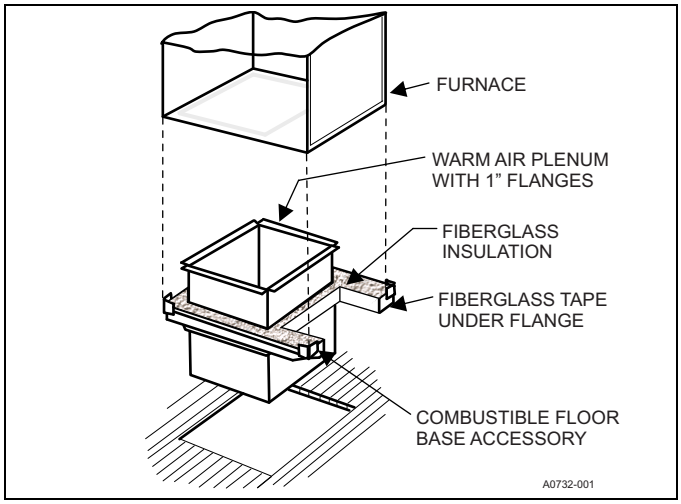


Figure 2: Combustible floor base accessory

Coil installation

Important: On all installations without a coil, use a removable access panel in the outlet duct, so that smoke or reflected light is observable inside the casing, indicating the presence of leaks in the heat exchanger. Attach this access cover in such a manner as to prevent leaks.

The indoor coil must be mounted on the supply side of the furnace as shown in Figure 3. Refer to the Installation Instructions provided with each indoor coil.

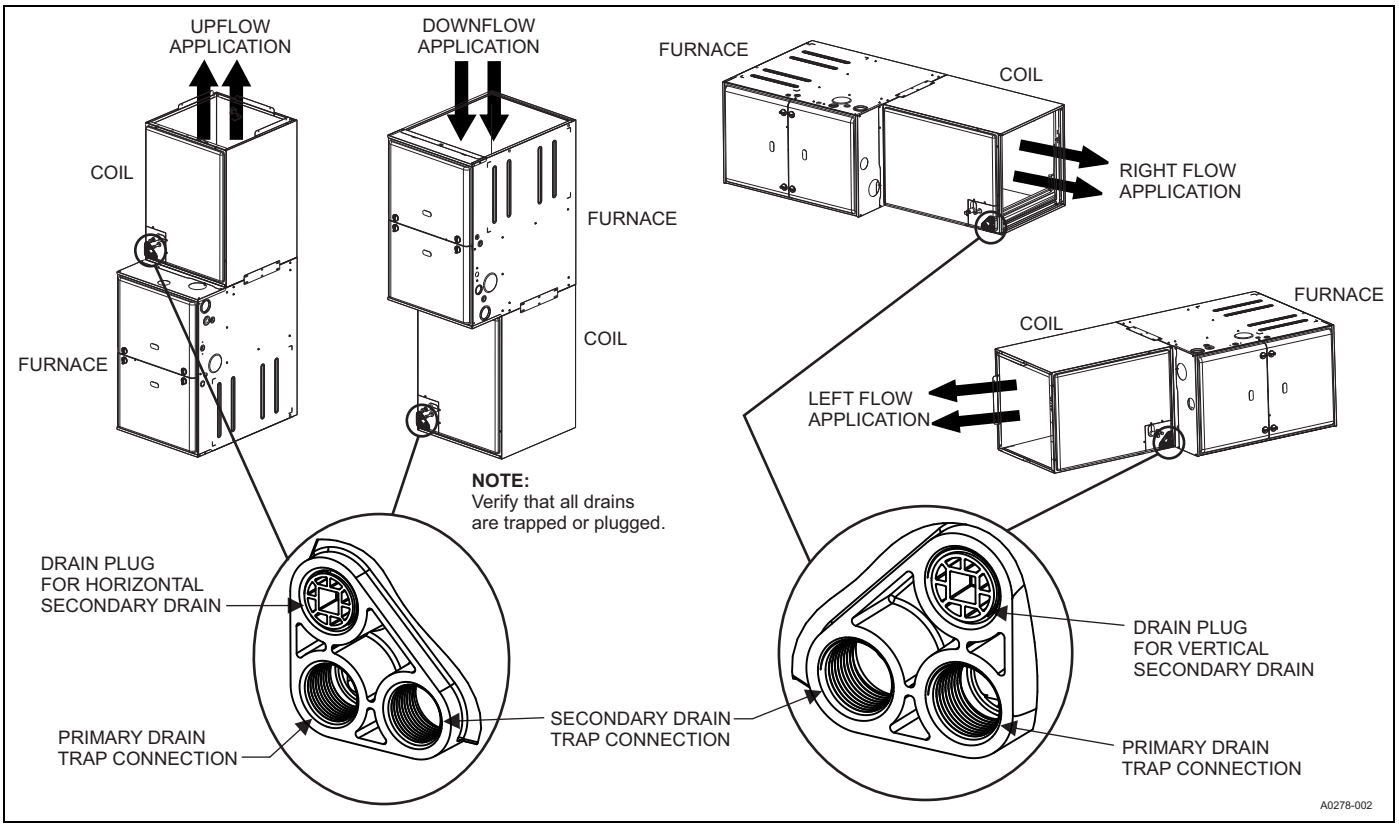


Figure 3: Furnace and coil attachment

Residential and modular home upflow return plenum connection

Return air may enter the furnace through the sides or bottom depending on the type of application. Return air may not be connected into the rear panel of the unit.

Side return application

Side return applications pull return air through an opening cut in the side of the furnace casing. This furnace is supplied with a bottom block-off panel that must be left in place if a side return is to be used. If the furnace is to be installed on a flat, solid surface, this bottom panel provides an adequate seal to prevent air leakage through the unused bottom opening. However, if the furnace is to be installed on a surface that is uneven, or if it is to be installed on blocks or otherwise raised off the floor, **it is necessary to seal the edges of the bottom panel to the casing using tape or other appropriate gasket material to prevent air leakage.**

Bottom return and attic installations

Bottom return applications normally pull return air through a base platform or return air plenum. Be sure the return platform structure or return air plenum is suitable to support the weight of the furnace.

The internal bottom panel must be removed for this application.

Attic installations must meet all minimum clearances to combustibles and have floor support with required service accessibility.

Horizontal application

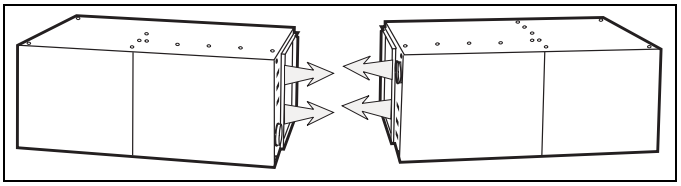


Figure 4: Horizontal application

Important: This furnace may be installed in a horizontal position on either side as shown above. It must not be installed on its back.

Attic installation

This appliance is certified for line contact when the furnace is installed in the horizontal left or right position. The line contact is only permissible between lines that are formed by the intersection of the top and two sides of the furnace and the building joists, studs or framing. This line may be in contact with combustible material. See Figure 5.

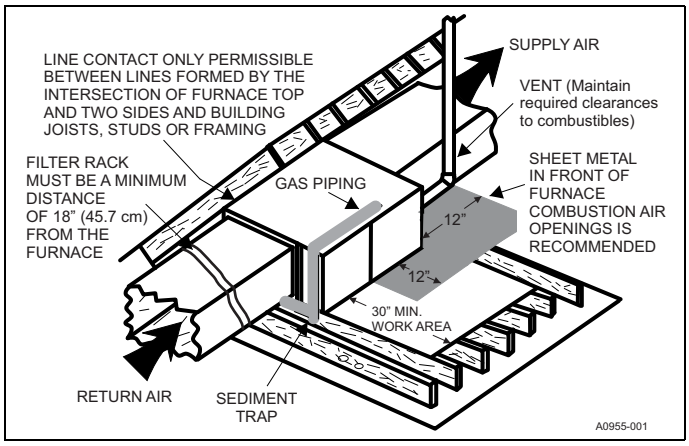


Figure 5: Typical attic installation

⚠ WARNING

When a furnace is installed in an attic or other insulated space, keep all insulating materials at least 12 in. (30.5 cm) away from furnace and burner combustion air openings.

Important: During installation, doors must remain on the furnace when moving or lifting.

When moving or handling this furnace prior to installation, always leave the doors on the furnace to provide support and to prevent damage or warping of the cabinet. When lifting the furnace, support the ends of the furnace rather than lifting by the cabinet flanges at the return air openings (bottom or sides) or supply air opening.

It is acceptable to use the primary heat exchanger tubes as a lifting point provided that the tubes are lifted at the front of the heat exchangers where attached to the vestibule panel. Do not use the top return bend of the heat exchangers as lifting points as the tubes may shift out of position or their location brackets/baffles.

Suspended furnace/crawl space installation

The furnace can be hung from floor joists or installed on suitable blocks or pad. Blocks or pad installations provide adequate height to ensure the unit is not subject to water damage. Units may also be suspended from rafters or floor joists using rods, pipe angle supports or straps. Angle supports must be placed at the supply air end, in the center near the blower deck, and at the return air end of the unit. All six suspension points must be level to ensure quiet furnace operation. When suspending the furnace, use a secure platform constructed of plywood or other building material secured to the floor joists. See Figure 6 for typical crawl space installation.

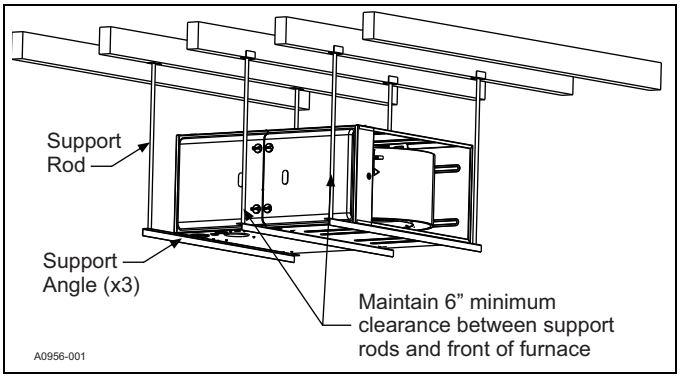


Figure 6: Typical suspended furnace/crawl space installation

Downflow application

To apply the furnace in a downflow position, it is necessary to rotate the vent blower 90° left or right so that the vent pipe passes through the side of the furnace casing. See Figure 7.

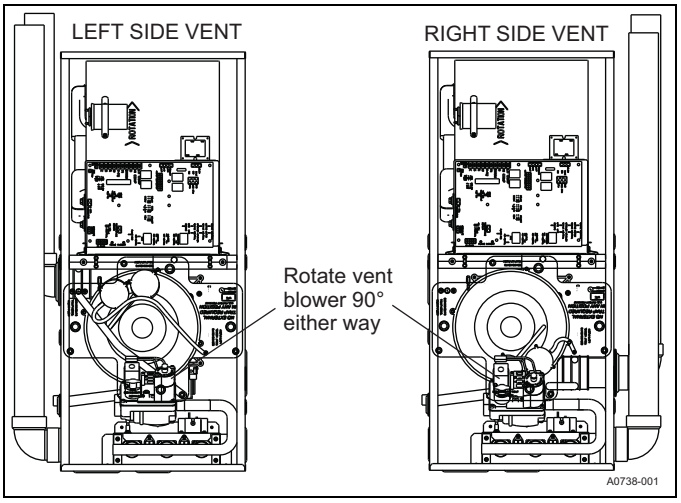


Figure 7: Downflow venting

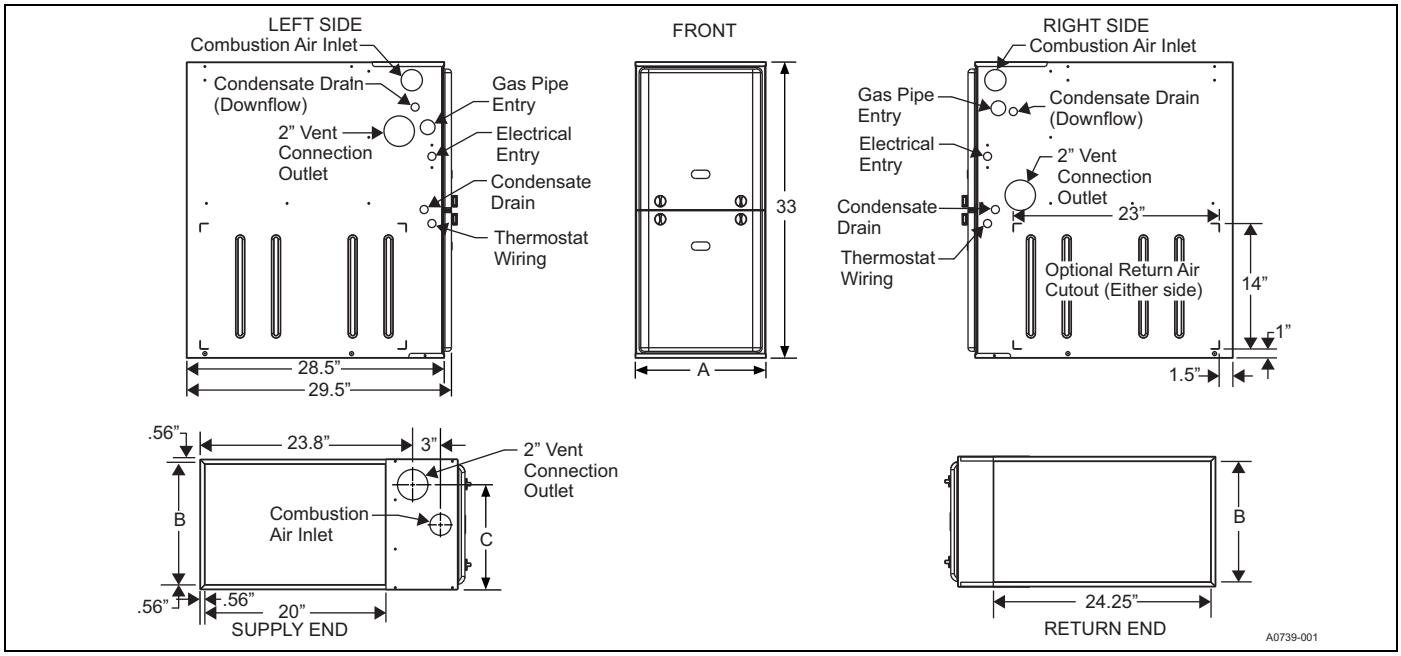


Figure 8: Dimensions

Table 2: Cabinet and duct dimensions

Btu/h (kW) input	Nominal CFM (m^3/min)	Cabinet size	Cabinet dimensions (illustrated in Figure 8)						Approximate operating weight
			A (in.)	A (cm)	B (in.)	B (cm)	C (in.)	C (cm)	lb (kg)
40 (11.7)	1,000 (28.3)	A	14 1/2	36.8	13 3/8	34.0	11 3/4	29.8	113 (51.2)
60 (17.6)	1,200 (34.0)	B	17 1/2	44.4	16 3/8	41.6	13 1/4	33.7	122 (55.3)
80 (23.4)	1,200 (34.0)	B	17 1/2	44.4	16 3/8	41.6	14 3/4	37.5	126 (57.1)
80 (23.4)	1,600 (45.3)	C	21	53.3	19 7/8	50.5	16 1/2	41.9	136 (61.7)
100 (29.3)	1,600 (45.3)	C	21	53.3	19 7/8	50.5	18 1/4	46.4	142 (64.4)
100 (29.3)	2,000 (56.6)	C	21	53.3	19 7/8	50.5	18 1/4	46.4	145 (65.8)
120 (35.1)	2,000 (56.6)	D	24 1/2	62.2	23 3/8	59.4	21 3/4	55.2	156 (70.7)

Section III: Filters

Filter installation

⚠ CAUTION

All filters and mounting provision must be field supplied. All installations must have a filter installed.

All applications require the use of a field installed filter. All filters and mounting provision must be field supplied.

Filters must be installed external to the furnace cabinet. **Do not attempt to install filters inside the furnace.**

NOTICE

Single side return above 1,800 CFM is approved as long as the filter velocity does not exceed the filter manufacturer's recommendation and a transition is used to allow use on a 20x25 filter.

Table 3: Recommended filter sizes (high velocity 600 FPM)

CFM (m^3/min)	Cabinet Size	Side (in.)	Bottom (in.)
1,000 (28.3)	A	16 x 25	14 x 25
1,200 (34.0)	B	16 x 25	16 x 25
1,600 (45.3)	C	16 x 25	20 x 25
2,000 (56.6)	C	(2) 16 x 25	20 x 25
2,000 (56.6)	D	(2) 16 x 25	22 x 25

1. Air velocity through throwaway type filters must not exceed 300 ft per minute (91.4 m/min). All velocities over this require the use of high velocity filters.
2. Do not exceed 1,800 CFM using a single side return and a 16x25 filter. For CFM greater than 1,800, you may use two side returns or one side and the bottom or one side return with a transition to allow use of a 20x25 filter.

Side return

Locate the "L" shaped corner locator's. These indicate the size of the cutout to be made in the furnace side panel. See Figure 8 and Figure 9.

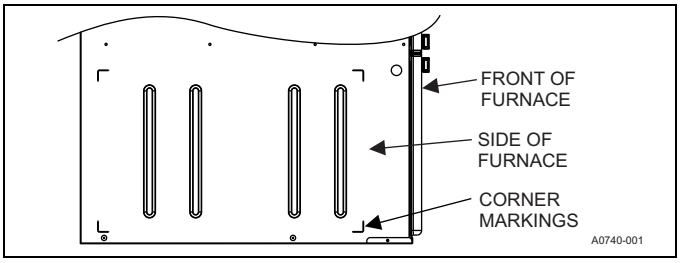


Figure 9: Side return cutout markings

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

Important: Some accessories such as electronic air cleaners and pleated media may require a larger side opening. Follow the instructions supplied with that accessory for side opening requirements. Do not cut the opening larger than the dimensions for the Optional Return Air Cutout shown in Figures 8 and 9.

Horizontal filters

Any branch duct (rectangular or round duct) attached to the plenum must attach to the vertical plenum before the filter. The use of straps or supports is required to support the weight of the external filter box.

Downflow filters

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

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

Section IV: Gas piping

Gas safety

⚠ DANGER

An overpressure protection device, such as a pressure regulator, must be installed in the gas piping system upstream of the furnace and must act to limit the downstream pressure to the gas valve so it does not exceed 0.5 psig [14 in. W.C. (3.48 kPa)]. Pressures exceeding 0.5 psig [14 in. W.C. (3.48 kPa)] at the gas valve causes damage to the gas valve, resulting in a fire or explosion, or causes damage to the furnace or some of its components, resulting in property damage and loss of life.

Important: Plan the gas supply routing before determining the correct gas pipe entry. Use 90° conventional elbows and short pipe nipples to enter through the cabinet access holes.

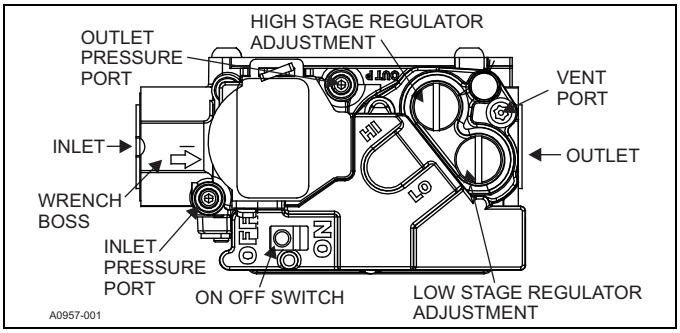


Figure 10: Gas valve

Gas piping installation

Important: Ensure that the gas connections have a 1/2 in. National Pipe Thread (NPT).

Correctly sized wrought iron, approved flexible, or steel pipe must be used when making gas connections to the unit. Some utility companies or local codes require pipe sizes larger than the minimum sizes listed in these instructions and in the codes. The furnace rating plate and the instructions in this section specify the type of gas approved for this furnace.

For left side supply gas pipe arrangement, two 1/2 in. elbows and two 1/2 in. x 1 1/2 in. pipe nipples must be used. The arrangement shown in Figure 11 aligns the entrance hole in the furnace casing with the supply gas pipe. The furnace casing does not support installations completed using street-elbows.

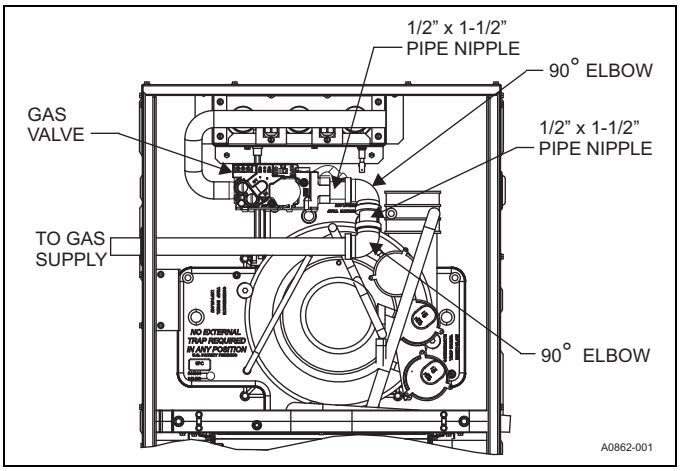


Figure 11: Left side supply gas pipe arrangement

If local codes allow the use of a flexible gas appliance connection, always use a new listed connector. Do not use a connector that has previously serviced another gas appliance. Use only approved gases. Use a drip leg and ground union as required. See Figure 12.

Important: An accessible manual shutoff valve must be installed upstream of the furnace gas controls and within 6 ft (1.8 m) of the furnace.

The furnace must be isolated from the gas supply piping system by closing its individual external manual shutoff valve during any pressure testing of the gas supply piping system at pressures equal to or less than 0.5 psig (3.5 kPa).

⚠ CAUTION

The gas valve body is a very thin casting that cannot take any external pressure. Never apply a pipe wrench to the body of the gas valve when installing piping. A wrench must be placed on the octagon hub located on the gas inlet side of the valve. Placing a wrench to the body of the gas valve will damage the valve, causing incorrect operation or the valve to leak.

Gas piping may be connected from either side of the furnace using any of the gas pipe entry knockouts on both sides of the furnace. See Figure 8 and Figure 12.

Gas orifice conversion for propane (LP)

This furnace is constructed at the factory for natural gas-fired operation, but may be converted to operate on propane (LP) gas by using a factory-supplied LP conversion kit. Follow the instructions supplied with the LP kit.

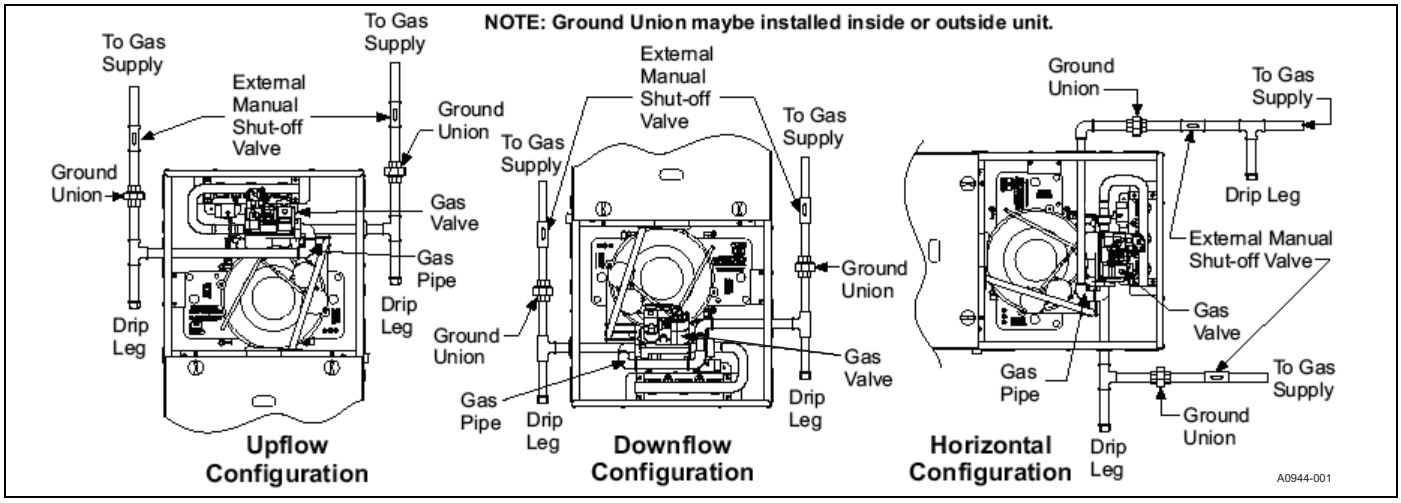


Figure 12: Gas piping

High altitude gas orifice conversion

This furnace is constructed at the factory for natural gas-fired operation at 0 ft to 7,999 ft (0 m to 2,438 m) above sea level.

The manifold pressure must be changed in order to maintain correct and safe operation when the furnace is installed in a location where the altitude is greater than 7,999 ft (2,438 m) above sea level. See Table 4 for correct manifold pressure settings.

High altitude pressure switch conversion

For installation where the altitude is less than 5,000 ft (1,524 m), it is not required that the pressure switch be changed unless you are in an area subject to low pressure inversions.

Table 4: Nominal manifold pressure - high fire

Manifold pressures					Manifold pressures			
Gas heating value (Btu/ft^3)	Altitude (ft)				Gas heating value (MJ/m^3)	Altitude (m)		
	0–7,999	8,000–8,999	9,000–9,999			0–2,437	2,438–2,742	2,743–3,048
	in. W.C.	in. W.C.	in. W.C.			kPa	kPa	kPa
800	3.5	3.5	3.5		29.8	0.87	0.87	0.87
850	3.5	3.5	3.5		31.7	0.87	0.87	0.87
900	3.5	3.5	3.5		33.5	0.87	0.87	0.87
950	3.5	3.5	3.3		35.4	0.87	0.87	0.81
1,000	3.5	3.2	2.9		37.3	0.87	0.80	0.73
1,050	3.5	2.9	2.7		39.1	0.87	0.73	0.67
1,100	3.2	2.7	2.4		41.0	0.80	0.66	0.61
2,500 (LP)	9.8	8.2	7.5		93.2 (LP)	2.44	2.03	1.86

Table 5: Nominal manifold pressure - low fire

Manifold pressures					Manifold pressures			
Gas heating value (Btu/ft^3)	Altitude (ft)				Gas heating value (MJ/m^3)	Altitude (m)		
	0–7,999	8,000–8,999	9,000–9,999			0–2,437	2,438–2,742	2,743–3,048
	in. W.C.	in. W.C.	in. W.C.			kPa	kPa	kPa
800	1.7	1.7	1.7		29.8	0.42	0.42	0.42
850	1.7	1.7	1.7		31.7	0.42	0.42	0.42
900	1.7	1.7	1.7		33.5	0.42	0.42	0.42
950	1.7	1.7	1.5		35.4	0.42	0.42	0.38
1,000	1.6	1.5	1.4		37.3	0.41	0.37	0.34
1,050	1.5	1.4	1.3		39.1	0.37	0.34	0.31
1,100	1.3	1.2	1.1		41.0	0.34	0.31	0.28
2,500 (LP)	4.1	3.8	3.5		93.2 (LP)	1.03	0.95	0.87

⚠ DANGER

PROPANE AND HIGH ALTITUDE CONVERSION KITS

It is very important to choose the correct kit and/or gas orifices for the altitude and the type of gas for which the furnace is being installed.

Only use natural gas in furnaces designed for natural gas. Only use propane (LP) gas for furnaces that have been correctly converted to use propane (LP) gas. Do not use this furnace with butane gas.

Incorrect gas orifices or a furnace that has been incorrectly converted will create an extremely dangerous condition resulting in premature heat exchanger failure, excessive sooting, high levels of carbon monoxide, personal injury, property damage, a fire hazard and/or death.

High altitude and propane (LP) conversions are required in order for the appliance to satisfactory meet the application.

An authorized distributor or dealer must make all gas conversions.

In Canada, a certified conversion station or other qualified agency, using factory specified and/or approved parts, must perform the conversion.

The installer must take every precaution to insure that the furnace has been converted to the correct gas orifice size when the furnace is installed. Do not attempt to drill out any orifices to obtain the correct orifice size. Drilling out a gas orifice will cause misalignment of the burner flames, causing premature heat exchanger burnout, high levels of carbon monoxide, excessive sooting, a fire hazard, personal injury, property damage and/or death.

Section V: Electrical power

Electrical power connections

⚠ CAUTION

Use copper conductors only.

Field wiring to the unit must be grounded. Electric wires that are field installed must conform to the temperature limitation for 63°F (35°C) rise wire when installed in accordance with instructions. See Table 6 for specific furnace electrical data.

Table 6: Ratings and physical/electrical data

Model	Input high/low		Output high/low		Nominal airflow		Cabinet width		High fire air temperature rise		Low fire air temperature rise	
	MBH	kW	MBH	kW	CFM	m^3/min	in.	cm	°F	°C	°F	°C
TM9V040A10	40/26	12/8	38/25	11/7	1,000	28.3	14 1/2	36.8	30–60	17–33	20–50	11–28
TM9V060B12	60/39	18/11	58/37	17/11	1,200	34	17 1/2	44.4	35–65	19–36	35–65	19–36
TM9V080B12	80/52	23/15	77/50	22/14	1,200	34	17 1/2	44.4	40–70	22–39	35–65	19–36
TM9V080C16	80/52	23/15	77/50	22/14	1,600	45.3	21	53.3	35–65	19–36	35–65	19–36
TM9V100C16	100/65	29/19	96/62	28/18	1,600	45.3	21	53.3	35–65	19–36	30–65	17–33
TM9V100C20	100/65	29/19	96/62	28/18	2,000	56.6	21	53.3	35–65	19–36	35–65	19–36
TM9V120D20	120/78	35/23	115/75	33/22	2,000	56.6	24 1/2	62.2	35–65	19–36	35–65	19–36

Model	Maximum outlet air temperature		Blower		Blower wheel size		AFUE	Total unit	Fuse or circuit breaker	Gas pipe connection NPT	Operating weight	
	°F	°C	HP	A	in.	cm	%	A	A	in.	lb	kg
TM9V040A10	190	88	1/2	7.7	11 x 8	27.9 x 20.3	96	9.6	15	1/2	113	51.2
TM9V060B12	190	88	1/2	7.7	11 x 8	27.9 x 20.3	96	9.6	15	1/2	122	55.3
TM9V080B12	190	88	1/2	7.7	11 x 8	27.9 x 20.3	96	9.6	15	1/2	126	57.1
TM9V080C16	190	88	3/4	9.6	11 x 10	27.9 x 25.4	96	11.5	15	1/2	136	61.7
TM9V100C16	190	88	3/4	9.6	11 x 10	27.9 x 25.4	96	11.5	15	1/2	142	64.4
TM9V100C20	190	88	1	12.8	11 x 11	27.9 x 27.9	96	14.7	20	1/2	145	65.7
TM9V120D20	190	88	1	12.8	11 x 11	27.9 x 27.9	96	14.7	20	1/2	156	70.7

Annual Fuel Utilization Efficiency (AFUE) numbers are determined in accordance with DOE Test procedures.

Wire size and over current protection must comply with the National Electrical Code (NFPA-70-latest edition) and all local codes.

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

Supply voltage connections

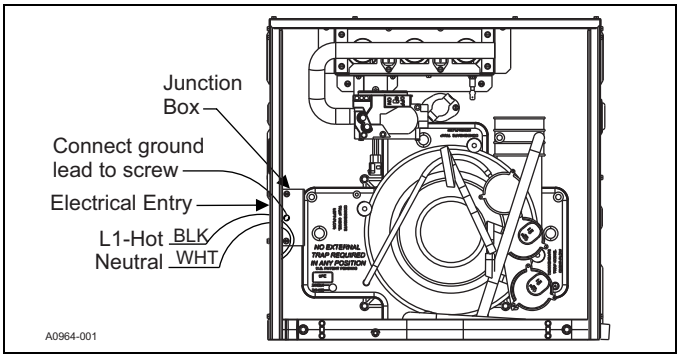


Figure 13: Electrical wiring

1. Provide a power supply separate from all other circuits. Install overcurrent protection and disconnect switch following local and national electrical codes. The switch must be close to the unit for convenience in servicing. With the disconnect or fused switch in the OFF position, check all wiring against the unit wiring label. See the *Wiring Diagram* in Section XII.
2. Remove the wiring box cover screws. Route all power wiring through a conduit connector or other correct bushing that is field installed into the unit opening and the junction box. In the junction box, there is a black wire, a white wire, and a green ground screw. Connect the power supply as shown on the unit's wiring label located on the inside of the blower compartment door or see Figure 13. Connect the black wire to L1 (hot) from the power supply. Connect the white wire to neutral. Connect the ground wire (installer-supplied) to the green (equipment ground) screw. An alternate wiring method is to use a field-provided 2 in. x 4 in. (5.1 cm x 10.2 cm) box and cover on the outside of the furnace. Route the furnace leads into the box using a protective bushing where the wires pass through the furnace panel. After making the wiring connections, replace the wiring box cover and screws. See Figure 13.
3. The furnace's control system requires correct polarity of the power supply and a correct ground connection. See Figure 13.

Important: The power connection leads and wiring box may be relocated to the opposite side of the furnace. Remove the screws and cut the wire tie holding the excess wiring. Reposition on the opposite side of the furnace and fasten using holes provided.

Control wiring

This furnace can be connected to the wall thermostat and outdoor A/C or heat pump using either conventional low voltage (24 VAC) thermostat wiring **or** using four-wire digital communications wiring. To use conventional low voltage wiring, see the *Conventional Low Voltage Control Wiring* section. To use four-wire communications control wiring, see the *Control Wiring using Communicating Controls* sections.

The Communicating System consists of several intelligent communicating components including the Communicating Thermostat Control (touch-screen wall thermostat), variable speed furnace, communicating capable air conditioner, or heat pump, which continually communicate with each other via a four-wire connection called the A-R-C-B.

Commands, operating conditions, and other data are passed continually between components over the A-R-C-B. See Figure 14. The result is a new level of comfort, versatility, and simplicity.

In order to use this furnace in full communications (COMM) mode, it **must** be installed with the matching touch-screen Communicating Control (wall thermostat) and an outdoor air conditioner or heat pump with a fully communicating control.

This furnace may be used with the Communicating Thermostat Control and a non-communicating outdoor air conditioner by installing the AC Communicating Control Board Kit to the outdoor unit. This system allows full communication between the furnace and thermostat and limited communication to the outdoor unit. See Figure 14.

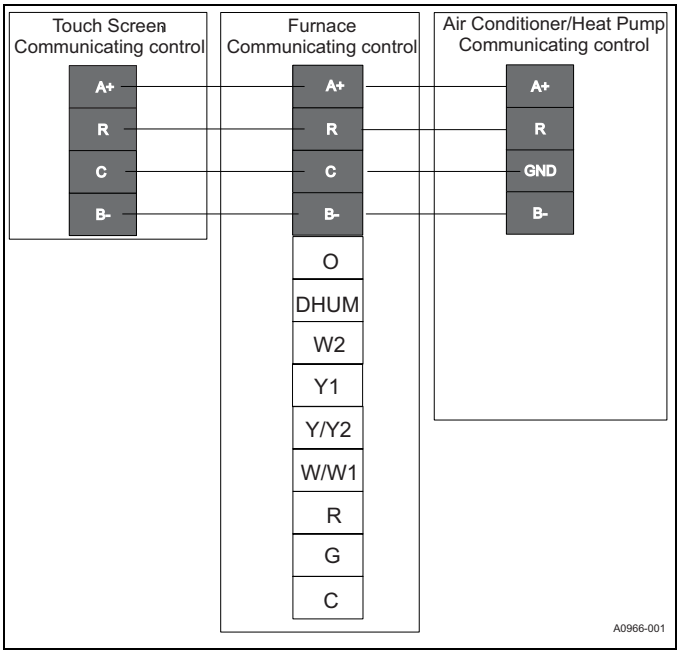


Figure 14: Two-stage furnace with communicating AC or HP

Control wiring using communicating controls (non-variable capacity outdoor models)

Use the wiring diagram to connect the furnace control, Communicating Control (wall thermostat), and communicating outdoor unit. Ensure that all of the **A** terminals are connected together, all of the **B** terminals are connected together, all of the **GND** or **C** terminals are connected together and all of the **R** terminals are connected together. See Figure 14. When using a fully communicating system, the large screw terminals (such as **C**, **G**, or **R**) on the furnace control are not used. The four small screw terminals in the terminal block on the labeled communications furnace control must be used.

Important: Do not place more than one wire under any single communication terminal screw (there are four communication terminal screws). If more than one wire must be connected, attach only the terminal end of a one-wire pigtail no longer than 6 in. and use a wire connector to connect the other end of the pigtail to the other wires. Failure to do this results in nuisance communication error faults. See Figure 16.

Float switch input

An optional switch may be connected to the FLT SWT terminals on the control board. This feature is only functional when used with the Communicating Control. It is intended for use with a water overflow switch that has contacts in either the normally open (NO) or (NC) position. **Do not** install a float switch in series with any thermostat wiring when using communicating controls.

Auxiliary switch input

An optional switch may be connected to the AUX SWT terminals on the control board. This feature is only functional when used with the Communication Control. Refer to the *Communication Control Installation Manual* (latest version).

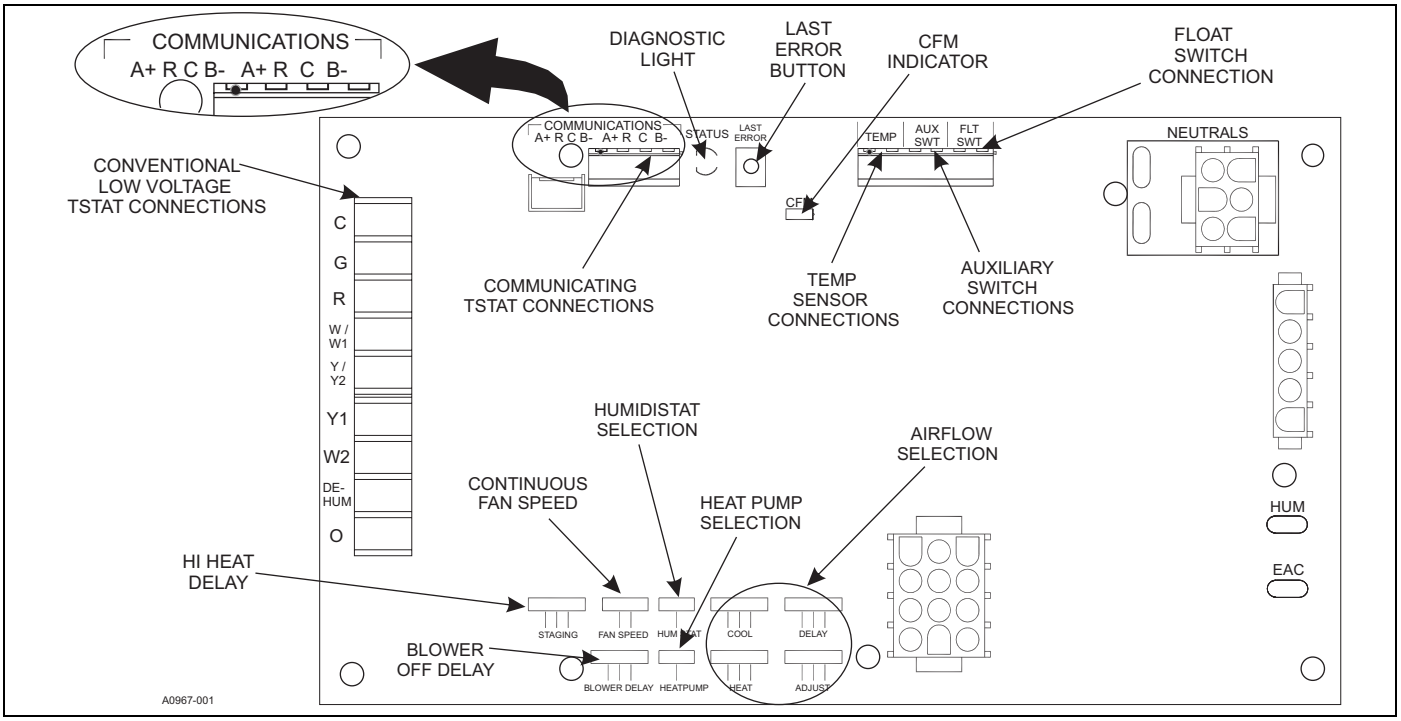


Figure 15: Furnace control board – communications connections

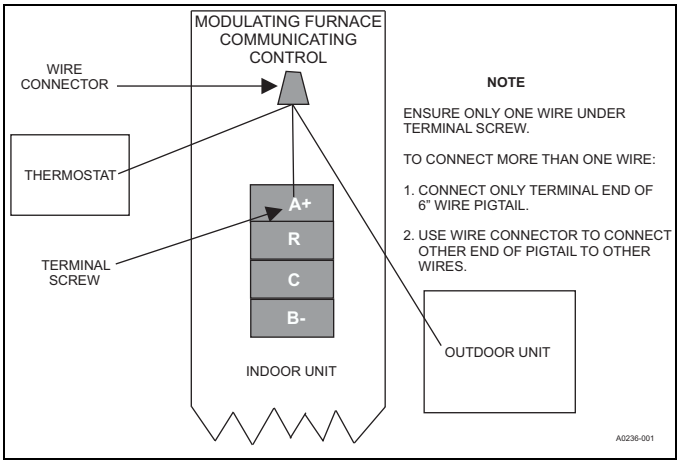


Figure 16: Terminal screw wire connection

Control wiring using communicating controls (variable capacity outdoor models)

The Communicating System consists of several intelligent communicating components including the Hx™ Thermostat, the variable speed furnace, and the variable capacity air conditioner or heat pump. These components continually communicate with each other through the wire connections shown in Figure 17. Commands, operating conditions, and other data are passed continually between components over the A-R-C-B and A-C-B bus. The result is a new level of comfort, versatility, and simplicity.

In order to use this furnace with a variable capacity outdoor unit, it must be installed with a communicating Hx thermostat.

Use the wiring diagram in Figure 17 to connect the furnace control and the Hx Thermostat (wall thermostat) to the communicating outdoor unit. Be sure that all of the **A+** terminals are connected together, all of the **B-** terminals are connected together, all of the **C** terminals are connected together and the **R** terminals from the Hx thermostat to the indoor unit are connected together. **Do not** connect the **R** wire to the outdoor unit. Use the four small screw terminals in the terminal block on the furnace control.

Connect a short piece of thermostat wire (18 AWG minimum) to the ARCB terminals on the furnace control board. Use wire connectors to connect this wire to the room thermostat wire and the outdoor unit thermostat wire. The outdoor unit contains its own control transformer. **Do not** run a thermostat **R** wire to the outdoor unit. See Figure 17 for details.

Important: Do not place more than one wire under any single communication terminal screw (there are four communication terminal screws). If more than one wire must be connected to a terminal screw, attach only the terminal end of a one-wire pigtail no longer than 6 in. and use a wire connector to connect the other end of the pigtail to the other wires. Failure to do this will result in nuisance communication error faults. See Figure 16.

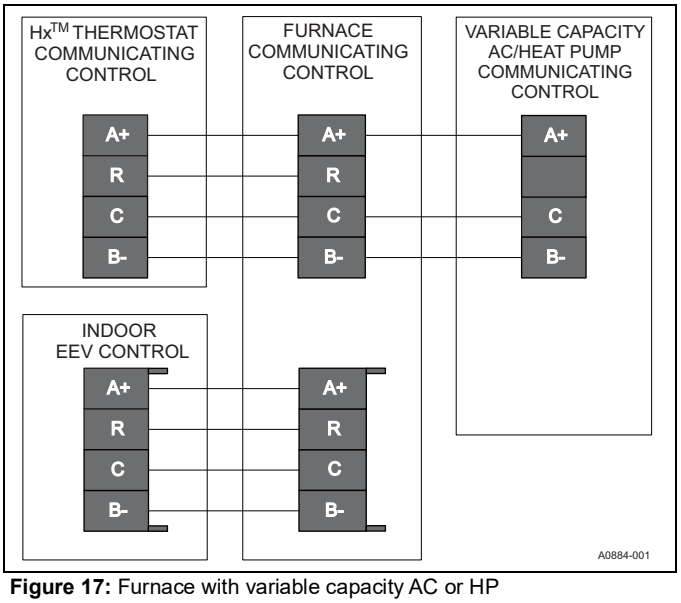


Figure 17: Furnace with variable capacity AC or HP

Float switch input

An optional switch may be connected to the **FLT SWT** terminals on the control board. This feature is only functional when used with the Communicating Control. It is intended for use with a water overflow switch that has contacts in either the normally open (NO) or (NC) position. **Do not** install a float switch in series with any thermostat wiring when using communicating controls.

Auxiliary switch input

An optional switch may be connected to the **AUX SWT** terminals on the control board. This feature is only functional when used with the Communication Control. Refer to the *Communication Control Installation Manual* (latest version).

Conventional low voltage control wiring

Install the field-supplied thermostat by following the instructions that come with the thermostat. With the thermostat set in the OFF position and the main electrical source disconnected, connect the thermostat wiring from the wiring connections on the thermostat to the terminal board on the ignition module, as shown in Figure 18 to Figure 21. Electronic thermostats may require the common wire to be connected. Apply strain relief to thermostat wires passing through cabinet. If air conditioning equipment is installed, use thermostat wiring to connect the **Y** and **C** terminals on the furnace control board to the correct wires on the condensing unit (outside unit).

Important: Set the heat anticipator in the room thermostat to 0.4 A. Setting it lower causes short cycles. Setting it higher causes the room temperature to exceed the set points.

Important: Some electronic thermostats do not have adjustable heat anticipators. They must be set to six cycles per hour. Follow the thermostat manufacturer's instructions.

The 24 V, 40 VA transformer is sized for the furnace components only, and must not be connected to power auxiliary devices such as humidifiers or air cleaners. The transformer may provide power for an air conditioning unit or heat pump.

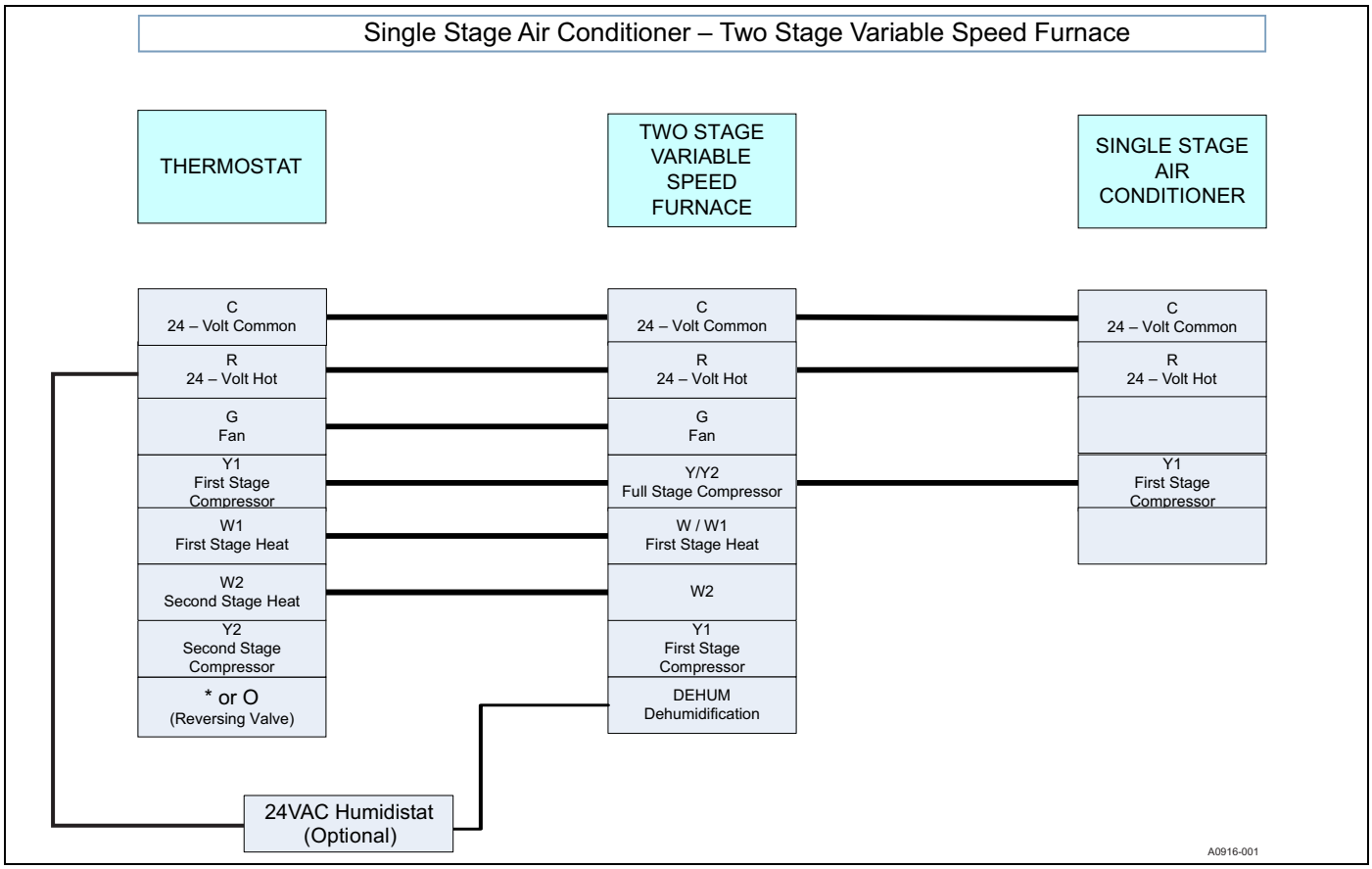


Figure 18: Thermostat chart - single stage air conditioner with two-stage variable speed furnace

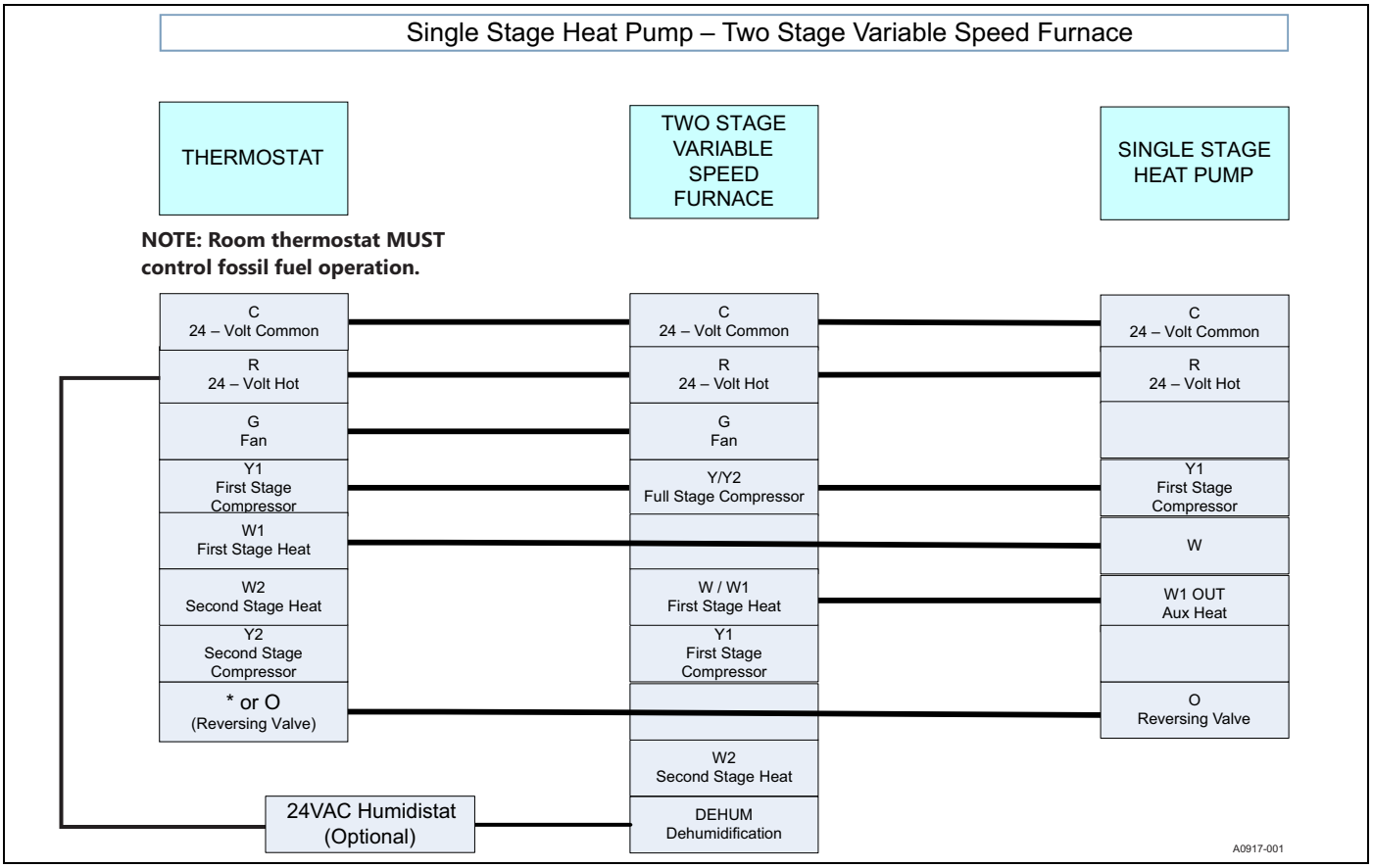


Figure 19: Thermostat chart - single stage heat pump with two-stage variable speed furnace

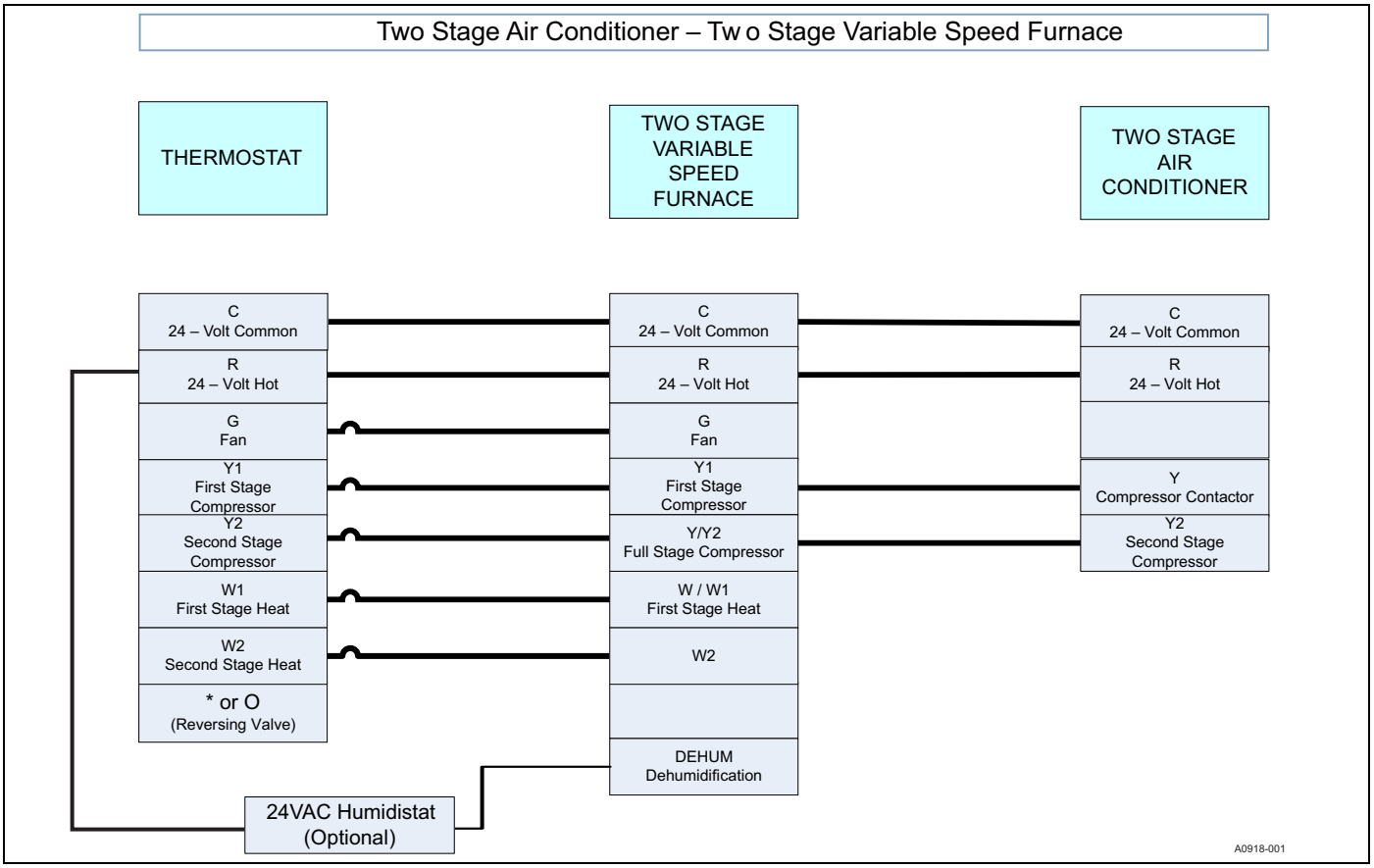


Figure 20: Thermostat chart - two-stage air conditioner with two-stage variable speed furnace

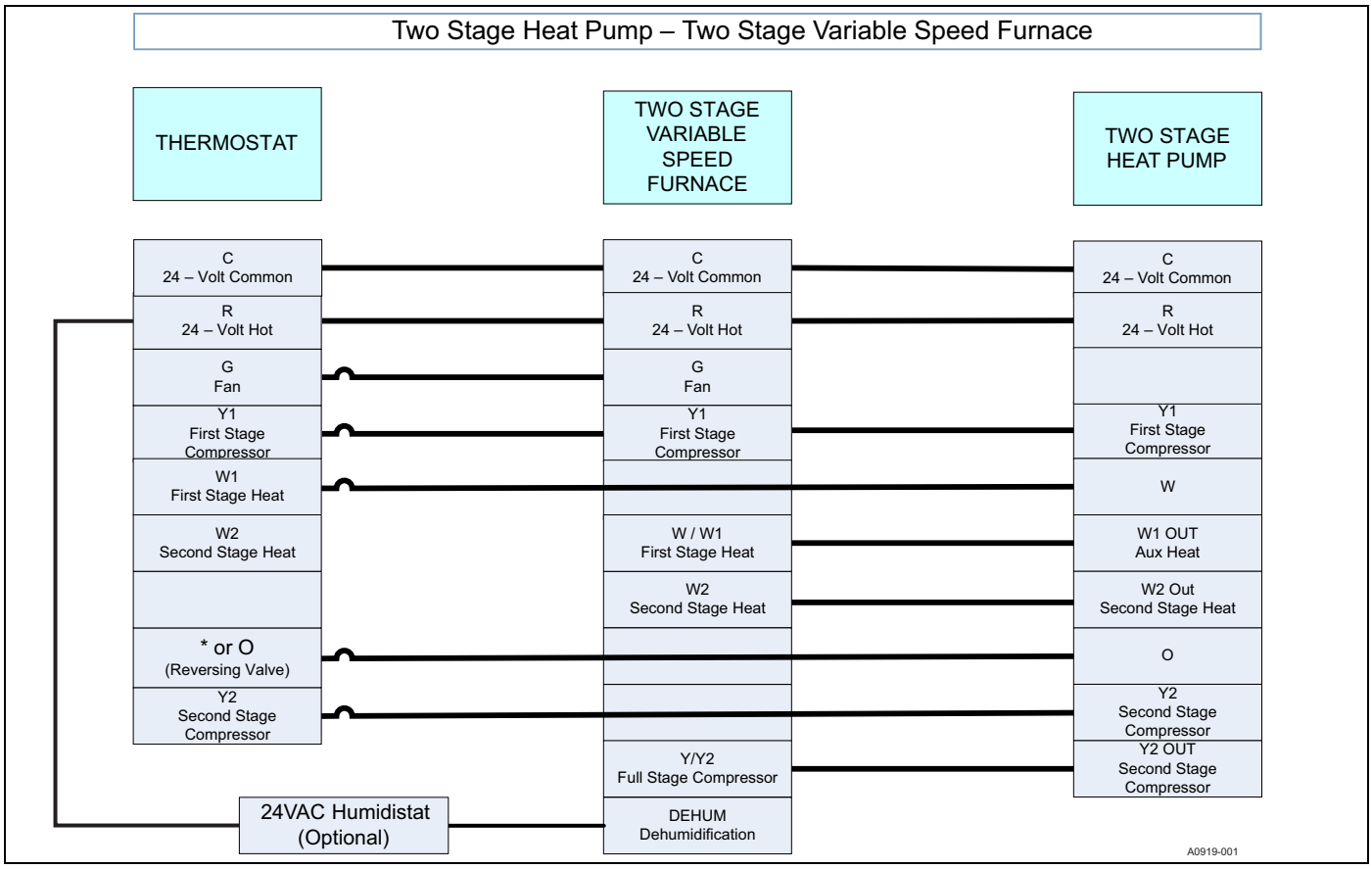


Figure 21: Thermostat chart - two-stage heat pump with two-stage variable speed furnace (hot heat pump or conventional)

Accessory connections

The furnace control will allow power-switching control of various accessories.

Electronic air cleaner connection

Two 1/4 in. (6.4 mm) spade terminals (EAC and NEUTRAL) for electronic air cleaner connections are located on the control board. The terminals provide 115 VAC (1.0 A maximum) during circulating blower operation.

Humidifier connection

Two 1/4 in. (6.4 mm) spade terminals (HUM and NEUTRAL) for humidifier connections are located on the control board. The terminals provide 115 VAC (1.0 A maximum) during heating system operation.

A mounting hole is provided on the control panel next to the furnace control board for mounting a humidifier transformer if required.

Single stage thermostat

If a single stage thermostat is used for gas heating, the high/low input staging will be controlled by the furnace control board using the staging jumper. If the staging jumper is set to the 10, 15, or 20 position, the furnace switches from low fire to high fire after 10 min, 15 min, or 20 min and stays in high fire until the thermostat is satisfied. If the staging jumper is left in the OFF position and a single stage thermostat is used, the furnace only operates at low fire.

Twinning

These furnaces are not to be twinned. If more than one furnace is needed in an application, each furnace must have its own complete duct system and its own wall thermostat.

Section VI: Condensate piping and furnace venting configuration

Condensate drain location

As shipped from the factory:

- For all 40k, 60k, and 80k input furnaces, the main drain is plumbed through the casing right-side opening when viewed from the front of the furnace.
- For all 100k, 120k, and 130k input furnaces, the main drain is plumbed through the casing left-side opening when viewed from the front of the furnace.

NOTICE

Figure 23 to Figure 26 show the condensate drain arrangement for the various possible furnace and vent blower positions.

The condensate hoses must slope downwards at all points.

⚠ CAUTION

The furnace condensate pan is self-priming and contains an internal trap to prevent flue gas leaking. **Do not** install an external condensate trap.

When drain hose routing changes are required (shown in Figure 23 to Figure 26), ensure to cap all unused openings.

If rerouting hoses, excess length must be cut off so that no sagging loops collect and hold condensate, which causes the furnace to not operate.

No hose clamps are needed for connecting to the condensate pan.

Important: The furnace, indoor coil, and humidifier drains may be combined and drained together. The indoor coil drain may have an external, field-supplied trap prior to the furnace drain connection to prevent conditioned air leakage. All drain connections (furnace, indoor coil, or humidifier) must be terminated into an open or vented drain as close to the respective equipment as possible. Regular maintenance is required on condensate drainage system.

Important: Condensate must be disposed of correctly. Follow local plumbing or wastewater codes. The drain line must maintain a 1/4 in./ft (20 mm/m) downward slope to the drain.

Important: If an external exhaust vent tee is being installed, then it must have its own condensate trap before it is disposed into an open or vented drain. This is not to be considered as a second trap as referenced elsewhere in this document.

The condensate flows to the drain better if an open stand pipe is installed in the drain line. See Figure 22.

If indoor coil or humidifier drains are combined with the furnace drain, do not drain into the top opening of the vent stand pipe. Instead, install a second tee in the vented drain tube below the furnace drain tee and route additional drainage through the new tee.

NOTICE

A loop has been added to the pressure switch vacuum hose. However, ensure that all pressure switch hoses are routed such that they prevent any condensate from entering the pressure switch.

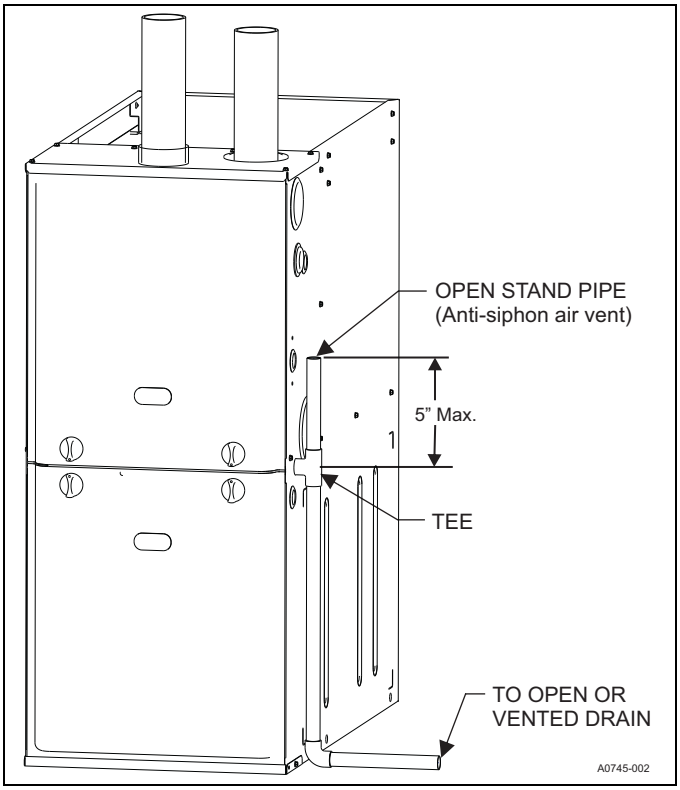


Figure 22: Typical condensate drain, vertical installation

⚠ CAUTION

It is possible for condensation to form inside the combustion air (intake) pipe in the summer months if significant length of combustion air pipe passes through conditioned space. This problem can be averted by installing the supplied vent drain and drain hose located in the loose parts bag. Install the intake drain hose by connecting it to the inlet pipe coupling and to the collector box as shown in Figure 23, Figure 25, and Figure 26. The drain hose must not sag or droop after it is installed. If glue is used when connecting the intake pipe to the intake coupling, the drain opening in the vent drain must not be plugged. If the intake drain is used, the bird screen **cannot** be installed. This is only approved for upflow and horizontal applications when the intake pipe is located on the top of the furnace. This is true for all long horizontal venting in any furnace configuration. This keeps condensate from entering the furnace.

Condensate drain termination

A condensate sump pump **must** be used if required by local codes, or if no indoor floor drain is available. The condensate sump pump must be approved for use with acidic condensate.

⚠ WARNING

Do not terminate the condensate drain in a chimney, or where the drain line may freeze. If the drain line will be exposed to temperatures below freezing, adequate measures must be taken to prevent the drain line from freezing. Failure to provide adequate protection from freezing can result in incorrect operation or damage to the equipment and possible property damage. When exposed to temperatures below freezing, use of a 3 W/ft to 6 W/ft at 115 VAC, 40°F (4.4°C) self-regulating, shielded, and waterproof heat tape is recommended on the drain line outside the furnace.

Do not trap the drain line at any location. The furnace has a condensate drain trap built into the drain pan.

⚠ WARNING

Liquid anti-freeze causes damage to internal plastic parts of this furnace. **DO NOT attempt to winterize the furnace using liquid anti-freeze.**

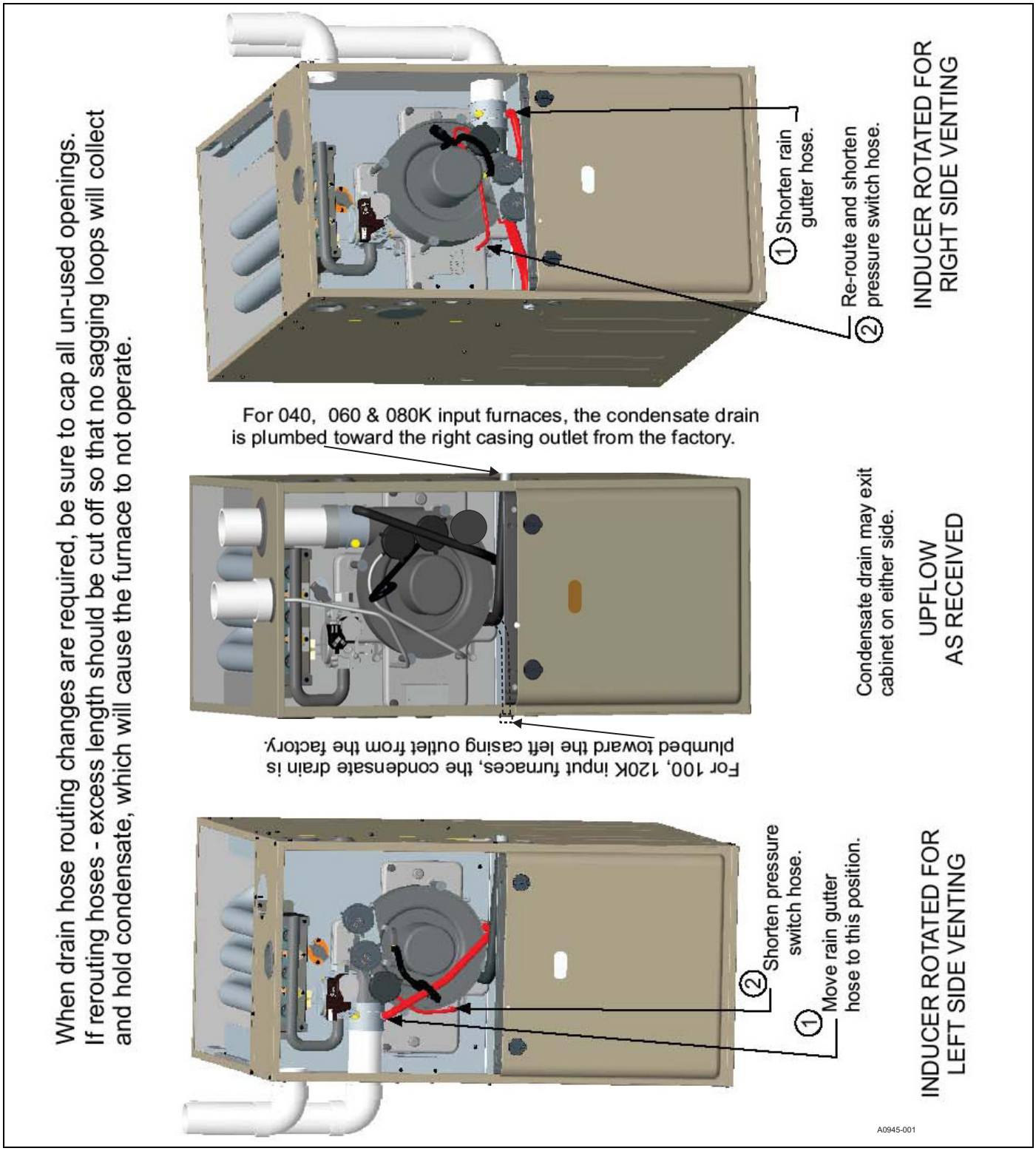


Figure 23: Upflow configuration

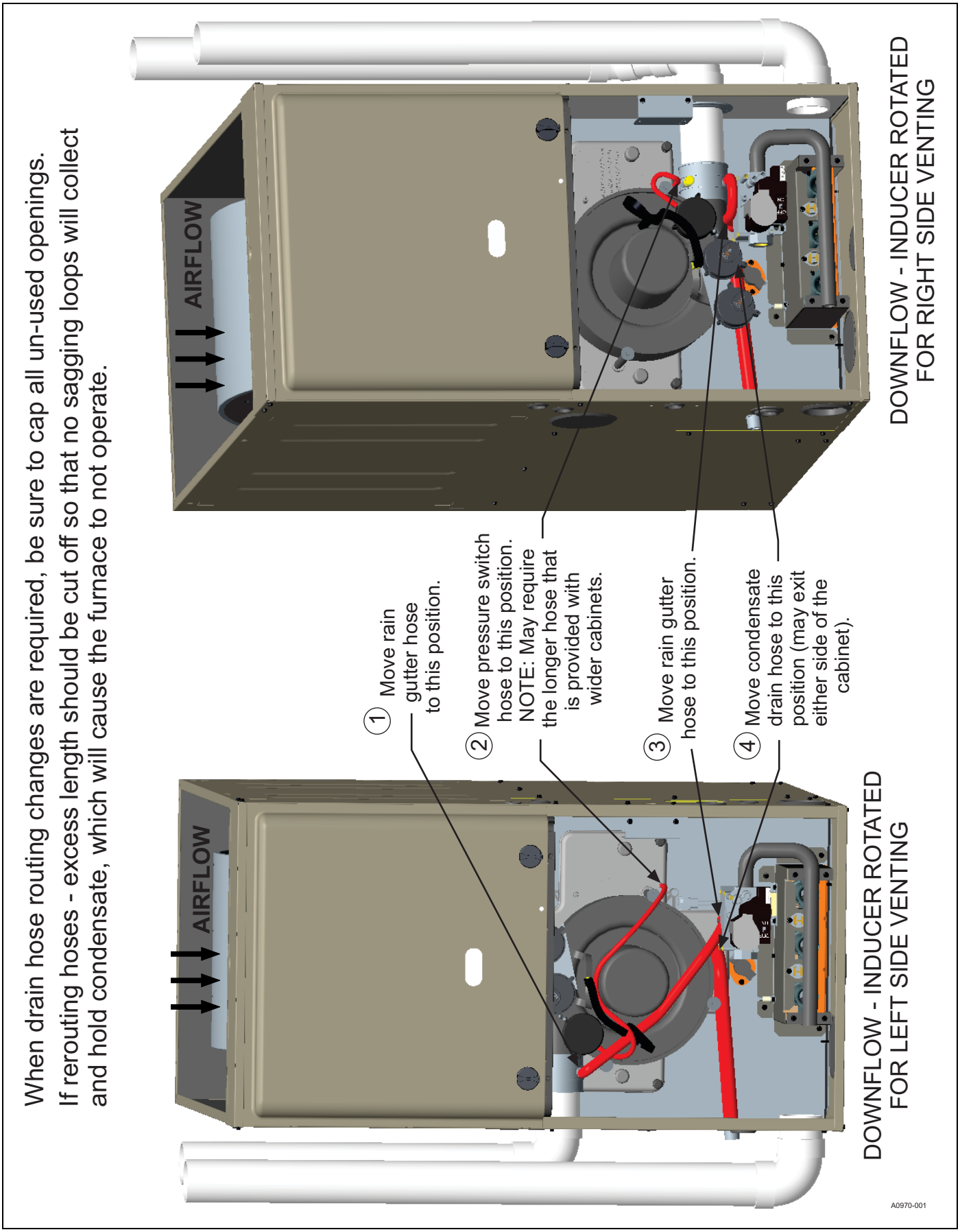


Figure 24: Downflow configuration

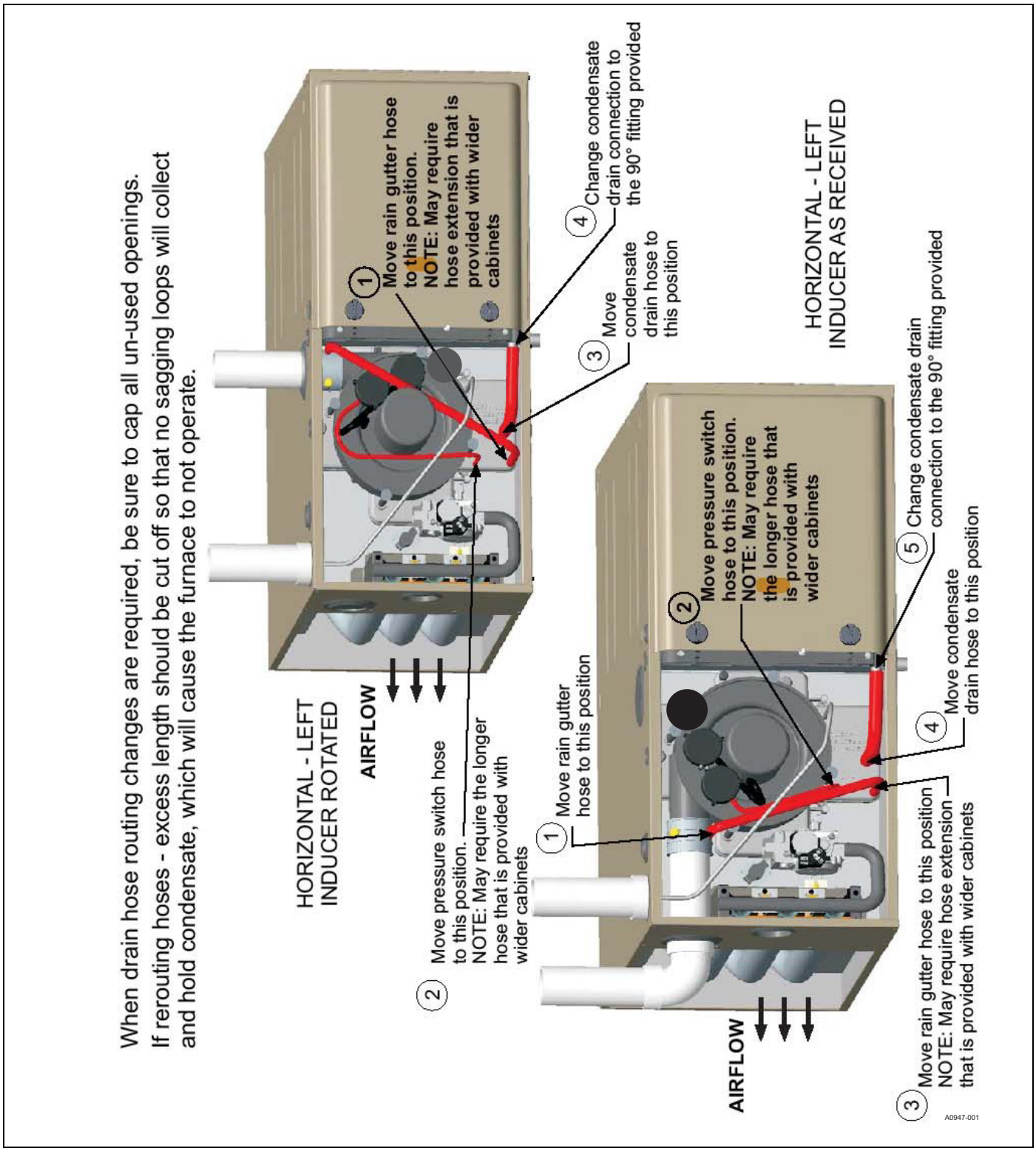


Figure 25: Horizontal left configuration

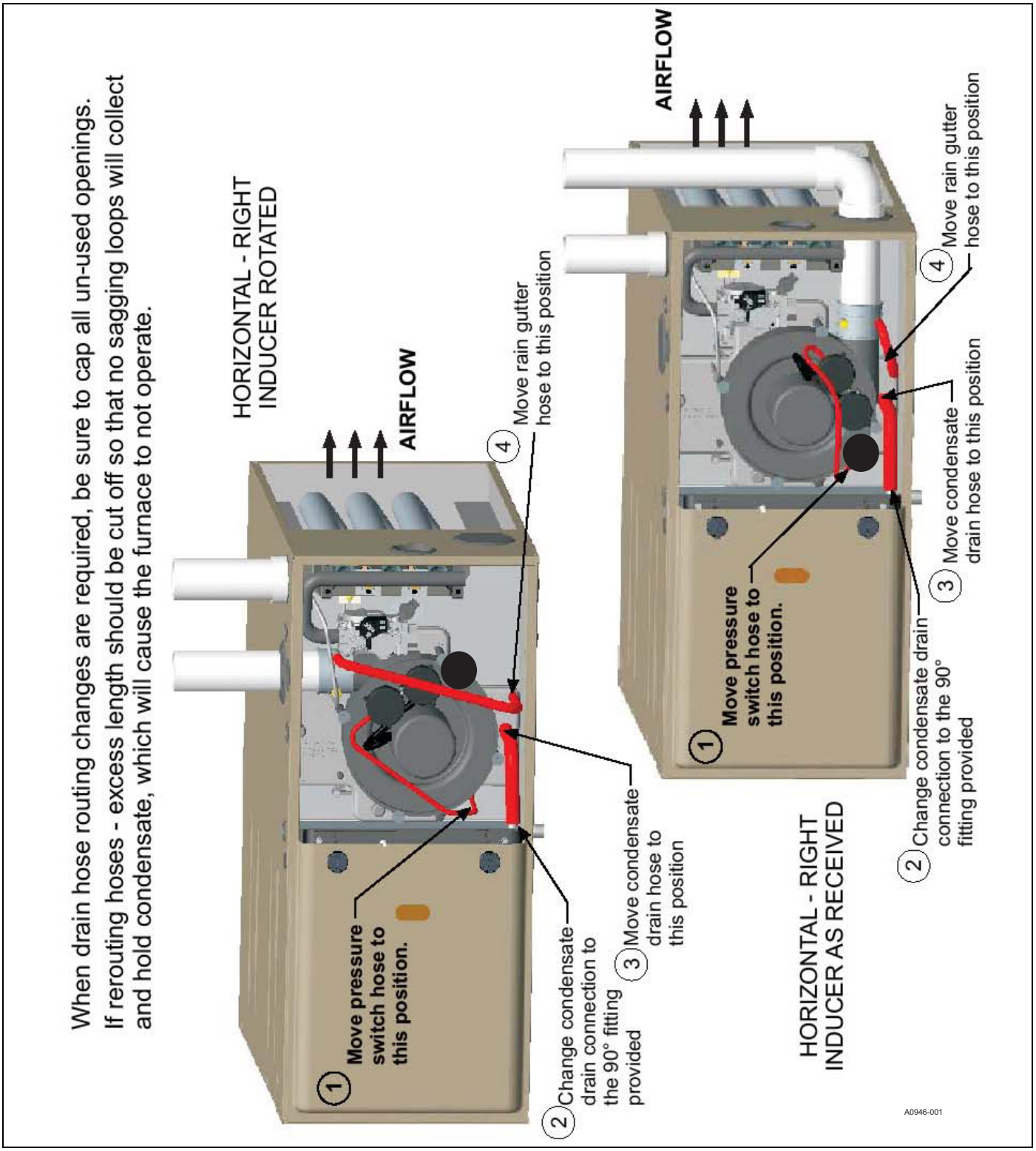


Figure 26: Horizontal right configuration

Section VII: Combustion air and vent system

Combustion air and vent safety

This Category IV, dual certified direct vent furnace is designed for residential application. It may be installed without modification to the condensate system in a basement, garage, equipment room, alcove, attic or any other indoor location that meets all required clearance to combustibles and other restrictions. The combustion air and the venting system must be installed in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code Z223.1/NFPA 54 (latest edition), or Sections 7.2, 7.3 or 7.4 of CSA B149.1, National Gas and Propane Codes (latest edition) or applicable provisions of the local building code and these instructions.

Important: The vent system must be installed as specified in these instructions for Residential and non-HUD Modular Homes. The direct vent system is the only configuration that can be installed in a non-HUD Modular Home.

⚠ WARNING

This furnace may not be common vented with any other appliance, since it requires separate, correctly sized air intake and vent lines. The furnace must not be connected to any type of B, BW or L vent or vent connector, and not connected to any portion of a factory-built or masonry chimney.

The furnace must not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.

⚠ CAUTION

When the combustion air pipe is installed above a suspended ceiling or when it passes through a warm and humid space, the pipe may need to be insulated if 2 ft or more of pipe is exposed.

Vent piping must be insulated if it will be subjected to freezing temperatures such as routing through unheated areas or through an unused chimney.

Combustion air/vent pipe sizing

The size of pipe required is determined by the furnace model, the total length of pipe required, and the number of elbows required.

Table 7 lists the maximum equivalent length of pipe allowed for each model of furnace. The equivalent length of pipe for each elbow installed is listed in Table 10. The equivalent length of the vent system is the total length of straight pipe **plus** the equivalent length of all of the elbows.

The following rules must also be followed:

1. If venting with PVC, drain, waste, and vent (DWV) elbows with a long radius (sweep) are recommended. Standard DWV elbows may be used, but since they have a longer equivalent length, they reduce the total length of pipe that is allowed. If venting with CPVC, long radius (sweep) elbows such as Spears Manufacturing LabWaste(R) series must be used. Short radius (plumbing or pressure) elbows are not allowed for venting. The standard dimensions of the acceptable elbows are shown in Figure 27.
2. The maximum equivalent length listed in Table 7 is for the vent piping and the air intake piping separately. For example, if the table allows 65 equivalent ft for a particular model, then the vent can have 65 equivalent ft of pipe, and the combustion air intake can have another 65 equivalent ft of pipe.
3. Three vent terminal elbows (two for the vent and one for the combustion air intake) are already accounted for and need not be included in the equivalent length calculation.
4. If using a flexible connector in the vent system, it must be made of a material that is resistant to acidic exposure and to at least 225°F (107.2°C) temperature. Flexible connectors are also allowed in the combustion air pipe.
5. All PVC, CPVC, or ABS combustion air and vent pipe must conform to American National Standards Institute (ANSI) and American Society for Testing and Materials (ASTM) standards D1785 (Schedule 40 PVC), D2665 (PVC-DWV), D2846 (CPVC), F441 (CPVC), F442 (CPVC), D2261 (ABS-DWV) or F628 (Schedule 40 ABS). All IPEX System 1738 must conform to UL 1738 Standards and American Society for Testing and Materials (ASTM) standards D2665. Pipe cement and primer must conform to ASTM Standard D2546 (PVC), F493 (CPVC), or D2235 (ABS). If ABS pipe is used, any joint where ABS pipe is joined to PVC pipe must be glued with cement that is approved for use with both materials.
6. All models are supplied with 2 in. (5.1 cm) vent connections. When the pipe must be increased to 3 in. (7.6 cm) diameter, the transition from 2 in. to 3 in. must be done as close to the furnace as possible. The 2 in. to 3 in. increase must be installed in the vertical position as to not create an area that pools water.
7. In Canada, vents must be certified to ULC S636, Standard for Type BH Gas Venting Systems.
8. In Canada, the first 3 ft (91.4 cm) of the vent must be readily accessible for inspection.
9. For single pipe systems, install the combustion air coupling provided and install approximately 18 in. of pipe on the furnace.
10. The minimum vent length for all models is 5 ft (1.5 m).

Polypropylene vent/intake piping

The ULC S636 approved polypropylene (PP) vent piping materials listed below have been tested and approved for use with this furnace. **Do not** mix parts made by different manufacturers. The entire vent/air intake system must be made from pipe, fittings, and termination made by the same manufacturer. Only single-wall rigid polypropylene pipe is approved for these furnaces. Use of flexible polypropylene pipe is not allowed.

Selkirk Polyflue (Hart & Cooley) part numbers

- Horizontal concentric termination - 2 in. - 2PF-HCT
- Horizontal concentric termination - 3 in. - 3PF-HCT
- Locking band - PF-LB

Consult the Polyflue installation instructions for assembly details.

For other Polyflue pipe and fitting part numbers, visit:
www.polyflue.com

DuraVent PolyPro part numbers

- Adapter to air intake coupling - 2PPS-ADL
- Adapter connector - PPS-PAC
- Twin pipe horizontal termination - 2 in. - 2PPS-HTPL
- Twin pipe horizontal termination - 3 in. - 3PPS-HTPL

Consult the PolyPro installation instructions for assembly details.

For other PolyPro pipe and fitting part numbers, visit:
www.duravent.com

Centrotherm InnoFlue

- Adapter to air intake coupling - ISAGL0202
- Adapter to draft inducer blower - ISAAL0202
- Low profile wall termination - 2 in. - ISLPT0202
- Low profile wall termination - 3 in. - ISLPT0303

Consult the InnoFlue installation instructions for assembly details.

For other InnoFlue pipe and fitting part numbers, visit:
www.centrotherm.us.com

IPEX System 1738

- 2 in. PVC FGV coupling - 397352
- 3 in. PVC FGV coupling - 397353

Consult the IPEX System 1738 installation instructions for assembly details. For other IPEX System 1738 pipe and fitting part numbers, visit website www.ipexna.com/usa/products/plumbing-mechanical/flue-gas-venting-systems/system-1738-pvc

Table 7: Maximum equivalent pipe length

Elevation sea level to 2,000 ft			Elevation 6,001 ft to 7,000 ft		
Model Input (Btu/h)	Pipe Size (in.)	Maximum equivalent Length (ft)	Model Input (Btu/h)	Pipe Size (in.)	Maximum equivalent Length (ft)
40,000	2	65	40,000	2	40
40,000	3	90	40,000	3	65
40,000	4	150	40,000	4	130
60,000	2	65	60,000	2	40
60,000	3	90	60,000	3	65
60,000	4	150	60,000	4	130
80,000	2	65	80,000	2	30
80,000	3	90	80,000	3	65
80,000	4	150	80,000	4	130
100,000	2	30	100,000	2	5
100,000	3	90	100,000	3	65
100,000	4	150	100,000	4	130
120,000	3	90	120,000	3	65
120,000	4	150	120,000	4	130
Elevation 2,001 ft to 4,000 ft			**Elevation 7,001 ft to 8,000 ft**		
Model Input (Btu/h)	Pipe Size (in.)	Maximum equivalent Length (ft)	Model Input (Btu/h)	Pipe Size (in.)	Maximum equivalent Length (ft)
40,000	2	55	40,000	2	35
40,000	3	80	40,000	3	60
40,000	4	145	40,000	4	125
60,000	2	55	60,000	2	35
60,000	3	80	60,000	3	60
60,000	4	145	60,000	4	125
80,000	2	55	80,000	2	25
80,000	3	80	80,000	3	60
80,000	4	145	80,000	4	125
100,000	2	20	100,000	2	NA
100,000	3	80	100,000	3	60
100,000	4	145	100,000	4	125
120,000	3	80	120,000	3	60
120,000	4	145	120,000	4	125
Elevation 4,001 ft to 5,000 ft			**Elevation 8,001 ft to 9,000 ft**		
Model Input (Btu/h)	Pipe Size (in.)	Maximum equivalent Length (ft)	Model Input (Btu/h)	Pipe Size (in.)	Maximum equivalent Length (ft)
40,000	2	50	40,000	2	30
40,000	3	75	40,000	3	55
40,000	4	140	40,000	4	120
60,000	2	50	60,000	2	30
60,000	3	75	60,000	3	55
60,000	4	140	60,000	4	120
80,000	2	50	80,000	2	20
80,000	3	75	80,000	3	55
80,000	4	140	80,000	4	120
100,000	2	15	100,000	2	NA
100,000	3	75	100,000	3	55
100,000	4	140	100,000	4	120
120,000	3	75	120,000	3	55
120,000	4	140	120,000	4	120
Elevation 5,001 ft to 6,000 ft			**Elevation 9,001 ft to 10,000 ft**		
Model Input (Btu/h)	Pipe Size (in.)	Maximum equivalent Length (ft)	Model Input (Btu/h)	Pipe Size (in.)	Maximum equivalent Length (ft)
40,000	2	45	40,000	2	25
40,000	3	70	40,000	3	50
40,000	4	135	40,000	4	115
60,000	2	45	60,000	2	25
60,000	3	70	60,000	3	50
60,000	4	135	60,000	4	115
80,000	2	35	80,000	2	15
80,000	3	70	80,000	3	50
80,000	4	135	80,000	4	115
100,000	2	10	100,000	2	NA
100,000	3	70	100,000	3	50
100,000	4	135	100,000	4	115
120,000	3	70	120,000	3	50
120,000	4	135	120,000	4	115

Table 8: High altitude pressure switches

High altitude pressure switches required for all installations above 5,000 ft	
Part number	**Models**
S1-1PS3308	All

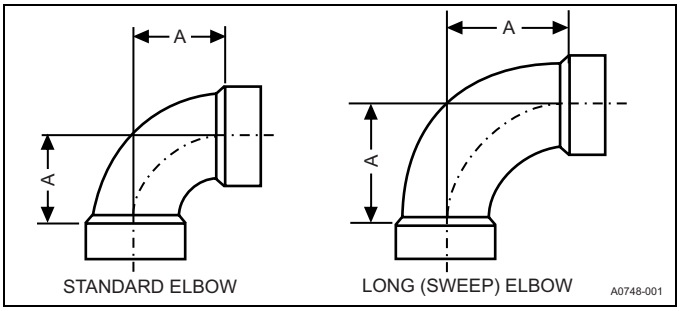


Figure 27: Dimensions

Table 9: Elbow dimensions

Elbow	Dimensions of A (in.) (See Figure 27)
2 in. Standard	2 5/16
3 in. Standard	3 1/16
2 in. Sweep	3 1/4
3 in. Sweep	4 1/16

Dimensions are those required in Standard ASTM D-3311.

Table 10: Equivalent length of fittings

Fitting	Equivalent length
2 in. 90° sweep elbow	5 ft of 2 in. pipe
2 in. 45° sweep elbow	2 1/2 ft of 2 in. pipe
2 in. 90° standard elbow	7 ft of 2 in. pipe
2 in. 45° standard elbow	3 1/2 ft of 2 in. pipe
3 in. 90° sweep elbow	5 ft of 3 in. pipe
3 in. 45° sweep elbow	2 1/2 ft of 3 in. pipe
3 in. 90° standard elbow	7 ft of 3 in. pipe
3 in. 45° standard elbow	3 1/2 ft of 3 in. pipe
4 in. 90° elbow (sweep or standard)	5 ft of 4 in. pipe
4 in. 45° elbow (sweep or standard)	2 1/2 ft of 4 in. pipe

Example:

An 80,000 Btu/h furnace requires 32 ft of pipe and five 90º elbows. Using 2 in. pipe and standard elbows, the total equivalent length will be:

32 ft of 2 in. pipe =	32 equivalent ft
five 90º standard 2 in. elbows = (5 x 7) =	35 equivalent ft
Total =	67 equivalent ft of 2 in. pipe

This exceeds the 65 ft maximum equivalent length of 2 in. pipe allowed for that model and is thus not acceptable.

By using sweep elbows, the total equivalent length will be:

32 ft of 2 in. pipe =	32 equivalent ft
five 90º sweep 2 in. elbows = (5 x 5) =	25 equivalent ft
Total =	57 equivalent ft of 2 in. pipe

This is less than the 65 foot maximum equivalent length of 2 in. pipe allowed for that model and is thus acceptable.

Alternatively, using 3 in. pipe and standard elbows, the total equivalent length will be:

32 ft of 3 in. pipe =	32 equivalent ft
five 90º standard 3 in. elbows = (5 x 7) =	35 equivalent ft
Total =	67 equivalent ft of 3 in. pipe

This is less than the 90 ft maximum equivalent length of 3 in. pipe allowed for that model and is thus acceptable.

Table 11: Combustion air intake and vent connection size at furnace (all models)

Furnace vent connection sizes	
Furnace input	All
Intake pipe size	2 in. (5.1 cm)
Vent pipe size	2 in. (5.1 cm)

Important: Furnace vent pipe connections are sized for 2 in. (5.1 cm) pipe. Any pipe size change must be made outside the furnace casing in a vertical pipe section to allow correct drainage of condensate. An offset using two 45º elbows is required for plenum clearance when the vent is increased to 3 in. (7.6 cm).

Important: Accessory concentric vent/intake termination kits 1CT0302 and 1CT0303, and for Canadian applications 1CT0302-636 and 1CT0303-636, are available and approved for use with these furnaces. Horizontal sidewall vent terminations kits 1HT0901 and 1HT0902 are also approved for use with these furnaces. The above listed termination kits are NOT to be used with CPVC vent piping.

Combustion air and vent piping assembly

The final assembly procedure for the combustion air and vent piping is as follows:

1. Cut piping to the correct length, beginning at the furnace.
2. Deburr the piping inside and outside.
3. Chamfer (bevel) the outer edges of the piping.
4. Dry-fit the vent piping assembly from the furnace to the outside termination, checking for correct fit support and slope.
5. Dry-fit the combustion air piping assembly checking for correct fit, support, and slope on the following systems:
   a. Sealed combustion air systems from the furnace to the outside termination.
   b. Ventilated combustion air systems from the furnace to the attic or crawl space termination.

⚠ CAUTION

Solvent cements are flammable and must be used in well-ventilated areas only. Keep them away from heat, sparks and open flames. Do not breathe vapors and avoid contact with skin and eyes.

6. Disassemble the combustion air and vent piping. Apply the cement primer and the cement per the manufacturer's instructions. Primer and cement must conform to ASTM D2564 for PVC, ASTM D2235 for ABS piping, or ASTM F493 for CPVC.
7. All joints must provide a permanent airtight and watertight seal.
8. Install the combustion air and vent piping such that it has a 1/4 in./ft (21 mm/m) grade, so that condensate flows back toward the furnace. Piping must be supported with pipe hangers to prevent sagging.
9. Seal around the openings where the combustion air and / or vent piping pass through the roof or sidewalls.

Combustion air/venting

Important: The vent must be installed with the minimum required clearances, and must comply with local codes and requirements.

Vent clearances

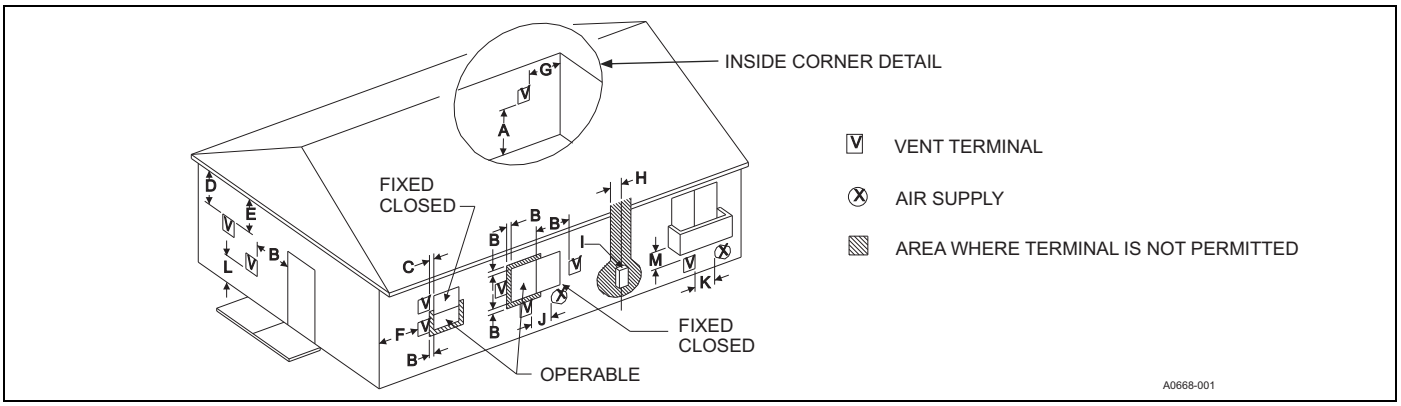


Figure 28: Home layout

Table 12: Vent clearances

Direct vent terminal clearances	Canadian installation[1,3]	US installation[2,3]
A. Clearance above grade, veranda, porch, deck, or balcony	12 in. (30.5 cm)	12 in. (30.5 cm)
B. Clearance to window or door that may be opened	12 in. (30.5 cm) for models <100,000 Btu/h (30 kW) 36 in. (91.4 cm) for models >100,000 Btu/h (30 kW)	Two-pipe (direct vent) applications: 9 in. (23 cm) for models <50,000 Btu/h (15 kW) 12 in. (30.5 cm) for models >50,000 Btu/h (15 kW) †† Single-pipe applications: 4 ft (1.2 m)
C. Clearance to permanently closed window	12 in. (30.5 cm)	12 in. (30.5 cm)
D. Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal	12 in. (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier	12 in. (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier
E. Clearance to unventilated soffit	12 in. (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier	12 in. (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier
F. Clearance to outside corner	12 in. (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier	12 in. (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier
G. Clearance to inside corner	3 ft (91.4 cm)	3 ft (91.4 cm)
H. Clearance to each side of center line extended above meter/regulator assembly	Within 3 ft (91.4 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m) above the meter/regulator assembly	Within 3 ft (91.4 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m) above the meter/regulator assembly
I. Clearance to service regulator vent outlet	3 ft (91.4 cm)	3 ft (91.4 cm) or in accordance with local installation codes and the requirements of the gas supplier
J. Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	12 in. (30.5 cm) for models <100,000 Btu/h (30 kW) 3 ft (91.4 cm) for models >100,000 Btu/h (30 kW)	Two-pipe (direct vent) applications: 9 in. (23 cm) for models <50,000 Btu/h (15 kW) 12 in. (30.5 cm) for models >50,000 Btu/h (15 kW) Single-pipe applications: 4 ft (1.2 m)
K. Clearance to a mechanical supply inlet	6 ft (1.83 m)	3 ft (91.4 cm) above if within 10 ft (3 m) horizontally
L. Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	7 ft (2.13 m) or in accordance with local installation codes and the requirements of the gas supplier
M. Clearance under veranda, porch, deck, or balcony	12 in. (30.5 cm)‡	12 in. (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier

1. In accordance with the current CSA B149.1-00, Natural Gas and Propane Installation Code
2. In accordance with the current ANSI Z223.1 / NFPA 54, National Gas Code
3. In accordance with the current ANSI Z21.47 * CSA 2.3 American National Standard

† A vent must not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

†† 12 in. (30.5 cm) up from the bottom edge of the structure for two-pipe (direct vent) applications per ANSI Z223.1 / NFPA 54, National Gas Code

‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor and the distance between the top of the vent termination and the underside of the veranda, porch, or deck is greater than 12 in. (30.5 cm) as specified in CSA B149.1-00.

A vent must not terminate less than 12 in. (30.5 cm) above a grade level.

Any fresh air or make up inlet for dryer or furnace area is considered to be a forced air inlet.

Avoid areas where condensate drippage may cause problems such as above planters, patios, or adjacent to windows where steam may cause fogging.

A terminus of a vent must be fitted with a cap in accordance with the vent manufacturer's installation instructions, or in accordance with the installation instructions for a special venting system.

Responsibility for the provision of correct, adequate venting and air supply for application rests with the installer.

Vents must extend high enough above buildings, or a neighboring obstruction, so that wind from any direction will not create a positive pressure in the vicinity of the vent.

Important: Consideration must be given for degradation of building materials by flue gases. Sidewall termination may require sealing or shielding of building surfaces with a corrosion resistant material to protect against combustion product corrosion. Consideration must be given to wind direction in order to prevent flue products or condensate from being blown against the building surfaces. If a metal shield is used, it must be a stainless steel material at a minimum dimension of 20 in. (51 cm). Attach a retaining type collar to the building surface to prevent movement of the vent pipe.

Vent system

This furnace is certified for installation with one of two possible vent configurations:

1. Horizontal vent system. This vent system can be installed completely horizontal or combinations of horizontal, vertical, or offset using elbows.
2. Vertical vent system. This vent system can be installed completely vertical or a combination of horizontal, vertical, or offset using elbows.

Vent applications and termination

When selecting the location for a combustion air/vent termination, the following must be considered:

1. Observe all clearances listed in Table 12.
2. Termination must be positioned where vent vapors do not damage plants or shrubs or air conditioning equipment.
3. Termination must be located where it is not affected by wind gusts, light snow, or airborne leaves, and it does not allow recirculation of flue gases.
4. Termination must be located where it cannot be damaged by or exposed to flying objects such as stones or balls.
5. Termination must be positioned where vent vapors are not objectionable.
6. Horizontal portions of the vent system must slope upwards and be supported to prevent sagging.
7. Direct vent systems must be installed so the vent and the combustion air pipes terminate in the same atmospheric zone. See Figures 30 or 31.

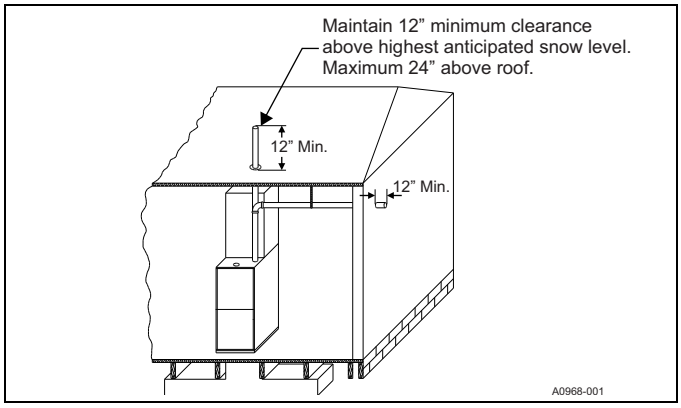


Figure 29: Termination configuration - single pipe

⚠ WARNING

Condensation in Intake Pipe

For installations where the furnace and intake pipe are located in a conditioned space and in a region that has hot, humid weather extending several consecutive days, condensate forms in the intake pipe. Use of the supplied intake drain ensures that any condensate is safely diverted away from the internal components of the furnace. Correct venting installation (of both intake and exhaust) and sealing any equipment air leaks that might contact the intake pipe help reduce condensation.

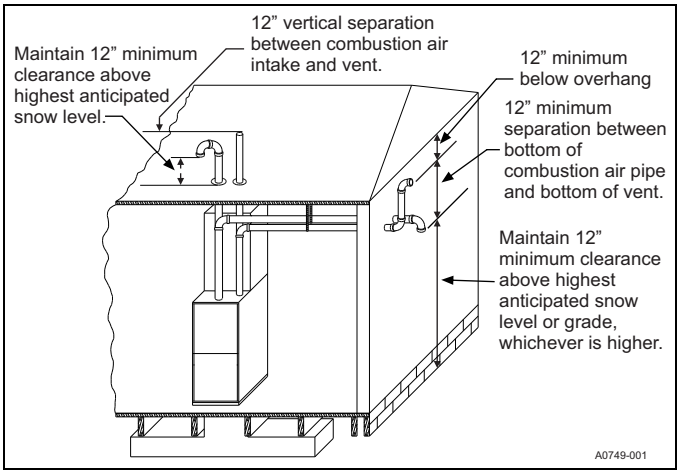


Figure 30: Termination configuration - two pipe

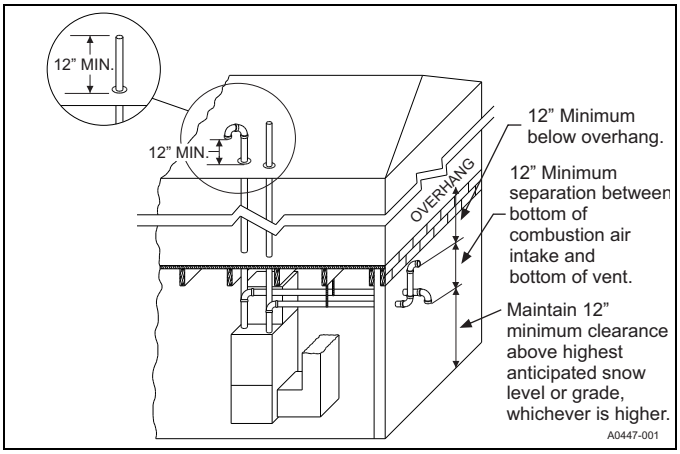


Figure 31: Termination configuration - two pipe (basement)

Venting multiple units

Multiple units can be installed in a space or structure as either a single-pipe configuration or a two-pipe configuration.

The combustion air side of the single-pipe configuration shown in Figure 36 is referred to in these instructions as ambient combustion air supply. Follow the instructions for *ambient combustion air* installations, paying particular attention to the section on air source from inside the building. The vent for a single-pipe system must be installed as specified in the venting section of these instructions with both vents terminating as shown in Figure 29. Each furnace must have a separate vent pipe. **Under no circumstances** can the two vent pipes be tied together.

The combustion air side of the two-pipe configuration shown in Figure 35 can be installed so the combustion air pipe terminates as described in the *outdoor combustion air* or *ventilated combustion air* sections in these instructions. Follow the instructions for *outdoor combustion air* or *ventilated combustion air,* and the instructions for *installing the vent system* with the vent terminating as shown in Figures 32 or 33. The two-pipe system must have a separate combustion air pipe and a separate vent pipe for each furnace. **Under no circumstances** can the two combustion air or vent pipes be tied together. The combustion air and vent pipes must terminate in the same atmospheric zone.

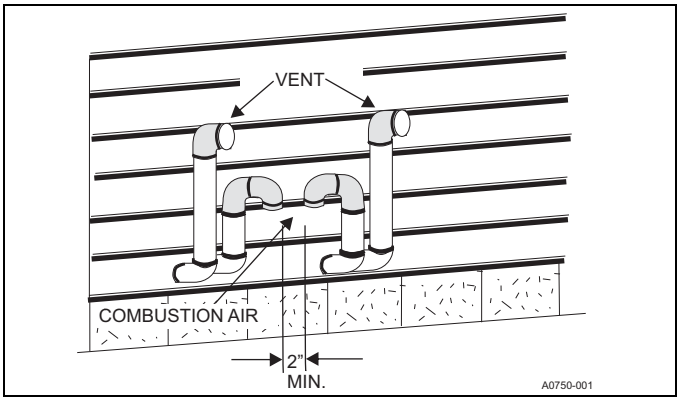


Figure 32: Double horizontal combustion air intake and vent term

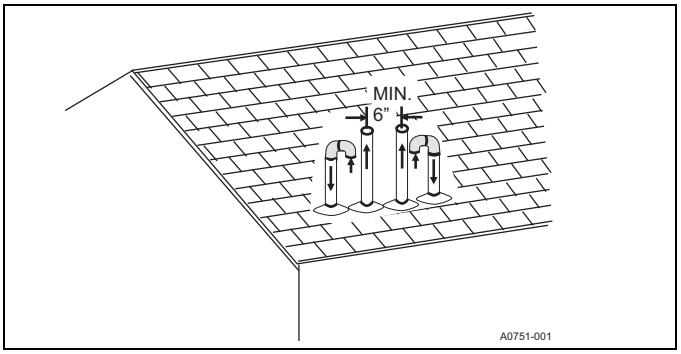


Figure 33: Double vertical combustion air intake and vent term

Downward venting

In some applications, it may be necessary to run the vent pipe and air intake downwards. If this is to be done, the following rules must be followed:

- A condensate trap hose must be connected to both the air intake pipe and the vent pipe at the lowest part of the horizontal run.
- The condensate drain trap must have a trap of a minimum of 6 in..
- The total vertical downward distance must not exceed 16 ft.
- The condensate drain hose must be connected to a condensate drain pump, an open or vented drain, or into the condensate drain line from the furnace.
- The condensate drain lines must not pass through unconditioned spaces where the temperature may fall below freezing.
- The condensate drain line must be primed at the initial start-up prior to the start of heating season.

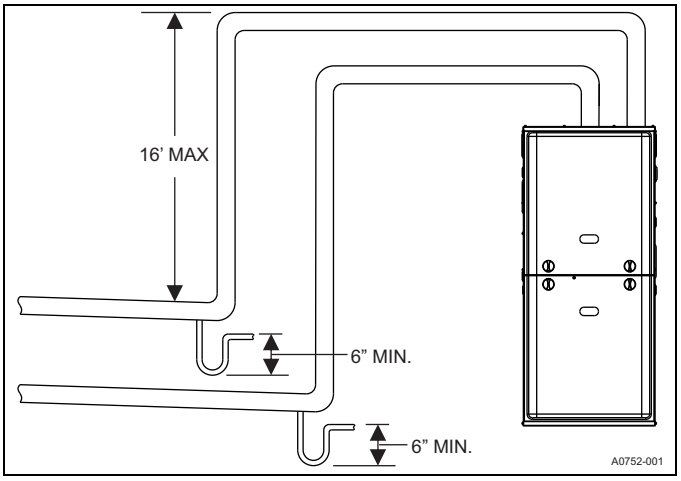


Figure 34: Downward venting

Combustion air supply

All installations must comply with Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 or Sections 7.2, 7.3 or 7.4 of CAN/CGA B149.1 or B149.2 Installation Code, latest editions.

This furnace is certified to be installed with one of three possible combustion air intake configurations:

1. **Outdoor combustion air:** This is a direct vent configuration where the combustion air is supplied through a PVC, CPVC, or ABS pipe that is connected to the coupling attached to the furnace and is terminated in the same atmospheric zone as the vent. This type of installation is approved on all models. See Figure 35.
2. **Ambient combustion air:** Combustion air is supplied from the area surrounding the furnace through openings in the furnace casing. The combustion air and the vent pipes are not terminated in the same atmospheric zone. See Figure 29 for vent terminations. See *Ambient Combustion Air Supply* for correct installation. See Figures 36 and 37.
3. **Ventilated combustion air:** Combustion air is supplied through a PVC, CPVC, or ABS pipe that is connected to the coupling attached to the burner box and is terminated in a ventilated attic or crawl space. The combustion air and the vent pipes are not terminated in the same atmospheric zone. See Figure 38 for attic and crawl space termination. Only the combustion air intake may terminate in the attic. The vent must terminate outside.

Outdoor combustion air

Combustion air intake/vent connections

This installation requires combustion air to be brought in from outdoors. This requires a correctly sized pipe (see Figure 35) that will bring air in from the outdoors to the furnace combustion air intake collar on the burner box. The second pipe (see Figure 35) is the furnace vent pipe.

NOTICE

An optional plastic birdscreen is shipped in the loose parts bag with every furnace. Install this in the intake collar to prevent any small objects from entering the furnace.

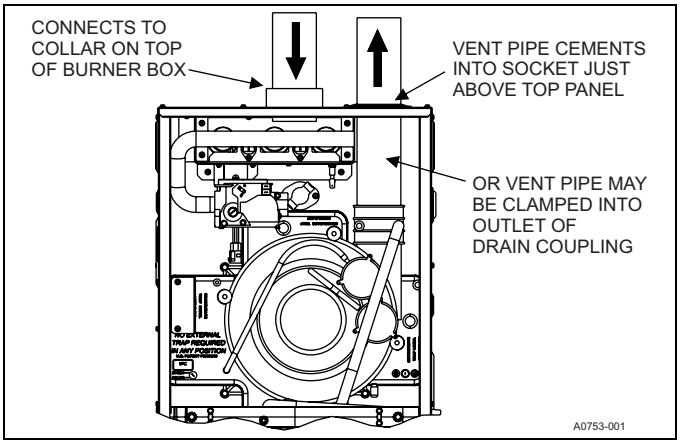


Figure 35: Direct vent air intake connection and vent connection

The combustion air intake pipe must be located either through the wall (horizontal or side vent) or through the roof (vertical vent). Care must be taken to locate side vented systems where trees or shrubs will not block or restrict supply air from entering the terminal.

Also, the terminal assembly must be located as far as possible from a swimming pool or a location where swimming pool chemicals might be stored. Be sure the terminal assembly follows the outdoor clearances listed in *Combustion Air Quality (List of Contaminants)* in Section I.

Ambient combustion air supply

This type installation draws the air required for combustion from within the space surrounding the appliance and from areas or rooms adjacent to the space surrounding the appliance. This may be from within the space in a non-confined location or it may be brought into the furnace area from outdoors through permanent openings or ducts. It is not piped directly into the furnace. A single, correctly sized pipe from the furnace vent connector to the outdoors must be provided. Attach the supplied intake coupling and 18 in. (46 cm) of pipe to the furnace to prevent accidental blockage of the combustion air intake.

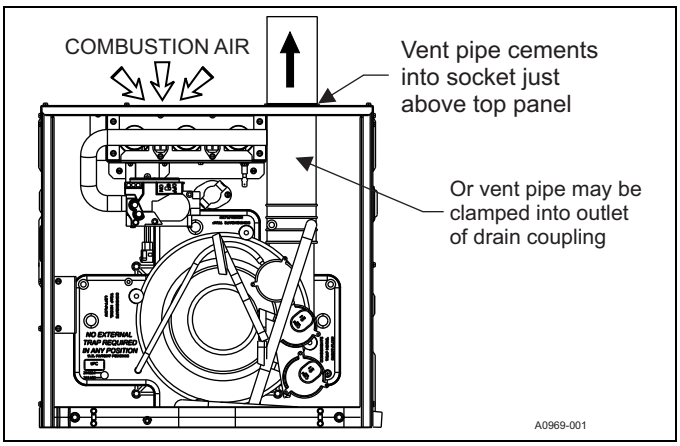


Figure 36: Combustion airflow path through the furnace casing

⚠ WARNING

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

An **unconfined space** is not less than 50 ft^3 (1.42 m^3) per 1,000 Btu/h (0.2928 kW) input rating for all of the appliances installed in that area.

Rooms communicating directly with the space containing the appliances are considered part of the unconfined space, if doors are furnished with openings or louvers.

A **confined space** is an area with less than 50 ft^3 (1.42 m^3) per 1,000 Btu/h (0.2928 kW) input rating for all of the appliances installed in that area. The following must be considered to obtain correct air for combustion and ventilation in confined spaces.

Combustion air source from outdoors

The blocking effects of louvers, grilles and screens must be given consideration in calculating free area. If the free area of a specific louver or grille is not known, see Table 12, to estimate free area.

Table 13: Estimated free area

Wood or metal louvers or grilles	Wood 20–25%* Metal 60–70% *
Screens+	1/4 in. (6.4 mm) mesh or larger 100%

* Do not use less than 1/4 in. (6.4 mm) mesh.
* Do not use less than 1/4 in. (6.4mm) mesh.
\+ Free area of louvers and grille varies widely; the installer must follow louver or grille manufacturer's instructions.

Dampers, louvers and grilles (Canada only)

1. The free area of a supply air opening shall be calculated by subtracting the blockage area of all fixed louvers grilles or screens from the gross area of the opening.
2. Apertures in a fixed louver, a grille, or screen shall have no dimension smaller than 1/4 in. (6.4 mm).
3. A manually operated damper or manually adjustable louvers are not permitted for use.
4. A automatically operated damper or automatically adjustable louvers shall be interlocked so that the main burner cannot operate unless either the damper or the louver is in the fully open position.

⚠ WARNING

When a Category I furnace is removed or replaced, the original venting system may no longer be correctly sized to correctly vent the attached appliances.

An incorrectly sized vent system can cause CARBON MONOXIDE to spill into the living space causing personal injury, and or death.

Table 14: Unconfined space minimum area

Btu/h input rating	Minimum free area required for each opening
40,000	40 $in.^2$ (258 cm^2)
60,000	60 $in.^2$ (387 cm^2)
80,000	80 $in.^2$ (516 cm^2)
100,000	100 $in.^2$ (645 cm^2)
120,000	120 $in.^2$ (742 cm^2)

Table 15: Free Area

Btu/h input rating	Minimum free area required for each opening		
	Horizontal duct (2,000 Btu/h)	Vertical duct or opening to outside (4,000 Btu/h)	Round duct (4,000 Btu/h)
40,000	20 $in.^2$ (129 cm^2)	10 $in.^2$ (64 cm^2)	4 in. (10 cm)
60,000	30 $in.^2$ (193 cm^2)	15 $in.^2$ (97 cm^2)	5 in. (13 cm)
80,000	40 $in.^2$ (258 cm^2)	20 $in.^2$ (129 cm^2)	5 in. (13 cm)
100,000	50 $in.^2$ (322 cm^2)	25 $in.^2$ (161 cm^2)	6 in. (15 cm)
120,000	60 $in.^2$ (387 cm^2)	30 $in.^2$ (193 cm^2)	7 in. (18 cm)

Determining free area - vertical example:
Appliance 1 + Appliance 2 = Total Input
100,000 + 30,000 = 130,000
Total Input ÷ Btu/h = **Minimum free area required**
130,000 ÷ 4,000 = **32.5 $in.^2$**

Determining free area - horizontal example:
Appliance 1 + Appliance 2 = Total Input
100,000 + 30,000 = 130,000
Total Input ÷ Btu/h = **Minimum free area required**
130,000 ÷ 2,000 = **65 $in.^2$**

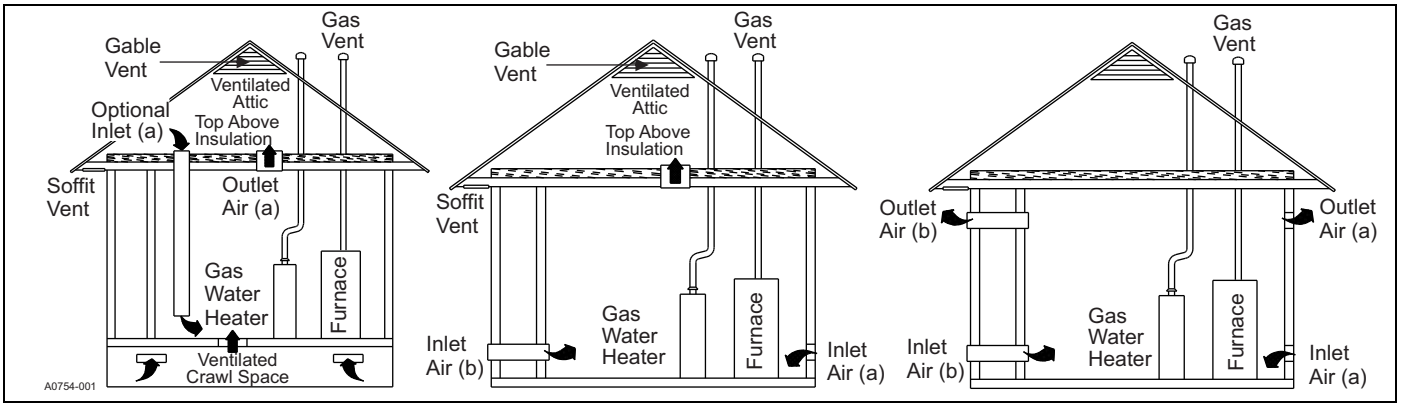


Figure 37: Ambient combustion air

Air supply openings and ducts

1. An opening may be used in lieu of a duct to provide the outside air supply to an appliance unless otherwise prohibited by the authority having jurisdiction. The opening must be located within 12 in. (30.5 cm) horizontally of the burner level of the appliance. See *Combustion Air Source From Outdoors* and *Vent and Supply Air Safety Check* in these instructions for additional information and safety check procedure.
2. The duct must be either metal or a material meeting the Class 1 requirements of CAN4-S110 Standard for Air Ducts.
3. The duct must be least the same cross-sectional area as the free area of the air supply inlet opening to which it connects.
4. The duct must terminate within 12 in. (30.5 cm) above, and within 24 in. (61 cm) horizontally, from the burner level of the appliance having the largest input.
5. Only use a square or rectangular-shaped duct when the required free area of the supply opening is 9 in^2 (58.06 cm^2) or larger. When a square or rectangular duct is used, its small dimension must not be less than 3 in. (7.6 cm).
6. An air inlet supply from outdoors must be equipped with a means to prevent the direct entry of rain and wind. Such means must not reduce the required free area of the air supply opening.
7. An air supply inlet opening from the outdoors must be located not less than 12 in. (30.5 cm) above the outside grade level.

Combustion air source from outdoors

1. Two permanent openings, one within 12 in. (30.5 cm) of the top and one within 12 in. (30.5 cm) of the bottom of the confined space, must communicate directly or by means of ducts with the outdoors, crawl spaces, or attic spaces.
2. One permanent opening, commencing within 12 in. (30.5 cm) of the top of the enclosure is permitted where the equipment has clearances of at least 1 in. (2.54 cm) from the sides and back, and 6 in. (15.2 cm) from the front, of the appliance. The opening must communicate directly with the outdoors and must have a minimum free area of:
   a. 1 $in.^2$/3,000 Btu/h (700 mm^2/kW) of the total input rating of all equipment located in the enclosure.
   b. Not less than the sum of all vent connectors in the confined space.
3. The duct must be at least the same cross-sectional area as the free area of the air supply inlet opening to which it connects.
4. The blocking effects of louvers, grilles, and screens must be given consideration in calculating the free area. If the free area of a specific louver or grille is not known, see Table 13.

Ventilated combustion air

The ventilated attic space or a crawl space from which the combustion air is taken must comply with the requirements specified in *Combustion Air Source From Outdoors* on this page or in *Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1* (latest edition). This type of installation requires two correctly sized pipes. One brings combustion air from a adequately ventilated attic space or crawl space and a second pipe extends from the furnace vent connection (top right of unit) to the exterior of the building. See Table 7 for intake pipe sizing, allowable length, and elbow usage. Follow all notes, procedures, and required materials in *Combustion Air Pipe Sizing* on page 22 when installing the combustion air pipe from the unit and into a ventilated attic or crawl space. **Do not** terminate the vent pipe in an attic or crawl space.

Ventilated combustion air termination

See Figure 38 for required attic termination for the combustion air intake pipe. For attic termination, use two 90° elbows with the open end in a downward position. Be sure to maintain 12 in. (30.5 cm) clearance above any insulation, flooring, or other material.

A crawl space combustion air installation consists of a straight pipe from the PVC coupling on the burner box that extends into the crawl space and terminates with a 1/4 in. (6.4 mm) mesh screen and no elbow.

⚠ 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 must be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:

1. Inspect the venting system for correct size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion,or other deficiencies which could cause an unsafe condition.
2. Close all building doors and windows.
3. Turn on clothes dryers and turn on any exhaust fans, such as range hoods and bathroom exhausts, so they are operating at maximum speed. Open the fireplace dampers. Do not operate a summer exhaust fan.
4. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust the thermostat so the appliance operates continuously.
5. Test each appliance (such as a water heater) equipped with a draft hood for spillage (down-draft or no draft) at the draft hood relief opening after 5 min of main burner operation. Appliances that do not have draft hoods need to be checked at the vent pipe as close to the appliance as possible. Use a combustion analyzer to check the CO_2 and CO levels of each appliance. Use a draft gauge to check for a downdraft or inadequate draft condition.
6. After it has been determined that each appliance adequately vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers, and any other gas burning appliance to their normal condition.
7. If inadequate venting is observed during any of the above tests, a problem exists with either the venting system or the appliance does not have enough combustion air (supply air from outside) to complete combustion. This condition must be corrected before the appliance can function safely.
8. Any corrections to the venting system or to the supply (outside) air system must be in accordance with the National Fuel Gas Code Z223.1 or CAN/CGA B149.1 Natural Gas and Propane Installation Code (latest editions). If the vent system must be resized, follow the appropriate tables in Appendix G of the above codes or for this appliance.

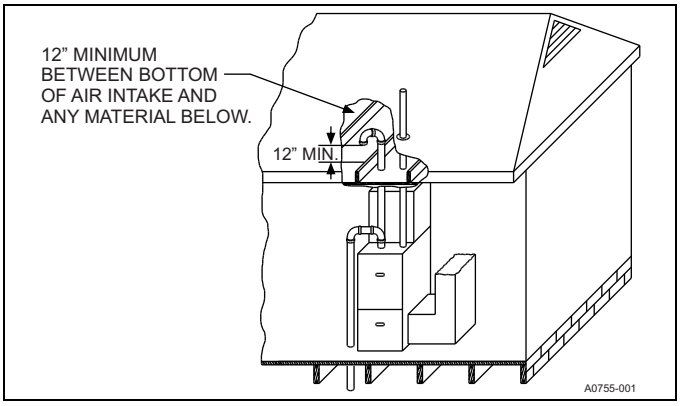


Figure 38: Attic and crawl space combustion air termination

Specially engineered installations

The above requirements can be waived where special engineering, approved by the authority having jurisdiction, provides an adequate supply of air for combustion and ventilation.

⚠ WARNING

Ensure to instruct the owner **not** to block this intake pipe.

Vent blower rotation

For ease of venting, the vent blower may be rotated 90° in either direction. For upflow installations, the vent may exit through the top or either side of the cabinet. For downflow installations, the vent blower must be rotated so that the vent exits through either side of the cabinet. See Figures 23 to 26 for illustrations of different inducer rotation positions.

Section VIII: Start-up and adjustments

The following start-up checks **must** be performed by the furnace installer on every new furnace installation:

1. Gas piping leak check
2. Furnace input rate check
3. Air temperature rise check

Instructions on how to perform each of these required installation checks are listed in the sections below.

Important: All electrical connections made in the field and in the factory must be checked for correct tightness.

When the gas supply is initially connected to the furnace, the gas piping may be full of air. In order to purge this air, loosen the ground union until the odor of gas is detected. When gas is detected, immediately retighten the union and check for leaks. Allow 5 min for any gas to dissipate before continuing with the start-up procedure. Ensure adequate ventilation is available to dilute and carry away any vented gas.

Gas piping leak check

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warnings exactly could result in serious injury, death, 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.

Important: Burner ignition may not be satisfactory on first start-up due to residual air in the gas line or until the gas manifold pressure is adjusted. The ignition control makes three attempts to light before locking out.

When the gas supply is first connected to the furnace, loosen the ground union until the odor of gas is detected. When gas is detected, immediately tighten the union and check for gas leaks. Allow 5 min for any gas to dissipate before continuing with the start-up procedure. Ensure that adequate ventilation is available to dilute and carry away any vented gas.

With the furnace in operation, check all of the pipe joints, gas valve connections, and manual valve connections for leakage using an approved gas detector, a non-corrosive leak detection fluid, or other leak detection methods. Take appropriate action to stop any leak. If a leak persists, replace the faulty component.

The furnace and its equipment shutoff valve must be disconnected from the gas supply during any pressure testing of that system at test pressures in excess of 0.5 psig (3.45 kPa).

The furnace must be isolated from the gas supply piping system by closing the equipment shutoff valve during any pressure testing of the gas supply system.

Ignition system sequence

1. Turn the gas supply ON at the external valve and the main gas valve.
2. Set the thermostat above room temperature to call for heat.
3. System start-up occurs as follows:
   a. The induced draft blower motor starts and comes up to speed. Shortly after inducer start-up, the hot surface igniter glows for about 17 s.
   b. After this warm up, the ignition module energizes (opens) the main gas valve.
   c. After flame is established, the supply air blower starts in about 30 s.

⚠ WARNING

HOT SURFACE IGNITION SYSTEM

Do not attempt to light this furnace by hand (with a match or any other means). There may be a potential shock hazard from the components of the hot surface ignition system. The furnace can only be lit automatically by its hot surface ignition system.

Calculating the furnace input (natural gas)

Burner orifices are sized to provide the correct input rate using natural gas with a heating value of 1,030 Btu/ft^3 (38.4 MJ/m^3). If the heating value of your gas is significantly different, it may be necessary to replace the orifices.

NOTICE

Do not set the manifold pressure to less than 3.2 in. W.C. or more than 3.8 in. W.C. for natural gas at sea level. If the manifold pressure is outside this range, change the main burner orifices.

NOTICE

If the orifice hole appears damaged or it is suspected to have been redrilled, check the orifice hole with a numbered drill bit of correct size. Never redrill an orifice. A burr-free and squarely aligned orifice hole is essential for correct flame characteristics.

⚠ CAUTION

Do not bottom out the gas valve regulator adjusting screw. This can result in unregulated manifold pressure and result in excess overfire and heat exchanger failures.

Verify the natural gas input rate by clocking the gas meter.

1. Turn off all other gas appliances and pilots.
2. Run the furnace for a minimum of 3 min in heating operation.
3. Measure the time (in seconds) for the gas meter to complete one revolution and note the reading. The 2-ft^3 dial provides a more accurate measurement of gas flow.
4. See Table 15 for cubic feet of gas per hour.
5. Multiply cubic feet per hour by heating value (Btu/ft^3) to obtain input.

If the clocked rate does not match the input rate from the unit nameplate, follow the steps in the next section to adjust the manifold pressure. Repeat Steps 2 to 5 until the correct input is achieved.

⚠ CAUTION

Be sure to relight any gas appliances that were turned off at the start of this input check.

Table 16: Gas rate (ft^3/h) at full input

Seconds for one revolution	Size of test dial		
	1 ft^3	**2** ft^3	**5** ft^3
10	360	720	1800
11	327	655	1636
12	300	600	1500
13	277	555	1385
14	257	514	1286
15	240	480	1200
16	225	450	1125
17	212	424	1059
18	200	400	1000
19	189	379	947
20	180	360	900
21	171	343	857
22	164	327	818
23	157	313	783
24	150	300	750
25	144	288	720
26	138	277	692
27	133	267	667
28	129	257	643
29	124	248	621
30	120	240	600
31	116	232	581
32	113	225	563
33	109	218	545
34	106	212	529
35	103	206	514
36	100	200	500
37	97	195	486
38	95	189	474
39	92	185	462
40	90	180	450
41	88	176	439
42	86	172	429
43	84	167	419
44	82	164	409
45	80	160	400
46	78	157	391
47	76	153	383
48	75	150	375
49	73	147	367
50	72	144	360
51	71	141	355
52	69	138	346
53	68	136	340
54	67	133	333

Seconds for one revolution	Size of test dial		
	1 ft^3	**2** ft^3	**5** ft^3
55	65	131	327
56	64	129	321
57	63	126	316
58	62	124	310
59	61	122	305
60	60	120	300
62	58	116	290
64	56	112	281
66	54	109	273
68	53	106	265
70	51	103	257
72	50	100	250
74	48	97	243
76	47	95	237
78	46	92	231
80	45	90	225
82	44	88	220
84	43	86	214
86	42	84	209
88	41	82	205
90	40	80	200
92	39	78	196
94	38	76	192
96	38	75	188
98	37	74	184
100	36	72	180
102	35	71	178
104	35	69	173
106	34	68	170
108	33	67	167
110	33	65	164
112	32	64	161
116	31	62	155
120	30	60	150
124	29	58	145
128	28	56	141
133	27	54	135
138	26	52	130
144	25	50	125
150	24	48	120
157	23	46	115
164	22	44	110
171	21	42	105
180	20	40	100

Adjustment of manifold gas pressure and input rate

The inlet and manifold gas pressure may be measured by connecting the “U” tube manometer to the gas valve with a piece of tubing. Follow the appropriate section in the instructions below. See Figure 39 for the locations of the pressure ports on the gas valve.

Turn the gas off at the ball valve or gas cock on the gas supply line before the gas valve. Find the pressure ports on the gas valve marked Out P and In P.

1. The manifold pressure must be taken at the port marked **Out P**.
2. The gas line pressure must be taken at the port marked **In P**.
3. Using a 3/32 in. (2.4 mm) hex head wrench, loosen the set screw by turning it one turn counterclockwise. **Do not remove the set screw from the pressure port.**

Read the inlet gas pressure

Connect the positive side of the manometer to the **In P** tap on the gas valve. Do not connect any tubing to the negative side of the manometer, as it references atmospheric pressure. See Figure 40 for connection details.

1. Turn the gas and electrical supplies on and follow the operating instructions to place the unit back in operation.

Table 17: Inlet gas pressure range

Inlet gas pressure range		
	Natural gas	**Propane (LP)**
Minimum	4.5 in. W.C. (1.12 kPa)	8.0 in. W.C. (1.99 kPa)
Maximum	10.5 in. W.C. (2.61 kPa)	13.0 in. W.C. (3.24 kPa)

Important: Table 17 specifies what the minimum and maximum gas line pressures must be for the furnace to operate safely. The gas line pressure must be a minimum of:

- 7 in. W.C. (1.74 kPA) for Natural Gas
- 11 in. W.C. (2.74 kPA) for Propane (LP) Gas

in order to obtain the Btu input specified on the rating plate or the nominal manifold pressure specified in these instructions and on the rating plate.

2. Once the correct gas inlet pressure has been established (see Table 17), turn the gas valve to **off** and turn the electrical supply switch to **off**. Then, remove the flexible tubing from the gas valve pressure tap and tighten the pressure tap plug using the 3/32 in. (2.4 mm) hex head wrench.
3. Turn the electrical and gas supplies back on, and with the burners in operation, check for gas leakage around the gas valve pressure port using an approved non-corrosive gas leak detection fluid, or other non-flammable leak detection methods.

Read the manifold gas pressure

Connect the positive side of the manometer to the ***Out P*** tap on the gas valve. Do not connect any tubing to the negative side of the manometer, as it references atmospheric pressure. See Figures 39 and 40 for connection details.

Important: The cap for the pressure regulator must be removed entirely to gain access to the adjustment screw. Loosening or tightening the cap does not adjust the flow of gas.

This gas valve has separate regulator adjustment screws for high fire and low fire, as shown in Figure 39. The procedure below is used to adjust either the high fire manifold pressure or the low fire manifold pressure.

NOTICE

Gas manifold pressure must be set on high fire before adjusting low fire pressure.

1. See Figure 39 for location of pressure regulator adjustment cap and adjustment screws on main gas valve.
2. Turn the gas and electrical supplies on and follow the operating instructions to place the unit back in operation.
3. Place jumper wire from W1 to W2 to R on the furnace control board for the furnace to operate high fire. Once correct manifold pressure is set (HI), remove the jumper wire from W2 for the furnace to operate on low fire. Set the manifold pressure (LO) to correct manifold pressure.

Table 18: Nominal manifold pressure

Nominal manifold pressure	
Natural Gas (High Fire)	3.5 in. W.C. (0.87 kPa)
Natural Gas (Low Fire)	1.6 in. W.C. (0.40 kPa)
Propane (LP) Gas (High Fire)	9.8 in. W.C. (2.488 kPa)
Propane (LP) Gas (Low Fire)	4.0 in. W.C. (0.99 kPa)

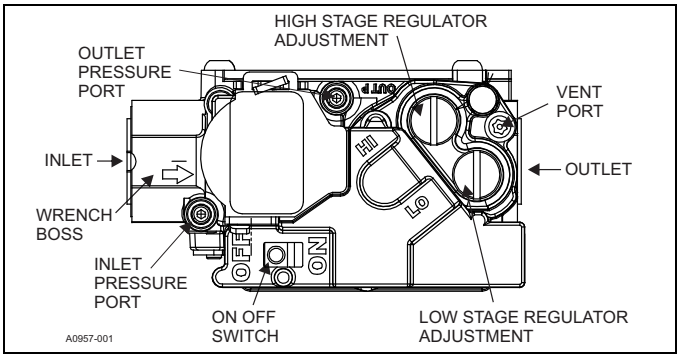


Figure 39: Gas valve

Important: If the gas valve regulator is turned in (clockwise), manifold pressure increases. If the screw is turned out (counterclockwise), manifold pressure decreases.

4. After the manifold pressure has been adjusted, re-calculate the furnace input to make sure you have not exceeded the specified input on the rating plate. See *Calculating The Furnace Input (Natural Gas) on page 31*.
5. Once the correct Btu (kW) input has been established, turn the gas valve to **off** and turn the electrical supply switch to **off**. Then, remove the flexible tubing from the gas valve pressure tap and tighten the pressure tap plug using the 3/32 in. (2.4 mm) hex head wrench.
6. Turn the electrical and gas supplies back on, and with the burners in operation, check for gas leakage around the gas valve pressure port using an approved non-corrosive gas leak detection fluid, or other non-flammable leak detection methods.

Manifold pressure “U” tube connection

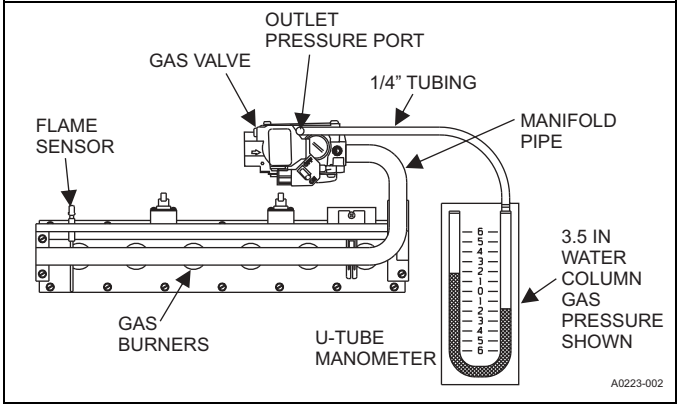


Figure 40: Reading gas pressure

Airflow settings

Cooling airflow settings

This unit is equipped with an electronically commutated (ECM) blower motor. The motor and blower are capable of delivering airflow over a wide range of operating conditions.

The desired cooling airflow may be selected by placing the COOL jumper on the control board in the desired position: **A**, **B**, **C** or **D**. The **A** position gives the highest airflow and the **D** position gives the lowest. Additional fine tuning of the cooling airflow can be done by using the ADJUST jumper. The nominal ADJUST setting is **A**, while the **B** jumper position gives a 10% increase in airflow over the **A** position and the **C** ADJUST jumper position gives a 10% decrease from the **A** position. Consult the blower airflow tables in this manual for the expected airflow at each speed setting. The speed must be selected so as to deliver approximately 350 CFM to 400 CFM per ton of A/C cooling capacity. Use of airflow outside of this range may result in diminished air conditioning performance, and may result in lower overall energy efficiency and higher electric utility bills. See Table 19 for default cooling blower settings.

Table 19: Default blower speeds

Model number	Default blower speeds		
	HEAT Jumper	COOL Jumper	FAN SPEED Jumper
060B12	B	A	L
080B12	C	A	L
080C16	D	A	L
100C16	B	A	L
100C20	B	A	L
120D20	B	A	L

Continuous fan airflow settings

The default blower speed for continuous fan operation is L (low) speed.

This furnace may be operated in continuous fan mode by setting the wall thermostat FAN switch to ON. To select the desired continuous fan airflow, set the FAN SPEED jumper on the control board to the desired position. There are three options:

1. With the FAN SPEED jumper in the **H** position the blower will run during continuous fan operation at 100% of the selected high stage cooling speed.
2. With the FAN SPEED jumper in the **M** position the blower will run during continuous fan operation at 70% of the selected high stage cooling speed.
3. With the FAN SPEED jumper in the **L** position the blower will run during continuous fan operation at 40% of the selected high stage cooling speed.

The default position is with the FAN SPEED jumper in the **L** position. In certain circumstances, it may be necessary to move the continuous fan speed to a different speed tap. However, doing so is not recommended since it will result in higher than normal electrical energy usage and higher than normal electric utility bills.

Gas heating airflow setting

The default heating blower speed is shown in Table 18.

This unit is equipped with an electronically commutated (ECM) blower motor. The motor and blower are capable of delivering airflow over a wide range of operating conditions.

The desired heating airflow may be selected by placing the HEAT jumper on the control board in the desired position **A**, **B**, **C** or **D**. The **A** position gives the highest airflow and the **D** position gives the lowest. Consult the blower airflow tables in this manual for the expected airflow at each speed setting. The heating blower speed is set at the factory to the default blower speed, which is the blower speed that delivers the correct airflow for correct heating operation in most applications. The default heating blower speed for each model is shown in Table 18. Use of a heating speed other than the default heating blower speed may result in reduced energy efficiency and higher electric utility bills.

In certain circumstances, it may be necessary to move the heating blower speed to a different motor speed tap. Not all motor heating speeds are appropriate for gas heating operation for all models and all applications. The use of heating airflow on a speed other than the default speed will result in diminished heating performance and may cause the furnace temperature limit controls to shut down the furnace.

Measurement of Temperature rise

⚠ DANGER

The temperature rise, or temperature difference between the return air and the supply (heated) air from the furnace, must be within the range shown on the furnace rating plate and within the application limitations shown in SECTION V.

The supply air temperature cannot exceed the **Maximum Supply Air Temperature** specified in these instructions and on the furnace rating plate. Under NO circumstances can the furnace be allowed to operate above the Maximum Supply Air Temperature. Operating the furnace above the Maximum Supply Air Temperature will cause premature heat exchanger failure, high levels of Carbon Monoxide, a fire hazard, personal injury, property damage, and/or death.

After about 10 min of operation, determine the furnace temperature rise. Measure the temperature of both the return air and the heated air in the ducts, about 6 ft (1.83 m) from the furnace where they will not be affected by radiant heat. Increase the blower speed to decrease the temperature rise; decrease the blower speed to increase the rise.

Adjustment of fan control settings

This furnace is equipped with a time-on/time-off heating fan control. The fan on delay is fixed at 30 s. The fan off delay has 4 settings (60 s, 90 s, 120 s, and 180 s). The fan off delay is factory set to 120 s. The fan-off setting must be long enough to adequately cool the furnace, but not so long that cold air is blown into the heated space. The fan-off timing may be adjusted by positioning the jumper on two of the four pins as shown in Figure 25.

Taking a flue gas sample

If it becomes necessary to obtain a flue gas sample for analysis, it is permissible to drill a small hole in the plastic flue pipe for a sample probe, provided that the vent piping is PVC and the hole is correctly sealed afterwards. If using a polypropylene vent system, the vent systems manufacturer test port fitting must be used. **Do not** drill a test port hole in polypropylene piping. Use the following procedure:

1. Drill a 11/32 in. hole in the side wall of the PVC vent pipe. If the hole is in a horizontal section of the vent pipe, ensure that it is located away from the bottom where condensation may be flowing back toward the furnace.
2. Operate the furnace a minimum of 10 min to ensure stable operation of the combustion process.
3. Sample the flue gas as necessary to obtain CO readings.
4. Using a 1/8 in. pipe tap, cut threads into the sampling hole of the PVC pipe.
5. Use high temp RTV as a sealant on the threads of a 1/8 in. brass MPT plug and insert it three turns into the hole to correctly seal it.

Heat pump

If heat pump is installed with a furnace the HEAT PUMP jumper must be set to YES.

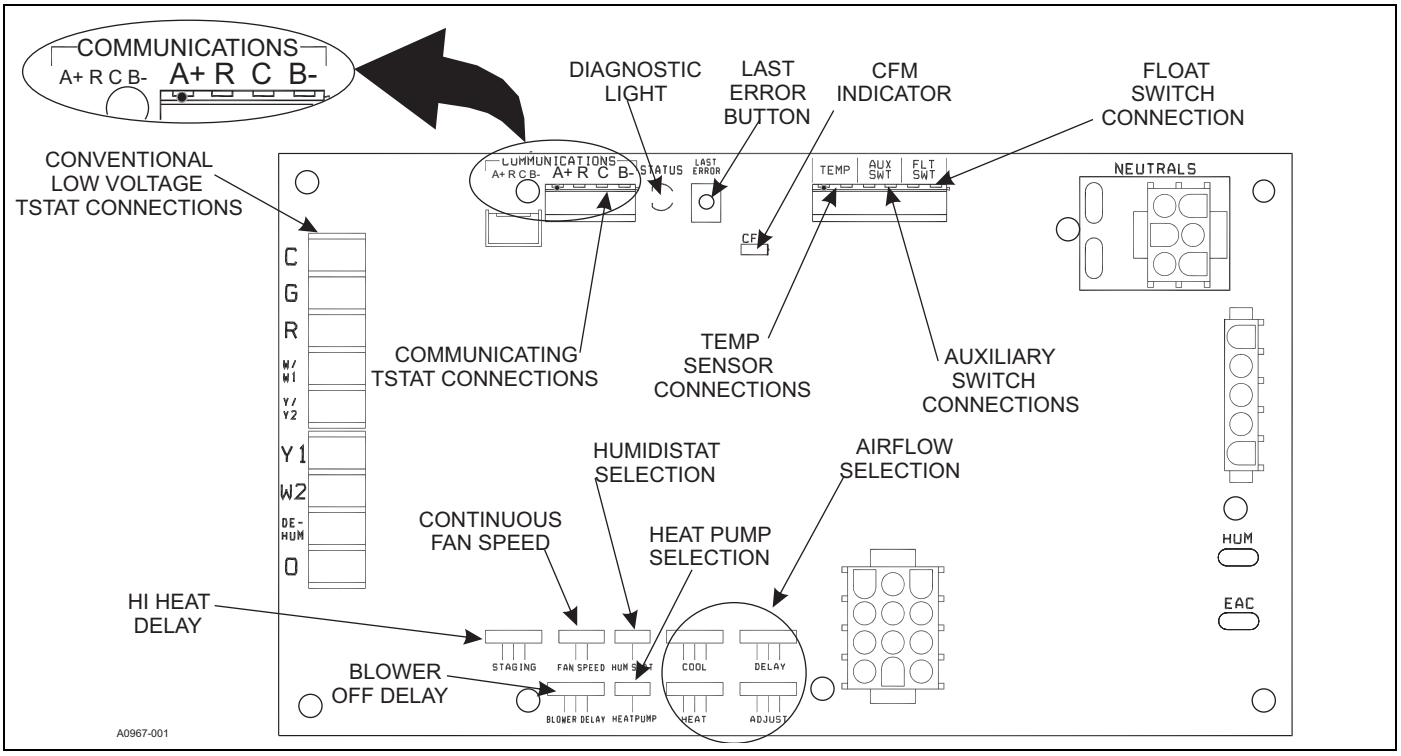


Figure 41: Furnace control board

Table 20: Airflow data

High/low speed cooling and heat pump CFM									
040A10		**060B12**		**080B12**		**080C16**		**Jumper Settings**	
HIGH COOL	**LOW COOL**	**HIGH COOL**	**LOW COOL**	**HIGH COOL**	**LOW COOL**	**HIGH COOL**	**LOW COOL**	**COOL Tap**	**ADJ Tap**
1033	749	1425	838	1228	834	1741	1049	A	B
941	666	1087	714	1058	739	1505	916	B	B
950	675	1200	771	1143	781	1446	946	A	A
877	611	996	658	952	686	1343	843	B	A
886	620	1075	703	1037	728	1402	858	A	C
785	538	861	579	845	611	1255	799	C	B
804	547	895	590	866	622	1167	769	B	C
685	483	669	454	686	505	1005	666	D	B
740	492	782	533	792	568	1108	710	C	A
630	428	613	421	632	473	916	593	D	A
666	437	714	477	739	526	990	637	C	C
565	428	556	421	579	473	828	534	D	C
		100C16		**100C20**		**120D20**		**Jumper Settings**	
		HIGH COOL	**LOW COOL**	**HIGH COOL**	**LOW COOL**	**HIGH COOL**	**LOW COOL**	**COOL Tap**	**ADJ Tap**
		1757	1093	2105	1423	2176	1374	A	B
		1531	966	1724	1121	1733	1100	B	B
		1474	995	1945	1282	1986	1248	A	A
		1376	896	1583	1021	1585	1016	B	A
		1432	910	1744	1141	1775	1121	A	C
		1291	854	1543	961	1501	973	C	B
		1206	825	1423	880	1374	910	B	C
		1051	727	1302	800	1248	847	D	B
		1150	769	1423	840	1332	889	C	A
		966	656	1182	700	1163	784	D	A
		1037	698	1242	760	1206	805	C	C
		882	600	1081	599	1037	699	D	C

Continued on next page

Table 20: Airflow data (Continued)

High/low heat CFM									
040A10		060B12		080B12		080C16		Jumper Settings	
HIGH HEAT	LOW HEAT	HIGH HEAT	LOW HEAT	HIGH HEAT	LOW HEAT	HIGH HEAT	LOW HEAT	HEAT Jumper	ADJ Jumper
890	770	1200	870	1366	1156	1580	1156	A	Any
790	660	1070	770	1293	1022	1422	1027	B	Any
711	578	970	693	1185	924	1293	924	C	Any
646	514	890	630	1094	840	1185	840	D	Any
		100C16		100C20		120D20		Jumper Settings	
		HIGH HEAT	LOW HEAT	HIGH HEAT	LOW HEAT	HIGH HEAT	LOW HEAT	HEAT Jumper	ADJ Jumper
		1975	1444	1975	1284	2250	1539	A	Any
		1778	1284	1778	1156	2133	1385	B	Any
		1616	1156	1616	1050	1939	1259	C	Any
		1481	1050	1481	963	1778	1154	D	Any

All CFMs are shown at 0.5 in. W.C. external static pressure.These units have variable speed motors that automatically adjust to provide constant CFM from 0.0 in. to 0.6 in. W.C. static pressure. From 0.6 in. to 1.0 in. static pressure, CFM is reduced by 2% per 0.1 in. increase in static. Do not operate on duct systems with greater than 1.0 in. W.C. external static pressure.

NOTE: At some settings, LOW COOL or LOW HEAT airflow may be lower that what is required to operate an airflow switch on certain models of electronic air cleaners. Consult the instructions for the electronic air cleaner for further details.

* Do not use the ADJ **D** tap.

Section IX: Safety controls

Control circuit fuse

A 3 A fuse is provided on the control circuit board to protect the 24 V transformer from overload caused by control circuit wiring errors. This is an ATO 3 automotive type fuse and is located on the control board.

Blower door safety switch

⚠ CAUTION

Main power to the unit must still be interrupted at the main power disconnect switch before any service or repair work is to be done to the unit. Do not rely upon the interlock switch as a main power disconnect.

Blower and burner must never be operated without the blower panel in place.

This unit is equipped with an electrical interlock switch mounted in the burner compartment. This switch interrupts all power at the unit when the panel covering the blower compartment is removed.

Electrical supply to this unit is dependent upon the panel that covers the blower compartment being in place and correctly positioned.

Rollout switch controls

These controls are mounted on the burner assembly. If the temperature in the area surrounding burner exceeds its set point, the gas valve is de-energized. The operation of this control indicates a malfunction in the combustion air blower, heat exchanger or a blocked vent pipe connection. Corrective action is required. These are manual reset controls that must be reset before operation can continue.

Pressure switches

This furnace is supplied with three pressure switches, which monitor the flow through the combustion air/vent piping and condensate drain system. These switches de-energize the gas valve if any of the following conditions are present:

1. Blockage of vent piping or terminal
2. Failure of combustion air blower motor
3. Blockage of combustion air piping or terminals
4. Blockage of condensate drain piping

See *Condensate Piping and Furnace Venting Configuration* in Section IV for tubing connections.

Limit controls

There is a high temperature limit control located on the furnace vestibule panel near the gas valve. This is an automatic reset control that provides over temperature protection due to reduced airflow. This may be caused by the following:

1. A dirty filter
2. The indoor fan motor failing
3. Too many supply or return registers closed or blocked off

The control module locks out if the limit trips five consecutive times. If this occurs, control resets and tries ignition again after 1 h.

Section X: Normal operation and diagnostics

Normal operation sequence

Heating and cooling airflow

The heating and the cooling airflows are preset at the factory. The heating airflow is set to the maximum CFM. The cooling airflow is set to provide 90% of the maximum CFM. The heating and cooling airflows must be field adjusted to match the HVAC system at installation. See Table 20 for the HEAT, COOL, and ADJUST (or ADJ) jumper settings to use for specific airflows.

CFM board - delay taps selection

The set of jumper pins on the control board labeled DELAY are used to set the delay profiles for the furnace. These can be chosen so as to maximize the comfort and sound levels for various regions of the country.

Tap A is the default profile. It provides a 30 s ramp-up from zero airflow to full capacity and a 30 s ramp-down from full capacity back to zero airflow. Whenever there is a change in airflow mode, such as from low heat to high heat, the motor takes 30 s to ramp from one speed to the other.

Tap B is the humid profile. This profile is best-suited for installations where the humidity is frequently very high during cooling season, such as in the southern part of the country. On a call for cooling, the blower ramps up to 50% of full capacity and stays there for 2 min, then it ramps up to 82% of full capacity and stays there for 5 min, and then it ramps up to full capacity, where it stays until the wall thermostat is satisfied. In every case, it takes the motor 30 s to ramp from one speed to another.

Tap C is the dry profile. This profile is best suited to parts of the country where excessive humidity is not generally a problem, where the summer months are usually dry. On a call for cooling, the motor ramps up to full capacity and stays there until the thermostat is satisfied. At the end of the cooling cycle, the blower ramps down to 50% of full capacity where it stays for 60 s. Then, it ramps down to zero. In every case, it takes the motor 30 s to ramp from one speed to another.

Tap D is the normal profile, best suited for most of the country, where neither excessive humidity nor extremely dry conditions are the norm. On a call for cooling, the motor ramps up to 63% of full capacity and stays there for 90 s, then it ramps up to full capacity. At the end of the cooling cycle, the motor ramps down to 63% of full capacity and stays there for 30 s, then ramps down to zero. In every case, it takes the motor 30 s to ramp from one speed to another.

Continuous blower operation

The blower runs continuously whenever the wall thermostat fan switch is in the ON position. The furnace blower runs at a speed based on a percentage of the CFM selected on the COOL and ADJ tab. There are three selections on the FAN SPEED tab (H = 100% CFM, M = 70% CFM, L = 40% CFM). The furnace is shipped with the jumper in the L position.

Intermittent blower cooling

On cooling and heating thermostats with a fan switch, when the fan switch is set in the auto position and the thermostat calls for cooling, a circuit is completed between the R, Y and G terminals. The motor is energized through the Y1 cool terminal and runs on the speed selected on the COOL tap of the control board. The fan off setting is fixed at 60 s for SEER enhancement. The control board can accommodate two-stage cooling. When a two-stage cool thermostat is connected to the Y1 and Y2 terminals on the board, the blower operates on LOW COOL speed when Y1 is energized and on HI COOL speed when Y1 and Y2 are energized.

Intermittent blower heating

On cooling and heating thermostats with a fan switch, when the fan switch is set in the auto position and the thermostat calls for heating, a circuit is completed between the R and W terminals. The indoor fan motor is energized through the W1 heat terminal and runs on the speed selected on the HEAT tap of the control board.

Humidistat

When a humidistat is installed in the system, the HUM STAT jumper on the control board must be moved to the YES position.
The cooling CFM then reduces by 15% whenever the humidistat indicates high humidity. If using a communicating control, set the HUM STAT jumper to YES.

Heating cycle

When the thermostat switch is set on HEAT and the fan is set on AUTO, and there is a call for heat, a circuit is completed between terminals R and W of the thermostat. When the correct amount of combustion air is being provided, the pressure switches close, the ignition control provides a 17 s ignitor warm-up period, the gas valve then opens, the gas starts to flow, ignition occurs, and the flame sensor begins its sensing function. The blower motor energizes 30 s after the gas valve opens, if a flame is detected. Normal furnace operation continues until the thermostat circuit between R and W is opened, which causes the ignition system and gas valve to de-energize and the burner flames to be extinguished. The vent motor operates for 15 s and the blower motor operates for the amount of time set by the BLOWER OFF DELAY jumper located on the control board. See Figure 41. The heating cycle is now complete, and ready for the start of the next heating cycle. This is a two-stage furnace. Ignition is always established at the high fire rate. After flame has been established for 10 s and there is no thermostat input on the furnace control WZ terminal, the furnace control shifts to low fire heating.

If the flame is not detected within 7 s of the gas valve opening, the gas valve is shut off and a retry operation begins. Also, if the flame is lost for 2 s during the 10 s stabilization period, the gas valve is shut off and a retry operation begins. During a retry operation, the vent motor starts a 15 s inter-purge and the ignitor warm-up time is extended to 27 s. If the flame is established for more than 10 s after ignition during a retry, the control clears the ignition attempt (retry) counter. If three retries occur during a call for heat, the furnace shuts down for 1 h. If at the end of the 1 h shutdown, there is a call for heat, the furnace initiates a normal start cycle. If the problem has not been corrected, the furnace again locks out after three retries.

A momentary loss of gas supply, flame blowout, or a faulty flame probe circuit results in a disruption in the flame and is sensed within 1 s. The gas valve de-energizes and the control begins a recycle operation. A normal ignition sequence begins after a 15 s inter-purge. If during the five recycles, the gas supply does not return, or the fault condition is not corrected, the ignition control locks out for 60 min.

During burner operation, a momentary loss of power for 50 ms or longer de-energizes the gas valve. When the power is restored, the gas valve remains de-energized and the ignition sequence immediately restarts.

Troubleshooting

The following visual checks must be made before troubleshooting:

1. Check to see that the power to the furnace and the ignition control module is ON.
2. The manual shut-off valves in the gas line to the furnace must be open.
3. Ensure all wiring connections are secure.
4. Review the sequence of operation. Start the system by setting the thermostat above the room temperature. Observe the system's response. Then use the troubleshooting section in this manual to check the system's operation.

⚠ WARNING

Never bypass any safety control to allow furnace operation. To do so allows the furnace to operate under potentially hazardous conditions.

Do not try to repair controls. Replace defective controls with UPG Source 1 Parts.

Never adjust the pressure switch to allow furnace operation.

Furnace control diagnostics

The furnace has built-in, self-diagnostic capability. A blinking LED light on the control board can flash red, green, or amber to indicate various conditions. The control continuously monitors its own operation and the operation of the system. If a failure occurs, the LED light indicates the failure code.

The SLOW flash speed is 2 s on and 2 s off.

The other flash codes listed below have the following timing: the LED light turns on for 1/3 s and off for 1/3 s. This pattern repeats the number of times equal to the code. There is a 2 s pause between codes. For example, the six red flash code flashes the LED light on and off six times, then it is off for 2 s. This pattern repeats as long as the fault condition remains. The continuous flash codes listed below flash the LED light on and off continuously, with no breaks or longer pauses.

SLOW GREEN FLASH: Normal operation, no thermostat calls.

SLOW AMBER FLASH: Normal operation with call for heat.

LED STEADY OFF – If the LED light does not flash at all, check for power to the board and check for a blown fuse on the board. If the board is sufficiently powered and the fuse is not blown, the control board may need to be replaced.

STEADY ON ANY COLOR: Control failure. Turn power to the furnace off and back on. If the fault code returns, the control board must be replaced. The control board is not field-repairable.

CONTINUOUS AMBER FLASH: Flame sense current is below 1.5 µA. Check and clean flame sensor. Check for correct gas flow. Verify that current is greater than 1.5 µA at flame current test pad.

1 RED FLASH: This indicates that flame was sensed when there was not a call for heat. The control turns on both the inducer motor and supply air blower. Check for a leaking or slow-closing gas valve.

2 RED FLASHES: This indicates that the pressure switch is closed when it must be open. The control confirms that the pressure switch contacts are open at the beginning of each heat cycle and does not let the ignition sequence continue if the pressure switch contacts are closed when they must be open. Check for a faulty pressure switch or miswiring.

3 RED FLASHES: This indicates the pressure switch contacts are open when they must be closed. Check for a faulty inducer, blocked vent pipe, broken pressure switch hose, disconnected pressure switch or inducer wires, or faulty pressure switch.

4 RED FLASHES: This indicates that the main limit switch has opened its normally closed contacts. The control turns on the supply air blower and inducer. Check for a dirty filter, incorrectly sized duct system, incorrect blower speed setting, incorrect firing rate, loose limit switch wiring, or faulty blower motor.

If the limit switch has not closed within 5 min, the control assumes that the blower is not functioning, starts a hard lockout, and begins to flash the 11 Red Flashes error code. If, after 15 min, the main limit still has not closed, the control assumes that a manual-reset rollout switch has opened and begins to flash the 5 Red Flash error code. See the description of *5 Red Flashes* and *11 Red Flashes* below.

If the main limit switch opens five times within a single call for heat, the control indicates 4 Red Flashes and enters a 1 h soft lockout.

5 RED FLASHES: This fault is indicated if the limit circuit is open for more than 15 min, usually indicating that a manual-reset rollout switch has opened. Check for correct combustion air, correct inducer operation, and primary heat exchanger failure or burner problem. The control enters a hard lockout and power has to be cycled off and on to reset the control after the problem has been corrected.

6 RED FLASHES: This indicates that while the unit was operating, the pressure switch opened four times during the call for heat. Check for a faulty inducer, a blocked vent pipe, or a faulty pressure switch. The furnace locks out for 1 h and then restarts.

7 RED FLASHES: This fault code indicates that the flame could not be established during three trials for ignition. Check that the gas valve switch is in the ON position. Check for low or no gas pressure, a faulty gas valve, a dirty or faulty flame sensor, a faulty hot surface ignitor, loose wires, or a burner problem. The furnace locks out for 1 h and then restarts.

8 RED FLASHES: This fault is indicated if the flame is lost five times (four recycles) during the heating cycle. Check for low gas pressure, a dirty or faulty flame sensor, or a faulty gas valve. The furnace locks out for 1 h and then restarts.

9 RED FLASHES: Indicates reversed line voltage polarity, a grounding problem, or reversed low voltage transformer wires. Both heating and cooling operations are affected. Check polarity at the furnace and branch. Check the furnace grounding. Check that the flame probe is not shorted to the chassis. The furnace does not start the ignition sequence until this problem is corrected.

10 RED FLASHES: Gas valve energized with no call for heat. The main blower and inducer blower run and no ignition sequence starts as long as this condition exists. Check the gas valve and gas valve wiring.

11 RED FLASHES: This indicates that the limit circuit has remained open for more than 5 min and less than 15 min. This condition is usually caused by a failed blower motor or blower wheel. The control enters a hard lockout and power has to be cycled off and on to reset the control after the problem has been corrected.

12 RED FLASHES: This indicates a loose or missing model ID plug.

13 RED FLASHES: This indicates that the high-fire pressure switch is open when it must be closed. Check for a partially blocked vent pipe, a loose or disconnected wire, and vent pressure.

4 AMBER FLASHES: The control is receiving a **Y** signal from the thermostat without a **G** signal. The furnace operates normally in both heating and cooling, but this fault code is displayed in order to alert the user that there is a wiring problem. Verify that the **G** wire from the thermostat is connected correctly.

SOFT LOCKOUT: This control includes a soft lockout that resets automatically after 1 h. This provides protection to an unoccupied structure if a temporary condition exists causing a furnace malfunction. An example of this is a temporary interruption in gas supply that would prevent the furnace from lighting. The control keeps trying to light each hour and resumes normal operation if the gas supply is restored.

HARD LOCKOUT: Some fault conditions result in a hard lockout, which requires power to the control to be turned off and then back on to reset the control. The control does not automatically restart.

Ignition control flame sense levels:
Normal flame sense current is approximately 3.7 µA DC.
Low flame signal warning starts at 1.5 µA.
Low flame signal control lockout point is 0.1 µA DC.

Diagnostic fault code storage and retrieval

The control in this furnace is equipped with memory that stores up to five error codes to allow a service technician to diagnose problems more easily. This memory is retained even if power to the furnace is lost. **This feature must only be used by a qualified service technician.**

If more than five error codes have occurred since the last reset, only the five most recent is retained. The furnace control board has a button, labeled LAST ERROR, that is used to retrieve error codes. This function only works if there are no active thermostat signals. So any call for heating, cooling, or continuous fan must be terminated before attempting to retrieve error codes.

To retrieve the error codes, push the LAST ERROR button. The LED on the control then flashes the error codes that are in memory, starting with the most recent. There is a 2 s pause between each flash code. After the error codes have all been displayed, the LED resumes the normal slow green flash after a 5 s pause. To repeat the series of error codes, push the button again.

If there are no error codes in memory, the LED flashes two green flashes. To clear the memory, push the LAST ERROR button and hold it for more than 5 s. The LED flashes three green flashes when the memory has been cleared and the button is released, then it resumes the normal slow green flash after a 5 s pause.

Section XI: Replacement parts list

Description
MOTOR
MOTOR, DIRECT DRIVE BLOWER
BLOWER, COMBUSTION TWO-STAGE
ELECTRICAL
CAPACITOR, RUN
SWITCH, LIMIT
CONTROL, FURNACE TWO-STAGE VS
IGNITER
SENSOR, FLAME
SWITCHES, PRESSURE
SWITCH, DOOR
TRANSFORMER
VALVE, GAS TWO-STAGE
CONTROL, TEMPERATURE
AIR MOVING
HOUSING, BLOWER
WHEEL, BLOWER
FABRICATED PARTS
RESTRICTOR, COMBUSTION BLOWER
BURNER, MAIN GAS
BRACKET, IGNITER
SHELF, BLOWER
RAIL, BLOWER (two required)
BRACKET, BLOWER TRACK (two required)
HEAT EXCHANGER ASSEMBLY

Description
FABRICATED PARTS (Continued)
MANIFOLD, GAS
PAN, BOTTOM
PANEL, TOP
PANEL, DOOR (two required)
PANEL, BLOCKOFF
MISCELLANEOUS
ORIFICE, BURNER (Natural #45)
SIGHT GLASS, OVAL (two required)
GASKET, FOAM (Door) (1.5 ft required)
PAN, CONDENSATE
BRACKET, DOOR
HARNESS, WIRING
FERRULE (three required)
GROMMET (three required)
MOTOR MOUNT
TUBING, SILICON
HOSE, RAIN GUTTER
HOSE, CONDENSATE
PLUG, SEAL, 7/8 in.
PLUG, SEAL, 2 3/8 in.
PLUG, VENT PIPE
BAG, PARTS
KNOB, QUARTER TURN (four required)
DIAGRAM, WIRING TWO-STAGE VS

Section XII: Replacement part contact information

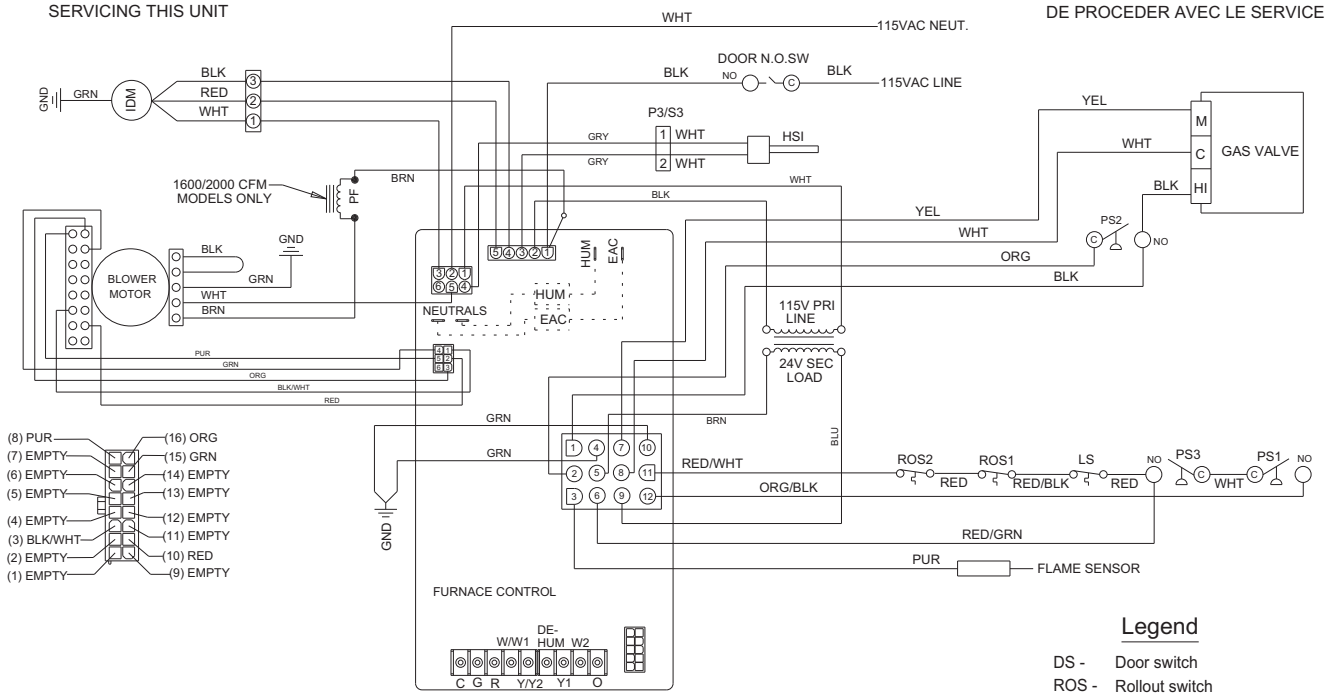
This is a generic parts list. To request a complete parts list, see the contact information below:

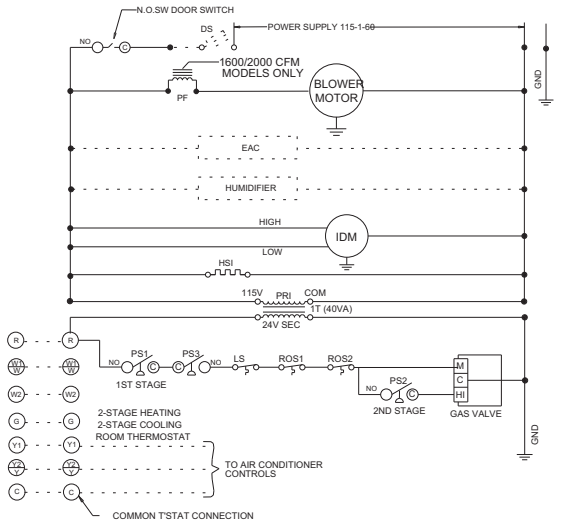
- Visit our website at www.source1parts.com for the following information:
    1. Search for a part or browse the catalog.
    2. Find a dealer or distributor.
    3. Customer Service contact information.
        a. Click on the **Brand Links** button
        b. Click on the **Customer Service** button
- You can contact us by mail. Just send a written request to:

Johnson Controls Ducted Systems
Consumer Relations
5005 York Drive
Norman, OK 73069

Section XIII: Wiring diagram

Wiring Diagram 96% Two-Stage COMM Furnace





Diagnostic Fault Codes

Flashes	Fault Condition
None	Power Off
Slow Green	Normal Operation
Slow Amber	Normal Operation with call for heat
Rapid Amber	Low flame sense current
4 Amber	No G from thermostat
Steady on Red	Control Failure
1 Red	Flame present with gas off
2 Red	Check pressure switch wiring
3 Red	Vent OR termination problem
4 Red	Airflow problem
5 Red	Flame Rollout
6 Red	Repeated 3 Red
7 Red	Failed to light burners
8 Red	Loss of flame during call for heat
9 Red	Hot/Neutral reversed OR poor ground/neutral
10 Red	Gas valve shorted "ON"
11 Red	Check blower motor/wiring
13 Red	Vent OR termination problem

Refer to Installation Manual for more detailed information.

Legend

DS -	Door switch
ROS -	Rollout switch
XFMR -	Transformer
HSI -	Hot surface igniter
PF-	Power factor choke
PS1 -	Pressure switch, 1 stage
PS2 -	Pressure switch, 2 stage
PS3 -	Pressure switch, condensate
IDM -	Inducer motor
EAC -	Electronic air cleaner
LS -	Limit switch
HUM -	Humidifier

Legende

DS -	Commutateur de porte
ROS -	Commutateur de roulement
XFMR -	Transformeur
HSI -	Ignition de surface chaud
PF -	Transformeur de facteur de puissance
PS1 -	Commutateur de pression, premier stage
PS2-	Commutateur de pression, deuxieme stage
PS3-	Commutateur de pression, condensation
IDM-	D'induct moteur
EAC-	Filtre électrique
LS -	Commutateur de limite
HUM -	Humidificateur

NOTES:
1. If any of the original wire as supplied with the furnace must be replaced, it must be replaced with wiring material having a temperature rating of at least 221 degrees F (105 degrees C).
2. Connectors suitable for copper conductors only.

NOTES:
1. Si l'un des fils d'origine fourni avec ce four doit filage doit être remplacé, il doit être remplacé avec le fil ayant un degré de température d'au moins 221 degrés F (105 degrés C).
2. Seulement des marettes pour fil de cuivre.

Fault Code Retrieval

Notice - Only a qualified service technician should use this feature.

Fault code retrieval functions will work only if there are no active thermostat signals.

To retrieve fault codes, push and release ERROR button on control board. The LED will flash the last five error codes, beginning with the most recent. If there are no fault codes in memory, the LED will give two green flashes. To clear the fault code memory, push and hold the ERROR button for at least five seconds. The LED will give three green flashes when the memory has been cleared.

1034866-UWD-C-0519

Figure 42: Wiring diagram

Section XIV: Start-up sheet

Proper furnace start up is critical to customer comfort and equipment longevity

Start-Up Date

Technician Performing Start-Up | Installing Contractor Name

Owner Information

Name | Address

City | State or Province | Zip or Postal Code

Equipment Data

Furnace Model | Furnace Serial

Indoor Coil Model | Indoor Coil Serial

Outdoor Unit Model | Outdoor Unit Serial

Furnace Configuration

◯ Upflow ◯ Downflow ◯ Horizontal Left ◯ Horizontal Right

Filter, Thermostat, Accessories

Filter Type | Filter Size | Filter Location(s)

Thermostat Type | Other System Equipment and Accessories

Connections -- All Per Installation Instructions and Local Code

☐ Unit is level or tilted slightly forward ☐ Gas piping is connected (including drip leg)

☐ Vent system is connected ☐ Supply plenum and return air are connected

Condensate Management

☐ Condensate tubing is correctly installed for the furnace position ☐ Condensate drain is connected

Venting

Intake Size | # of 90 Degree Ells | # of 45 Degree Ells | Length

Exhaust Size | # of 90 Degree Ells | # of 45 Degree Ells | Length

☐ Venting system is the proper size, within the limitations of the chart in the installation instructions, properly connected to the furnace, and properly pitched

Exhaust Termination ◯ Roof ◯ Sidewall

Intake Termination ◯ Roof ◯ Sidewall ◯ Attic

Electrical: Line Voltage

☐ Polarity is correct (black is L1 (hot), white is N (neutral) ☐ Ground wire is connected from the furnace to electrical panel

Line voltage value to furnace (volts AC)

Electrical: Low Voltage

☐ Thermostat wiring is complete ☐ Thermostat heat anticipator set to .4 or (6 cycles per hour for electronic thermostats)

Low voltage value between "R" and "C" on furnace control board (volts AC)

Staging:

Thermostat Staging: ◯ OFF ◯ 10 MIN ◯ 15 AUTO ◯ 20 MIN

Continued on next Page

Gas Side

Gas Type ◯ Natural Gas ◯ LP Gas (Requires LP conversion kit)

LP Gas Conversion Kit Part # Used _____ LP Conversion Kit Installed By _____

Inlet Gas Pressure (in. w.c.") _____ Low Fire Manifold Gas Pressure (in. w.c.") _____ High Fire Manifold Gas Pressure (in. w.c.") _____

Calculated input in btuh - clock the gas meter in high fire (Nat Gas Only) _____

☐ Burner flame inspected -- flames are blue and extending directly into the primary heat exchanger cells

Air Side: System External Static Pressure

Supply static before indoor coil (in w.c.") _____ Supply static after indoor coil (in w.c.") _____

Return Static (in w.c.") before filter _____ Return Static (in w.c.") after filter (furnace side) _____

Total External Static Pressure _____

Air Side: Heating (PSC)

Low Heat Blower Speed Selected ◯ Red (Low) ◯ Yel (Med Low) ◯ Blue (Med/Med High) ◯ Black (High)

High Heat Blower Speed Selected ◯ Red (Low) ◯ Yel (Med Low) ◯ Blue (Med/Med High) ◯ Black (High)

Temperature rise in degrees F measured in low fire _____

Temperature rise in degrees F measured in high fire _____

Air Side: Heating (Variable Speed ECM)

Heat Speed Selected ◯ A ◯ B ◯ C ◯ D

Temperature rise in degrees F measured in Low fire _____

Temperature rise in degrees F measured in high fire _____

Other Jumpers

De-humidistat ◯ Yes ◯ No

Heat Pump ◯ Yes ◯ No

Air Side: Cooling (PSC)

Low Cool Blower Speed Selected ◯ Red (Low) ◯ Yel (Med Low) ◯ Blue (Med/Med High) ◯ Black (High)

High Cool Blower Speed Selected ◯ Red (Low) ◯ Yel (Med Low) ◯ Blue (Med/Med High) ◯ Black (High)

Cooling CFM delivery (use Blower Performance Data Chart) Hi _____ Low _____

Air Side: Cooling (Variable Speed ECM)

COOL Speed Selected ◯ A ◯ B ◯ C ◯ D

ADJUST Setting ◯ A ◯ B ◯ C ◯ D

DELAY Setting ◯ A ◯ B ◯ C ◯ D

Air Side: Continuous Fan (PSC)

Blower Speed Selected ◯ Lo Heat ◯ HI Heat ◯ Lo Cool ◯ Hi Cool

Air Side: Continuous Fan (Variable Speed ECM)

Blower (5-Speed) Selected ◯ Lo Cool ◯ HI Cool ◯ Hi Heat ◯ Lo Heat ◯ VSG

Blower (3-Speed) Selected ◯ L (Low) ◯ M (Med) ◯ H (High)

Cycle Test

☐ Operate the furnace through several heating cycles from the thermostat, noting and correcting any problems

☐ Operate the furnace through continuous fan cycles from the thermostat, noting and correcting any problems

☐ Operate the furnace through cooling cycles (as applicable), noting and correcting any problems

Clean Up

☐ Installation debris disposed of and furnace area cleaned up?

Owner Education

☐ Give owner the owner's manual provided

☐ Explain operation of system to equipment owner

☐ Explain the importance of regular filter replacement and equipment maintenance

☐ Explain thermostat use and programming (if applicable) to owner

5750149-UIM-I-0423
Supersedes: 5750149-UIM-H-1122

York International Corp.
5005 York Drive
Norman, OK 73069