Installation Manual: Y92V Series - Two-Stage Variable Speed ECM Gas Furnace - Multi-Position

JC Residential and Light Commercial LLC,
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Supersedes: Nothing

Contents

About the unit

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

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

These units are Category IV listed and can not be common-vented with another gas appliance as prohibited by the *National Fuel Gas Code*.

Important: Do not twin these units. If more than one unit is needed in an application, each unit must have its own complete duct system and its own wall thermostat.

GoTemp Pro app (Formerly DS Solutions app)

JC Residential and Light Commercial LLC believes in empowering our customers with up-to-date, unit-specific information. Download GoTemp Pro app, a powerful, comprehensive app designed for contractors on the jobsite, available now in the App Store for iOS and Google Play for Android. Use the app to scan the unique QR code on the unit rating plate for easy access to product information and resources such as nomenclature, technical guide, installation manual, wiring diagrams, parts list, product registration, warranty, and much more. Simplify your tasks, save time, and stay ahead with the most comprehensive app built for professionals.

GoTemp Pro

iOS

Android

Certification

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

polyflue

DESIGN CERTIFIED

ENERGY STAR

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

CSA CERTIFIED

5 YEAR COMPLETE ASSURANCE LIMITED WARRANTY PLEDGE

ENERGY STAR QUALIFIED ONLY IN U.S. SOUTH: AL, AZ, AR, CA, DC, DE, FL, GA, HI, KY, LA, MD, MS, NV, NM, NC, OK, SC, TN, TX, VA

Note: The Energy Star rating for unit models varies depending on the unit orientation. See Table 1 and Table 2 for the Energy Star rating by orientation and the Energy Star criteria.

Energy Star Version 5.0

In accordance with Energy Star Version 5.0, Table 1 shows the Energy Star rating according to orientation. Table 2 shows the Energy Star criteria.

Table 1: Energy Star rating by orientation

Heating input (Btu/h)	CFM	Cabinet size	Orientation	AFUE (%)	Energy Star region
40,000	1000	A	Upflow	97	US North US South
			Horizontal	97	US North US South
			Down flow	96	US South only
60,000	1200	B	Upflow	97	US North US South
			Horizontal	96	US South only
			Down flow	95	US South only
80,000	1200	B	Upflow	97	US North US South
			Horizontal	96	US South only
			Down flow	96	US South only
80,000	1600	C	Upflow	97	US North US South
			Horizontal	97	US North US South
			Down flow	96	US South only
100,000	1600	C	Upflow	96	US South only
			Horizontal	96	US South only
			Down flow	96	US South only
100,000	2000	C	Upflow	96	US South only
			Horizontal	96	US South only
			Down flow	95	US South only
120,000	2000	D	Upflow	97	US North US South
			Horizontal	96	US South only
			Down flow	95	US South only

Table 2: Energy Star criteria

US regional split for Energy Star		AFUE
US North	Alaska, Colorado, Connecticut, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming	≥97.0
US South	Alabama, American Samoa, Arizona, Arkansas, California, Delaware, District of Columbia, Florida, Georgia, Guam, Hawaii, Kentucky, Louisiana, Maryland, Mississippi, Nevada, New Mexico, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, and Virginia	≥95.0

Safety

It is important to understand the safety symbols used in this manual. Read safety information carefully and follow all safety requirements.

Understanding safety symbols and instructions

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**, as well as the **NOTICE**, **Important**, and **Note** alerts.

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.

NOTICE indicates information considered important, but not hazard-related, such as messages relating to property damage.

Important indicates information that is essential to complete a task or may result in damage to the device if not followed.

Note indicates something of special interest or importance. Notes can contain any type of information except safety information.

Safety requirements

⚠ WARNING

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

Improper 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 should install this product.

⚠ WARNING

Personnel must be qualified according to local, state, and national building and safety codes and regulations. Incorrect installation could cause leaks, electric shock, fire or explosion. Additionally, in N.A., the US EPA regulations (40 CFR Part 82, Subpart F) under Section 608 of the Clean Air Act requires that technicians who maintain, service, repair, or dispose of equipment that could release refrigerants into the atmosphere must be certified.

⚠ WARNING

Perform the test run in its entirety to ensure normal operation. Safety guards, shields, barriers, covers, and protective devices must be in place while the compressor/unit is operating. During the test run, keep fingers and clothing away from any moving parts. Clean up the site when finished, remembering to check that no metal scraps or bits of wiring have been left inside the unit being installed. After installation work for the system has been completed, explain the Safety Precautions, use, and maintenance of the unit to the customer according to the information in all manuals that accompanied the system. All manuals and warranty information must be given to the user or left near the Indoor Unit.

⚠ WARNING

• Check that the ground wire is securely connected. Do not connect ground wiring to gas piping, water piping, lighting conductor, or telephone ground wiring.

• If a circuit breaker, fuse or safety sensor is frequently activated, i.e. rapid red flashes, shut down the system and contact your service contractor. Please follow all instructions provided in this manual. Any disregard of the steps outlined in this manual is taken at the user's own risk.

⚠ WARNING

Unauthorized modifications to these products are prohibited as they:

- may create hazards which could result in death, serious injury or equipment damage.

- will void product warranties.

- may invalidate product regulatory certifications.

- may violate OSHA standards.

⚠ WARNING

Use appropriate personal protective equipment, such as gloves and protective goggles and, where appropriate, have a gas mask nearby. Also, use electrical protection equipment and tools suited for electrical operation purposes. Do not touch or adjust any safety devices inside the indoor or outdoor units. All safety features, disengagement, and interlocks must be in place and functioning correctly before the equipment is put into operation. If these devices are improperly adjusted or tampered with in any way, a serious accident can occur. Never bypass or wire around any safety device.

⚠ 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.

Adhere to the following:

- Only natural gas or propane (LP) gas are approved for use with this furnace.
- Install this furnace only in a location and position as specified in this manual.
- A gas-fired furnace for installation in a residential garage must be installed as specified in this manual.
- Provide adequate combustion and ventilation air to the furnace space as specified in this manual.
- Combustion products must be discharged outdoors. Connect this furnace only to an approved vent system, as specified in this manual.
- Test for gas leaks as specified in this manual.

⚠ 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.

- Always install the furnace to operate within the intended temperature rise range of the furnace. Only connect the furnace to a duct system that has an external static pressure within the allowable range, as specified on the furnace rating plate.
- When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air must also be handled by ducts sealed to the furnace casing and terminating outside the space containing the furnace.
- It is permitted to use the furnace for heating of buildings or structures under construction where the application and use comply with all manufacturer installation instructions including the following:
  - There is proper vent installation.
  - The furnace is operating under thermostatic control.
  - The return air duct is sealed to the furnace.
  - The air filters are in place.
  - The furnace input rate and temperature rise are set according to the rating plate marking.
  - There is a means for providing the outdoor air required for combustion.
  - The return air temperature is maintained between 55ºF (13ºC) and 80ºF (27ºC).
  - The air filters are replaced upon substantial completion of the construction process.
  - The furnace, ductwork and components are cleaned upon substantial completion of the construction process, and the furnace operating conditions, including ignition, input rate, temperature rise and venting, are verified according to the manufacturer instructions.
- When installed in a non-HUD-approved modular home or building constructed on-site, combustion air must not be supplied from occupied spaces.
- The size of the unit should be based on an acceptable heat loss calculation for the structure. Use ACCA Manual J or another approved method.
- When moving or handling the furnace before installation, leave the doors on the furnace to provide support and 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.

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

- 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 they are attached to the vestibule panel. Do not use the top return bend of the heat exchangers as lifting points because the tubes may shift out of position.
- Refer to the unit rating plate for the furnace model number, and then see Figure 1 for supply air plenum dimensions. The plenum must be installed according to the instructions.
- Provide clearances from combustible materials as listed in Table 4.
- 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 installation on combustible flooring must not be installed directly on carpeting, tile, or other combustible material other than wood flooring.
- Check the rating plate and power supply to make 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.**
- Install the furnace 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 apply.

Avoiding contaminants for combustion air

Adhere to the following:

- The furnace requires **outdoor air** for combustion when the furnace is located in any of the following environments:
  - Restricted environments
  - Commercial buildings
  - Buildings with indoor pools
  - Laundry rooms
  - Hobby or craft rooms
  - Areas near chemical storage areas
  - Areas where there is chemical exposure
- The furnace requires **outdoor air** for combustion when the furnace is located in an area where the furnace is exposed to the following substances and/or chemicals:
  - Permanent wave solutions
  - Chlorinated waxes and cleaners
  - Chlorine based swimming pool chemicals
  - Water softening chemicals
  - De-icing salts or chemicals
  - Carbon tetrachloride
  - Halogen type refrigerants
  - Cleaning solvents such as perchloroethylene
  - Printing inks, paint removers, varnishes, and other similar substances
  - Hydrochloric acid

  - Cements and glues
  - Antistatic fabric softeners for clothes dryers
  - Masonry acid washing materials
- 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.

⚠ 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.

Following 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 and local building, heating, plumbing, and other codes. In the 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/CSA 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 National Fire Protection Association Inc.,Batterymarch Park, Quincy, MA 02269. Or for only the NFGC, contact American Gas Association, 400 N. Capital, N.W., Washington DC 20001 or http://www.NFPA.org.
- **Canada**: NSCNGPIC. For a copy, contact Standard Sales, CSA International, 178 Rexdale Boulevard, Etobicoke, (Toronto), Ontario Canada M9W 1R3.

Combustion and ventilation air

- **US**: Section 9.3 of the NFGC, air for Combustion and Ventilation
- **Canada**: Part 8 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) 2021 Fundamentals Handbook

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**: NFPA 54/ANSI Z223.1 and NFGC, chapters 5, 6, 7 and 8 and National Plumbing Codes
- **Canada**: CAN/CSA-B149.1, Parts 4, 5, 6 and 9 and 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 that do not reflect 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 backup 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.

Installation

Complete all installation stages. You may not need to perform some tasks outlined, depending on the specific installation. See System components and operation to familiarize yourself with system safety controls and system operation as required, and see Troubleshooting if needed.

➤ **Important:**

- Do not twin these units. If more than one unit is needed in an application, each unit must have its own complete duct system and its own wall thermostat.
- If you are using a communicating system, use the Smart Home Control Touch Screen Thermostat (S1-TSHC510). The thermostat is referred to as the Smart Home Control (S1-TSHC510) in this document.

Preparing for installation

Complete the necessary preparation before you begin the installation.

Selecting a location for installation

Before starting the installation, you must select a suitable location for the unit. For residential applications, you can install the unit in a basement, closet, alcove, attic, recreation room, garage, or crawl space. You can also install the unit in commercial applications.

⚠ WARNING

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

⚠ 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.**

➤ **Important:** Potential damage to the internal components can occur if the unit is installed in an unconditioned space and an extended power failure occurs. Following a power failure, do not operate the unit until inspection and repairs are performed.

To select a location for installation, do the following:

- Select a location for the unit that meets the following general requirements for installation:
  - Requires a minimum amount of air intake or vent piping and elbows
  - Is as centralized with the air distribution as possible
  - Has adequate combustion air available, particularly when the appliance is not using outdoor combustion air
  - Does not interfere with proper air circulation in the confined space
  - Allows you to install the unit level

    ➤ **Important:** The unit is designed to be installed level. It is permissible to create up to 1/4 in. (6 mm) slope from back to front to assist in condensate drainage. Do this by shimming the back edge of the unit in contact with the ground or platform.
  - Allows you to maintain all required clearances

- Select a location for the unit that meets any requirements that are specific to the type of installation as outlined in Table 3.

Table 3: Additional location requirements for each type of installation

Type of installation	Additional location requirements
Installation in freezing temperatures	The location of the unit is 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. ➤ **Important:** Do not allow return air temperature to be below 55ºF (13°C) for extended periods. To do so may cause condensation to occur in the main heat exchanger, leading to premature heat exchanger failure.
Installation in a residential garage	The location of the unit allows you to do the following: • Install the unit so the burners and the ignition source are located at least 18 in. (46 cm) above the floor. • Locate or protect the unit to avoid physical damage by vehicles.
Installation in an attic	The location of the unit has floor support for required service access.
Installation on a ground or platform	The unit is installed on a ground or platform with no more than 1/4 in. (6 mm) slope side to side and front to back.

Providing the required clearances

You must provide all required clearances, for example, for combustible materials and unit access and service.

➤ **Important:** In all cases, accessibility clearances take precedence over clearances for combustible materials where accessibility clearances are greater.

To provide the required clearances, do the following:

- Provide ample clearances to permit easy access to the unit. Maintain the following minimum clearances:
  - 24 in. (61 cm) between the front of the unit and an adjacent wall or another appliance, when access is required for servicing or cleaning
  - 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 or vent connections
- Provide clearances in accordance with Table 4.

Unit clearances to combustibles

Table 4: Unit clearances to combustibles

Application	Upflow	Downflow	Horizontal
Top (in.)	1	0	0
Vent (in.)	0	0	0
Rear (in.)	0	0	0
Side (in.)	0	0	1
Front (in.)*	0	0	0
Floor	Combustible	Combustible**	Combustible
Closet	Yes	Yes	Yes
Line contact	No	No	Yes

ⓘ **Note:**
- *Maintain a 24 in. (61 cm) clearance in front of the unit and 18 in. (46 cm) clearance on the side of the unit for service access. All unit models are approved for alcove and attic installation.
- **You must use a combustible floor base accessory or an air conditioning coil if installing the unit in a downflow application on a combustible floor.
- The unit is certified for line contact only when the unit 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 unit and the building joists, studs, or framing.

Inspecting the unit

ⓘ **Note:** There are no shipping or spacer brackets that need to be removed from the interior of the unit.

To inspect the unit, do the following:

1. Inspect the unit immediately after receiving it for possible damage during transit.
2. If damage is evident, do the following:
   a. Note the extent of any damage on the carrier's receipts.
   b. Make a separate written request for the carrier's agent to inspect the unit.
   c. Contact the local distributor for more information.

Transporting and handling the unit

- Leave the doors on the unit when moving or handling the unit to provide support and to prevent damage or warping of the cabinet.
- When lifting the unit, support the ends of the unit rather than lifting the unit by the cabinet flanges at the return air openings (bottom or sides) or supply air opening.
- You can use the primary heat exchanger tubes as a lifting point if the tubes are lifted at the front of the heat exchangers where attached to the vestibule panel.

  Important: Do not use the top return bend of the heat exchangers as lifting points because the tubes may shift out of position.
- Make sure that you check the unit for screws or bolts that may have loosened in transit before you begin the installation.

  Note: There are no shipping or spacer brackets that need to be removed from the interior of the unit.

Becoming familiar with the unit dimensions

- Make sure that you are familiar with the unit dimensions before you begin the installation. See Figure 1 and Table 5.

Dimensions

Figure 1: Dimensions (in.)

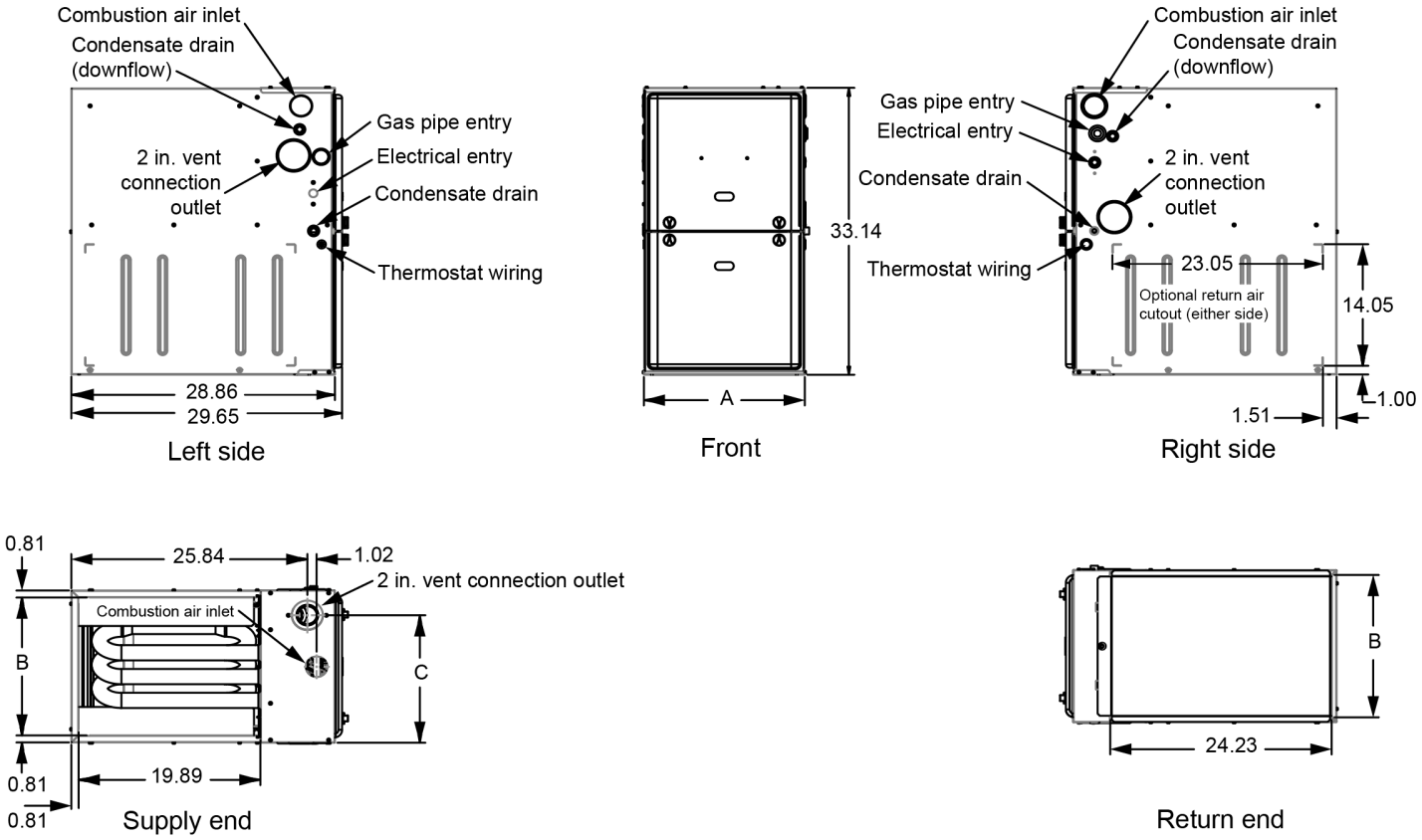


Table 5: Cabinet and duct dimensions

MBH (kW) input	Nominal CFM (m^3/min)	Cabinet size	Cabinet dimensions						Approximate operating weights
			A (in.)	A (cm)	B (in.)	B (cm)	C (in.)	C (cm)	lb (kg)
40 (11.7)	1000 (28.3)	A	14.5	36.8	13.4	34	11.7	29.7	114 (52)
60 (17.6)	1200 (34.0)	B	17.5	44.4	16.4	41.6	14.7	37.4	123 (56)
80 (23.4)	1200 (34.0)	B	17.5	44.4	16.4	41.6	14.7	37.4	127 (58)
80 (23.4)	1600 (45.3)	C	21	53.3	19.8	50.5	18.2	46.2	137 (62)
100 (29.3)	1600 (45.3)	C	21	53.3	19.8	50.5	18.2	46.2	143 (65)
100 (29.3)	2000 (56.6)	C	21	53.3	19.8	50.5	18.2	46.2	146 (66)
120 (35.1)	2000 (56.6)	D	24.5	62.2	23.4	59.4	21.7	55.1	153 (70)

Installing the unit

You can install the unit in upflow, horizontal, or downflow applications.

Important: When installing the unit, ensure to install the indoor coil if applicable. For applications without an indoor coil, install a removable access panel in the outlet duct.

Designing and installing the ductwork

It is vital to the success of an installation to design and install the ductwork correctly. If the duct system is incorrectly sized, the unit does not operate correctly.

WARNING

The duct system must be properly 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 to Table 11 for the correct rise range.

If the ducts are undersized, the result will be 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.

CAUTION

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

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

To design and install the ductwork, do the following:

- Make sure that the design and installation of the duct system adhere to the following:
  - The duct system must handle an air volume appropriate for the served space and within the operating parameters of the unit specifications.
  - The duct system must be installed in accordance with the National Fire Protection Association as outlined in NFPA standard 90B (latest editions) or applicable national, provincial, state, and local fire and safety codes.
  - The duct system must be a closed duct system. For residential and non-HUD modular home installations, when a unit is installed so that the supply ducts carry air circulated by the unit to areas outside the space containing the unit, the return air must also be handled by a duct sealed to the unit casing and terminating outside the space containing the unit.
  - The duct system must complete a path for heated or cooled air to circulate through the air conditioning and heating equipment and to and from the conditioned space.
- Be aware of the following for installations with an indoor coil:
  - You must install the indoor coil parallel with, or in the supply air side of the unit to avoid condensation in the primary heat exchanger. When using a parallel flow arrangement, dampers or other means used to control airflow must be adequate to prevent chilled air from entering the unit. If manually operated, the damper must be equipped with means to prevent the unit or the air conditioner from operating unless the damper is in full heat or cool position. See Installing an indoor coil.

- You may place the indoor coil directly on the unit outlet and seal it to prevent leakage. If you are installing an uncased indoor coil with a thermoplastic drain pan in the upflow or horizontal configuration, provide an extra 2 in. (5.1 cm) minimum spacing to protect against drain pan distortion. See Installing an indoor coil.

- Be aware that for installations without an indoor coil, you must install a removable access panel in the outlet duct. See Installing a removable access panel in the outlet duct.
- Make sure that the ducts attached to the unit plenum are of sufficient size so the unit operates at the specified external static pressure and within the air temperature rise specified on the unit rating plate.
- When replacing an existing unit, if the existing plenum is not the same size as the new unit, remove the existing plenum and install a new plenum that is the correct size for the new unit. 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.

Using an existing duct system

- Check that the ductwork meets requirements and is correctly sized, and adjust the ductwork if needed. See Designing and installing the ductwork for more information about requirements.

Using the duct flanges

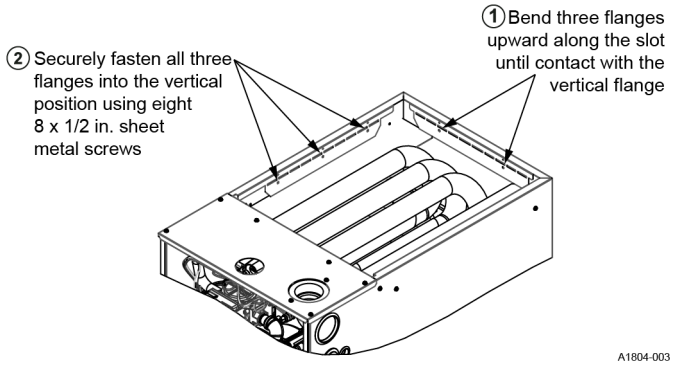
Three duct flanges are part of the unit casing. The flanges are rotated down for shipment.

Important: If you do not use the duct flanges, they must remain in the rotated down position as shipped.

To use the duct flanges, do the following:

1. Bend the three duct flanges upward along the slots until the duct flanges come into contact with the vertical casing flange.
2. Secure each duct flange to the casing in the vertical position using eight #8 x 1/2 in. screws in the holes provided. The screws are not provided. See Figure 2.

Figure 2: Duct attachment



Configuring the unit for downflow application

This task applies only for downflow applications. The unit is shipped in the upflow configuration. You must configure the unit for use in a downflow application by rotating the vent blower as outlined in this procedure. Use a field-supplied internal vent accessory kit for downflow applications where the vent pipe must be routed through the blower compartment. The following kits are available:

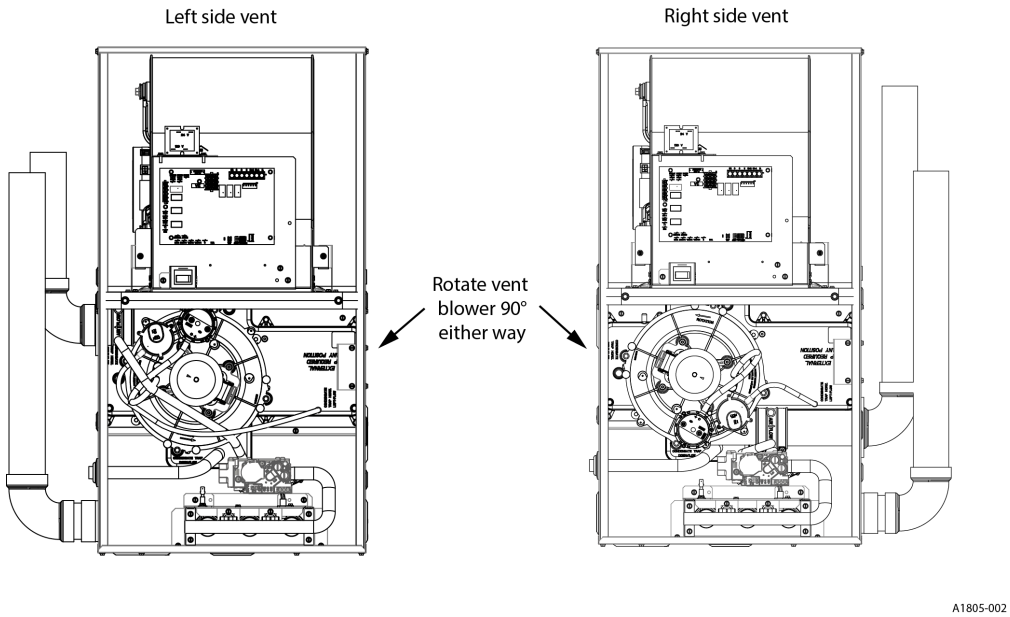
- S1-37348990001 internal vent kit 17.5 in.
- S1-37348991001 internal vent kit 21.0 in.
- S1-37348992001 internal vent kit 24.5 in.

Note: There is no kit available for **A width** cabinet models.

To configure the unit for downflow application, do the following:

- Rotate the vent blower 90° left or right so the vent pipe passes through the side of the unit casing. Use the applicable internal vent kit if the vent pipe needs to be routed through the blower compartment. See Figure 3.

Figure 3: Downflow venting



Installing an indoor coil

This task applies only for applications with an indoor coil.

CAUTION

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

Important:

- For details of the coil cabinet dimensions and installation requirements, refer to the *Installation Manual* for the indoor coil
- For downflow applications, make sure that the indoor coil cabinet part number is specifically intended for downflow applications.

To install the indoor coil, do the following:

- Follow the installation instructions in the *Installation Manual* for the indoor coil. Mount the indoor coil on the supply side of the unit as shown in Figure 4 and Figure 5, Figure 6, Figure 7, or Figure 8 as relevant.

Figure 4: Furnace and coil attachment

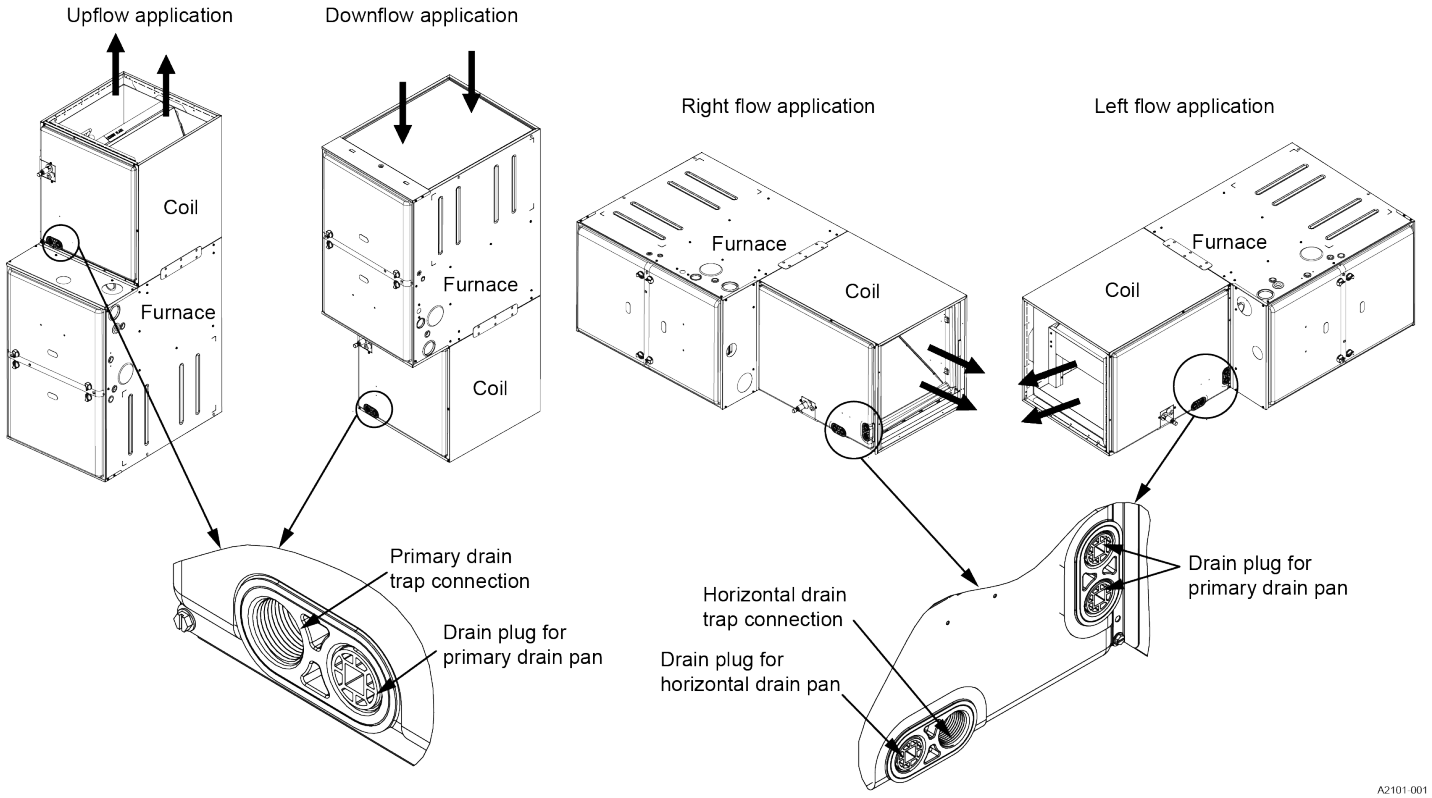


Figure 5: Vertical upflow application with furnace

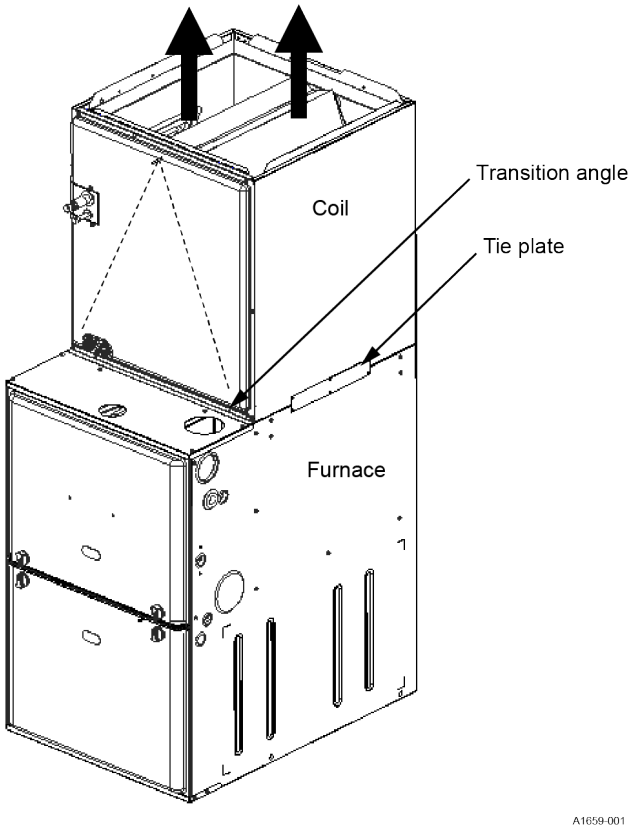


Figure 6: Vertical downflow application with furnace

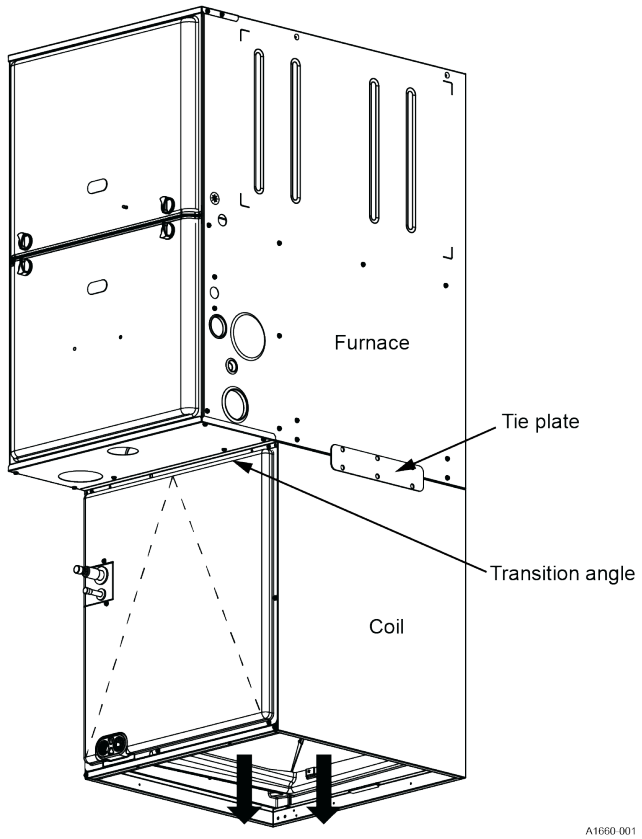


Figure 7: Horizontal right application of coil with furnace

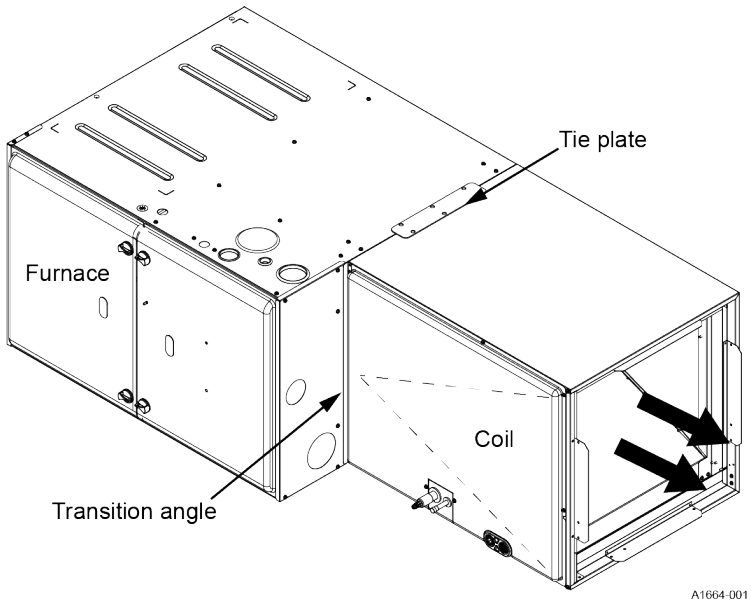
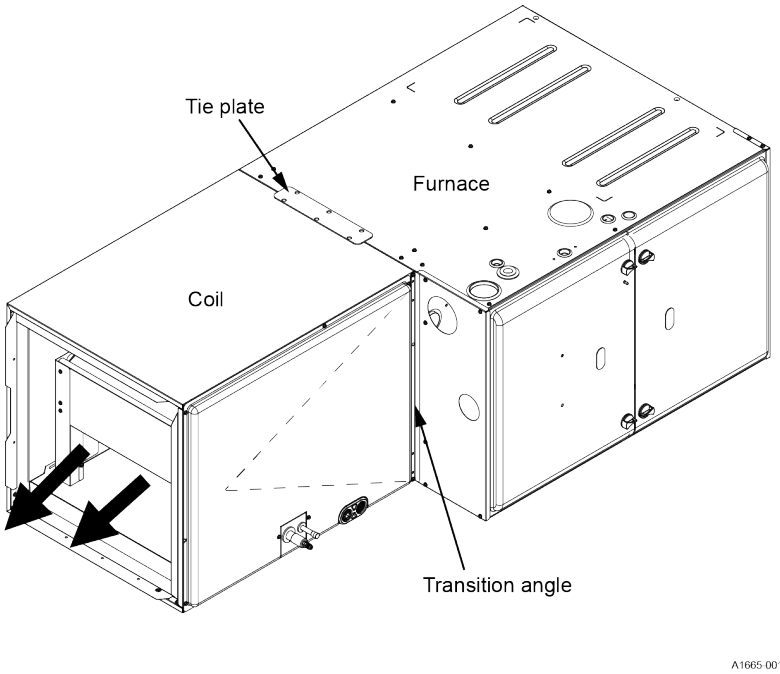


Figure 8: Horizontal left application of coil with furnace



ⓘ **Note:** You may place the indoor coil directly on the unit outlet and seal it to prevent leakage. If you are installing an uncased indoor coil with a thermoplastic drain pan in the upflow or horizontal configuration, provide an extra 2 in. (5.1 cm) minimum spacing to protect against drain pan distortion.

- For downflow applications, follow the installation instructions in the *Installation Manual* for the indoor coil to attach the indoor coil cabinet to the duct connector. Then, position the unit on top of the indoor coil cabinet and seal the connection to the unit, indoor coil cabinet, duct connector, and supply air duct to prevent air leakage.

Installing a removable access panel in the outlet duct

This task applies only for applications without an indoor coil.

- Install a removable access panel in the outlet duct so any smoke or reflected light is observable inside the casing to indicate the presence of leaks in the heat exchanger. Attach the access panel securely to prevent leaks.

Positioning the unit

Before you begin:
Make sure that the location you have selected for the unit is suitable and you can provide the required clearances. See Selecting a location for installation and Providing the required clearances.

How you position the unit varies depending on the type and place of installation. You can install the unit in an upflow, horizontal, or downflow application. For residential applications, you can install the unit in a basement, closet, alcove, attic, recreation room, garage, or crawl space. You can also install the unit in commercial applications. You can set the unit on blocks or pads or suspend or hang the unit from rafters or floor joists as required.

⚠ 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.

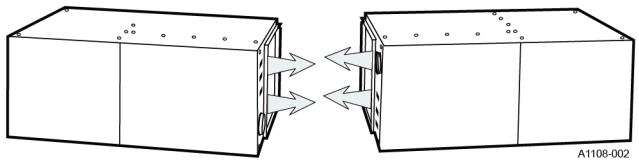
Important: During installation, doors must remain on the unit when moving or lifting the unit.

To position the unit, follow the guidance for your specific application:

- **For horizontal applications**, install the unit in a horizontal position on either side as shown in Figure 9.

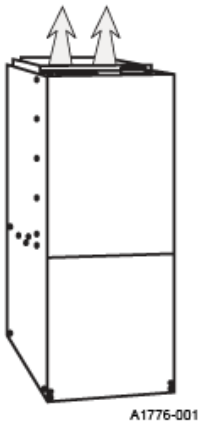
  Important: Do not install the unit on its back.

Figure 9: Horizontal application



- **For upflow applications**, install the unit in an upflow position as shown in Figure 10.

Figure 10: Upflow application



- **For downflow applications where the unit is installed on a combustible material or directly on a floor**, use one of the following approaches:

- Use a combustible floor base accessory. See Figure 11 and Figure 12. Make sure to plug intake and vent pipe holes in the bottom panel and move the grommet to the required vent side exit.

Figure 11: Combustible floor base accessory

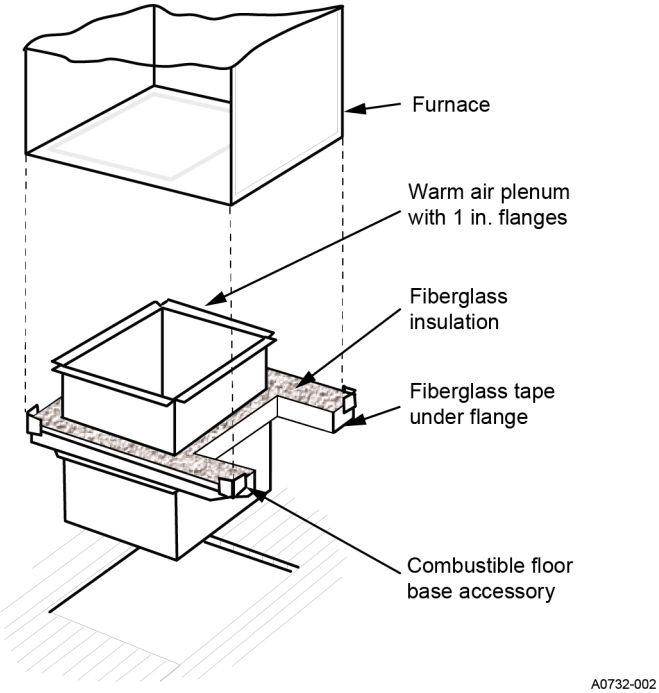
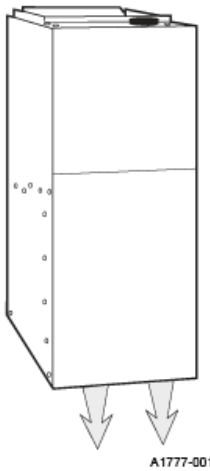


Figure 12: Downflow application - floor base

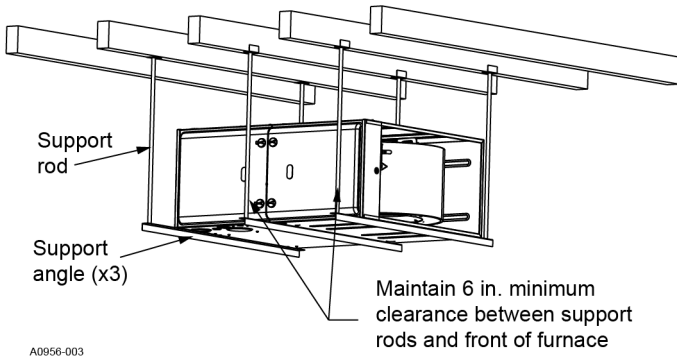


- Use an indoor coil that is correctly sealed to prevent leaks instead of a combustible floor base accessory. See Installing an indoor coil for more information about positioning the unit in downflow applications with an indoor coil.

- **For applications where the unit is suspended**, for example, in attic or crawl space installations where the unit is suspended from rafters or floor joists, use rods, pipe angle supports, or straps as follows:
  - Support the unit with rods, pipe angle supports or straps at three locations. Place one support at the supply end of the unit, place the second support approximately in the center of the unit near the blower shelf, and place the third support at the return end of the unit.
  - Maintain a 6 in. (15.2 cm) minimum clearance between the front of the unit and the support rods or straps.

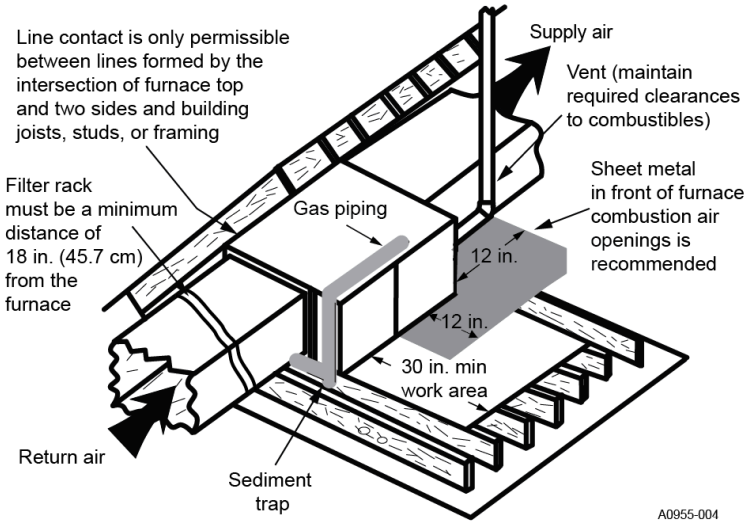
- Make sure that all six suspension points are level to ensure correct and quiet unit operation.
- Use a secure platform constructed of plywood or other building materials secured to the floor or ceiling joists. See Figure 13.

Figure 13: Typical suspension of unit in an attic or crawl space installation



- **For applications where the unit is installed on blocks or pads**, make sure that the blocks or pads are suitable and provide adequate height to ensure that the unit is not subject to water damage.
- **For applications in an attic**, be aware that the unit is certified for line contact only when the unit 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 unit and the building joists, studs, or framing. This line may be in contact with combustible material. . The filter rack must be a minimum distance of 18 in. (45.7 cm) from the unit. Make sure to maintain required clearances. See Figure 14.

Figure 14: Typical attic installation - line contact



Connecting the unit to the ductwork

How you connect the unit to the ductwork varies depending on the type of application.

To connect the unit to the ductwork, follow the guidance for your specific application:

- **For upflow or horizontal applications**, attach the supply plenum to the unit outlet. Use an approved flexible duct connector and seal the connection to prevent air leakage. Make sure that the sheet metal is crosshatched to eliminate any popping of the sheet metal when the indoor fan is energized.

- **For all applications**, when connecting the return plenum, be aware that return air may enter the unit through the sides or bottom depending on the type of application. **Do not connect return air into the rear panel of the unit.**
- **For downflow applications**, see Installing an indoor coil for more information about connecting the unit to the ductwork in downflow applications with an indoor coil. If an indoor coil is not used, use a combustible floor base accessory for applications on combustible material or directly on any floors, as shown in Figure 11.
- **For side return applications**, return air is pulled through an opening cut in the side of the unit casing. See Figure 15. Leave the bottom blockoff panel that is supplied with the unit in place. If the unit is installed on a flat, solid surface, the bottom blockoff panel provides an adequate seal to prevent air leakage through the unused bottom opening. However, if the unit is installed on a surface that is uneven or if the unit is installed on blocks or otherwise raised off the floor, seal the edges of the bottom blockoff panel to the casing using tape or other appropriate gasket material to prevent air leakage.
- **For bottom return applications**, return air is usually pulled through a base platform or return air plenum. Make sure the return platform structure or return air plenum is suitable to support the weight of the unit. Remove the internal bottom panel.

Installing air filters

You must install an air filter or air filters for all applications. Air filters are field-supplied. Install air filters external to the unit cabinet. **Do not attempt to install an air filter inside the unit**. See Table 6 for recommended air filter sizes. Depending on the specific application, you may install side return, horizontal, or downflow air filters. When installing side return air filters, you need to make a cutout in the unit side panel as shown in Figure 15.

⚠ CAUTION

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

⚠ CAUTION

In horizontal furnace arrangement, the filter must be located a minimum of 18 in. from the return air inlet of the furnace.

⚠ CAUTION

In downflow furnace arrangement, the filter must be located a minimum of 12 in. from the return air inlet of the furnace.

NOTICE

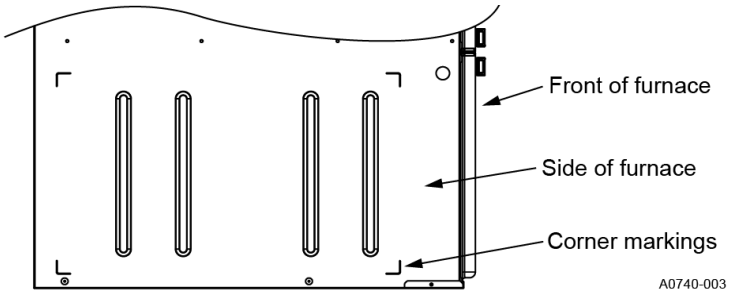
Single side return above 1800 CFM is approved if the air filter velocity does not exceed the air filter manufacturer recommendation and a transition is used to allow use on a 20 x 25 in. air filter.

Table 6: Recommended air filter sizes - high velocity 600 FPM

CFM (m^3/min)	Cabinet size	Side (in.)	Bottom (in.)
1000 (28.3)	A	16 x 25	14 x 25
1200 (34.0)	B	16 x 25	16 x 25
1600 (45.3)	C	16 x 25	20 x 25
2000 (56.6)	C	(2) 16 x 25	20 x 25
2000 (56.6)	D	(2) 16 x 25	22 x 25

Note:
- Air velocity through disposable air filters may not exceed 300 ft/min (91.4 m/min). All velocities over this require the use of high-velocity air filters.
- Do not exceed 1800 CFM using a single side return and a 16 in. x 25 in. air filter. For CFM greater than 1800, you may use two side returns, or one side and the bottom, or one side return with a transition to allow use of a 20 in. x 25 in. air filter.

Figure 15: Side-return cutout markings



- Install the air filter or air filters as outlined for the specific type of air filter installation in Table 7.

Table 7: Installing air filters

Type of filter installation	Approach
Side return	1. Locate the L-shaped corner locators. 2. Use the L-shaped corner locators to determine the size of the cutout to be made in the unit side panel. See Figure 15. 3. Install the side return filter rack accessory kit using the instructions provided with the kit. **Note:** If an air filter is provided at another location in the return air system, the ductwork may be directly attached to the unit side panel. **Important:** Some accessories such as electronic air cleaners and pleated media may require a larger side opening. Follow the instructions supplied with the accessory for side opening requirements. **Do not** cut the opening larger than the dimensions for the optional return air cutout shown in Figure 1.
Horizontal	**Typical approach** • Locate the air filter on the return air end of the unit, extending into the return air plenum. Make sure that the air filter is located a minimum of 18 in. from the return air inlet of the unit. • Note that any branch duct (rectangular or round duct) attached to the plenum must attach to the vertical plenum before the air filter. • Use straps and/or supports to support the weight of the external air filter box.
	Alternative approach • Locate the air filter in the duct system external to the unit using an external duct filter box attached to the unit plenum or at the end of the duct in a return air filter grille. Make sure that the air filter is located a minimum of 18 in. from the return air inlet of the unit. • Use straps and/or supports to support the weight of the external air filter box.

Table 7: Installing air filters

Type of filter installation	Approach
Downflow	**Typical approach** • Locate the air filter above the unit, extending into the return air plenum or duct. Make sure that the air filter is located a minimum of 12 in. from the return air inlet of the unit. • Note that any branch duct (rectangular or round duct) attached to the plenum must attach to the vertical plenum above the air filter height. • Use straps and/or supports to support the weight of the external air filter box.
	Alternative approach • Locate the air filter in the duct system external to the unit using an external duct filter box attached to the unit plenum or at the end of the duct in a return air filter grille. Make sure that the air filter is located a minimum of 12 in. from the return air inlet of the unit. • Use straps and/or supports to support the weight of the external air filter box.

Connecting the gas supply

Follow all requirements when connecting the gas supply.

Converting the unit for operation with propane (LP) gas

The unit is constructed at the factory for natural gas-fired operation. To convert the unit for operation with propane (LP) gas, you must use a factory-supplied propane (LP) conversion kit.

⚠ 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 properly converted to use propane (LP) gas. Do not use this furnace with butane gas.

Incorrect gas orifices or a furnace that has been improperly 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 ensure that the furnace has been converted to the proper gas orifice size when the furnace is installed. Do not attempt to drill out any orifices to obtain the proper 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.

To convert the unit for operation with propane (LP) gas, do the following:

- Follow the installation procedure in the *Installation Manual* for the propane (LP) conversion kit.

Installing the gas piping

See Figure 16 for the gas valve components. See Figure 17 for the gas piping.

Figure 16: Gas valve

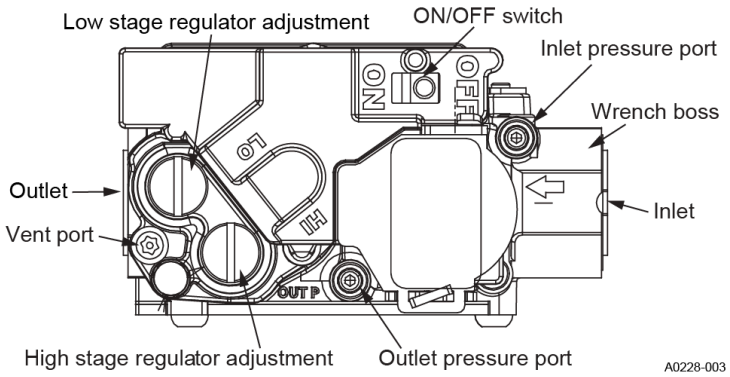
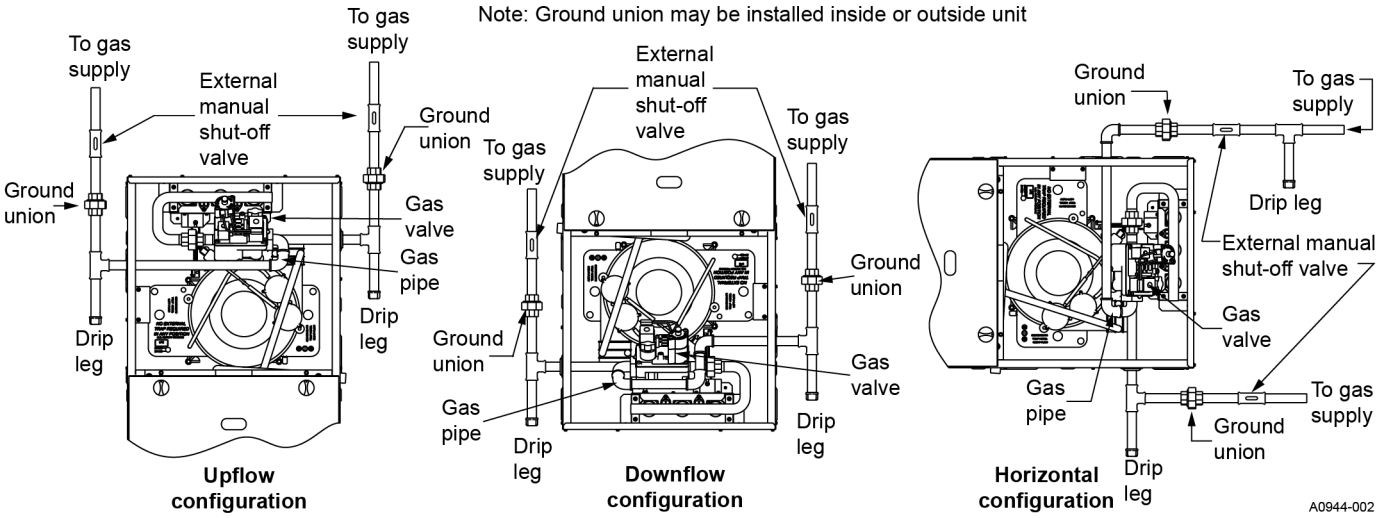


Figure 17: Gas piping



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 PSI (14 in. W.C. [3.48 kPa]). Pressures exceeding 0.5 PSI (14 in. W.C. [3.48 kPa]) at the gas valve will cause damage to the gas valve, resulting in a fire or explosion or cause damage to the furnace or some of its components that will result in property damage and loss of life.

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

To install the gas piping, do the following:

- Use correctly sized wrought iron or approved flexible or steel pipe when making gas connections to the unit. 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.

- Be aware that some utility companies or local codes require pipe sizes larger than the minimum sizes listed in these instructions and in the codes.
- For a left side supply gas pipe arrangement, use two 1/2 in. elbows and two 1/2 in. x 1 1/2 in. pipe nipples.
- Be aware that the arrangement shown in Figure 17 aligns the entrance hole in the unit casing with the supply gas pipe. The unit casing does not support installations completed using street elbows.
- Use only a gas type that is approved for the unit as specified on the unit rating plate and in these instructions.
- Install a drip leg and a ground union. See Figure 17.

  Important: You must install an accessible manual shutoff valve upstream of the unit gas controls and within 6 ft (1.8 m) of the unit.

- Isolate the unit 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 1/2 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 improper operation and/or the valve to leak.

- Be aware that you can connect gas piping from either side of the unit using any of the gas pipe entry on both sides of the unit. See Figure 1 and Figure 17.

Meeting requirements for high-altitude applications

The gas input rate indicated on the unit rating plate is for natural gas-fired operation at 0 ft to 2,000 ft (0 m to 610 m) above sea level. If the unit is installed in a location where the altitude is greater than 5,000 ft (1,524 m) above sea level, you may need to install a high-altitude application conversion accessory kit, which includes a pressure switch. You may also need to install a high-altitude application conversion accessory kit for applications where the altitude is less than 5,000 ft (1,524 m) above sea level but the area is subject to low pressure inversions. Use the correct accessory kit for the unit input rate and size as shown in Table 8 and the unit *Technical Guide*. You must reduce (derate) manifold pressure to reduce the unit input rate for installations at altitudes above 5,000 ft (1524 m). This rate of input reduction (derate) must be in accordance with Table 9.

Table 8: High-altitude application conversion accessory kit

Unit input rate (kBtu/h) and size	Accessory kit part number
040A10	S1-1PS3317
060B12	No kit required
080B12	S1-1PS3317
080C16	S1-1PS3315
100C16	No kit required
100C20	No kit required
120D20	No kit required

Table 9: Altitude derating

Unit input rate in kBtu/h and size	Altitude (ft)															
	0 ft to 2,000 ft				2,000 ft to 5,400 ft				5,401 ft to 7,800 ft				7,801 ft to 10,000 ft			
	Natural gas manifold pressure (in. W.C.)		LP manifold pressure (in. W.C.)		Natural gas manifold pressure (in. W.C.)		LP manifold pressure (in. W.C.)		Natural gas manifold pressure (in. W.C.)		LP manifold pressure (in. W.C.)		Natural gas manifold pressure (in. W.C.)		LP manifold pressure (in. W.C.)	
	High stage	Low stage	High stage	Low stage	High stage	Low stage	High stage	Low stage	High stage	Low stage	High stage	Low stage	High stage	Low stage	High stage	Low stage
040A10	3.5	1.6	9.8	4	3.5	1.6	9.8	4	3.5	1.6	9.8	4	3.5	1.6	9.8	4
060B12	3.5	1.6	9.8	4	3.5	1.6	9.8	4	3.5	1.6	9.8	4	3.5	1.6	9.8	4
080B12	3.5	1.6	9.8	4	3.5	1.6	9.2	4	3.5	1.6	8.9	4	3.5	1.6	8.9	4
080C16	3.5	1.6	9.8	4	3.5	1.6	9.8	4	3.5	1.6	9.2	4	3.5	1.6	8.8	4
100C16	3.5	1.6	9.8	4	3.5	1.6	9.8	4	3.5	1.6	8.9	4	3.5	1.6	8.3	4
100C20	3.5	1.6	9.8	4	3.5	1.6	10	4	3.5	1.6	8.9	4	3.5	1.6	8.3	4
120D20	3.5	1.6	9.8	4	3.5	1.6	8.9	4	3.5	1.6	8.4	4	3.5	1.6	8.4	4

Note:
- The orifice for natural gas is #45.
- The orifice for propane (LP) gas is #55.

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 properly converted to use propane (LP) gas. Do not use this furnace with butane gas.

Incorrect gas orifices or a furnace that has been improperly 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 proper gas orifice size when the furnace is installed. Do not attempt to drill out any orifices to obtain the proper 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.

To meet requirements for high-altitude applications, do the following:

- Install a high-altitude application conversion kit if required for your specific installation. Follow the installation procedure in the *Installation Manual* for the high-altitude application conversion kit. See Table 8.
- For US applications above 5,000 ft (1524 m), be aware that when checking and configuring the system after startup, you must reduce (derate) the manifold pressure so it is in accordance with Table 9. To do so:
  - For natural gas applications, follow the procedures in Checking the unit input rate for natural gas and Measuring and adjusting manifold gas pressure but use the altitude derating values in Table 9.
  - For propane (LP) gas applications, follow the procedure in Measuring and adjusting manifold gas pressure but use the altitude derating values in Table 9.

Connecting the electrical wiring

Follow all requirements when connecting the unit wiring and see Table 11 and Figure 52 as needed. You must connect the control wiring as required for the type of system and outdoor unit you are using:

- For conventional systems, you connect the unit to the wall thermostat and the outdoor unit (air conditioner or heat pump) using conventional low-voltage (24 VAC) thermostat wiring.
- For communicating systems, you connect the unit to the Smart Home Control (S1-TSHC510) and the outdoor unit (air conditioner or heat pump) using four-wire digital communications wiring. The control wiring differs for communicating systems with non-variable capacity outdoor units and communicating systems with variable capacity outdoor units.

Connecting the power supply

See Figure 52 for the unit wiring diagram and see Table 11 for specific unit electrical data as needed throughout this procedure.

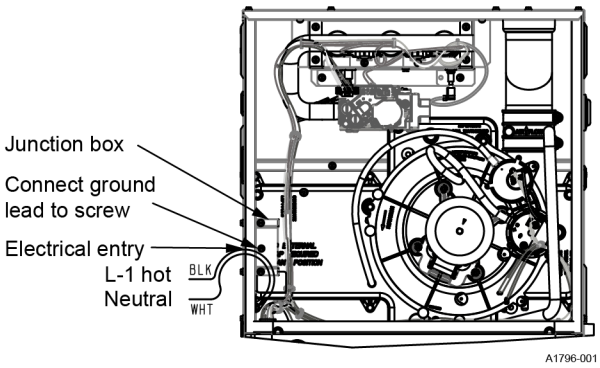
⚠ CAUTION

Use copper conductors only.

Important:

- 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.
- The residential supply must have a bonded neutral.

Figure 18: Electrical wiring



To connect the power supply, do the following

1. Provide a power supply separate from all other circuits. Install overcurrent protection and a disconnect switch in accordance with local and national electrical codes.

   Important: You must locate the disconnect switch close to the unit for convenience in servicing.

2. With the disconnect or fused switch in the **OFF** position, check all wiring against the unit wiring label. See Figure 52.
3. Use one of the wiring methods outlined in Table 10 to connect the power wiring.

Table 10: Connecting the power wiring

Wiring method	Approach
Using a conduit connector or other proper connection	1. Remove the screws from the wiring box cover. 2. Route the power wiring through the opening in the unit into the junction box with a conduit connector or other proper connection. 3. Observe that in the junction box there is a black wire, a white wire, and a green ground screw. 4. Connect the power supply as shown on the unit wiring label on the inside of the blower compartment door or the wiring diagram and Figure 18 as follows: a. Connect the black wire to the L1 (hot) wire from the power supply. b. Connect the white wire to neutral. c. Connect the installer-supplied ground wire to the green equipment ground screw. 4. When the wiring connections are complete, replace the wiring box cover and screws.
Using a field provided box and cover	1. Use a field provided 2 in. (5.1 cm) x 4 in. (10.2 cm) box and cover on the outside of the unit. 2. Route the furnace leads into the box using a protective bushing where the wires pass through the unit panel.

3. Make sure that the unit control system has correct polarity of the power supply and a proper ground connection. See Figure 18.

Important: The power connection leads and wiring box are factory-installed on the left side of the unit. These can be relocated to the opposite side of the unit, except when the inducer is rotated to exit from the right side of the unit. Remove the screws and cut the wire tie holding the excess wiring. Reposition on the opposite side of the unit and fasten using the holes provided.

Ratings and physical and electrical data

Table 11: Ratings and physical and electrical data

Input - high fire/low fire		Output - high fire/low fire		Nominal airflow		Total unit	High fire air temp rise		Low fire air temp rise		Maximum outlet air temp		Blower		Blower size	Gas pipe connection NPT
MBH	kW	MBH	kW	CFM	m^3/min	A	°F	°C	°F	°C	°F	°C	HP	A	in.	in.
40/26	12/8	39/25	11/7	1000	28.3	8.3	30–60	17–33	25–55	14–31	190	88	1/2	6.8	11 x 8	1/2
60/39	18/11	58/37	17/11	1200	34	8.3	35–65	19–36	30–60	17–33	190	88	1/2	6.8	11 x 8	1/2
80/52	23/15	77/50	22/14	1200	34	8.3	40–70	22–39	30–60	17–33	190	88	1/2	6.8	11 x 8	1/2
80/52	23/15	77/50	22/14	1600	45.3	10.8	40–70	22–39	25–55	14–30	190	88	3/4	9.6	11 x 10	1/2
100/65	29/19	96/62	28/18	1600	45.3	10.8	40–70	22–39	30–60	17–33	190	88	3/4	9.6	11 x 10	1/2
100/65	29/19	96/62	28/18	2000	56.6	12.55	35–65	19–36	30–60	17–33	190	88	1	11.5	11 x 11	1/2
120/78	35/23	116/75	33/22	2000	56.6	12.55	45–75	25–42	30–60	17–33	190	88	1	11.5	11 x 11	1/2

Note:
- 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.
- Install the unit so the electrical components are protected from water.
- See Energy Star Version 5.0 for AFUE information according to orientation.

Connecting the control wiring for conventional systems

This task applies only for conventional systems.

Important: If the unit has an add-on indoor coil to be paired with an outdoor unit using an A2L refrigerant, you must typically use a refrigerant detection system (RDS), depending on the refrigerant charge.

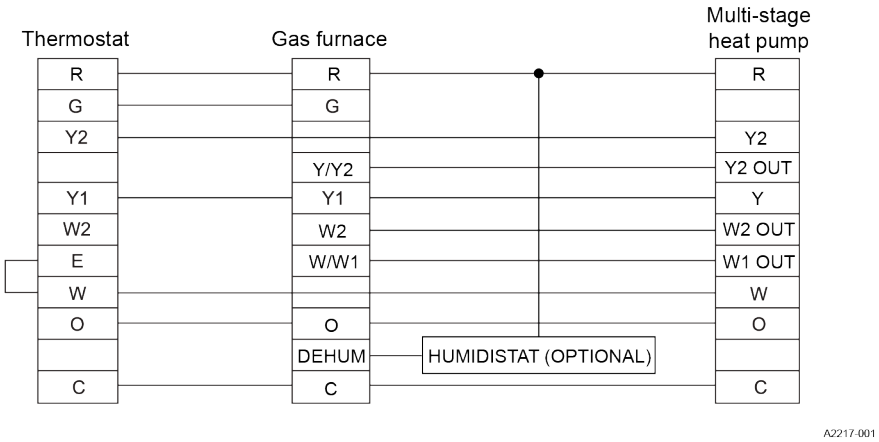
The unit control board allows power-switching control of various accessories. You can use the following if required:

- Humidifier: There are two 1/4 in. (0.64 cm) spade terminals for humidifier connections on the unit control board: HUM and HUM-N. The HUM and HUM-N terminals provide 115 VAC (1.0 A maximum) during heating system operation. A mounting hole is provided on the control panel next to the unit control board for mounting a humidifier transformer if required.
- Electronic air cleaner: There are two 1/4 in. (0.64 cm) spade terminals for electronic air cleaner connections on the unit control board: EAC and EAC-N. The EAC and EAC-N terminals provide 115 VAC (1.0 A maximum) during circulating blower operation.

To connect the control wiring for conventional systems, do the following:

1. If you are using a single-stage thermostat, see Using a single-stage thermostat.
2. Install the field-supplied thermostat according to the installation instructions included with the thermostat.
3. Refer to the control wiring diagrams in the *Installation Manual* for the outdoor unit in your specific application.
4. Make sure that the thermostat set to the **OFF** position and the main electrical source is disconnected.
5. Connect the thermostat wiring from the wiring connections on the thermostat to the terminal board on the ignition module as shown in Figure 19, Figure 20, Figure 21, Figure 22, or Figure 23, depending on your specific application.

Figure 19: Control wiring - variable ECM multi-stage gas furnace and premium multi-stage heat pump - conventional wiring



NOTICE

Do not bond any of the outdoor unit W wires together.

Fossil fuel operation **must** be controlled by room thermostat.

Figure 20: Control wiring - variable ECM multi-stage furnace and standard multi-stage air conditioner - conventional wiring

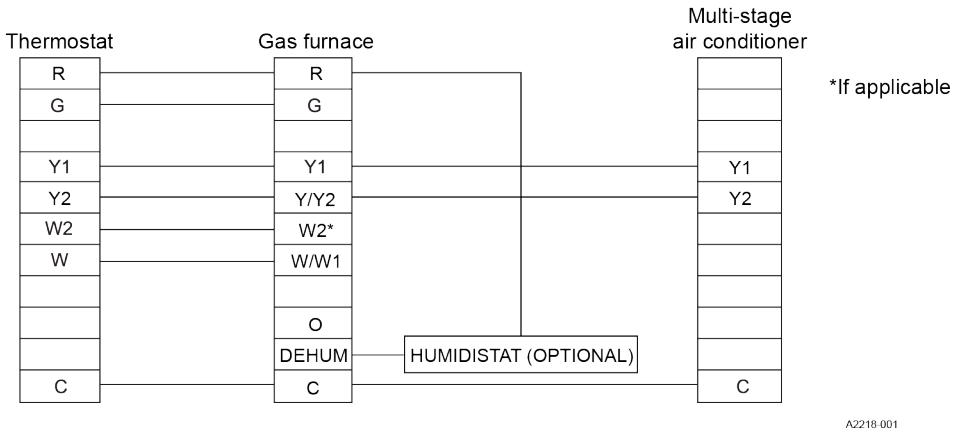
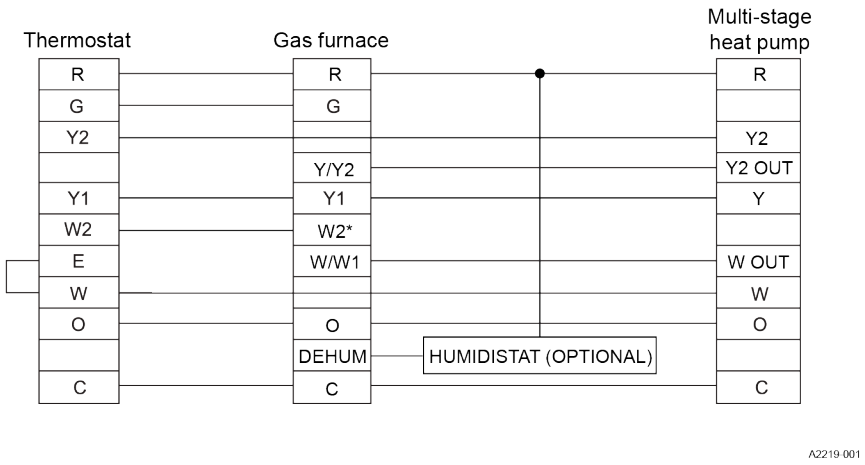


Figure 21: Control wiring - variable ECM multi-stage gas furnace and standard multi-stage heat pump - conventional wiring



NOTICE

Do not bond any of the outdoor unit W wires together.

Fossil fuel operation **must** be controlled by room thermostat.

Figure 22: Control wiring - variable ECM multi-stage furnace and single-stage air conditioner - conventional wiring

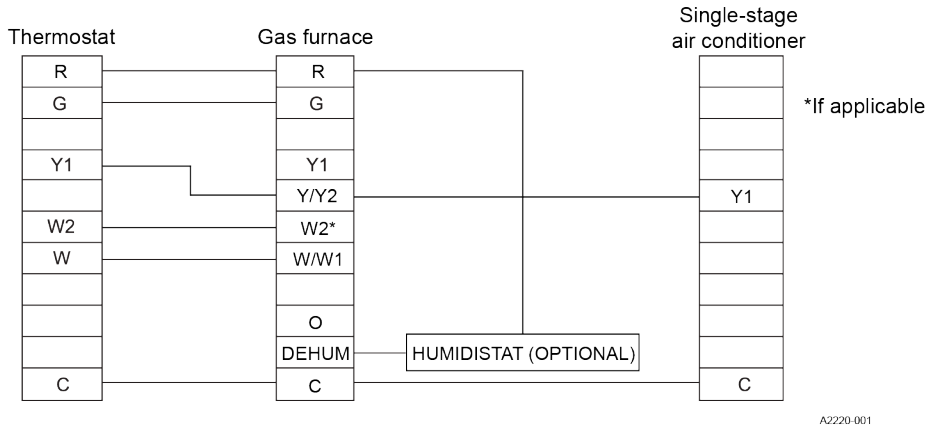
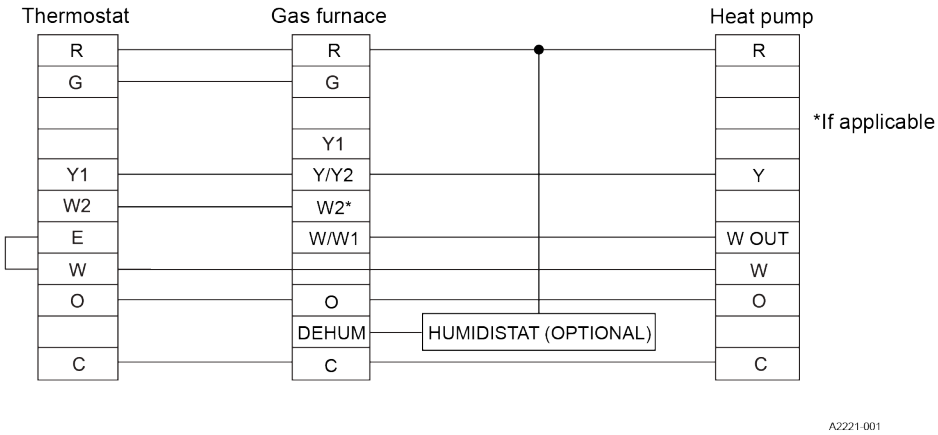


Figure 23: Control wiring - variable ECM multi-stage gas furnace and single-stage heat pump - conventional wiring



NOTICE

Do not bond any of the outdoor unit W wires together.

Fossil fuel operation **must** be controlled by room thermostat.

6. Electronic thermostats require a 24V common wire. **Do not** use power-stealing thermostats.
7. Apply strain relief to the thermostat wires passing through the unit cabinet.
8. If air conditioning equipment is installed, use thermostat wiring to connect the **Y** and **C** terminals on the unit control board to the correct wires on the outdoor unit.
9. If you are using a conventional system with an outdoor unit containing A2L refrigerants, interface the RDS with the conventional system. Refer to the *Installation Manual* for the RDS or an indoor coil with a factory-installed RDS for low-voltage wiring instructions and diagrams.

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.
- Electronic thermostats do not have adjustable heat anticipators. They must be set to six cycles per hour. Follow the instructions provided by the thermostat manufacturer.

Important: The 24 V, 40 VA transformer is sized only for the unit components, so do not connect it to power auxiliary devices such as humidifiers and air cleaners. The 24 V, 40 VA transformer may provide power for an air conditioning unit or heat pump.

10. If a humidifier is installed, connect the humidifier to the **HUM** and **HUM-N** terminals on the unit control board. This is a 120V line connection. If a bypass type 24V humidifier is used, connect the primary side of the humidifiers 24V transformer to this connection.
11. If an electronic air cleaner is installed, connect the electronic air cleaner to the **EAC** and **EAC-N** terminals on the unit control board.

Using a single-stage thermostat

For conventional systems, you can use a single-stage thermostat. If you use a single-stage thermostat, the high and low input staging is controlled by the unit control board. You configure the heat staging settings when you are setting up the unit control board. See Configuring heat staging settings.

Connecting the control wiring for communicating systems with non-variable capacity outdoor units

This task applies only for communicating systems with non-variable capacity outdoor units.

Important:

- If you are using a communicating system, use the Smart Home Control (S1-TSHC510).
- If the unit has an add-on indoor coil to be paired with an outdoor unit using an A2L refrigerant, you must typically use a refrigerant detection system (RDS), depending on the refrigerant charge.

The communicating system consists of several intelligent communicating components including the following:

- Smart Home Control (S1-TSHC510), a communicating wall thermostat
- Variable speed furnace
- Non-variable capacity air conditioner or heat pump

These components continually communicate with each other using a four-wire connection called the A-R-C-B bus. Commands, operating conditions, and other data are passed continually between components over the A-R-C-B bus. See Figure 25.

To use the unit in full communications (COMM) mode, you must install it with the matching Smart Home Control (S1-TSHC510) and an outdoor air conditioner or heat pump with a fully communicating control.

The unit control board allows power-switching control of various accessories. You can use the following if required:

- Humidifier: There are two 1/4 in. (0.64 cm) spade terminals for humidifier connections on the unit control board: HUM and HUM-N. The HUM and HUM-N terminals provide 115 VAC (1.0 A maximum) during heating system operation. A mounting hole is provided on the control panel next to the unit control board for mounting a humidifier transformer if required.
- Electronic air cleaner: There are two 1/4 in. (0.64 cm) spade terminals for electronic air cleaner connections on the unit control board: EAC and EAC-N. The EAC and EAC-N terminals provide 115 VAC (1.0 A maximum) during circulating blower operation.

For communicating systems, you have the option to use the following features, which are only functional when used with the Smart Home Control (S1-TSHC510):

- Float switch: You can connect a float switch to the FLT and R terminals on the unit control board. This feature is intended for use with a water overflow switch that has contacts in either the normally open (NO) or normally closed (NC) position. **Do not** install a float switch in series with any thermostat wiring when using communicating controls.
- Auxiliary switch: You can connect an auxiliary switch to the AUX and R terminals on the unit control board. Refer to the *Installation Manual* for the Smart Home Control (S1-TSHC510).

To connect the control wiring for communicating systems with variable capacity outdoor units, do the following:

1. Refer to the control wiring diagrams in the *Installation Manual* for the outdoor unit in your specific application.
2. Connect the furnace control, Smart Home Control (S1-TSHC510), and non-variable capacity communicating outdoor unit as shown in Figure 24. 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. **Do not** use the large screw terminals, for example, **C**, **G**, and **R,** on the furnace control. Use the four small screw terminals in the terminal block on the furnace control labeled communications. See Figure 24 and Figure 25.

Figure 24: Two-stage furnace with communicating AC or HP with no RDS connected

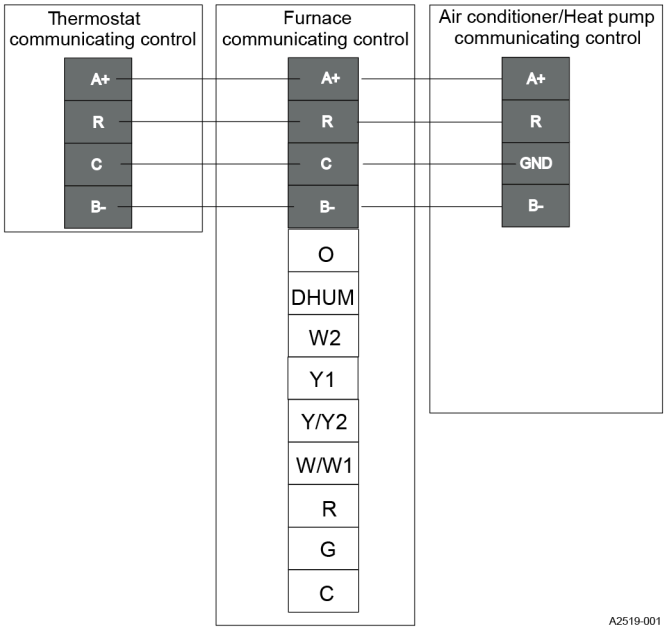
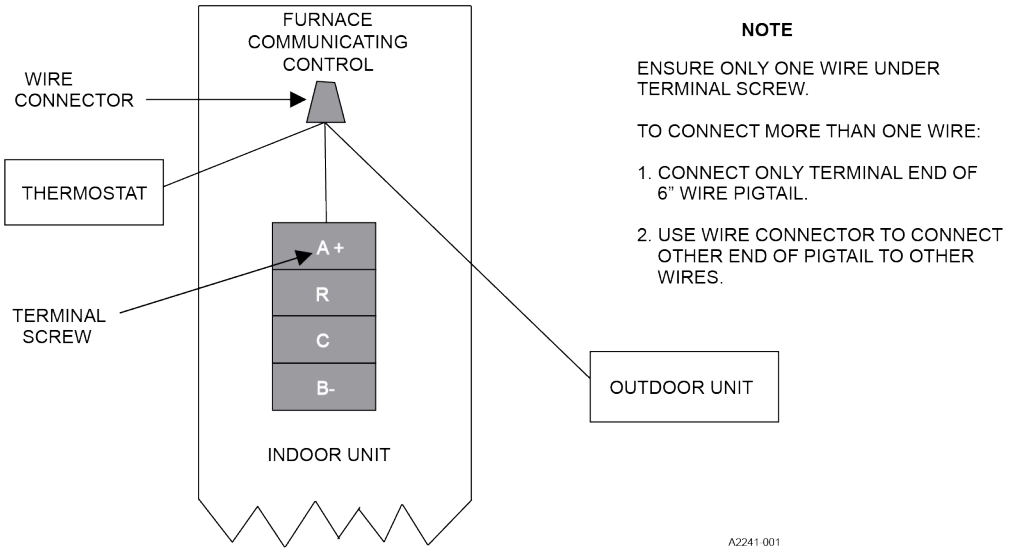


Figure 25: Terminal screw wire connection



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 results in nuisance communication error faults. See Figure 25.

3. If you are using a fully communicating system with an outdoor unit containing A2L refrigerants, interface the RDS with the communicating system. Refer to the *Installation Manual* for the RDS or an indoor coil with a factory-installed RDS for low-voltage wiring instructions and diagrams.

Connecting the control wiring for communicating systems with variable capacity outdoor units

This task applies only for communicating systems with variable capacity outdoor units.

Important:

- If you are using a communicating system, use the Smart Home Control (S1-TSHC510).
- If the unit has an add-on indoor coil to be paired with an outdoor unit using an A2L refrigerant, you must typically use a refrigerant detection system (RDS), depending on the refrigerant charge.

The communicating system consists of several intelligent communicating components including the following:

- Smart Home Control (S1-TSHC510), a communicating wall thermostat
- Variable speed furnace
- Variable capacity air conditioner or heat pump

These components continually communicate with each other using the wire connections shown in Figure . Commands, operating conditions, and other data are passed continually between components over the A-R-C-B and A-C-B bus.

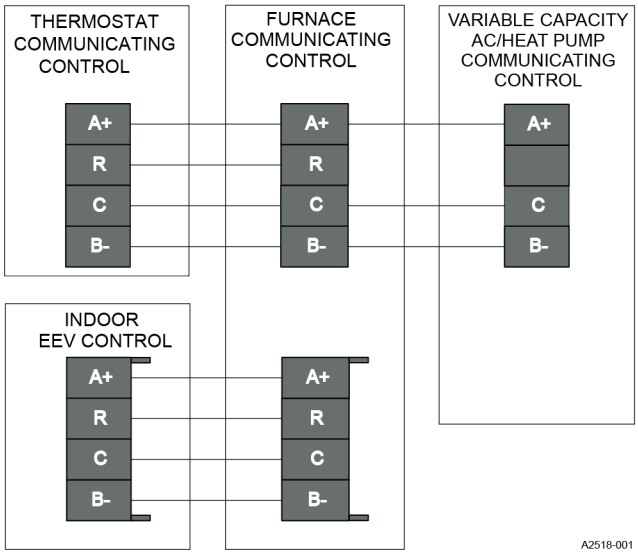
To use a variable capacity outdoor unit with the unit, you have to use a communicating system. You cannot use a conventional system with a variable capacity outdoor unit.

To connect the control wiring for communicating systems with variable capacity outdoor units, do the following:

1. Refer to the control wiring diagrams in the *Installation Manual* for the outdoor unit in your specific application.

2. Connect the furnace control, Smart Home Control (S1-TSHC510), and variable capacity communicating outdoor unit as shown in Figure 26. Ensure 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 Smart Home Control (S1-TSHC510) 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. See Figure 26 and Figure 25.

Figure 26: Furnace with communicating AC or HP with no RDS connected



➤ **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 results in nuisance communication error faults. See Figure 25.

3. Connect a short piece of thermostat wire (18 gauge minimum) to the **ARCB** terminals on the furnace control. Use wire connectors to connect the short piece of thermostat 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 26.
4. If you are using a fully communicating system with an outdoor unit containing A2L refrigerants, interface the RDS with the communicating system. Refer to the *Installation Manual* for the RDS or an indoor coil with a factory-installed RDS for low-voltage wiring instructions and diagrams.

Installing the condensate drain

NOTICE

Figure 28, Figure 29, Figure 30, and Figure 31 show the condensate drain arrangement for the various possible furnace and vent blower positions.

⚠ 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.

NOTICE

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

⚠ CAUTION

It is possible for condensation to form inside the combustion air (intake) pipe in the summer months if a significant length of combustion air pipe passes through conditioned space. You can avoid this problem 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 28, Figure 29, Figure 30, Figure 31, and Figure 40. 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 you use the intake drain, the bird screen **can not** 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 the case for all long horizontal venting in any furnace configuration. This stops condensate from entering the furnace.

⚠ 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 proper protection from freezing can result in improper operation or damage to the equipment and possible property damage. When exposed to temperatures below freezing, use of a 3 to 6 watt per foot 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 will cause damage to internal plastic parts of this furnace. **Do not attempt to winterize the furnace using liquid anti-freeze.**

Important:

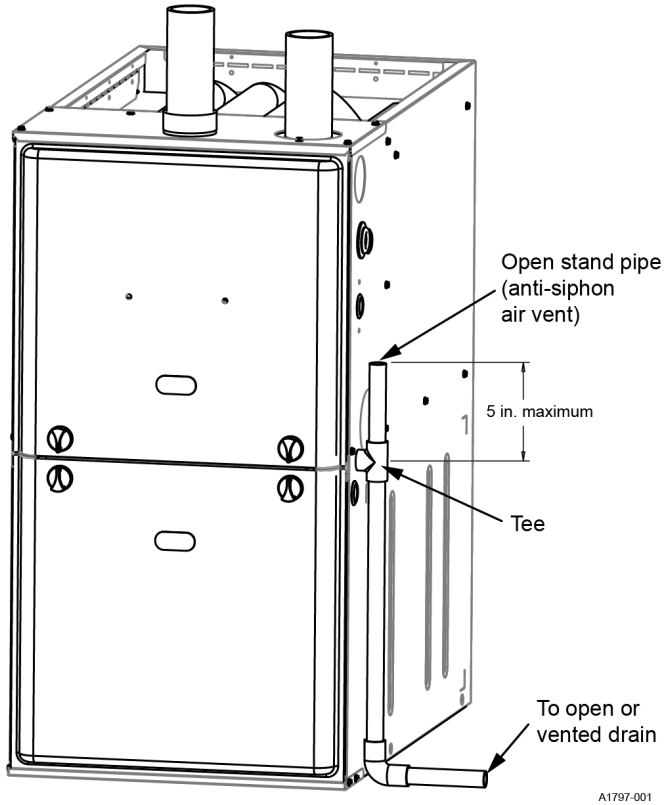
- The unit, indoor coil, and humidifier drains can be combined and drained together. The indoor coil drain can have an external, field-supplied trap before the unit drain connection to prevent conditioned air leakage. All drain connections (unit, indoor coil, or humidifier) must be terminated into an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

- 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.
- If an external vent tee is being installed, then the drain line may have its own condensate trap before it is disposed into an open or vented drain. **This is not to be considered a second trap**.

To install the condensate drain, do the following:

- Be aware that as shipped from the factory:
  - **For 40k, 60k, and 80k input units**, the main drain is plumbed through the casing right-side opening when viewed from the front of the unit.
  - **For 100k and 120k input units**, the main drain is plumbed through the casing left-side opening when viewed from the front of the unit.
- Make sure that the condensate hoses slope downwards at all points.
- When drain hose routing changes are required, as shown in Figure 28, Figure 29, Figure 30, and Figure 31, make sure to cap all unused openings.
- If rerouting hoses, cut off excess length so no sagging loops collect and hold condensate, because this stops the unit operating.
- Hose clamps are not needed for connecting to the condensate pan.
- Install an open stand pipe in the drain line so the condensate flows to the drain better. See Figure 27.

Figure 27: Typical condensate drain, vertical installation



- Do not drain other devices, such as a humidifier and indoor coil, into the top opening of the vent stand pipe. Instead, install a second tee in the vented drain tube below the unit drain tee and route additional drainage through the new tee.
- Use a condensate sump pump 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.

Figure 28: Upflow configuration

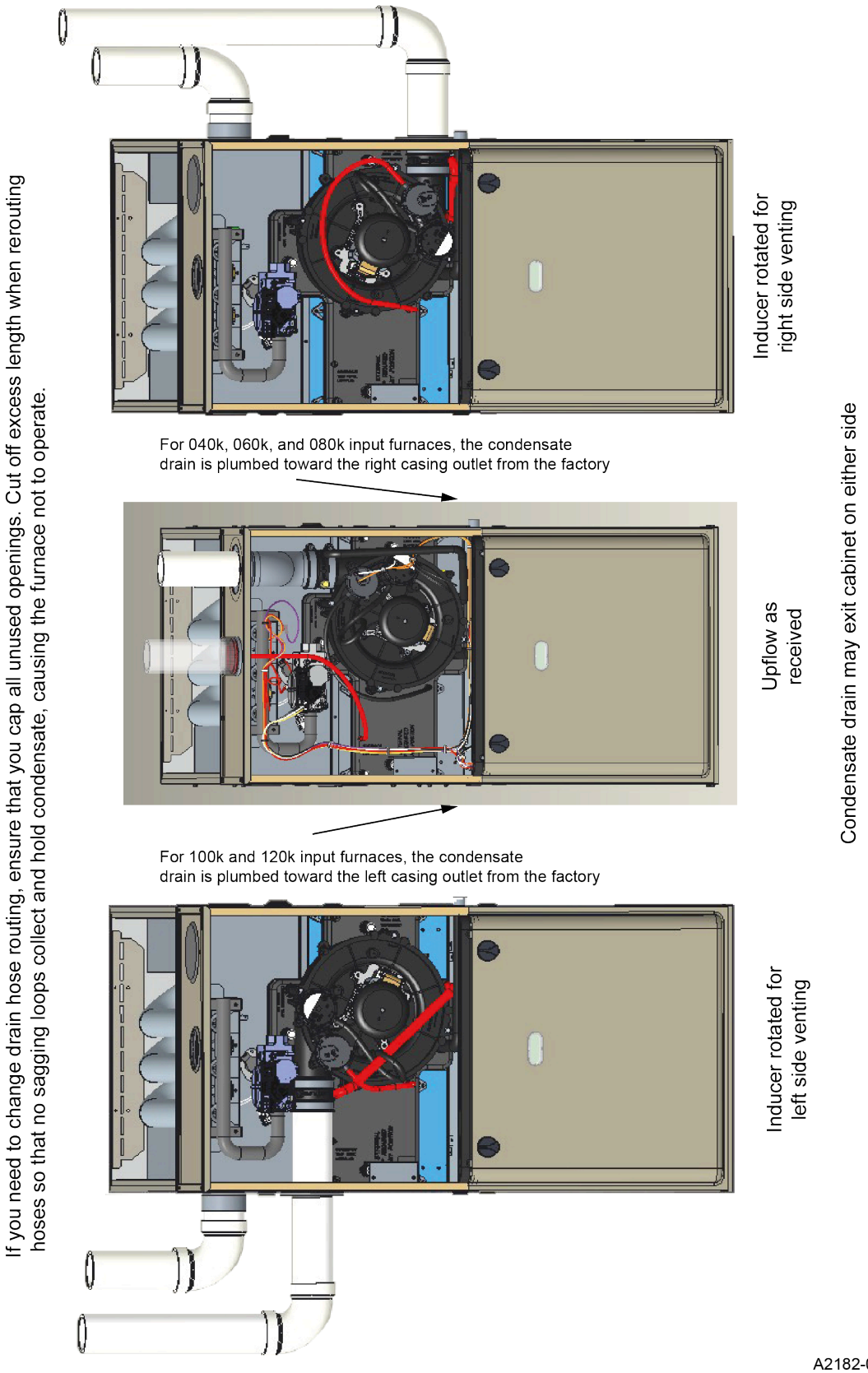


Figure 29: Downflow configuration

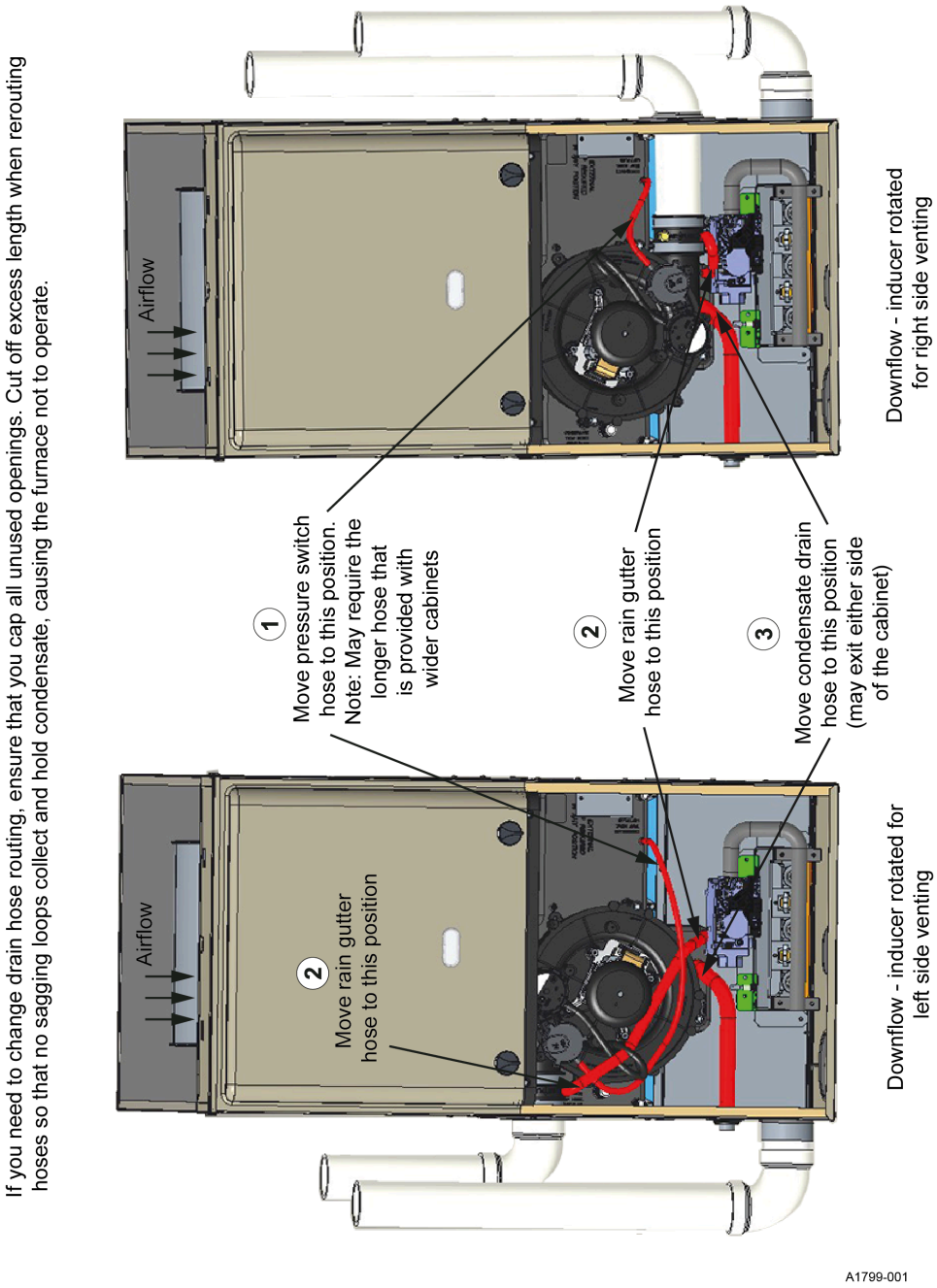


Figure 30: Horizontal left configuration

If you need to change drain hose routing, ensure that you cap all unused openings. Cut off excess length when rerouting hoses so that no sagging loops collect and hold condensate, causing the furnace not to operate.

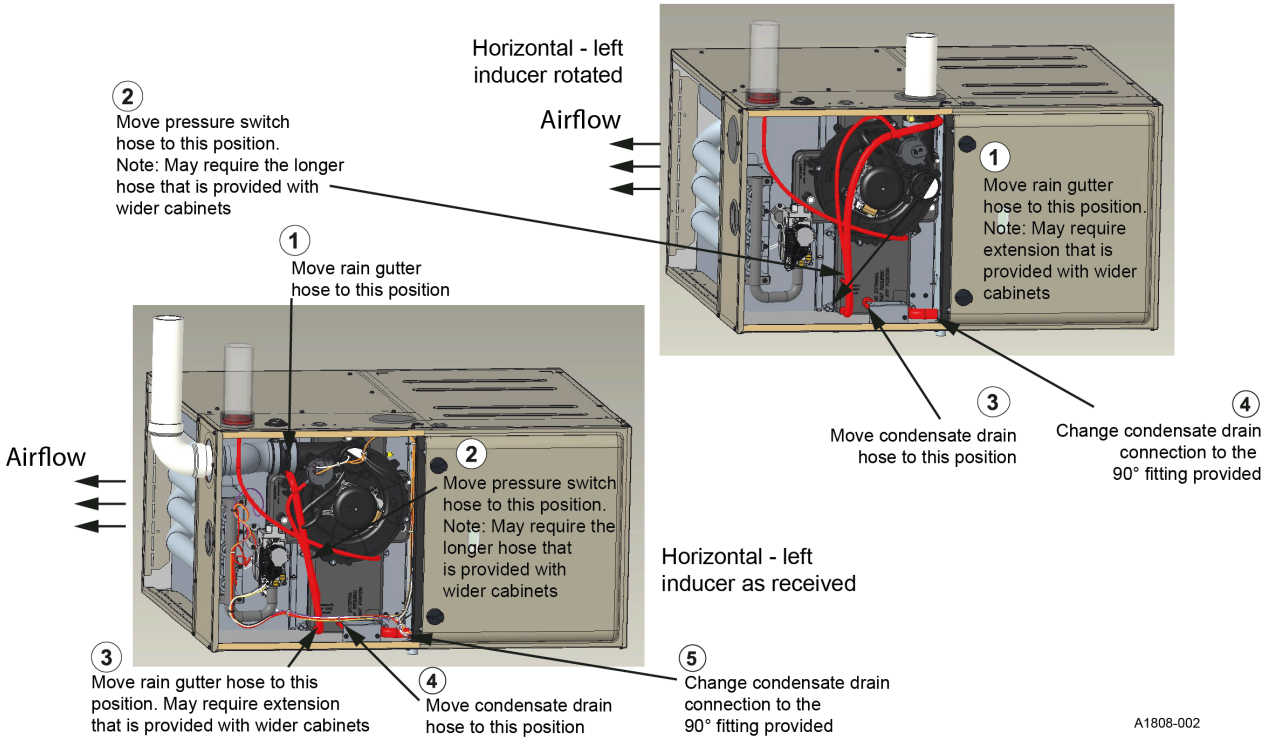
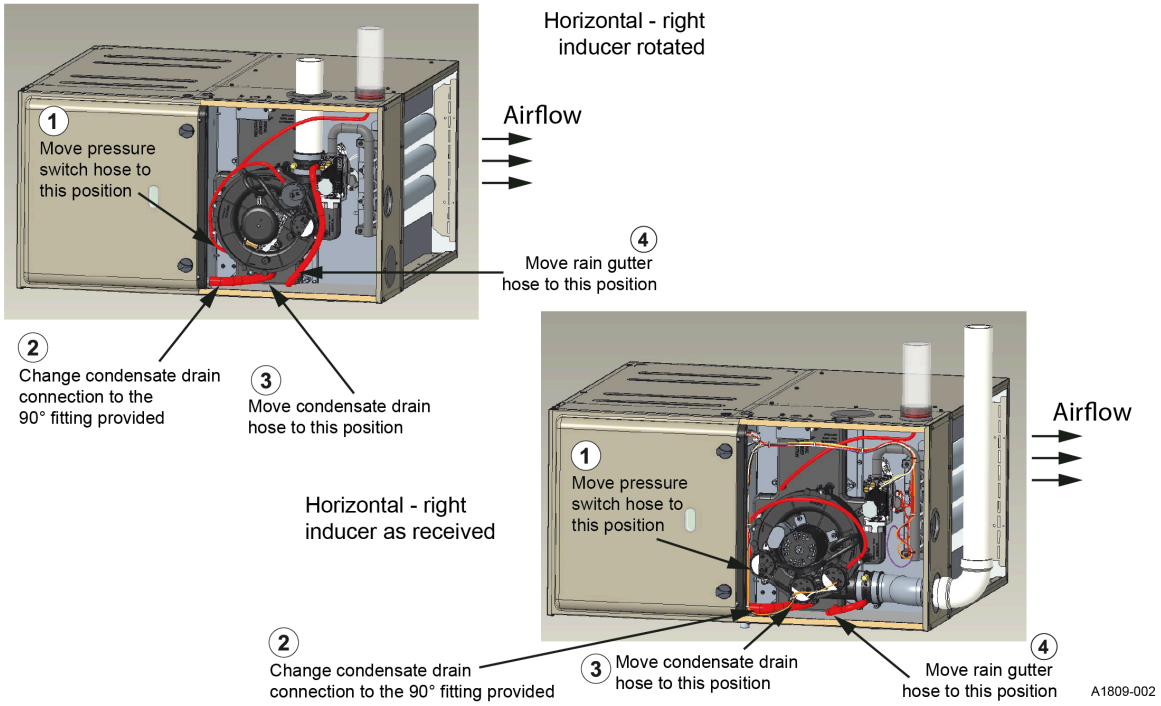


Figure 31: Horizontal right configuration

If you need to change drain hose routing, ensure that you cap all unused openings. Cut off excess length when rerouting hoses so that no sagging loops collect and hold condensate, causing the furnace not to operate.



Connecting the vent system

- **Follow all requirements for connecting the vent system** as outlined in relevant codes and standards, Safety, and the following:
  - Combustion air and vent system safety
  - Combustion air and vent pipe sizing
  - Polypropylene vent or intake piping
  - Combustion air and venting
  - Vent clearances
  - Vent system
  - Vent applications and termination
  - Venting multiple units
  - Downward venting
  - Combustion air supply
  - Outdoor combustion air - combustion air intake/vent connections
  - Ambient combustion air supply
  - Dampers, louvers and grilles - Canada only
  - Air supply openings and ducts - Canada only
  - Combustion air source from outdoors
  - Ventilated combustion air
  - Ventilated combustion air termination
  - Vent and supply (outside) air safety check procedure
  - Specially engineered installations
  - Vent blower rotation

Combustion air and vent system safety

This Category IV, dual certified direct vent furnace is designed for residential application. It can be installed without modification to the condensate system in a basement, garage, equipment room, alcove, attic, or any other indoor location where all required clearance to combustibles and other restrictions are met.

The combustion air and venting system must be installed in accordance with the following:

- Section 9.3, Air for Combustion and Ventilation, of the National Fuel Gas Code Z223.1/NFPA 54 (latest edition)
- Sections 7.2, 7.3 or 7.4 of CSA B149.1, National Gas and Propane Codes (latest edition)
- 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, properly sized air intake and vent lines. The furnace shall 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 shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.

⚠ CAUTION

When 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 and vent pipe sizing

Determine the size of pipe by the furnace model, the total length of pipe required, and the number of elbows required. See Table 12, which 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 14. The equivalent length of the vent system is the total length of straight pipe plus the equivalent length of all of the elbows.

Follow these rules:

1. If venting with PVC, use drain, waste, and vent (DWV) elbows with a long radius (sweep). Standard DWV elbows can be used, but as they have a longer equivalent length, they reduce the total length of pipe that will be allowed. If venting with CPVC, use long radius (sweep) elbows such as the Spears Manufacturing LabWaste(R) series. Short radius (plumbing or pressure) elbows are not allowed for venting. The standard dimensions of the acceptable elbows are shown in Figure 32.
2. **The maximum equivalent length listed in Table 14 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 do not need to be included in the equivalent length calculation.
4. All PVC, CPVC, or ABS combustion air and vent piping 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 using ABS pipe, glue any joint where an ABS pipe joins to a PVC pipe with cement that is approved for use with both materials. Do not use metallic materials for venting or air intake.
5. All models are supplied with 2 in. (5.1 cm) PVC 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. Install the 2 in. to 3 in. increase in the vertical position, to avoid creating an area that will pool water.
6. In Canada, vents must be certified to ULC S636, Standard for Type BH Gas Venting Systems.
7. In Canada, the first 3 ft (91.4 cm) of the vent must be readily accessible for inspection.
8. For single pipe systems, it is advised to install the combustion air coupling provided and install approximately 18 in. of pipe on the furnace.
9. The minimum vent length for all models is 5 ft (1.5 m).

Polypropylene vent or intake piping

The ULC S636 approved polypropylene (PP) vent piping materials listed in this section 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 permitted.

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, go to http://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, go to http://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, go to http://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, go to http://www.ipexna.com/usa/products/plumbing-mechanical/flue-gas-venting-systems/system-1738-pvc.

Table 12: Maximum equivalent pipe length

Furnace input rate in kBtu/h and size	Pipe size (in.)	Maximum equivalent pipe length (ft) by altitude (ft)				
		0 ft to 2,000 ft	2,001 ft to 3,600 ft	3,601 ft to 5,400 ft	5,401 ft to 7,800 ft	7,801 ft to 10,100 ft
40A10	2	65	65	65	65	65
	2 1/2	115	115	115	115	115
	3	150	150	150	150	150
	4	200	200	200	200	200
60B12	2	65	65	65	65	65
	2 1/2	115	115	115	115	115
	3	150	150	150	150	150
	4	200	200	200	200	200

Table 12: Maximum equivalent pipe length

Furnace input rate in kBtu/h and size	Pipe size (in.)	Maximum equivalent pipe length (ft) by altitude (ft)				
		0 ft to 2,000 ft	2,001 ft to 3,600 ft	3,601 ft to 5,400 ft	5,401 ft to 7,800 ft	7,801 ft to 10,100 ft
80B12	2	55	39	20	20	10
	2 1/2	100	90	80	80	50
	3	140	140	140	140	94
	4	190	190	190	190	120
80C16	2	65	53	40	25	20
	2 1/2	115	100	95	95	95
	3	150	150	150	150	150
	4	200	200	200	200	200
100C16	2	20	20	20	20	—
	2 1/2	50	45	45	40	30
	3	65	65	65	60	55
	4	130	130	130	130	130
100C20	2	20	20	20	20	—
	2 1/2	50	45	45	40	30
	3	65	65	65	60	55
	4	130	130	130	130	130
120D20	2	—	—	—	—	—
	2 1/2	60	50	40	—	—
	3	90	79	66	36	36
	4	150	138	125	95	95

Figure 32: Elbow dimensions

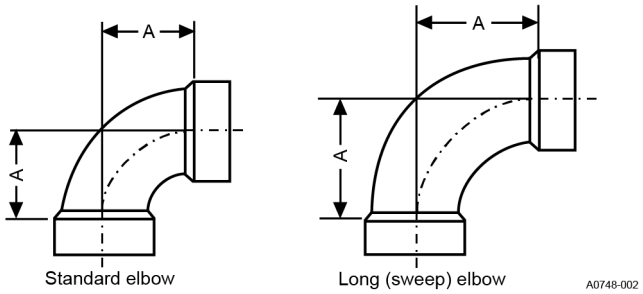


Table 13: Elbow dimensions

Elbow	Dimension A
2 in. standard	2 5/16 in.
3 in. standard	3 1/16 in.
2 in. sweep	3 1/4 in.
3 in. sweep	4 1/16 in.

The dimensions are those required in Standard ASTM D-3311.

Table 14: 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

Table 14: Equivalent length of fittings

Fitting	Equivalent length
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
2 in. corrugated connector	10 ft of 2 in. pipe
3 in. corrugated connector	10 ft of 3 in. pipe
4 in. corrugated connector	10 ft of 4 in. pipe

Example: How to calculate the equivalent length of pipe

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 is:

32 ft of 2 in. pipe = 32 equivalent ft
5 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 for that model and is **not** acceptable.

By using sweep elbows, the total equivalent length is:

32 ft of 2 in. pipe = 32 equivalent ft
5 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 ft maximum equivalent length of 2 in. pipe allowed for that model and is therefore acceptable.

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

32 ft of 3 in. pipe = 32 equivalent ft
5 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 therefore acceptable.

Table 15: 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)

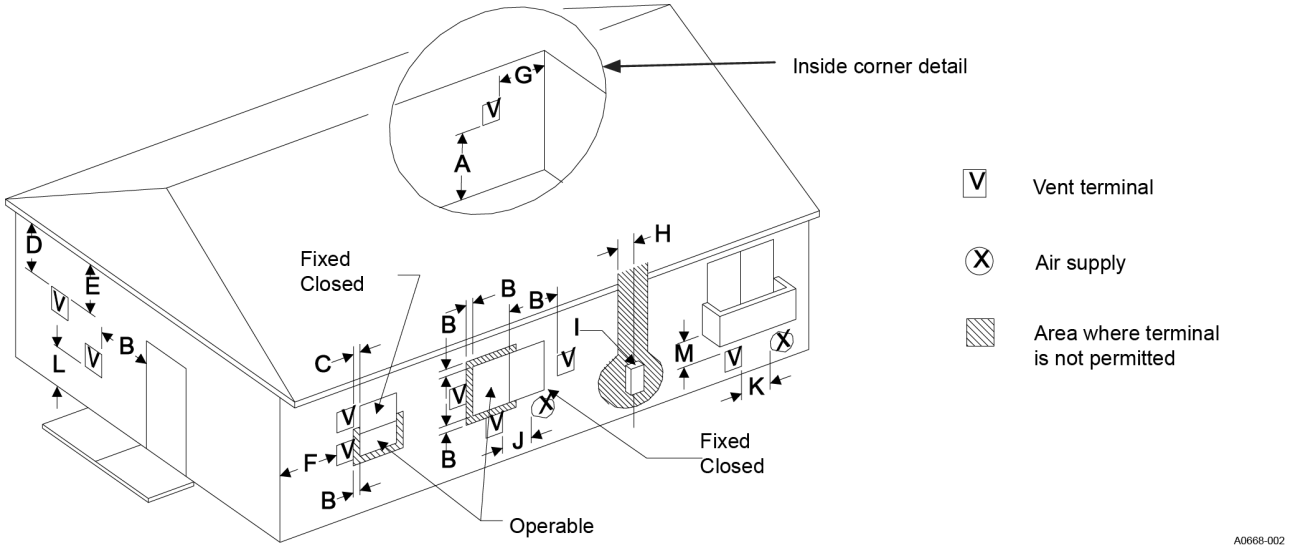
- **Important:** Furnace vent pipe connections are sized for 2 in. (5.1 cm) pipe. Any pipe size change must be made outside the furnace casing in a vertical pipe section to allow correct drainage of condensate. An offset using two 45º elbows is required for plenum clearance when the vent is increased to 3 in. (7.6 cm) or 4 in. (10.16 cm).
- **Important:** Accessory concentric vent/intake termination kits 1CT0302 and 1CT0303 for United States applications, and 1CT0302-636 and 1CT0303-636 for Canadian applications 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 venting

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

Vent clearances

Figure 33: Home layout



Direct vent terminal clearances	Canadian installation	US installation
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	Above a meter/regulator assembly within 3 ft (91.4 cm) horizontally of the vertical centerline of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m) above the meter/regulator assembly	Above a meter/regulator assembly within 3 ft (91.4 cm) horizontally of the vertical centerline 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

Direct vent terminal clearances	Canadian installation	US installation
J. Clearance to non-mechanical 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

ⓘ **Note:** Canadian installations:

- Must be in accordance with the current CSA B149.1-00, Natural Gas and Propane Installation Code and the current ANSI Z21.47 * CSA 2.3 American National Standard.
- For clearance above paved sidewalk or paved driveway located on public property, a vent must not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
- The clearance under a veranda, porch, deck, or balcony is 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.

ⓘ **Note:** US installations:

- Must be in accordance with the current ANSI Z223.1/NFPA 54, National Gas Code and the current ANSI Z21.47 * CSA 2.3 American National Standard.
- The clearance to a window or door that may be opened must be 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.

Consider the following for vent clearances:

- A vent must not terminate less than 12 in. (30.5 cm) above a grade level.
- Any fresh air or make up inlet for a dryer or a 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 can 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.
- The installer has responsibility for the provision of correct, adequate venting and air supply for the application.
- The vent must extend high enough above the building, or a neighboring obstruction, so that wind from any direction does 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 and/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). Use a retaining type collar that is attached to the building surface to prevent movement of the vent pipe.

Vent system

This furnace is certified to be installed with one of the following vent configurations:

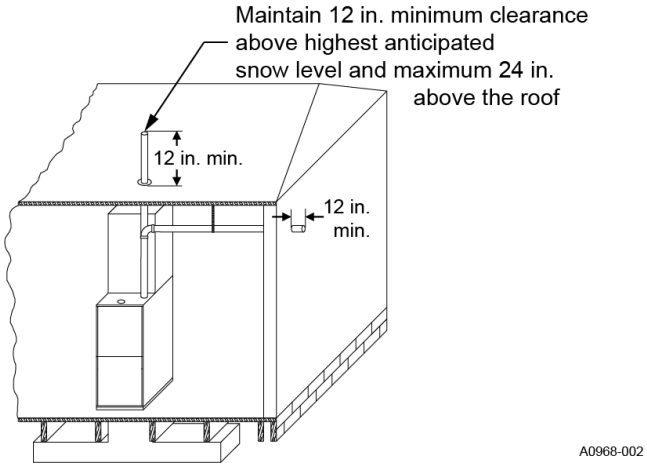
- **Horizontal vent system**: This vent system can be installed completely horizontal or combinations of horizontal, vertical, or it can be offset using elbows.
- **Vertical vent system**: This vent system can be installed completely vertical or a combination of horizontal, vertical, or it can be offset using elbows.

Vent applications and termination

When selecting the location for a combustion air/vent termination, adhere to the following:

- Observe all clearances listed in Vent clearances.
- Position the termination where vent vapors do not damage plants, or shrubs, or air conditioning equipment.
- Locate the termination where it is not affected by wind gusts, light snow, airborne leaves, or susceptible to recirculation of flue gases.
- Locate the termination where it cannot be damaged or exposed to flying stones, balls, and similar.
- Position the termination where vent vapors are not objectionable.
- Horizontal portions of the vent system must slope upwards and be supported to prevent sagging.
- Install direct vent systems so that the vent and the combustion air pipes terminate in the same atmospheric zone. See Figure 35 and Figure 36.

Figure 34: Termination configuration - one pipe



WARNING

Condensation in Intake Pipe

Installations where the furnace and intake pipe are to be located in a conditioned space and in a region that may have hot, humid weather extending several consecutive days will have condensate form in the intake pipe. Use of the supplied intake drain will ensure that any condensate will be safely diverted away from the internal components of the furnace. Proper venting installation (of both intake and exhaust) and sealing any equipment air leaks that might contact the intake pipe will help reduce condensation.

Figure 35: Termination configuration - two pipe

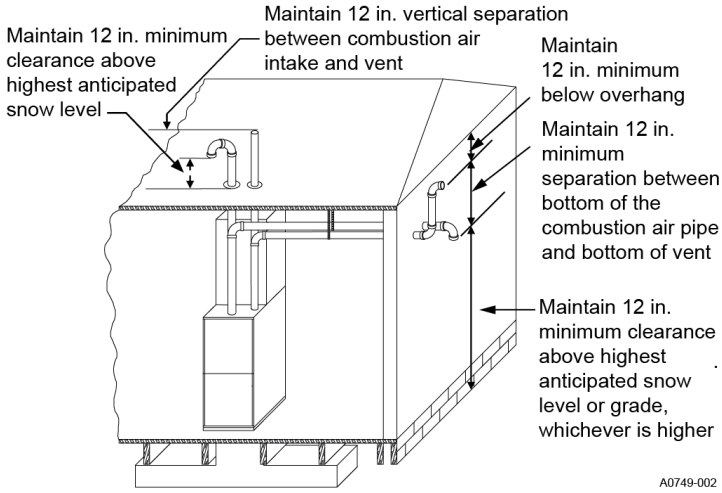
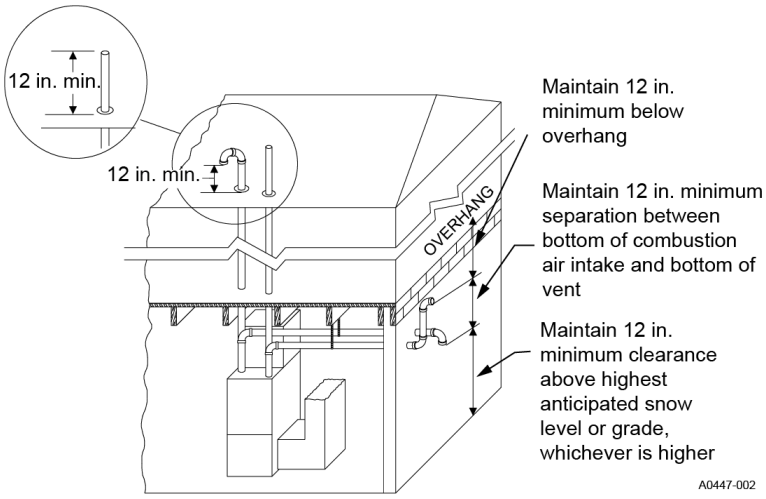


Figure 36: Termination configuration - two pipe basement



Venting multiple units

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

The combustion air side of the single-pipe configuration shown in Figure 34 and Figure 42 is referred to in these instructions as ambient combustion air supply. Follow the instructions for ambient combustion air installations, paying particular attention to the Ambient combustion air supply section. The vent for a single-pipe system must be installed as specified in Vent applications and termination with both vents terminating as shown in Figure 37 and Figure 38. 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 36 and Figure 37 can be installed so the combustion air pipe terminates as described in Outdoor combustion air - combustion air intake/vent connections or Ventilated combustion air. Follow the instructions in Outdoor combustion air - combustion air intake/vent connections or Ventilated combustion air and the instructions for installing the vent system with the vent terminating as shown in Figure 37 or Figure 38. 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 37: Double horizontal combustion air intake and vent termination

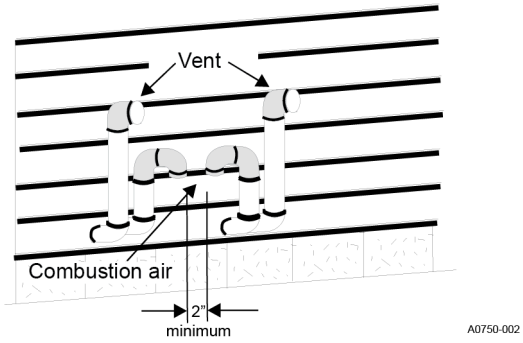
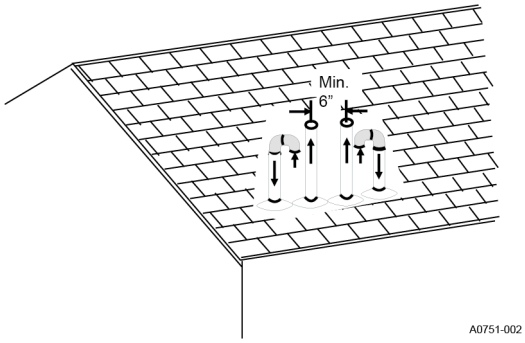


Figure 38: Double vertical combustion air intake and vent termination

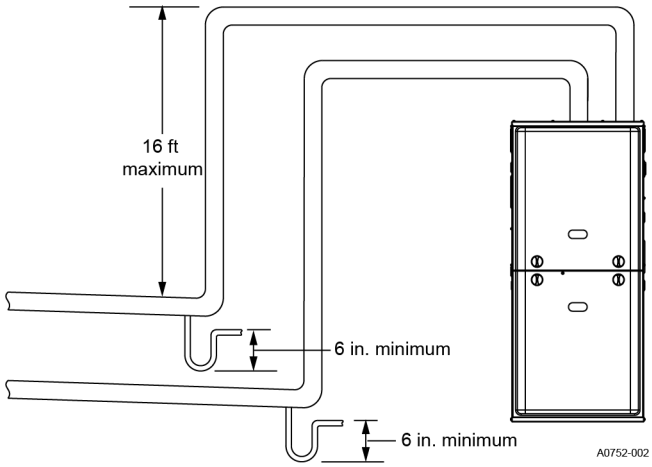


Downward venting

In some applications, it may be necessary to run the vent pipe and air intake downwards. In this case, follow these rules:

- Connect a condensate trap hose 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 can fall below freezing.
- The condensate drain line must be primed at the initial start-up before the start of heating season.

Figure 39: 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 and Figure 36.
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 33 for vent terminations. See Ambient combustion air supply for proper installation. See Figure 42.
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 43 for attic and crawl space termination. Only the combustion air intake may terminate in the attic. The vent must terminate outside.

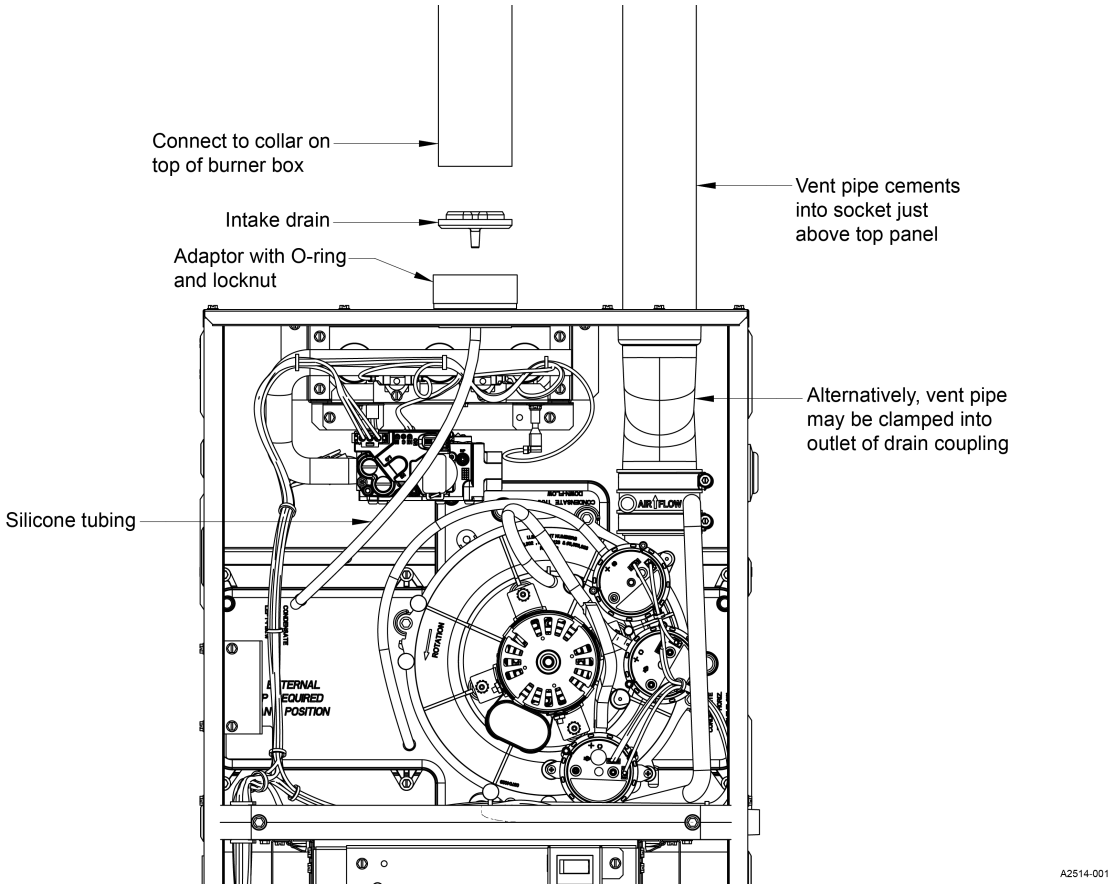
Outdoor combustion air - combustion air intake/vent connections

This installation requires combustion air to be brought in from outdoors. This requires a correctly sized pipe, shown in Figure 40, to bring air in from the outdoors to the furnace combustion air intake collar on the burner box. The second pipe, shown in Figure 40, is the furnace vent pipe.

NOTICE

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

Figure 40: Direct vent air intake connection and vent connection



Locate the combustion air intake pipe either through the wall (horizontal or side vent) or through the roof (vertical vent). Do not locate side vented systems where trees or shrubs can block or restrict supply air from entering the terminal.

In addition, locate the terminal assembly as far as possible from a swimming pool or a location where swimming pool chemicals are stored. Ensure that the terminal assembly follows the outdoor clearances listed in Avoiding contaminants for combustion air.

Ambient combustion air supply

This type of installation draws the air required for combustion from within the space surrounding the furnace and from areas or rooms adjacent to the space surrounding the furnace. The combustion air can 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 41: Ambient combustion air

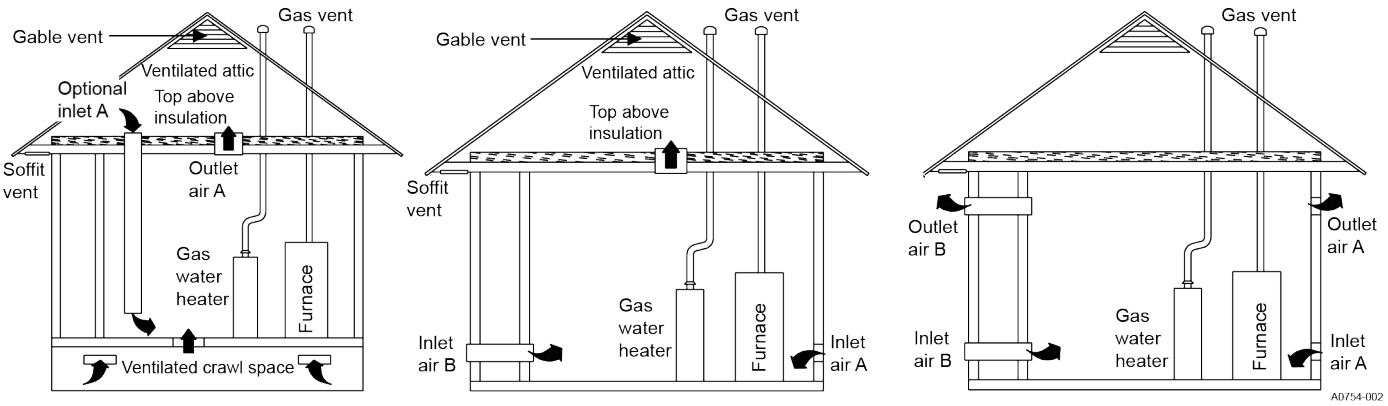
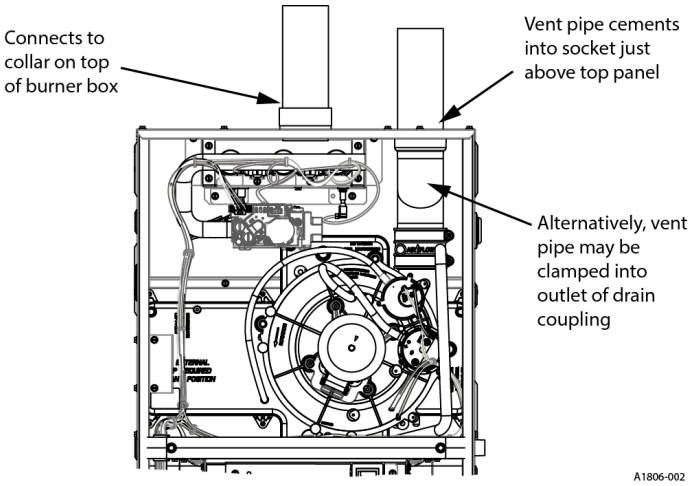


Figure 42: Combustion airflow path through the furnace casing



WARNING

This type of installation requires that the supply air to the appliances be of a sufficient amount to support all of the appliances 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 have 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 adequate air for combustion and ventilation in confined spaces.

Table 16: Unconfined space minimum area

Btu/h input rating	Minimum free area required for each opening - in² (cm²)
40,000	40 (258)
60,000	60 (387)
80,000	80 (516)
100,000	100 (645)
120,000	120 (742)

Table 17: Free area

Btu/h input rating	Minimum free area required for each opening		
	Horizontal duct 2,000 Btu/h in² (cm²)	Vertical duct or opening to outside 4,000 Btu/h in² (cm²)	Round duct 4,000 Btu/h in² (cm²)
40,000	20 (129)	10 (64)	4 (10)
60,000	30 (193)	15 (97)	5 (13)
80,000	40 (258)	20 (129)	5 (13)
100,000	50 (322)	25 (161)	6 (15)
120,000	60 (387)	30 (193)	7 (18)
Example: Determining free area. Appliance 1 + appliance 2 100,000 + 30,000 = (130,000 ÷ 4,000) Appliance 1 + appliance 2 total input 100,000 + 30,000 = (130,000 ÷ 2,000)		Total input = 32.5 in.² vertical Total input = 65 in. ² horizontal	

Dampers, louvers and grilles - Canada only

- Calculate the free area of a supply air opening by subtracting the blockage area of all fixed louvers grilles or screens from the gross area of the opening.
- Apertures in a fixed louver, a grille, or a screen have no dimension smaller than 1/4 in. (0.64 cm).
- Manually operated dampers or manually adjustable louvers are not permitted for use.
- Automatically operated dampers or automatically adjustable louvers are interlocked so that the main burner cannot operate unless either the damper or the louver is in the fully open position.

⚠ WARNING

If this furnace is replacing a Category I furnace, and the vent system was shared with additional Category I appliances, verify the existing venting system is properly sized for the other existing appliances.

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

Air supply openings and ducts - Canada only

- An opening may be used in lieu of a duct to provide the outside air supply to the furnace unless otherwise permitted by the authority having jurisdiction. The opening must be located within 12 in. (30.5 cm) horizontally from the burner level of the furnace. See Combustion air source from outdoors and Combustion air and vent system safety for additional information.
- The duct must be either metal or a material meeting the class I requirements of CAN4-S110 Standard for Air Ducts.
- 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.
- The duct must terminate within 12 in. (30.5 cm) above and within 24 in. (61 cm) horizontally from the burner level of the furnace with the largest input.
- 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 using a square or rectangular duct, its small dimension must not be less than 3 in. (7.6 cm).
- An air inlet supply from outdoors must be equipped with a means to prevent the direct entry of rain and wind that does not reduce the required free area of the air supply opening.
- Locate an air supply inlet opening from the outdoors not less than 12 in. (30.5 cm) above the outside grade level.

Combustion air source from outdoors

- 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.
- One permanent opening starting 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 have a minimum free area of:
  - 1 in^2/3,000 Btu/h (700 mm^2/kW) of the total input rating of all equipment located in the enclosure
  - Not less than the sum of all vent connectors in the confined space
- 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.
- 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 18.

Table 18: Estimated free area

Wood or metal Louvers or grilles	Wood 20% to 25%[1] Metal 60% to 70%[1]
Screens[2]	1/4 in. (6.4 mm) mesh or larger 100%

Note:
1. Do not use less than 1/4 in. (6.4 mm) mesh.
2. The free area of louvers and grille varies widely. The installer must follow louver or grille manufacturer's instructions.

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 supply 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 pipe brings combustion air from a correctly ventilated attic space or crawl space. A second pipe extends from the furnace vent connection (top right of unit) to the exterior of the building. See Table 15 for intake pipe sizing, allowable length, and elbow usage.

Follow all notes, procedures and required materials in Combustion air and vent pipe sizing when installing the combustion air pipe from the unit and into a ventilated attic space or crawl space.

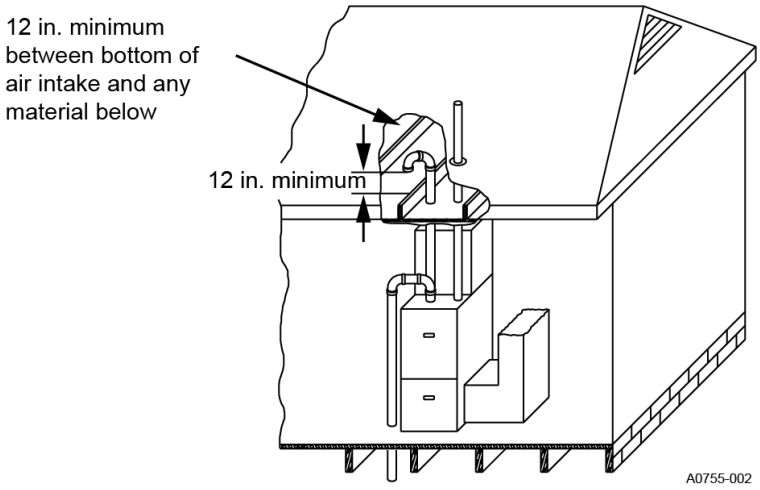
Do not terminate a vent pipe in an attic or a crawl space.

Ventilated combustion air termination

See Figure 43 for the required attic termination for the combustion air intake pipe. For attic termination, use two 90° elbows with the open end in a downward position. Ensure that you 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 elbows.

Figure 43: Attic and crawl space combustion air termination



Vent and supply (outside) air safety check procedure

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

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

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

1. Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion or other deficiencies, which could cause an unsafe 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 shall operate 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 thermostat so the appliance shall operate continuously.

5. Test each appliance (such as a water heater) equipped with a draft hood for spillage (down-draft or no draft) at the draft hood relief opening after 5 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 properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their normal condition.

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

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

Specially engineered installations

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

⚠ WARNING

Be sure to instruct the owner not to block the intake pipe.

Vent blower rotation

For ease of venting, the vent blower can be rotated 90° in either direction. For upflow installations, the vent can 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 Figure 28, Figure 29, Figure 30, and Figure 31 for illustrations of different inducer rotation positions. An internal vent accessory kit for downflow applications is available for B, C, and D width model units. The kit allows the intake and exhaust piping to extend through the blower compartment to exit the top of the unit. See Configuring the unit for downflow application.

Starting up the unit

⚠ 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.

- **Important:** Burner ignition may not be satisfactory when you start up the unit for the first time due to residual air in the gas line or until you adjust the gas manifold pressure. The ignition control makes three attempts to light before locking out.
- **Important:** All electrical connections made in the field and in the factory must be checked for proper tightness.

To start up the unit, do the following:

1. Check all electrical connections made in the factory and in the field for correct tightness.
2. Turn on the gas supply at the external valve and main gas valve.
3. Set the temperature setting on the thermostat higher than the room temperature to create a call for heating.
4. Wait while 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. The unit lights at the high fire input rate. If the thermostat is calling for low fire, the rate drops to low fire after flame is established.
   d. After flame is established, the supply air blower starts in about 30 s.
5. With the unit in operation, proceed to check and configure the system.

Checking and configuring the system

You **must** complete all required checks and configure unit settings correctly at the time of installation to ensure correct system operation.

Checking the gas piping for leaks

You **must** do a gas piping leak check for every new furnace installation. When the gas supply is initially connected to the unit, the gas piping may be full of air, so you must purge it by loosening the ground union before you check the gas piping for leaks.

⚠ 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:

- The unit and its equipment shut-off valve must be disconnected from the gas supply during any pressure testing of that system at test pressures in excess of 1/2 PSIG (3.45 kPa).
- The unit must be isolated from the gas supply piping system by closing the equipment shut-off valve during any pressure testing of the gas supply system.

Important: Burner ignition may not be satisfactory when you start up the unit for the first time due to residual air in the gas line or until you adjust the gas manifold pressure. The ignition control makes three attempts to light before locking out.

To check the gas piping for leaks, do the following:

1. Make sure that correct ventilation is available to dilute and carry away any vented gas.
2. Loosen the ground union until the odor of gas is detected. When gas is detected, immediately retighten the union.
3. Allow 5 min for any gas to dissipate before proceeding to check for leaks.
4. With the unit 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.
5. If a leak or leaks are detected, take appropriate action to stop any leak. If a leak persists, replace the faulty component.

Checking the unit input rate for natural gas

For natural gas applications, you **must** verify the natural gas input rate by clocking the gas meter for every new furnace installation.

Important:

- If applicable for your specific application, make sure the manifold pressure is in accordance with the altitude derating values in Table 9 in Meeting requirements for high-altitude applications.
- You can obtain the average yearly gas heat value, at the installed altitude and location, from the local gas supplier,

NOTICE

Burner orifices are sized to provide proper input rate using natural gas with a heating value of 1030 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 manifold pressure less than 3.2 in. W.C. or more than 3.8 in. W.C. for natural gas at sea level. If manifold pressure is outside this range, change main burner orifices.

⚠ CAUTION

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

NOTICE

If orifice hole appears damaged or it is suspected to have been redrilled, check 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 proper flame characteristics.

To check the unit input rate for natural gas, do the following:

1. Turn off all other gas appliances and pilots served by the meter.
2. Run the unit for a minimum of 3 min in high fire heating operation.
3. Measure the time in seconds for the gas meter to complete 1 revolution and note this measurement.

   ⓘ **Note:** The 2 cubic feet test dial provides a more accurate measurement of gas flow.
4. See Table 19 for the cubic feet per hour of gas for the specific time and test dial size.
5. Multiply the cubic feet per hour by the heating value (Btuh/cu ft) to calculate the input rate.
6. Check if the input rate matches the input rate on the unit rating plate. If the input rate does not match the input rate on the unit rating plate, adjust the manifold pressure as outlined in . Repeat Step 2 to Step 6 until you get the correct input rate.

⚠ CAUTION

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

Gas rate in cubic feet per hour

Table 19: Gas rate in cubic feet per hour

Time for 1 revolution (s)	Size of test dial		
	1 cu ft	2 cu ft	5 cu ft
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
55	65	131	327
56	64	129	321
57	63	126	316
58	62	124	310
59	61	122	305
60	60	120	300

Table 19: Gas rate in cubic feet per hour

Time for 1 revolution (s)	Size of test dial		
	1 cu ft	2 cu ft	5 cu ft
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

Measuring and adjusting inlet gas pressure

You can measure inlet gas pressure by connecting a manometer to the inlet pressure port on the gas valve with a piece of tubing. See Figure 16 for the location of the inlet pressure port, which is the port marked **IN P**.

Important: You take the inlet gas pressure reading at the port marked **IN P**. You take the manifold gas pressure reading at the port marked **OUT P**.

To measure and adjust inlet gas pressure, do the following:

1. Turn off gas at the ball valve or gas cock on the gas supply line before the gas valve, and turn off the electrical supply.
2. Locate the inlet pressure port marked **IN P** on the gas valve as shown in Figure 16.
3. Using a 3/32 in. (2.4 mm) hex head wrench, loosen the set screw by turning it 1 turn counter clockwise. **Do not remove the set screw from the inlet pressure port.**
4. 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, because it references atmospheric pressure.

   Note: See Figure 44 for an illustration of connecting a U-tube manometer.
5. Turn on the gas and electrical supplies and follow the operating instructions to place the unit back in operation.
6. Measure the inlet gas pressure. Adjust the inlet gas pressure if needed so it is in accordance with Table 20.

   Table 20: Inlet gas pressure operating range

Gas type	Minimum	Maximum
Natural gas	4.5 in. W.C. (1.12 kPa)	10.5 in. W.C. (2.61 kPa)
Propane (LP) gas	8.0 in. W.C. (1.99 kPa)	13.0 in. W.C. (3.24 kPa)

   Important: The table specifies what the minimum and maximum gas line pressure must be for the unit to operate safely. The gas line pressure **must be** a minimum of 7 in. W.C. (1.74 kPA) for natural gas and 11 in. W.C. (2.74 kPA) for propane (LP) gas to obtain the Btu input specified on the nameplate and/or the nominal manifold pressure specified in these instructions and on the unit rating plate.
7. When the inlet gas pressure is correct, turn the gas valve to **OFF** and turn the electrical supply switch to **OFF**. Then, remove the flexible tubing from the **IN P** pressure tap on the gas valve and tighten the **IN P** pressure tap plug using the 3/32 in. (2.4 mm) hex head wrench.
8. Turn on the electrical and gas supplies, and with the burners in operation, check for gas leakage around the inlet pressure port on the gas valve using an approved non-corrosive gas leak detection fluid or other non-flammable leak detection methods.

Measuring and adjusting manifold gas pressure

You can measure manifold gas pressure by connecting a manometer to the outlet pressure port on the gas valve with a piece of tubing. See Figure 16 for the location of the outlet pressure port, which is the port marked **OUT P**.

Important:

- You take the inlet gas pressure reading at the port marked **IN P**. You take the manifold gas pressure reading at the port marked **OUT P**.
- The gas valve has separate high stage (high fire) and low stage (low fire) pressure regulators as shown in Figure 15 (gas valve). You must adjust the high fire setting first.

Important: If applicable for your specific application, make sure the manifold pressure is in accordance with the altitude derating values in Table 9 in Meeting requirements for high-altitude applications.

NOTICE

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

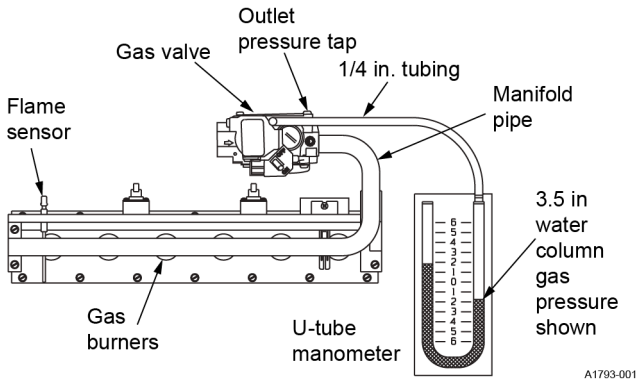
Important: If the gas valve regulator screw is turned in (clockwise), the manifold pressure increases. If the gas valve regulator screw is turned out (counter clockwise), the manifold pressure decreases.

To measure and adjust manifold gas pressure, do the following:

1. Turn off gas at the ball valve or gas cock on the gas supply line before the gas valve, and turn off the electrical supply.
2. Locate the outlet pressure port marked **OUT P** on the gas valve as shown in Figure 16.
3. Using a 3/32 in. (2.4 mm) hex head wrench, loosen the set screw by turning it 1 turn counter clockwise. **Do not remove the set screw from the outlet pressure port.**
4. 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, because it references atmospheric pressure.

   Note: See Figure 44 for an illustration of connecting a U-tube manometer.

Figure 44: Connecting a U-tube manometer to read manifold gas pressure



5. Locate the high stage and low stage pressure regulators on the gas valve as shown in Figure 16.

NOTICE

The high stage regulator adjustment MUST be set before adjusting the low stage regulator.

6. Turn on the gas and electrical supplies and follow the operating instructions to place the unit back in operation.
7. Provide a thermostat call for high stage heating or jumper the R and W1+W2 thermostat connections on the unit control board.
8. Measure the manifold gas pressure at high fire. Adjust the manifold gas pressure for the type of gas used if needed so the manifold gas pressure is in accordance with Table 21. To do so, remove the cap from the high stage pressure regulator on the gas valve to gain access to the adjustment screw. Turn the screw counterclockwise (out), using a slotted head screwdriver, to decrease the input rate. Adjust the screw clockwise (in) to increase the input rate.

Important: You must remove the cap from the pressure regulator entirely to gain access to the adjustment screw. Loosening or tightening the cap does not adjust the flow of gas.

Table 21: Nominal manifold pressure

Gas type	High fire	Low fire
Natural gas	3.5 in. W.C. (0.87 kPa)	1.6 in. W.C. (0.40 kPa)
Propane (LP) gas	9.8 in. W.C. (2.488 kPa)	4.0 in. W.C. (0.99 kPa)

9. When the correct manifold pressure is set for high fire, replace the cap on the high stage pressure regulator.
10. Remove the W2 thermostat call or the jumper wire from W2 so the unit drops to low fire or first stage heating.
11. Measure the manifold gas pressure at low fire. Adjust the manifold gas pressure for the type of gas used if needed so the manifold gas pressure is in accordance with Table 21. To do so, remove the cap from the low stage pressure regulator on the gas valve to gain access to the adjustment screw. Turn the screw counterclockwise (out), using a slotted head screwdriver, to decrease the input rate. Adjust the screw clockwise (in) to increase the input rate.
12. When the correct manifold pressure is set for low fire, replace the cap on the low stage pressure regulator.
13. Make sure that you have not exceeded the specified unit input rate on the unit rating plate as follows:
    - For natural gas applications, check the unit input rate as outlined in Checking the unit input rate for natural gas.
    - For propane (LP) gas applications, check the unit input rate by repeating the steps in this procedure to measure the manifold pressure at high fire and low fire.
14. When the Btu (kW) input is correct, turn the gas valve to **OFF** and turn the electrical supply switch to **OFF**. Then, remove the flexible tubing from the **OUT P** pressure tap on the gas valve and tighten the **OUT P** pressure tap plug using the 3/32 in.(2.4 mm) hex head wrench.
15. Turn on the electrical and gas supplies, and with the burners in operation, check for gas leakage around the outlet pressure port on the gas valve using an approved non-corrosive gas leak detection fluid or other non-flammable leak detection methods.

⚠ DANGER

Fire hazard

Failure to follow this warning could result in personal injury, death, and/or property damage. Reinstall the manifold pressure tap plug-in gas valve to prevent gas leak.

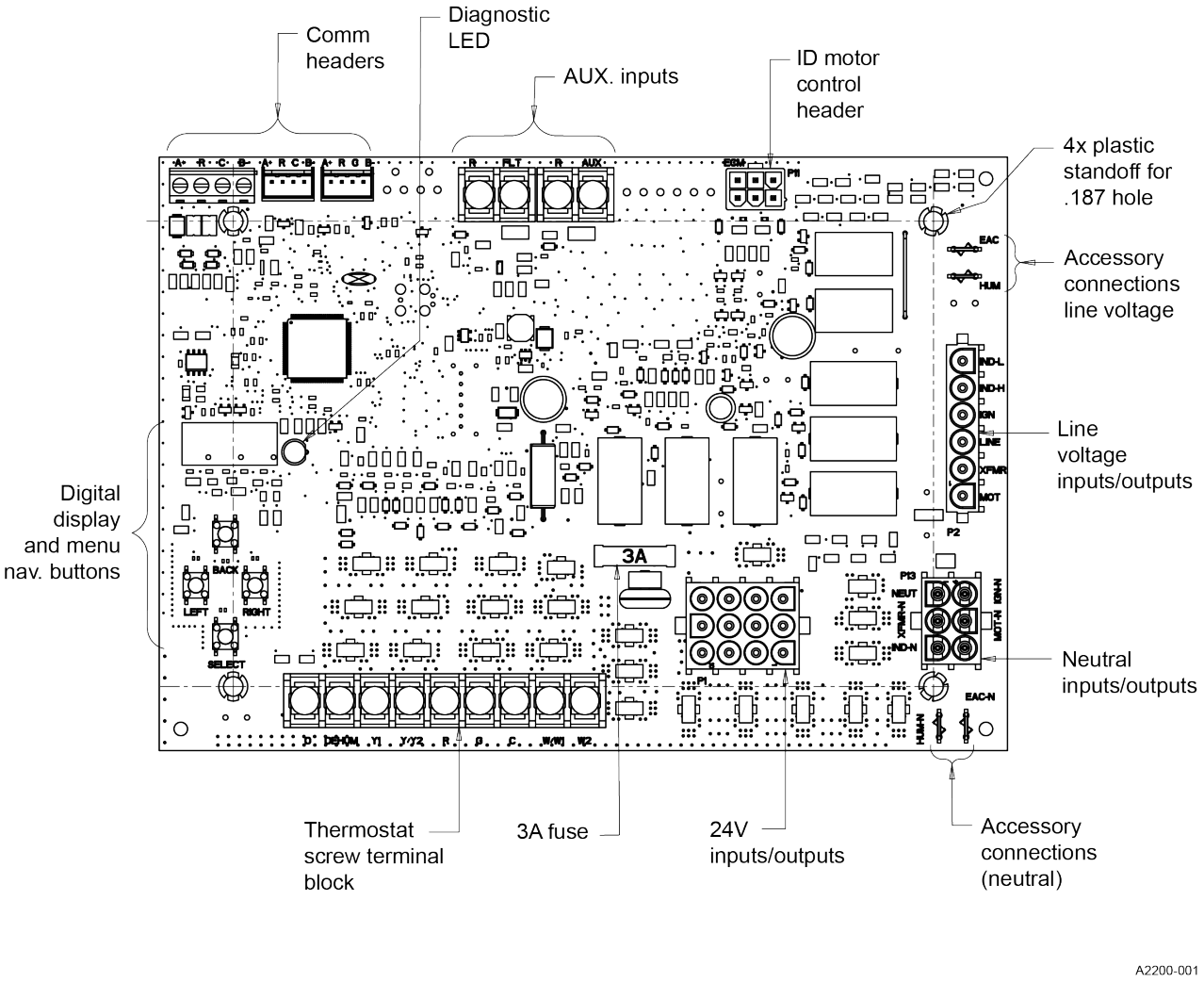
Setting up the unit control board

Important:

- You must set up the unit control board correctly at the time of installation to ensure correct system operation. **STOP and read all of the information and tasks relating to control board setup included in this manual before you start to set up the control board.** This is because it is vital to understand all aspects of setting up the control board before you make **any** changes to control board settings. Otherwise, you may configure settings incorrectly and cause difficulties in the installation process. Adjustments of controls must be made only by a qualified service technician.
- It is important to check that the model ID is set correctly as outlined in Checking the unit model configuration. **Do not change the model ID unless the model ID programmed in the unit control board has been changed to an incorrect model or you are replacing the unit control board. Incorrect configuration of the model ID could lead to equipment failure and damage.**

Setting up the unit control board involves configuring various system settings. Familiarize yourself with how the control board works and follow the procedures for configuring specific settings as needed. For airflow data, see Table 29, Table 30, and Table 31. Figure 45 shows the control board.

Figure 45: Unit control board



The unit control board can interface with the following:

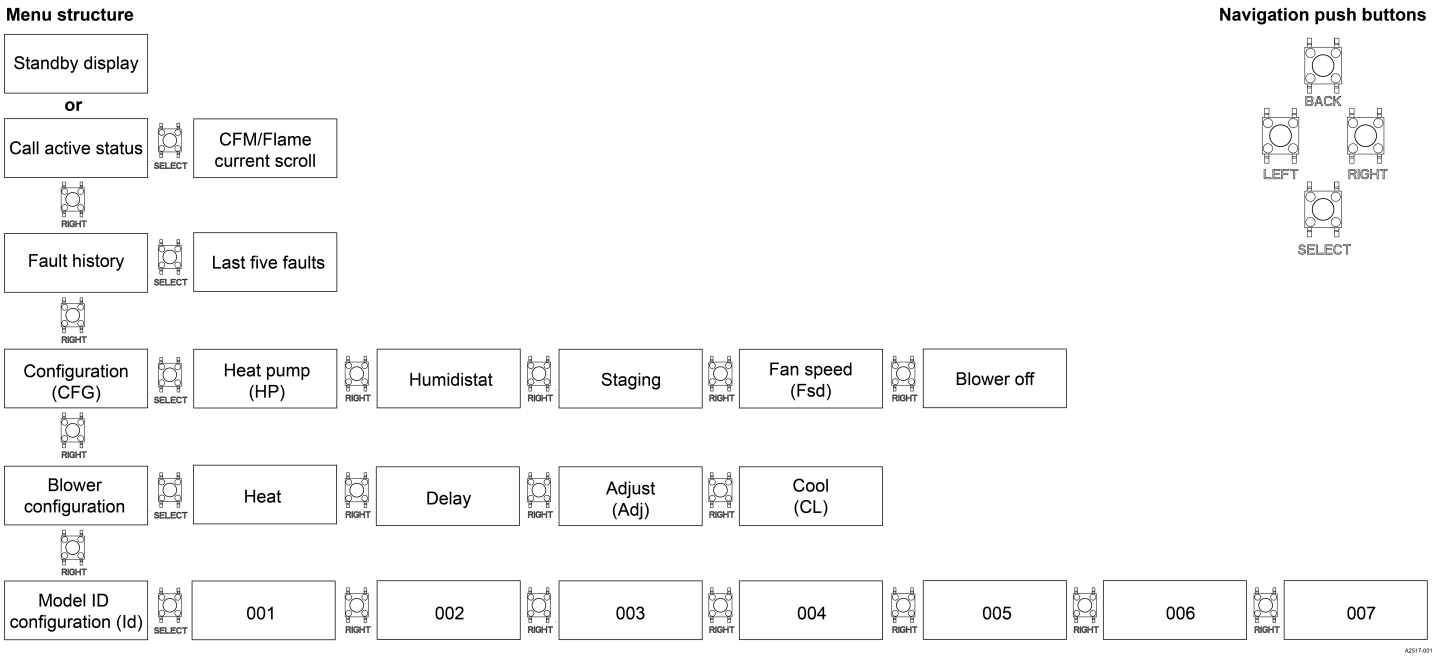
- Conventional room thermostat
- Smart Home Control (S1-TSHC510), a communicating room thermostat. Smart Home Control (S1-TSHC510) software communicates with the unit control board.

  Important: The unit control board can interface with the Hx 3 Touch Screen Thermostat, an older communicating room thermostat model. If an Hx 3 Touch Screen Thermostat is used and wired using communications, it must have software version 3.05zn or later. Refer to the Hx 3 Touch Screen Thermostat *Installation Manual* for installation guidance.

The unit control board includes a status LED that indicates active calls and fault codes and three 7-segment LED displays that support unit setup and diagnostics and allow you to view the unit mode or status. See Using unit control board diagnostics. The 7-segment LED displays show the standby display, active calls from the thermostat, fault history, and unit configuration settings. You use four push buttons on the control board to navigate left, right, and back on the 7-segment LED displays and make selections.

Figure 46: 7-segment LED displays

Figure 47: 7-segment LED displays - navigation overview



Note: Figure 47 shows how to use the right and select push buttons to navigate the unit control board menu options. Use the left and back push buttons to scroll back as required.

The unit control board has two modes: locked mode and unlocked mode. When the control board is in locked mode, you can view the current settings but you can not adjust them. When the control board is in unlocked mode, you can adjust all of the configuration, blower configuration, and model ID configuration settings. See Activating unlocked mode.

You configure unit settings using the following:

- **Configuration settings menu (CFG)**: The CFG menu has five options as shown in Figure 47:
  - Heat pump (HP): Used to enable or disable heat pump operation. The default setting is off.
  - Humidistat (HSt): Used to enable or disable a humidistat. The default setting is off.
  - Staging (Stg): Used to configure the unit heat staging. The default setting is off.
  - Fan speed (FSd): Used to configure the continuous fan speed during thermostat calls for fan only operation. The default setting is A.
  - Blower off delay (bdy): Used to configure the heating blower off delay time. The default setting is 60 s.
- **Blower configuration settings menu (CF2)**: The CF2 menu has four options as shown in Figure 47:
  - Heat (Ht): Used to configure the gas heating blower speed. The default setting is A.

  - Delay (Dly): Used to configure the blower delay profile. The default setting is A.
  - Adjust (Adj): Used to increase or decrease airflow for selected blower speeds for cooling and continuous fan operation. The default setting is A.
  - Cool (CL): Used to configure the cooling blower speed. The default setting is A.
- **Model ID configuration menu (Id)**: Each unit model has a specific model ID that identifies the motor horsepower and airflow configuration of the unit. You use the ID menu to check that the model ID for the unit is set correctly. For example, for a 060B12 model, the ID menu displays 002 . See Figure 47 and Table 28. **Do not change the model ID unless the model ID programmed in the unit control board has been changed to an incorrect model or you are replacing the unit control board. Incorrect configuration of the model ID could lead to equipment failure and damage.**

Activating unlocked mode

The unit control board has two modes: locked mode and unlocked mode. When the control board is in locked mode, you can view settings but you can not adjust settings. You must activate unlocked mode to adjust settings.

To activate unlocked mode, do the following:

- On the unit control board, press and hold the **Left** and **Right** push buttons for 5 s. The 7 segment LED displays show **UnL**.

Figure 48: Unlocked mode

A2186-001

Important: To exit unlocked mode, press the **Left** and **Right** push buttons on the unit control board. The control board automatically exits unlocked mode after 10 min of idle time.

Enabling heat pump operation

If the outdoor unit is a heat pump, you must enable heat pump operation using the heat pump (HP) option in the configuration (CFG) menu, so the humidity control for the system is correct. The default setting is off (disabled).

To enable heat pump operation, do the following:

1. Make sure that the control board is in unlocked mode. See Activating unlocked mode.
2. Navigate to the **CFG** menu, then press **Select**.
3. Navigate to the **HP** option, then press **Select**.
4. Navigate to the **On** option, then press **Select**.

Enabling a humidistat

If a humidistat is installed in the system, you must enable the humidistat using the humidistat (Hst) option in the configuration (CFG) menu. The default setting is off (disabled).

To enable a humidistat, do the following:

1. Make sure that the unit control board is in unlocked mode. See Activating unlocked mode.
2. Navigate to the **CFG** menu, then press **Select**.
3. Navigate to the **Hst** option, then press **Select**.
4. Navigate to the **On** option, then press **Select**.

Configuring heat staging settings

You can select different heat staging settings for the unit using the Staging (Stg) option in the configuration (CFG) menu. The default setting is auto. Table 22 shows the available settings.

Table 22: Stg settings

Setting	Description
OFF	The unit only operates in low fire.
10	The unit switches from low fire to high fire after 10 min and stays in high fire until the thermostat is satisfied.
Aut (auto)	The unit uses the recent heating duty cycle information to determine the optimal time to energize high-stage heating.
20	The unit switches from low fire to high fire after 20 min and stays in high fire until the thermostat is satisfied.

To configure heat staging settings, do the following:

1. Make sure that the unit control board is in unlocked mode. See Activating unlocked mode.
2. Navigate to the **CFG** menu, then press **Select**.
3. Navigate to the **Stg** option, then press **Select**.
4. Navigate to the required setting, then press **Select**.

Configuring continuous fan airflow settings

You configure the blower speed for continuous fan operation (fan only operation) using the fan speed (Fsd) option in the configuration (CFG) menu. The Fsd option works in conjunction with the adjust (Adj) option in the CF2 menu, which allows you to increase or decrease the airflow for the selected continuous fan blower speed and cooling blower speed settings. The default blower speed for continuous fan operation is A (low) speed as shown in Table 31. In certain circumstances, it may be necessary to adjust the default blower speed, but this is not best practice because it results in higher than normal electrical energy usage and electric utility bills. Table 23 and Table 27 show the available settings.

Table 23: Fsd settings

Setting	Description
A	Low - blower speed is based on 40% of the selected high stage cooling speed (CL setting) and the selected adjust (Adj) setting
B	Medium - blower speed is based on 70% of the selected high stage cooling speed (CL setting) and the selected adjust (Adj) setting
C	High - blower speed is based on 100% of the selected high stage cooling speed (CL setting) and the selected adjust (Adj) setting

Adjust the continuous fan blower speed setting if required as follows:

1. Make sure that the unit control board is in unlocked mode. See Activating unlocked mode.
2. Navigate to the **CFG** menu, then press **Select**.
3. Navigate to the **Fsd** option, then press **Select**.
4. Navigate to the required setting, then press **Select**.

Configuring heating blower off delay settings

The unit is equipped with a time-on and time-off heating fan control. The heating fan on delay time is fixed at 30 s. There are four options for the heating fan off delay or heating blower off delay time: 60s, 90s, 120s, and 180s. The default setting is 60 s. You can adjust the heating blower off delay time using the blower off delay (bdy) option in the configuration (CFG) menu. The selected time setting must be long enough to adequately cool the unit, but not so long that cold air is blown into the heated space.

To configure heating blower off delay settings, do the following:

1. Make sure that the unit control board is in unlocked mode. See Activating unlocked mode.
2. Navigate to the **CFG** menu, then press **Select**.
3. Navigate to the **bdy** option, then press **Select**.
4. Navigate to the required setting, then press **Select**.

Configuring heating airflow settings

The unit is equipped with an ECM blower motor. The motor and blower are capable of delivering airflow over a wide range of operating conditions. It is important to configure gas heating airflow settings correctly. You configure the gas heating blower speed using the heat (Ht) option in the blower configuration (CF2) menu. Table 24 shows the available settings. See Table 29 and Table 30 for the expected airflow at different settings. The default gas heating blower speed is A as shown in Table 31. The default blower speed delivers the correct airflow for correct heating operation in most applications.

Table 24: Ht settings

Setting	Description
A	Delivers medium high airflow
B	Delivers the highest airflow
C	Delivers medium airflow
D	Delivers the lowest airflow

To configure gas heating airflow settings, do the following:

1. Make sure that the unit control board is in unlocked mode. See Activating unlocked mode.
2. Navigate to the **CF2** menu, then press **Select** .
3. Navigate to the **Ht** option, then press **Select**.
4. Navigate to the required setting, then press **Select**.

Configuring the blower delay profile

You can choose from four blower delay profiles for the unit to provide optimum comfort and sound levels for installations in different regions of the country. You configure the blower delay profile using the delay (dLy) option in the blower configuration (CF2) menu. Table 25 shows the available settings. The default setting is A.

Table 25: dLy settings

Setting	Description
A	Delay profile A is the default profile. This profile 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.
B	Delay profile 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 at 50% of full capacity for 2 min, then ramps up to 82% of full capacity and stays at 82% of full capacity for 5 min, and then ramps up to full capacity and stays at full capacity until the wall thermostat is satisfied. In every case, it takes the motor 30 s to ramp from one speed to another.
C	Delay profile C is the dry profile. This profile is best suited for installations in 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 at full capacity until the thermostat is satisfied. At the end of the cooling cycle, the blower ramp down to 50% of full capacity and stays at 50% of full capacity for 60 s, and then ramps down to zero. In every case, it takes the motor 30 s to ramp from one speed to another.
D	Default profile D is the normal profile. This profile is best suited for installations in most of the country, where neither excessive humidity nor extremely dry conditions are typical. On a call for cooling, the motor ramps up to 63% of full capacity and stays at 63% of full capacity for 90 s, and then ramps up to full capacity. At the end of the cooling cycle, the motor ramp down to 63% of full capacity and stays at 63% of full capacity for 30 s, and then ramps down to zero. In every case, it takes the motor 30 s to ramp from one speed to another.

To configure blower delay profile settings, do the following:

1. Make sure that the unit control board is in unlocked mode. See Activating unlocked mode.
2. Navigate to the **CF2** menu, then press **Select**.
3. Navigate to the **dLy** option, then press **Select**.
4. Navigate to the required setting, then press **Select**.

Configuring cooling airflow settings

The 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. It is important to configure cooling airflow settings correctly. You configure the cooling blower speed using the cool (CL) option in the blower configuration (CF2) menu. The CL option works in conjunction with the adjust (Adj) option in the CF2 menu, which allows you to increase or decrease the airflow for the selected cooling blower speed and continuous fan blower speed settings. Table 26 and Table 27 show the available settings. The default cooling blower speed is A as shown in Table 31. See Table 29 and Table 30 for the expected airflow at different settings. When configuring the cooling airflow settings, select settings 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, lower overall energy efficiency, and higher electric utility bills.

Table 26: CL settings

Setting	Description
A	Delivers the highest airflow
B	Delivers medium high airflow
C	Delivers medium low airflow
D	Delivers the lowest airflow

Table 27: Adj settings

Setting	Description
A	Nominal - no adjustment
B	10% increase in airflow from nominal
C	10% decrease in airflow from nominal
D	Nominal - no adjustment

To configure cooling airflow settings, do the following:

1. Use Table 29 and Table 30 to determine the required settings for your specific application.
2. Adjust the cooling blower speed setting if required as follows:
   a. Make sure that the control board is in unlocked mode. See Activating unlocked mode.
   b. Navigate to the **CF2** menu, then press **Select**.
   c. Navigate to the **CL** option, then press **Select**.
   d. Navigate to the required setting, then press **Select**.
3. Increase or decrease the airflow for the cooling blower speed setting if required as follows:
   a. Make sure that the unit control board is in unlocked mode.
   b. Navigate to the **CF2** menu, then press **Select**.
   c. Navigate to the **Adj** option, then press **Select**.
   d. Navigate to the required setting, then press **Select**.

   ⓘ **Note:** The **Adj** option applies to the selected cooling blower speed setting and the selected continuous fan blower speed setting.

Checking the unit model configuration

The unit control board is programmed at the factory with the correct model ID for the specific Btu rating of the unit. The model ID identifies the motor horsepower and airflow configuration of the unit. Table 28 shows the model IDs. You can view the model ID on the 7-segment LED displays using the model ID configuration (Id) menu. It is important to check that the model ID is set correctly. Do not change the model ID unless the model ID programmed in the unit control board has been changed to an incorrect model or you are replacing the unit control board. Incorrect configuration of the model ID could lead to equipment failure and damage. You can view the model ID when the unit control board is in locked or unlocked mode.

Table 28: Model IDs

Model	Motor HP	Model ID - displayed on 7-segment LED displays	Description
Not configured	—	0	Configuration fault unless programmed through comm
040A10	1/2	1	97.0% 2S VS ECM 040BTU 10CFM MP COMM
060B12	1/2	2	97.0% 2S VS ECM 060BTU 12CFM MP COMM
080B12	1/2	3	97.0% 2S VS ECM 080BTU 12CFM MP COMM
080C16	3/4	4	97.0% 2S VS ECM 080BTU 16CFM MP COMM
100C16	3/4	5	96.8% 2S VS ECM 100BTU 16CFM MP COMM
100C20	1	6	96.4% 2S VS ECM 100BTU 20CFM MP COMM
120D20	1	7	97.0% 2S VS ECM 120BTU 20CFM MP COMM

To check the unit model configuration, do the following:

1. Navigate to the **Id** menu, then press **Select** to view the model ID.
2. Check the model ID using Table and proceed as follows:
   - If the model ID is correct, press **Back** to exit without making changes.
   - If the model ID is not correct, follow the procedure in Setting the unit model.

Checking the air temperature rise

You **must** check the air temperature rise for every new furnace installation.

⚠ 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 Table 11.

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.

To check the air temperature rise, do the following:

1. After about 10 min of operation, determine the unit 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 unit where they are not affected by radiant heat.
2. Increase the blower speed to decrease the temperature rise or decrease the blower speed to increase the temperature rise if needed. See Configuring cooling airflow settings and Configuring heating airflow settings.

Taking a flue gas sample

If it is 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 system's manufacturer test port fitting must be used. **Do not** drill a test port hole in polypropylene piping.

To take a flue gas sample, do the following:

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 unit.
2. Operate the unit for 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.

High and low speed cooling and heat pump CFM

Table 29: High and low speed cooling and heat pump CFM

Model	High cool	Low cool	Settings	
			Cool	Adj
040A10	1000	650	A	A
	850	550	B	A
	650	425	C	A
	450	400	D	A
	1100	725	A	B
	925	600	B	B
	725	475	C	B
	500	400	D	B
	900	575	A	C
	775	500	B	C
	575	400	C	C
	400	400	D	C
060B12	1100	725	A	A
	850	550	B	A
	650	425	C	A
	450	400	D	A
	1200	775	A	B
	925	600	B	B
	725	475	C	B
	500	400	D	B
	1000	650	A	C
	775	500	B	C
	575	400	C	C
	400	400	D	C

Table 29: High and low speed cooling and heat pump CFM

Model	High cool	Low cool	Settings	
			Cool	Adj
080B12	1100	725	A	A
	850	550	B	A
	650	425	C	A
	450	400	D	A
	1200	775	A	B
	925	600	B	B
	725	475	C	B
	500	400	D	B
	1000	650	A	C
	775	500	B	C
	575	375	C	C
	400	275	D	C
080C16	1500	975	A	A
	1400	900	B	A
	1150	750	C	A
	800	525	D	A
	1650	1075	A	B
	1550	1000	B	B
	1275	825	C	B
	875	575	D	B
	1350	875	A	C
	1250	825	B	C
	1025	675	C	C
	725	475	D	C
100C16	1500	975	A	A
	1400	900	B	A
	1150	750	C	A
	800	525	D	A
	1650	1075	A	B
	1550	1000	B	B
	1275	825	C	B
	875	575	D	B
	1350	875	A	C
	1250	825	B	C
	1025	675	C	C
	725	475	D	C
100C20	1800	1175	A	A
	1575	1025	B	A
	1150	750	C	A
	900	575	D	A
	1975	1275	A	B
	1725	1125	B	B
	1275	825	C	B
	1000	650	D	B
	1625	1050	A	C
	1425	925	B	C
	1025	675	C	C
	800	525	D	C

Table 29: High and low speed cooling and heat pump CFM

Model	High cool	Low cool	Settings	
			Cool	Adj
120D20	1800	1175	A	A
	1575	1025	B	A
	1150	750	C	A
	900	575	D	A
	1975	1275	A	B
	1725	1125	B	B
	1275	825	C	B
	1000	650	D	B
	1625	1050	A	C
	1425	925	B	C
	1025	675	C	C
	800	525	D	C

High and low heat CFM

Table 30: High and low heat CFM

Model	High heat	Low heat	Settings	
			Heat	Adj
040A10	697	497	A	Any
	803	573	B	Any
	634	452	C	Any
	560	399	D	Any
060B12	1021	719	A	Any
	1138	801	B	Any
	905	637	C	Any
	847	596	D	Any
080B12	1220	940	A	Any
	1325	1021	B	Any
	1126	868	C	Any
	1021	719	D	Any
080C16	1177	1064	A	Any
	1306	1181	B	Any
	1096	991	C	Any
	951	860	D	Any
100C16	1480	1144	A	Any
	1648	1274	B	Any
	1327	1026	C	Any
	1220	943	D	Any
100C20	1787	1287	A	Any
	1975	1422	B	Any
	1620	1167	C	Any
	1495	1077	D	Any
120D20	1752	1475	A	Any
	1870	1574	B	Any
	1594	1342	C	Any
	1495	1259	D	Any

Default blower speeds

Table 31: Default blower speeds

Model number	Default setting for heat speed	Default setting for cool speed	Default setting for continuous fan speed
040A10	C	A	A
060B12	C	A	A
080B12	D	A	A
080C16	D	A	A
100C16	D	A	A
100C20	D	A	A
120D20	D	A	A

System components and operation

It is important to be familiar with the different system components and understand how they operate.

Safety controls

The unit has the following safety controls:

- **Control circuit fuse**: A 3-amp fuse is provided on the unit control board to protect the 24 V transformer from overload caused by control circuit wiring errors. This is an ATO 3, automotive fuse located on the unit control board.
- **Blower door safety switch**: The unit is equipped with an electrical interlock switch mounted in the blower compartment. This switch interrupts all power at the unit when the panel covering the blower compartment is removed. Electrical supply to the unit is dependent on the panel that covers the blower compartment being in place and correctly positioned.

> **⚠ 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.

- **Rollout switch controls**: The rollout switch controls are mounted on the burner assembly. If the temperature in the area surrounding the burner exceeds its setpoint, the gas valve is de-energized. The operation of these controls indicates a malfunction in the combustion air blower or 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**: The unit is supplied with three pressure switches, which monitor the flow through the combustion air/vent piping and the condensate drain system. These switches deenergize the gas valve if any of the following conditions are present:
  - Blockage of combustion air piping or terminals
  - Blockage of condensate drain piping
  - Blockage of vent piping or terminal
  - Failure of combustion air blower motor

- **Limit control**: There is a high temperature limit control located on the unit vestibule panel near the gas valve. This is an automatic reset control that provides overtemperature protection due to reduced airflow. This may be caused by the following:
  - A dirty filter.
  - Indoor fan motor failure
  - Too many supply or return registers closed or blocked off
  - Incorrectly set manifold gas pressure
  - Incorrectly set indoor blower motor speed

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

Hot surface ignition system

The unit has a hot surface ignition system.

⚠ 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.

Humidistat

If a humidistat is installed in the system, you must enable the humidistat using the humidistat (Hst) option in the configuration (CFG) menu on the control board. The default setting for the humidistat is off (disabled). See Enabling a humidistat. When the humidistat is enabled, the cooling CFM is reduced by 15% whenever the humidistat indicates high humidity.

Blower functions

It is important to understand the blower functions for the unit:

- **Heating and cooling airflow**: The heating and cooling airflow are preset at the factory and must be field adjusted to match the HVAC system at installation. See Table 29 and Table 30 for the heat (Ht), cool (CL), and adjust (Adj) settings to use for specific airflow and see Configuring cooling airflow settings and Configuring heating airflow settings.
- **Blower delay profiles**: The unit has four blower delay profiles. The default is blower delay profile A but you can select blower delay profile B, C, or D on the unit control board instead if required for the specific installation. See Configuring the blower delay profile. See Table 25 for an overview of how each blower delay profile operates.
- **Continuous blower operation**: You can operate the unit in continuous fan mode by setting the fan switch on the wall thermostat to the on position. The blower runs in accordance with the selected fan speed (Fsd) setting (low speed, medium speed, or high speed) on the unit control board. See Configuring continuous fan airflow settings. See Table 23 for an overview of each Fsd setting.

- **Intermittent blower cooling**: On cooling/heating thermostats with a fan switch, when the fan switch is set to 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 at the speed selected using the cool (CL) option in the blower configuration (CF2) menu on the unit control board. See Configuring cooling airflow settings. The fan off setting is fixed at 60 s for SEER enhancement. The unit control board can accommodate two-stage cooling. When a two-stage cool thermostat is connected to the Y1 and Y2 terminals on the unit control 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/heating thermostats with a fan switch, when the fan switch is set to the auto position and the thermostat calls for heating, a circuit is completed between the R and W terminals. The indoor fan motor runs at the speed selected using the heat (Ht) option in the blower configuration (CF2) menu on the unit control board. See Configuring heating airflow settings.

Lockout

It is important to understand the following:

- **Soft lockout**: The unit control board has a built-in 1 h soft lockout. A soft lockout resets automatically after 1 h. This provides protection for an unoccupied structure if a temporary condition causes a unit malfunction, for example, if a temporary interruption in gas supply prevents the unit from lighting. The unit control board keeps trying to light each hour and resumes normal operation if the gas supply is restored. To reset a soft lockout and override the 1 h lockout time, follow the procedure outlined in Resetting a lockout.
- **Hard lockout**: Some fault conditions result in a hard lockout. A hard lockout does not reset automatically. To reset a hard lockout, follow the procedure outlined in Resetting a lockout.

Troubleshooting

⚠ WARNING

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

Do not try to repair controls. Replace defective controls with JC Residential and Light Commercial LLC Source 1 Parts.

Never adjust pressure switch to allow furnace operation.

Complete the following checks before doing the detailed troubleshooting outlined in Using unit control board diagnostics:

1. Check to see that the power to the unit and the ignition control module is on.
2. Check that the manual shut-off valves in the gas line to the unit are open.
3. Make sure that 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 response. Then, use the information in Using unit control board diagnostics to check the system operation and follow the troubleshooting guidance for specific issues as need.

Using unit control board diagnostics

The unit has built-in, self-diagnostic capability. The unit control board continuously monitors its own operation and the operation of the system. The status LED on the unit control board flashes red, green, or amber to indicate various conditions, for example, when there are active faults, when there are no thermostat calls, when there is a call for heat, and when there is a call for continuous fan operation. The 7-segment LED displays show some active faults, show active thermostat calls, and allow you to view CFM and flame current and fault code history. See Viewing CFM and flame current during active calls and Viewing and clearing fault code history.

Figure 49 illustrates how the 7-segment LED displays show calls for heating, cooling, and heat pump operation.

Figure 49: Viewing active calls on the 7-segment LED displays

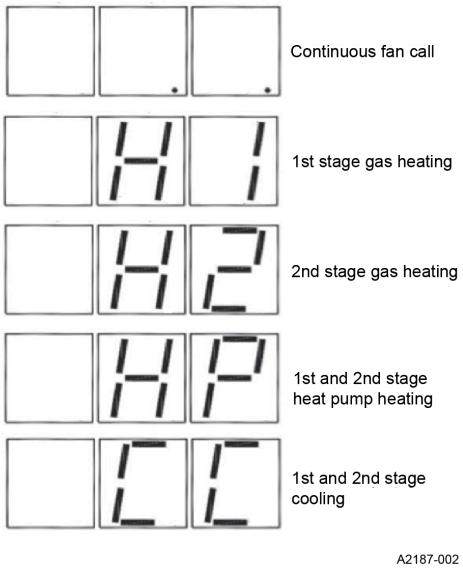


Table 32 provides an overview of the status LED codes and how active calls and faults display on the 7-segment LED displays.

Note:

- For the slow flash codes, the slow flash speed of the status LED is 2 s on and 2 s off.
- For the continuous flash codes, the status LED flashes on and off continuously with no breaks or longer pauses.
- For the red flash codes, the status LED turns on for 1/3 s and turns off for 1/3 s. This pattern is repeated the number of times equal to the code. There is a 2 s pause between codes. For example, for the six red flashes code, the status LED flashes on and off six times and then remains off for 2 s. This pattern repeats as long as the fault condition remains.

Table 32: Understanding status LED codes and the 7-segment LED displays

Status LED	7-segment LED displays	Condition	Solution
Slow green flash	—	Normal operation, no thermostat calls	Normal operation. No action is required.
Slow amber flash	—	Normal operation with call for heat	Normal operation. No action is required.
Solid amber	..	G call for continuous fan	Normal operation. No action is required.

Table 32: Understanding status LED codes and the 7-segment LED displays

Status LED	7-segment LED displays	Condition	Solution
—	H1	Call for first-stage heat	Normal operation. No action is required.
—	H2	Call for second-stage heat	Normal operation. No action is required.
—	HP	Call for heat pump operation	Normal operation. No action is required.
—	CC	Call for cooling	Normal operation. No action is required.
Rapid green	FF	Indicates unit control board is in the factory test mode	To reset, cycle power to unit off then back on.
LED steady off	—	Indicates an issue with power to the unit control board or possible unit control board failure.	If the LED light does not flash at all, check for power to the unit control board and check for an open fuse on the unit control board. If the unit control board is properly powered and the fuse is closed, the unit control board may need to be replaced.
Steady on any color	—	Possible unit control board failure	Remove and check the control voltage fuse. An open fuse results in a steady on red LED. Turn power to the unit off and back on. If the fault code returns, the unit control board must be replaced. The unit control board is not field repairable.
Continuous amber flash	—	Flame sense current is below 0.35 micro amps	Check and clean flame sensor. Check for proper gas flow. Verify that current is greater than 0.35 micro amps at the flame current test pad.
Alternating red and amber flashes	rL	Indicates that a refrigerant leak has been detected near the unit	Check for refrigerant leak.
1 red flash	01	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.

Table 32: Understanding status LED codes and the 7-segment LED displays

Status LED	7-segment LED displays	Condition	Solution
2 red flashes	02	Indicates that the pressure switch is closed when it should be open. The unit control board 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 should be open.	Check for a faulty pressure switch or miswiring.
3 red flashes	03	Indicates that the pressure switch contacts are open when they should be closed	Check for faulty inducer, blocked vent pipe, broken pressure switch hose, disconnected pressure switch or inducer wires or faulty pressure switch.
4 red flashes	04	Indicates that the main limit switch has opened its normally closed contacts. The unit control board 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 unit control board operates as if the blower is not functioning. The unit control board starts a hard lockout and the status LED emits 11 red flashes. If, after 15 min, the main limit still has not closed, the unit control board operates as if a manual-reset rollout switch has opened and the status LED emits 5 red flashes. See the 11 red flashes and 5 red flashes fault code entries in this table and Resetting a lockout.

Table 32: Understanding status LED codes and the 7-segment LED displays

Status LED	7-segment LED displays	Condition	Solution
5 red flashes	05	Indicates that the normally closed rollout switch is open or the limit switch has been open longer than 15 min	The rollout control is manually reset. Check for proper combustion air, proper inducer operation, and primary heat exchanger failure or a burner problem. The unit control board enters a hard lockout and power must be cycled off and on to reset the unit control board after the problem is corrected. See Resetting a lockout.
6 red flashes	06	Indicates that while the unit was operating, the pressure switch opened four times during the call for heat	Check for faulty inducer, blocked vent pipe or faulty pressure switch. The unit locks out for 1 h and then restarts. See Resetting a lockout.
7 red flashes	07	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, faulty gas valve, dirty or faulty flame sensor, faulty hot surface ignitor, loose wires or a burner problem. The unit locks out for 1 h and then restarts. See Resetting a lockout.
8 red flashes	08	Indicates that the flame has been lost five times (four recycles) during the heating cycle	Check for low gas pressure, dirty or faulty flame sensor or faulty gas valve. The unit locks out for 1 h and then restarts. See Resetting a lockout.
9 red flashes	09	Indicates reversed line voltage polarity, grounding problem, or reversed low voltage transformer wires. Both heating and cooling operations are affected.	Check polarity at unit and branch. Check unit grounding. Check that flame probe is not shorted to chassis. The unit does not start the ignition sequence until this problem is corrected.

Table 32: Understanding status LED codes and the 7-segment LED displays

Status LED	7-segment LED displays	Condition	Solution
10 red flashes	10	Gas valve energized with no call for heat. The main blower and inducer blower run and no ignition sequence is started as long as this condition exists.	Check gas valve and gas valve wiring.
11 red flashes	11	Indicates that the main limit switch has opened its normally-closed contacts and has remained open for more than 5 min. This condition is usually caused by a failed blower motor or blower wheel. The unit control board enters a hard lockout and power has to be cycled off and on to reset the unit control board after the problem is corrected.	Check limit switch wiring. Verify that limit switch is closed. Check for faulty blower motor.
12 red flashes	12	Model ID configuration error. This is unlikely to happen but could occur due to an incorrect blower selection.	Not user adjustable. Contact a service technician.
13 red flashes	13	Indicates that the second-stage (high) pressure switch is open with a call for second-stage heating (high fire) present	Check for faulty inducer, blocked vent pipe, broken or disconnected pressure switch hoses, disconnected pressure switch or inducer wiring, or faulty pressure switch.
17 red flashes	17	If the secondary voltage drops below approximately 19 VAC, the unit control board continues to energize any relays that are already energized, but does not energize any additional relays until the voltage level increases.	Verify that the unit is receiving the proper line voltage. Check the transformer for correct low voltage output.
18 red flashes	18	If the secondary voltage drops below approximately 16 VAC, the unit control board immediately de-energizes the relay outputs and does not energize any relays until the voltage level increases above approximately 20 VAC.	Verify that the unit is receiving the proper line voltage. Check the transformer for correct low voltage output.

Table 32: Understanding status LED codes and the 7-segment LED displays

Status LED	7-segment LED displays	Condition	Solution
Rapid red flashes	FUS	Indicates that the fuse on the unit control board has opened	Replace the fuse.
4 amber flashes	44	The unit control board is receiving a Y signal from the thermostat without a G signal. The unit operates normally in both heating and cooling, but this status code is displayed to alert the user that there is a wiring problem.	Verify that the G wire from the thermostat is connected correctly.

NOTICE

If a flame is detected the control flashes the LED for 1/8 of a second and then enters a flame stabilization period.

IGNITION CONTROL FLAME SENSE LEVELS
Normal flame sense current is approximately
3.7 microamps DC (ua)
Low flame signal warning starts at 1.5 microamps.
Low flame signal control lockout point is
0.1 microamps DC (ua)

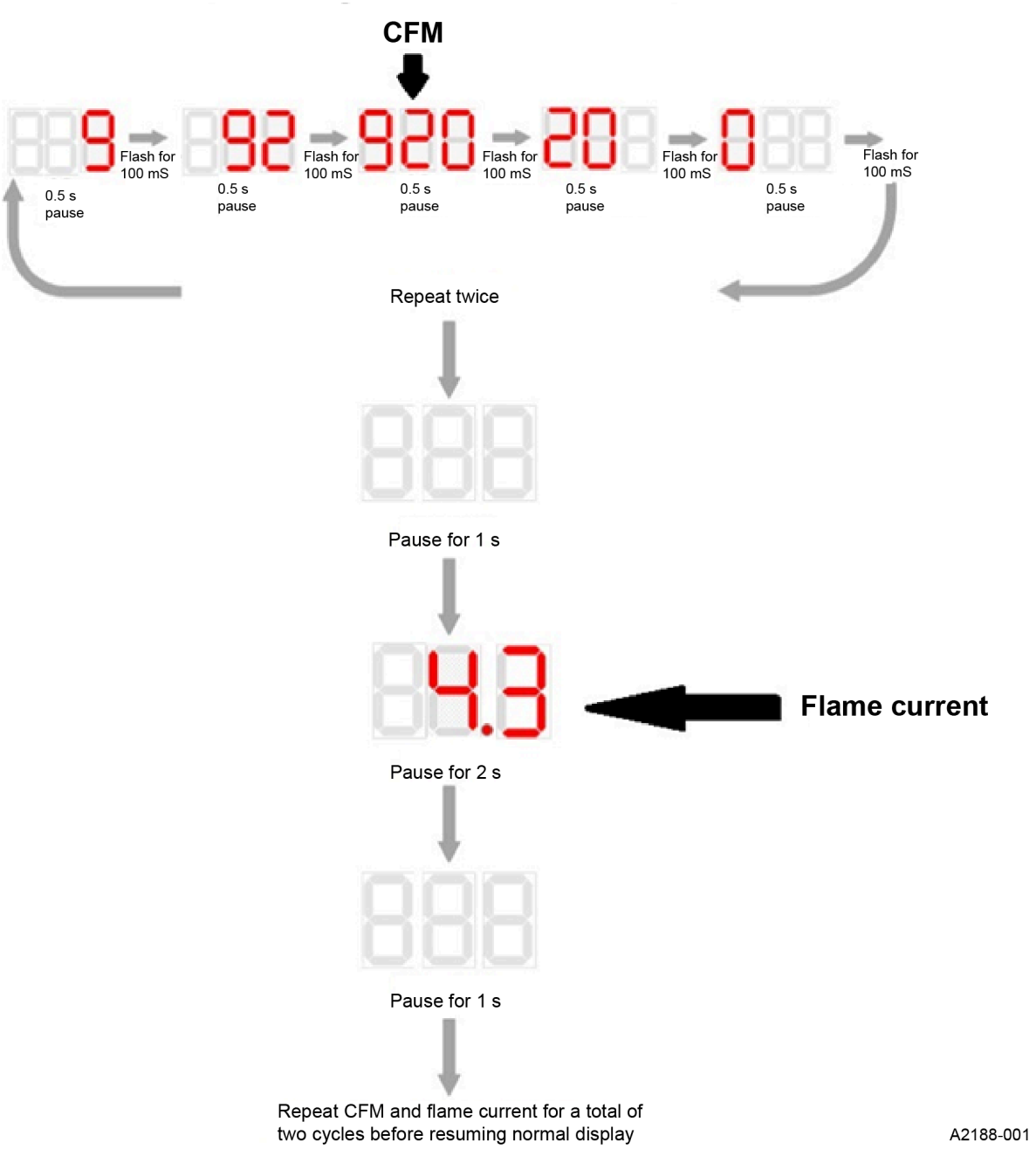
Viewing CFM and flame current during active calls

You can view the CFM of the circulating blower and the flame current on the 7-segment LED displays on the unit control board during active thermostat calls for heating, cooling, and continuous fan

To viewing CFM and flame current during active calls, do the following:

- When an active call is displayed on the 7-segment LED displays, press the **Select** push button. The CFM displays and scrolls from right to left on the 7-segment LED displays for 5 s, and, after a 1 s pause, the flame current displays if applicable and available. This display cycle is repeated once and then the 7-segment LED displays return to showing the active call. See Figure 50.

Figure 50: Viewing CFM and flame current on the 7-segment LED displays during active calls



Viewing and clearing fault code history

The status LED and the 7-segment LED displays on the unit control board indicate active faults. See Using unit control board diagnostics and Table 32. The unit control board is equipped with memory that stores up to five fault codes to allow service technicians to diagnose problems more easily. This memory is retained even if power to the unit is lost. If more than five fault codes have occurred since the last reset, only the five most recent fault codes are retained. You view and clear fault code history using the last five faults (L5F) menu.

Important: This feature must be used only by a qualified service technician.

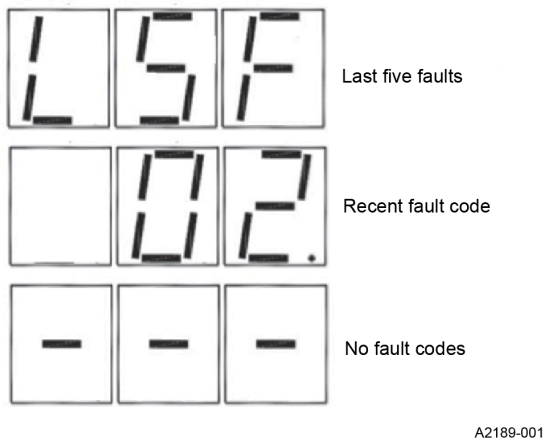
To view and clear fault code history, do the following:

1. Make sure that there are no active thermostat calls.

2. Navigate to the **L5F** menu, then press **Select** . The 7-segment LED displays show the most recent stored fault. See Figure 51.

   Note: If there are no fault codes, the 7-segment LED displays show **---**. See Figure 51.

Figure 51: Viewing fault code history



3. Use the right push button to navigate the other stored fault codes.
4. To clear the existing fault codes, make sure that the control board is in unlocked mode. See Activating unlocked mode. Then, press and hold **Select** for 5 s. The 7-segment LED displays show **---** and the status LED emits 3 green flashes to indicate that the fault code history is cleared.

Setting the unit model

The unit control board is programmed at the factory with the correct model ID for the specific BTU rating of the unit. The model ID identifies the motor horsepower and airflow configuration of the unit. Do not change the model ID unless the model ID programmed in the unit control board has been changed to an incorrect model or you are replacing the unit control board. Incorrect configuration of the model ID could lead to equipment failure and damage.

To set the unit model, do the following:

1. Make sure that the unit control board is in unlocked mode. See Activating unlocked mode.
2. Navigate to the **Id** menu, then press **Select** to view the model ID.
3. Check the required model ID in Table 28, then navigate the model ID options. When the correct model ID is displayed, press **Select**.

Resetting a lockout

You can reset a soft or hard lockout if required. Soft lockouts reset automatically after 1 h. Hard lockouts do not reset automatically. See Lockout for more information about soft and hard lockouts.

- **To reset a soft lockout**, turn off the power to the unit control board and turn on the power again **or** let the 1 h lockout time expire.
- **To reset a hard lockout**, turn off the power to the unit control board and turn on the power again.

Sourcing replacement parts

Table 33: Replacement parts list

Part type	Description
Motor	Blower, combustion
	Motor, direct drive blower
Electrical	Control, furnace
	Control, temperature
	Igniter
	Sensor, flame
	Switch, door
	Switch, limit
	Switches, pressure
	Transformer
	Valve, gas
Air moving	Housing, blower
	Wheel, blower
Fabricated parts	Bracket, igniter/flame sensor
	Burner, main gas
	Heat exchanger, assembly
	Manifold, gas
	Panel, blockoff
	Panel, door (2 required)
	Panel, top
	Shelf, blower
Miscellaneous	Bag, parts
	Bracket, door
	Diagram, wiring
	Gasket, foam (door) (1.5 ft required)
	Harness, wiring
	Hose, condensate
	Hose, rain gutter
	Knob, quarter turn (4 required)
	Motor mount kit
	Orifice, burner (natural #45)
	Pan, condensate
	Plug, seal, 7/8 in.
	Plug, seal, 2 3/8 in.
	Plug, vent pipe
	Sight glass, oval (2 required)
	Tubing, silicon
	Vent adapter

This is a generic parts list. To request a complete parts list, use the customer service contact information available online or send a written request by mail. Visit our website at http://www.source1parts.com to search for a part or browse the catalog, find a dealer or distributor, or find customer service contact information. To do so, select **Brand Links**, then select **Customer Service**. To contact us by mail, use the following address:

JC Residential and Light Commercial LLC

Customer Relations

5005 York Drive

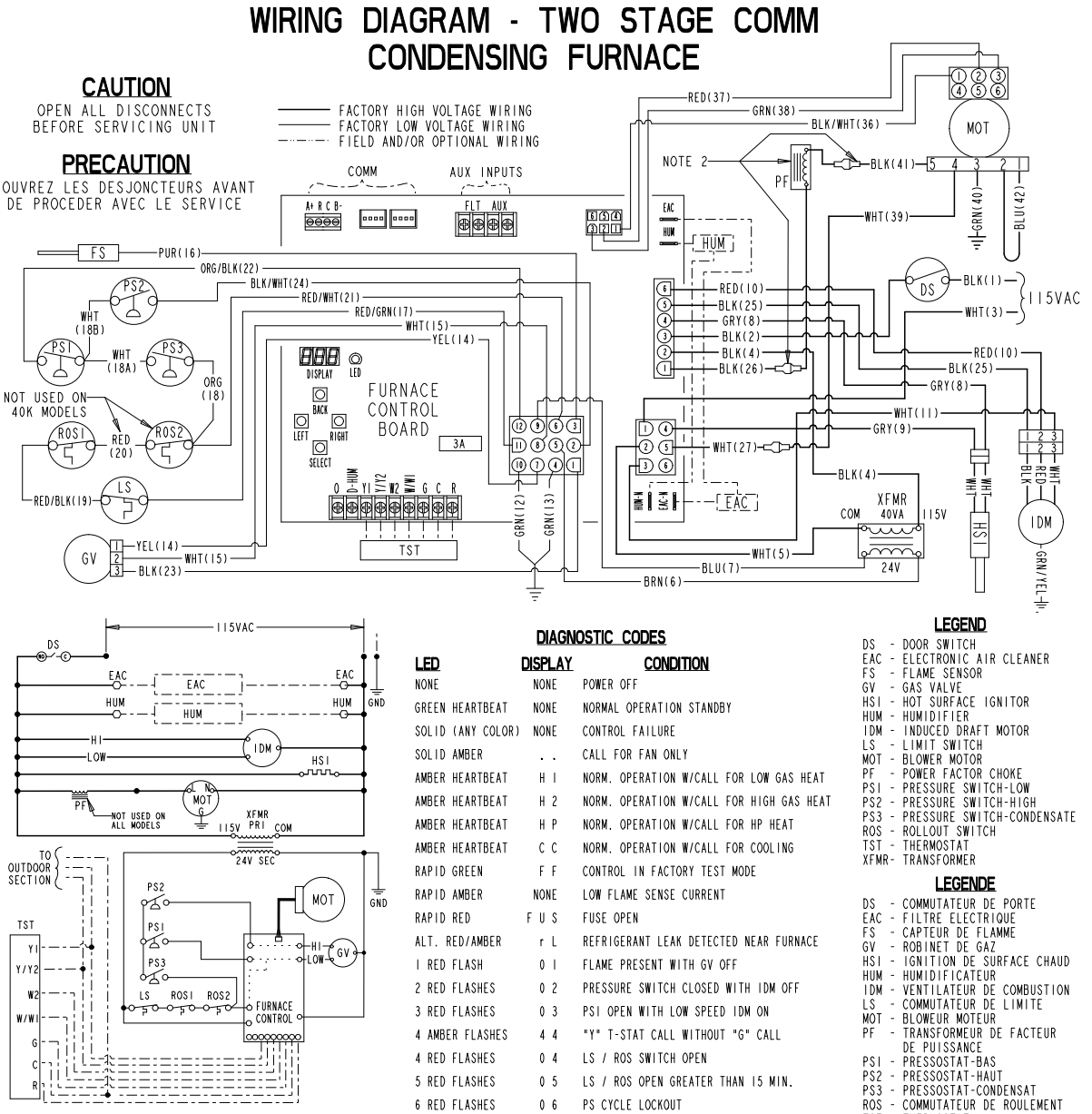
Normal, OK 73069

Third-party trademarks

Third-Party Trademarks Notice: For information about third-party trademarks, refer to the relevant company websites.

Wiring diagram

Figure 52: Wiring diagram



NOTES:

1. If any of the original wire as supplied with the furnace must be replaced, it must be replaced with wiring having a temperature rating of at least 221°F(105°C).
2. PF Choke installed with 3/4-1.0 HP motors only. BLK(41) connects to main harness BLK(26) when not equipped with PF Choke.
3. Connectors suitable for copper conductors only.

NOTES:

1. Si l'un des fils d'origine fournis avec la fournaise doit être remplacé, il doit être remplacé par un fil ayant une température nominale d'au moins 221°F (105°C).
2. PF installé avec des moteurs 3/4 - 1HP uniquement. BLK(41) se connecte au fil BLK(26) lorsqu'il n'est pas équipé de PF.
3. Seulement des marettes pour fil de cuivre.

DIAGNOSTIC CODES

LED	DISPLAY	CONDITION
NONE	NONE	POWER OFF
GREEN HEARTBEAT	NONE	NORMAL OPERATION STANDBY
SOLID (ANY COLOR)	NONE	CONTROL FAILURE
SOLID AMBER	. .	CALL FOR FAN ONLY
AMBER HEARTBEAT	H 1	NORM. OPERATION W/CALL FOR LOW GAS HEAT
AMBER HEARTBEAT	H 2	NORM. OPERATION W/CALL FOR HIGH GAS HEAT
AMBER HEARTBEAT	H P	NORM. OPERATION W/CALL FOR HP HEAT
AMBER HEARTBEAT	C C	NORM. OPERATION W/CALL FOR COOLING
RAPID GREEN	F F	CONTROL IN FACTORY TEST MODE
RAPID AMBER	NONE	LOW FLAME SENSE CURRENT
RAPID RED	F U S	FUSE OPEN
ALT. RED/AMBER	r L	REFRIGERANT LEAK DETECTED NEAR FURNACE
1 RED FLASH	0 1	FLAME PRESENT WITH GV OFF
2 RED FLASHES	0 2	PRESSURE SWITCH CLOSED WITH IDM OFF
3 RED FLASHES	0 3	PSI OPEN WITH LOW SPEED IDM ON
4 AMBER FLASHES	4 4	"Y" T-STAT CALL WITHOUT "G" CALL
4 RED FLASHES	0 4	LS / ROS SWITCH OPEN
5 RED FLASHES	0 5	LS / ROS OPEN GREATER THAN 15 MIN.
6 RED FLASHES	0 6	PS CYCLE LOCKOUT
7 RED FLASHES	0 7	LOCKOUT DUE TO FAILED IGNITION
8 RED FLASHES	0 8	LOCKOUT DUE TO FLAME DROPOUTS
9 RED FLASHES	0 9	INCORRECT LINE VOLTAGE POLARITY
10 RED FLASHES	1 0	GV FAULT
11 RED FLASHES	1 1	LS/ROS OPEN FROM 5 TO 15 MIN.
12 RED FLASHES	1 2	MODEL ID CONFIGURATION ERROR
13 RED FLASHES	1 3	PS2 OPEN WITH HIGH SPEED IDM ON
17 RED FLASHES	1 7	LOW VOLTAGE < 19.2VAC - PREVENTS FURTHER RELAY OUTPUTS FOR > 2 SECONDS
18 RED FLASHES	1 8	LOW VOLTAGE < 16 VAC - STOPS CURRENT RELAY OUTPUTS FOR > 2 SECONDS

Refer to Installation Manual for more detailed information

LEGEND

DS - DOOR SWITCH
EAC - ELECTRONIC AIR CLEANER
FS - FLAME SENSOR
GV - GAS VALVE
HSI - HOT SURFACE IGNITOR
HUM - HUMIDIFIER
IDM - INDUCED DRAFT MOTOR
LS - LIMIT SWITCH
MOT - BLOWER MOTOR
PF - POWER FACTOR CHOKE
PSI - PRESSURE SWITCH-LOW
PS2 - PRESSURE SWITCH-HIGH
PS3 - PRESSURE SWITCH-CONDENSATE
ROS - ROLLOUT SWITCH
TST - THERMOSTAT
XFMR- TRANSFORMER

LEGENDE

DS - COMMUTATEUR DE PORTE
EAC - FILTRE ELECTRIQUE
FS - CAPTEUR DE FLAMME
GV - ROBINET DE GAZ
HSI - IGNITION DE SURFACE CHAUD
HUM - HUMIDIFICATEUR
IDM - VENTILATEUR DE COMBUSTION
LS - COMMUTATEUR DE LIMITE
MOT - BLOWEUR MOTEUR
PF - TRANSFORMEUR DE FACTEUR DE PUISSANCE
PSI - PRESSOSTAT-BAS
PS2 - PRESSOSTAT-HAUT
PS3 - PRESSOSTAT-CONDENSAT
ROS - COMMUTATEUR DE ROULEMENT
TST - THERMOSTAT
XFMR- TRANSFORMEUR

FAULT CODE RETRIEVAL

1. Press "LEFT" button until "LSF" is displayed then press "SELECT" button.
2. The last error code will be displayed with a dot in the bottom right corner of the display. Press "RIGHT" button to cycle to next older fault.
   If no error codes are present, the display will show "--".
3. Press and hold "SELECT" button for longer than 5 sec. while in "LSF" menu to clear stored error codes. LED will flash green three times when complete. Faults can only be cleared while control is in "UNLOCKED" mode.

6540996-UWD-A-0925

Start-up sheet

33 in. ECM two stage gas furnace 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 ☐ Gas piping is connected (including drip leg) ☐ Supply plenum and return air are connected

☐ Vent system is connected

Condensate management

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

Venting

Intake size # of 90 degree ells # 0f 45 degree ells Length

Exhaust size # of 90 degree ells # 0f 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

Electrical: Line voltage

☐ Polarity is correct (black is L1 (hot), white is N (neutral) ☐ Ground wire is connected

Line voltage value to furnace (volts AC)

Electrical: Low voltage

☐ Thermostat wiring is complete ☐ Thermostat heat anticipator set to .40 (if present)

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

Thermostat

Thermostat staging: ◯ OFF ◯ 10 MIN ◯ AUTO ◯ 20 MIN

Continued on next page

Gas side

Gas type ◯ Natural gas ◯ LP gas (requires LP conversion kit)

LP conversion kit part number _____ 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 (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 (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 (variable speed ECM)

Blower (5-speed) selected ◯ Lo Cool ◯ HI Cool ◯ Hi Heat ◯ Lo Heat ◯ VSG

Blower (3-speed) selected ◯ A ◯ B ◯ C

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 user's information 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