Installation Manual: Y82V and Z8VT Series - Two-Stage Variable Speed ECM Gas Furnace - Non-Condensing - Multi-Position

BHC Group Heating & Cooling, 5005 York Drive, Norman, OK 73069

6762470-UIM-A-0126

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Contents

About the unit

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

These furnaces 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 I listed and may be common vented with another gas appliance as allowed by the National Fuel Gas Code.

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

Certification

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

DESIGN CERTIFIED®

5 YEAR COMPLETE ASSURANCE LIMITED WARRANTY PLEDGE

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

GoTemp Pro app (Formerly DS Solutions app)

BHC Group Heating & Cooling 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

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.

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 these instructions.
- A gas-fired furnace for installation in a residential garage must be installed as specified in these instructions.
- Provide adequate combustion and ventilation air to the furnace space as specified in these instructions.

- Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in Connecting the vent system.
- Test for gas leaks as specified in these instructions.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

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

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

- Always install the furnace to operate within the furnace's intended temperature rise range. Only connect the furnace to a duct system that has an external static pressure within the allowable range, as specified on the furnace nameplate.
- 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's installation instructions including:
  - Proper vent installation
  - Furnace operating under thermostatic control
  - Return air duct sealed to the furnace
  - Air filters in place
  - Set furnace input rate and temperature rise per nameplate marking
  - Means for providing outdoor air required for combustion
  - Return air temperature maintained between 55ºF (13ºC) and 80ºF (27ºC)
  - **Air filter is replaced** upon substantial completion of the construction process
  - Furnace, ductwork and components are cleaned upon substantial completion of the construction process and furnace operating conditions including ignition, input rate, temperature rise and venting are verified according to the manufacturer's 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. ACCA, Manual J or other approved methods may be used.
- 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 attached to the vestibule panel. Do not use the top return bend of the heat exchangers as lifting points as the tubes may shift out of position or their location brackets/baffles.
- Refer to the unit nameplate for the furnace model number, and then see Figure 1 for return air plenum dimensions. The plenum must be installed according to the instructions.

- Provide clearances from combustible materials as listed in Table 2.
- 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 nameplate 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 should install, repair, or service gas heating equipment. Untrained service personnel can perform basic maintenance functions such as cleaning and replacing the air filters. When working on heating equipment, observe precautions in the manuals and on the labels attached to the unit and other safety precautions that may apply.

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
  - Furnaces installed in laundry rooms
  - Furnaces installed in hobby or craft rooms
  - Furnaces installed 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, local building, heating, plumbing, and other codes. In absence of local codes, the installation must comply with the national codes listed below and all authorities having jurisdiction.

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

Safety

- **US**: National Fuel Gas Code (NFGC) NFPA 54/ANSI Z223.1 and the Installation Standards, Warm Air Heating and Air Conditioning Systems ANSI/NFPA 90B
- **Canada**: CAN/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 the
  National Fire Protection Association Inc.
  Batterymarch Park
  Quincy, MA 02269
  or for only the NFGC, contact the
  American Gas Association,
  400 N. Capital, N.W.
  Washington DC 20001
  or www.NFPA.org
- **Canada**: NSCNGPIC. For a copy, contact:
  Standard Sales, CSA International
  178 Rexdale Boulevard
  Etobicoke, (Toronto) Ontario Canada M9W 1R3

Combustion and ventilation air

- **US**: Section 5.3 of the NFGC, air for Combustion and Ventilation
- **Canada**: Part 7 of NSCNGPIC, Venting Systems and Air Supply for Appliances

Duct systems

- **US and Canada**: Air Conditioning Contractors Association (ACCA) Manual D, Sheet Metal and Air Conditioning Contractors Association National Association (SMACNA), or American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 1997 Fundamentals Handbook Chapter 32.

Acoustical lining and fibrous glass duct

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

Gas piping and gas pipe pressure testing

- **US**: NFGC, chapters 2, 3, 4, and 9 and National Plumbing Codes
- **Canada**: NSCNGPIC Part 5

Electrical connections

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

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those 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 furnaces. If more than one furnace is needed in an application, each furnace must have its own complete duct system and its own wall thermostat.
- If you are using a communicating system, you must use the Hx™3 Touch Screen Thermostat (S1-THXU430W).

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.

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/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 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 1.

Table 1: 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. ➤ **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 furnace so the burners and the ignition source are located not less that 18 in. (46 cm) above the floor. • Locate or protect the furnace to avoid physical damage by vehicles.
Installation in an attic	The location of the unit has floor support for required service access.

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. The following minimum clearances are recommended:
  - 24 in. (61 cm) between the front of the furnace 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 Unit clearances to combustibles.

Unit clearances to combustibles

Table 2: Unit clearances to combustibles - all surfaces identified with the unit in a upflow configuration

Application	Top in. (cm)	Front in. (cm)	Rear in. (cm)	Left side in. (cm)	Right side in. (cm)	Flue in. (cm)	Floor/bottom	Closet	Alcove	Attic	Line contact
Upflow	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.2)	Combustible	Yes	Yes	Yes	No
Upflow B-vent	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.5)	Combustible	Yes	Yes	Yes	No
Downflow	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.2)	1 (24.4)[1]	Yes	Yes	Yes	No
Downflow B-vent	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.5)	1 (24.4)[1]	Yes	Yes	Yes	No
Horizontal	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.2)	Combustible	No	Yes	Yes	Yes[2]
Horizontal B-vent	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.5)	Combustible	No	Yes	Yes	Yes[2]

ⓘ **Note:**
1. A combustible floor base accessory or air conditioning coil is required for use on combustible floor.
2. Line contact is only permitted between lines formed by the intersection of the rear panel and side panel (top panel when in horizontal position) of the furnace jacket and 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 furnace when moving or handling the furnace to provide support and to prevent damage or warping of the cabinet.
- When lifting the furnace, support the ends of the furnace rather than lifting it 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 or their location brackets or baffles.

- 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 3.

Dimensions

Figure 1: Dimensions

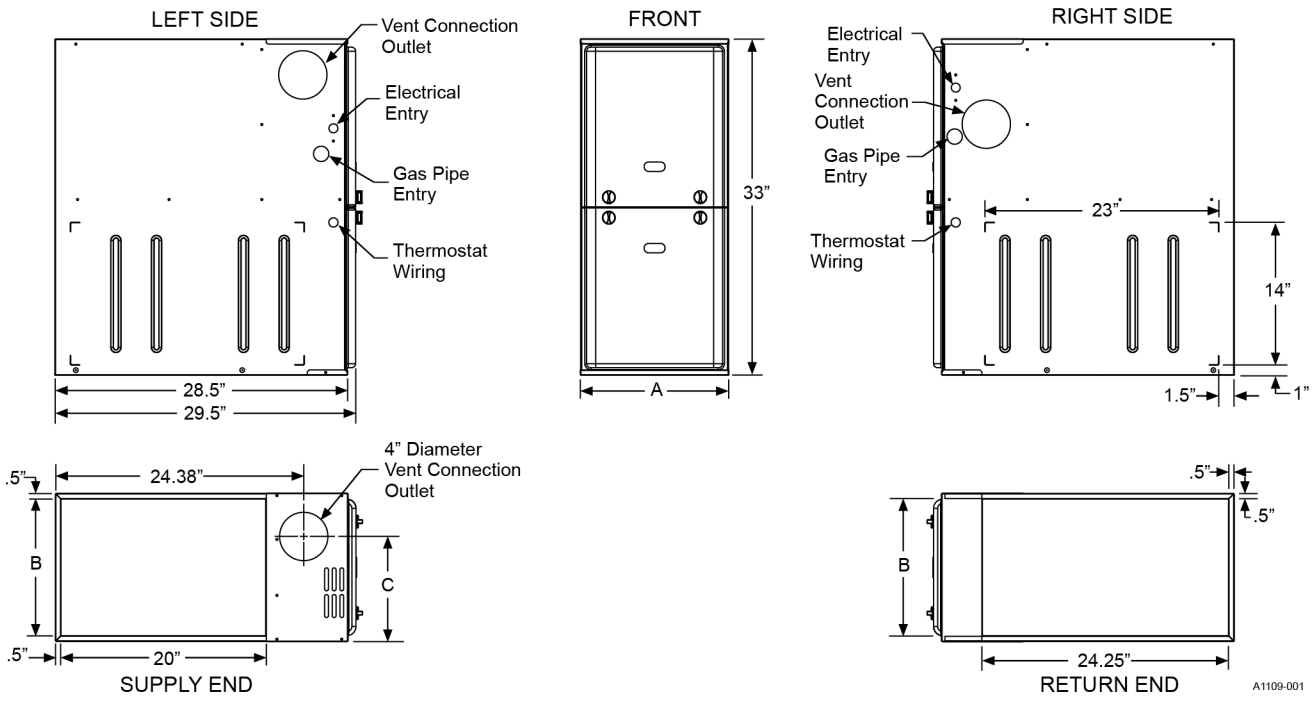


Table 3: Cabinet and duct dimensions

Btu/h (kW) input	Nominal CFM (m^3/min)	Cabinet size	Cabinet dimensions					
			A (in.)	A (cm)	B (in.)	B (cm)	C (in.)	C (cm)
60 (17.6)	1200 (34.0)	A	14 1/2	36.8	13 3/8	34.0	10.3	26.2
80 (23.4)	1200 (34.0)	B	17 1/2	44.4	16 3/8	41.6	11.8	29.9
80 (23.4)	1600 (45.3)	C	21	53.3	19 7/8	50.5	13.6	34.5
100 (29.3)	1600 (45.3)	C	21	53.3	19 7/8	50.5	13.6	34.5
100 (29.3)	2000 (56.6)	C	21	53.3	19 7/8	50.5	13.6	34.5
120 (35.1)	2000 (56.6)	C	21	53.3	19 7/8	50.5	13.6	34.5

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 furnace 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 Table 9 or the furnace rating plate for the correct rise range and static pressures.

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 furnace does not operate correctly on a shorter plenum height. The minimum recommended rectangular duct height is 4 in. (10 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 furnace 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 furnace is installed so that the supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air must also be handled by a duct sealed to the furnace casing and terminating outside the space containing the furnace.
  - 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 furnace 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 furnace. If manually operated, the damper must be equipped with means to prevent the furnace or the air conditioner from operating unless the damper is in full heat or cool position. See Installing an indoor coil.
  - You may place the indoor coil directly on the furnace outlet and seal it to prevent leakage. If you are installing thermoplastic indoor coil drain pans in the upflow or horizontal configuration, then an extra 2 in. minimum spacing may be needed 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 furnace plenum are of sufficient size so the furnace operates at the specified external static pressure and within the air temperature rise specified on the unit nameplate.
- When replacing an existing furnace, if the existing plenum is not the same size as the new furnace, remove the existing plenum and install a new plenum that is the correct size for the new furnace. If the plenum is shorter than 12 in. (30.5 cm), the turbulent air flow may cause the limit controls not to operate as designed or the limit controls may not operate at all.

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

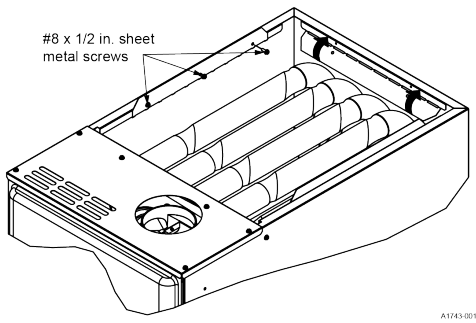
Three duct flanges are part of the furnace casing. The flanges are rotated down for shipment.

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. Fold the flanges upward along the slots until the flanges contact the casing flange.
2. Secure each flange to the casing using #8 x 1/2 in. screws in the holes provided. The screws are not provided. See Figure 2.

Figure 2: Duct attachment



Installing 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.

ⓘ **Note:** 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 furnace as shown in Figure 3.

Figure 3: Furnace and coil attachment

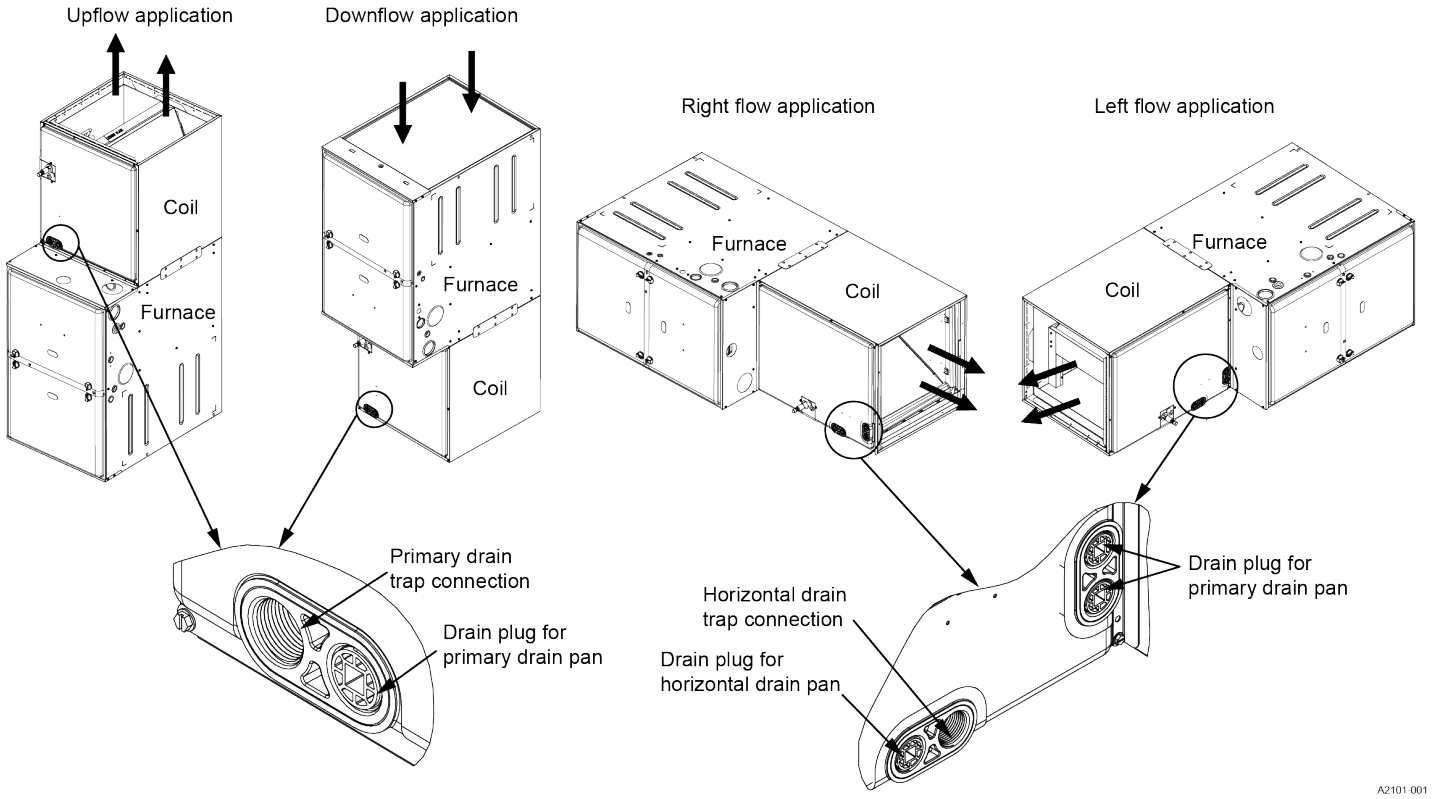


Figure 4: Vertical upflow applications with furnaces

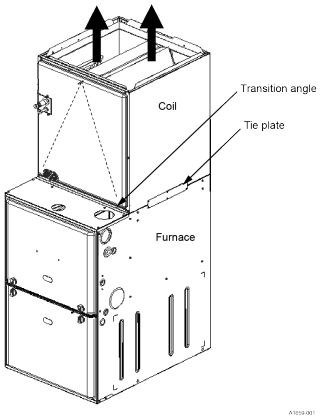


Figure 5: Vertical downflow applications with furnaces

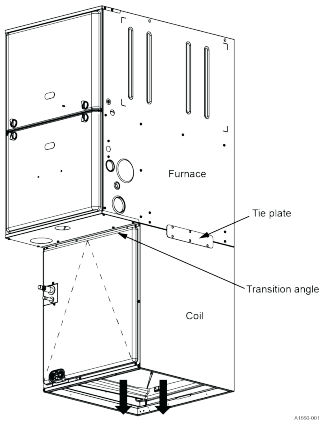


Figure 6: CTM horizontal right application with furnace

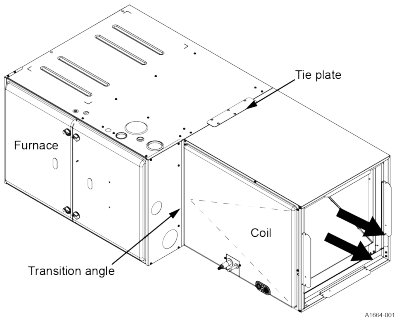
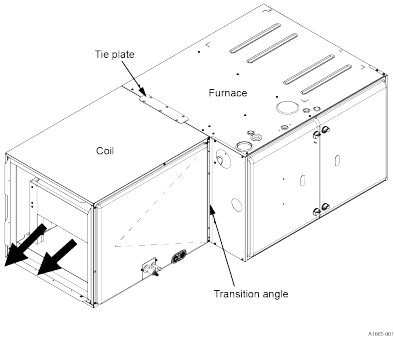


Figure 7: CTM horizontal left application with furnace



Note: You may place the indoor coil directly on the furnace outlet and seal it to prevent leakage. If you are installing thermoplastic indoor coil drain pans in the upflow or horizontal configuration, then an extra 2 in. minimum spacing may be needed 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. Remove the cap from the appropriate side vent outlet location on the cabinet, cut the insulation in the cabinet to the same size as the hole provided, and re-install the cap in the hole in the top panel. Do not block the combustion air inlet. Then, position the furnace on top of the indoor coil cabinet and seal the connection to the furnace, 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 that any smoke or reflected light is observable inside the casing to indicate the presence of leaks in the heat exchanger. Attach the access panel in a way that prevents 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.

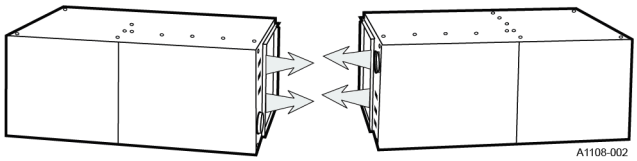
Important: During installation, doors must remain on the furnace when moving or lifting the furnace.

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

- **For horizontal applications**, install the furnace in a horizontal position on either side as shown in Figure 8 .

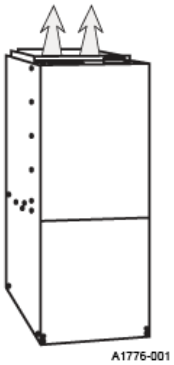
  Important: Do not install the furnace on its back.

Figure 8: Horizontal application



- **For upflow applications**, install the furnace in an upflow position as shown in Figure 9.

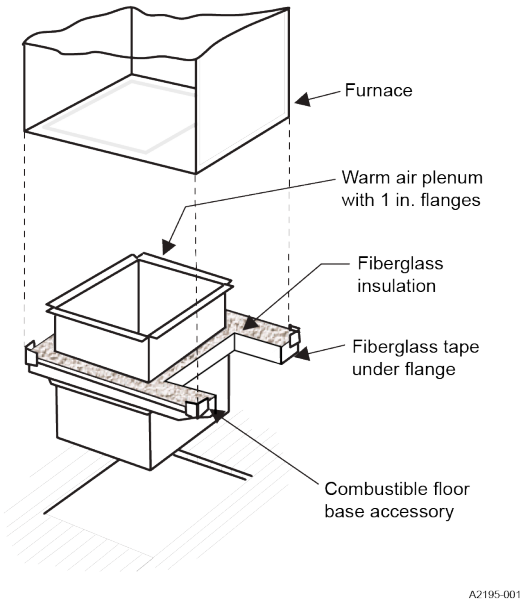
Figure 9: Upflow application



- **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 10.

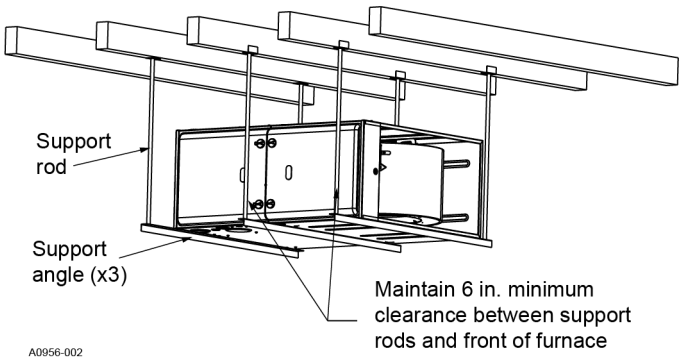
Figure 10: Combustible floor base accessory



- 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.

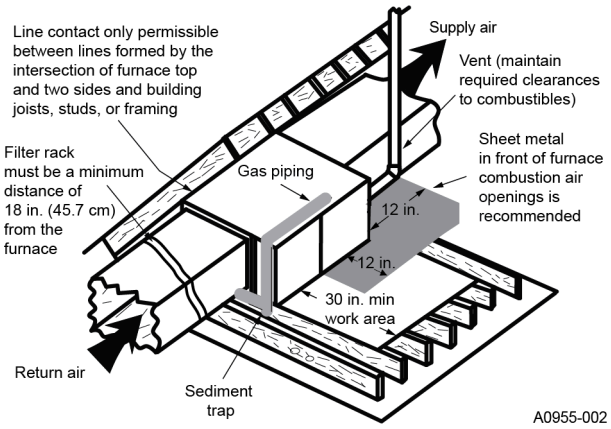
• **For applications where the unit is suspended**, for example, in attic or crawl space installations where the unit is suspended from rafters or floor joists, use rods, pipe angle supports, or straps as follows:
  - Support the furnace with rods, pipe angle supports or straps at three locations. Place one support at the supply end of the furnace, place the second support approximately in the center of the furnace near the blower shelf, and place the third support at the return end of the furnace.
  - Maintain a 6 in. (15.2 cm) minimum clearance between the front of the furnace and the support rods or straps.
  - Make sure that all six suspension points are level to ensure correct and quiet furnace operation.
  - Use a secure platform constructed of plywood or other building materials secured to the floor or ceiling joists. See Figure 11.

Figure 11: Typical suspension of furnace 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 furnace is installed in the horizontal left or right position. The line contact is only permissible between lines that are formed by the intersection of the top and two sides of the furnace and the building joists, studs, or framing. This line may be in contact with combustible material. See Figure 12.

Figure 12: 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 furnace 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 furnace through the sides or bottom depending on the type of application. **Do not connect return air into the rear panel of the furnace.**
- **For downflow applications**, use a suitable duct connector that is approved by the furnace manufacturer for use with the furnace. The duct connector is designed to be connected to the rectangular duct under the floor and sealed. Follow the installation instructions provided with the duct connector for correct installation. See Installing an indoor coil for more information about connecting the unit to the ductwork in downflow applications with an indoor coil.
- **For side return applications**, return air is pulled through an opening cut in the side of the furnace casing. See Figure 13. Leave the bottom blockoff panel that is supplied with the furnace in place. If the furnace 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 furnace is installed on a surface that is uneven or if the furnace 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 furnace. Remove the internal bottom panel.

Installing the air filter

You must install a field-supplied air filter for all applications. Install the air filter external to the furnace cabinet. **Do not attempt to install the air filter inside the furnace**. See Installing the air filter 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 furnace side panel as shown in Figure 13.

⚠ 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 as long as the filter velocity does not exceed filter manufacturer's recommendation.

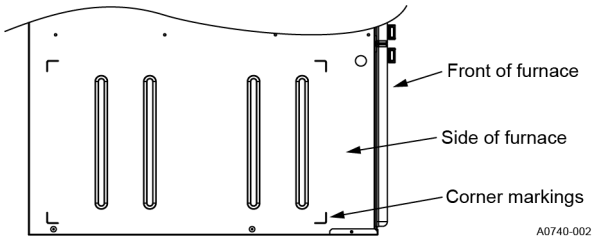
Table 4: Recommended air filter sizes - high velocity 600 FPM

CFM (m^3/min)	Cabinet size	Side (in.)	Bottom (in.)
1200 (34.0)	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

ⓘ **Note:**

- Air velocity through disposable air filters may not exceed 300 ft per minute (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. filter. For CFM greater than 1800, you may use two side returns, one side and the bottom, or one return with a transition to allow use of a 20 in. x 25 in. filter.

Figure 13: Side-return cutout markings



To install the air filter, do the following:

- Install the air filter as outlined for the specific type of filter installation in Table 5.

Table 5: Installing the air filter

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 furnace side panel. See Figure 13. 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 furnace side panel. ➧ **Important:** Some accessories such as electronic air cleaners and pleated media may require a larger side opening. Follow the instructions supplied with the accessory for side opening requirements. **Do not** cut the opening larger than the dimensions shown in Dimensions.
Horizontal	• Note that any branch duct (rectangular or round duct) attached to the plenum must attach to the vertical plenum before the filter. • Use straps and/or supports to support the weight of the external air filter box. • Make sure that the air filter is located a minimum of 18 in. from the return air inlet of the furnace.
Downflow	**Typical approach** • Locate the air filter above the furnace, 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 furnace. • 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 furnace using an external duct filter box attached to the furnace 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 furnace. • 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 gas

The furnace is constructed at the factory for natural gas-fired operation. To convert the furnace for operation with propane 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.

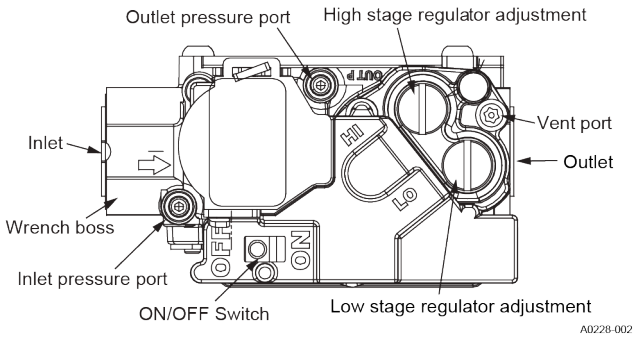
To convert the unit for operation with propane gas, do the following:

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

Installing the gas piping

See Figure 14 for the gas valve components.

Figure 14: Gas valve



DANGER

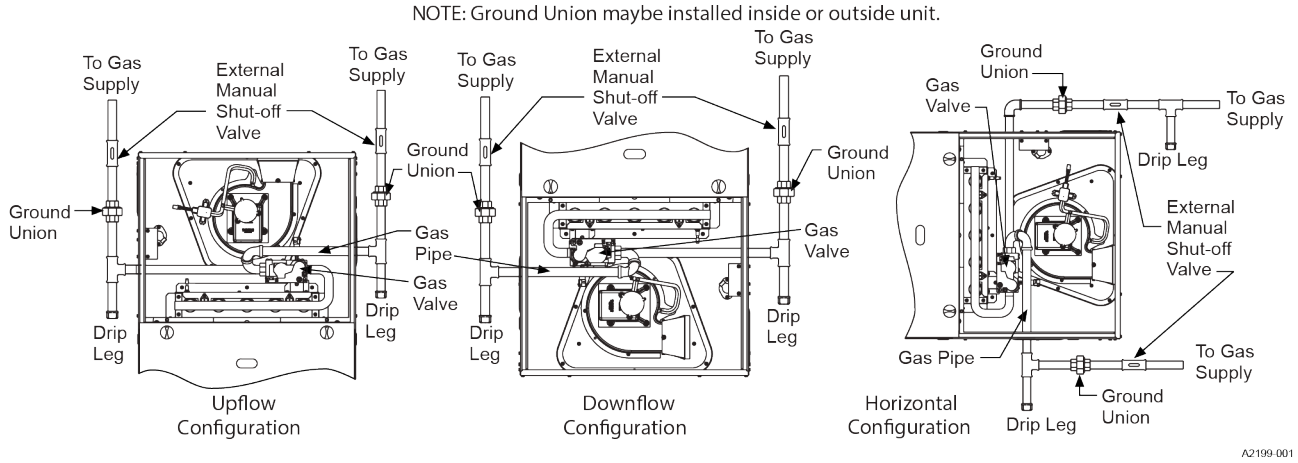
An overpressure protection device, such as a pressure regulator, must be installed in the gas piping system upstream of the furnace and must act to limit the downstream pressure to the gas valve so it does not exceed 0.5 PSI (14 in. W.C. [3.48 kPa]). Pressures exceeding 0.5 PSI (14 in. W.C. [3.48 kPa]) 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.
- Use only a gas type that is approved for the furnace as specified on the unit nameplate and in these instructions.
- Install a drip leg and a ground union. See Figure 15.

Figure 15: Gas piping



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

- Isolate the furnace 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 furnace using any of the gas pipe entry on both sides of the furnace. See Figure 1 and Figure 15.

Installing a high-altitude application conversion kit

You must install a high-altitude application conversion kit, which includes a pressure switch, in the following cases:

- If the furnace is installed in a location where the altitude is greater than 5,000 ft (1,524 m) above sea level
- If the furnace is installed in a location where the altitude is less than 5,000 ft (1,524m) above sea level but the area is subject to low pressure inversions

⚠ 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 install a high-altitude application conversion kit, do the following:

- Follow the installation procedure in the *Installation Manual* for the high-altitude application conversion kit.

Adjusting the manifold gas pressure for high-altitude applications

The furnace is constructed at the factory for natural gas-fired operation at 0 ft to 5,000 ft (0 m to 1,524 m) above sea level. If the furnace is installed in a location where the altitude is greater than 5,000 ft (1,524 m) above sea level, you must change the manifold gas pressure to maintain correct and safe operation.

To adjust the manifold gas pressure for high-altitude applications, refer to Table 6 and Table 7, and do the following:

1. Turn gas off at the ball valve or gas cock on gas supply line before the gas valve. Find the pressure ports on the gas valve marked Out P and In P.
2. Take the manifold pressure at the port marked OUT P.
3. Take the gas line pressure at the port marked IN P.
4. Using a 3/32 in. (2.4 mm) hex head wrench, loosen the set screw by turning it one turn counter-clockwise. Do not remove the set screw from the pressure port.

Nominal manifold pressure - high fire

Table 6: Nominal manifold pressure - high fire

Manifold pressures (in. W.C.)				Manifold pressures (kPa)			
Gas heating value (Btu/cu ft.)	Altitude(ft)			Gas heating value (MJ/cu m)	Altitude (m)		
	0-7999	8000-8999	9000-9999		0-2437	2438-2742	2743-3048
800	3.5	3.5	3.5	29.8	0.87	0.87	0.87
850	3.5	3.5	3.5	31.7	0.87	0.87	0.87
900	3.5	3.5	3.5	33.5	0.87	0.87	0.87
950	3.5	3.5	3.3	35.4	0.87	0.87	0.81
1000	3.5	3.2	2.9	37.3	0.87	0.80	0.73
1050	3.5	2.9	2.7	39.1	0.87	0.73	0.67
1100	3.2	2.7	2.4	41.0	0.80	0.66	0.61
2500 (LP)	9.8	8.2	7.5	93.2 (LP)	2.44	2.03	1.86

Nominal manifold pressure - low fire

Table 7: Nominal manifold pressure - low fire

First stage manifold pressures (in. W.C.)				First stage manifold pressures (kPa)			
Gas heating value (BTU/cu ft.)	Altitude(ft)			Gas heating value (MJ/cu m)	Altitude (m)		
	0-7999	8000-8999	9000-9999		0-2437	2438-2742	2743-3048
800	1.7	1.7	1.7	29.8	0.42	0.42	0.42
850	1.7	1.7	1.7	31.7	0.42	0.42	0.42
900	1.7	1.7	1.7	33.5	0.42	0.42	0.42
950	1.7	1.7	1.5	35.4	0.42	0.42	0.38
1000	1.6	1.5	1.4	37.3	0.41	0.37	0.34
1050	1.5	1.4	1.3	39.1	0.37	0.34	0.31
1100	1.3	1.2	1.1	41.0	0.34	0.31	0.28
2500 (LP)	4.1	3.8	3.5	93.2 (LP)	1.03	0.95	0.87

Connecting the electrical wiring

Follow all requirements when connecting the unit wiring and see Table 9 and Wiring diagramas 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 furnace 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 furnace to the Hx 3 Touch Screen Thermostat 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 37 for the unit wiring diagram and see Table 9 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.

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.

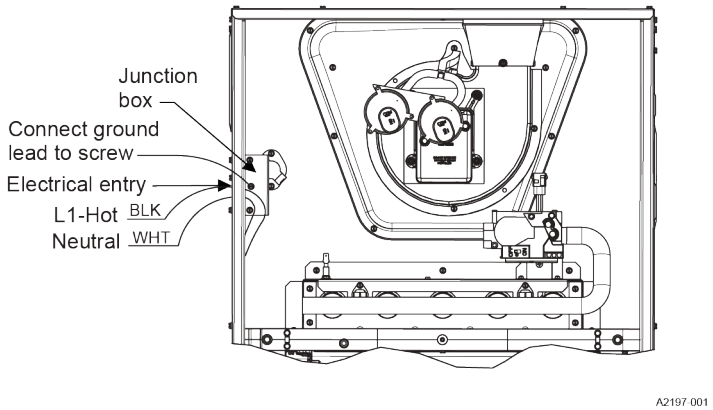
   Important: You must locate the disconnect switch close to the unit for convenience in servicing.

2. With the disconnect or fused switch in the **OFF** position, check all wiring against the unit wiring label. See Figure 37.
3. Use one of the wiring methods outlined in Table 8 to connect the power wiring.

Table 8: 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 16 as follows: a. Connect the black furnace lead to the L1 (hot) wire from the power supply. b. Connect the white furnace screw to neutral. c. Connect the power supply ground to the green screw (equipment ground). 5. 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 furnace panel.

Figure 16: Electrical wiring



3. Make sure that the furnace's control system has correct polarity of the power supply and a proper ground connection. See Figure 16.

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

Ratings and physical and electrical data

Table 9: Ratings and physical and electrical data

High fire input		Low fire input		High fire output		Low fire output		Nominal airflow		Recommended fuse or circuit breaker amps	Maximum outlet air temperature	
MBH	kW	MBH	kW	MBH	kW	MBH	kW	CFM	m^3/min		°F	°C
60	17.6	39	11.4	48	14.1	31	9.1	1200	34.0	15	190	88
80	23.4	52	15.2	64	18.7	42	12.3	1200	34.0	15	190	88
80	23.4	52	15.2	64	18.7	42	12.3	1600	45.3	15	190	88
100	29.3	65	19.0	80	23.4	52	15.2	1600	45.3	15	190	88
100	29.3	65	19.0	80	23.4	52	15.2	2000	56.6	20	190	88
120	35.1	78	22.8	96	28.1	62	18.1	2000	56.6	20	190	88

High fire air temperature rise 35/23		Low fire air temperature rise		Blower		Blower size		AFUE	Total unit amps	Gas pipe connection, NPT	Operating weight	
°F	°C	°F	°C	HP	Amps	in.	cm	%			lb.	kg
30 - 60	17 - 33	20 - 50	11 - 28	1/2	7.7	11 x 8	27.9 x 20.3	80	10.3	½ in.	95	43
30 - 60	17 - 33	20 - 50	11 - 28	1/2	7.7	11 x 8	27.9 x 20.3	80	10.3	½ in.	104	47
30 - 60	17 - 33	20 - 50	11 - 28	3/4	9.6	11 x 10	27.9 x 25.4	80	12.2	½ in.	115	52
30 - 60	17 - 33	20 - 50	11 - 28	3/4	9.6	11 x 10	27.9 x 25.4	80	12.1	½ in.	119	54
30 - 60	17 - 33	20 - 50	11 - 28	1.2	12.8	11 x 11	27.9 x 27.9	80	15.3	½ in.	123	56
30 - 60	17 - 33	20 - 50	11 - 28	1.2	12.8	11 x 11	27.9 x 27.9	80	15.3	½ in.	130	59

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

Connecting the control wiring for conventional systems

This task applies only for conventional systems.

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

The furnace 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 furnace 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 furnace 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 furnace 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. Make sure that the thermostat set to the **OFF** position and the main electrical source is disconnected.
4. Connect the thermostat wiring from the wiring connections on the thermostat to the terminal board on the ignition module as shown in Figure 17, Figure 18, Figure 19, Figure 20, Figure 21, or Figure 22, depending on your specific application.

Figure 17: Control wiring - variable ECM multi-stage gas furnace and premium multi-stage air conditioner - conventional wiring

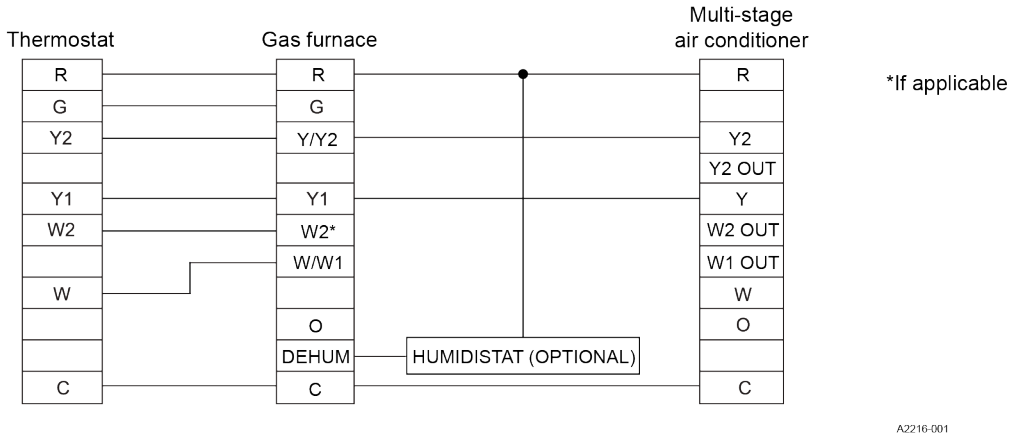
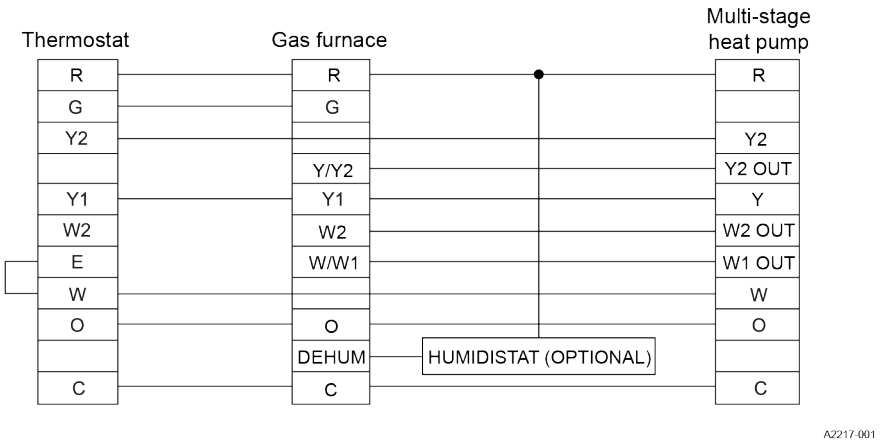


Figure 18: Control wiring - variable ECM multi-stage gas furnace and premium multi-stage heat pump - conventional wiring



NOTICE

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

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

Figure 19: Control wiring - variable ECM multi-stage furnace and standard multi-stage air conditioner - conventional wiring

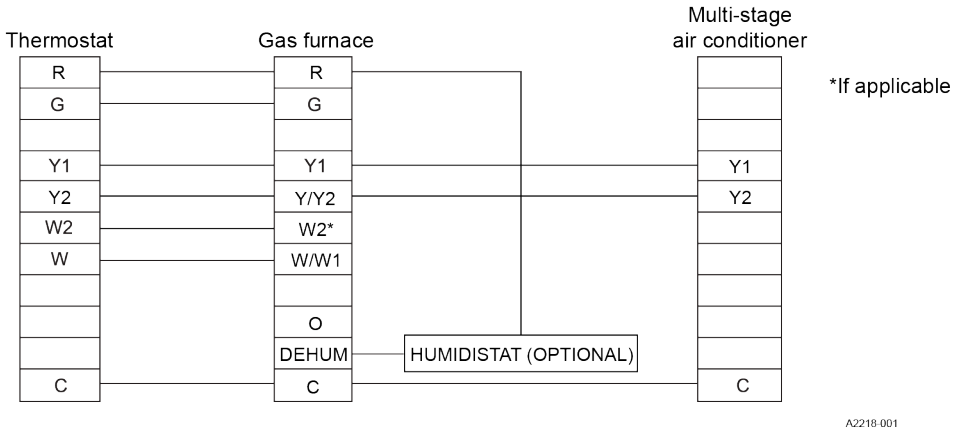
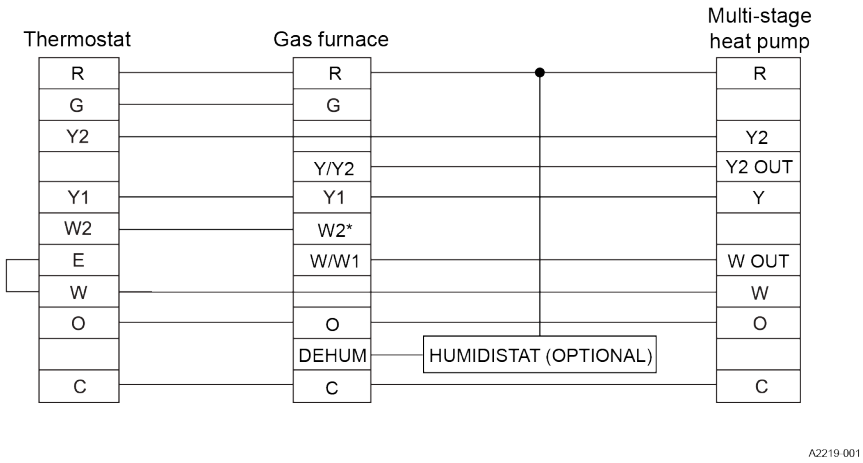


Figure 20: Control wiring - variable ECM multi-stage gas furnace and standard multi-stage heat pump - conventional wiring



NOTICE

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

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

Figure 21: Control wiring - variable ECM multi-stage furnace and single-stage air conditioner - conventional wiring

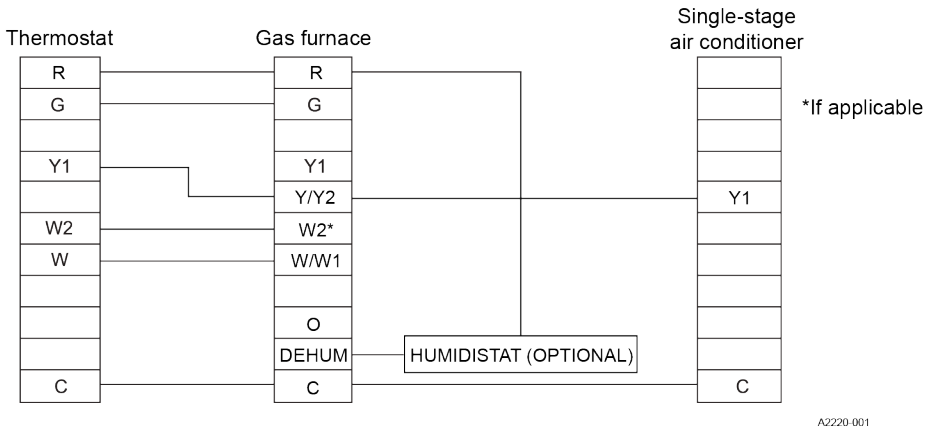
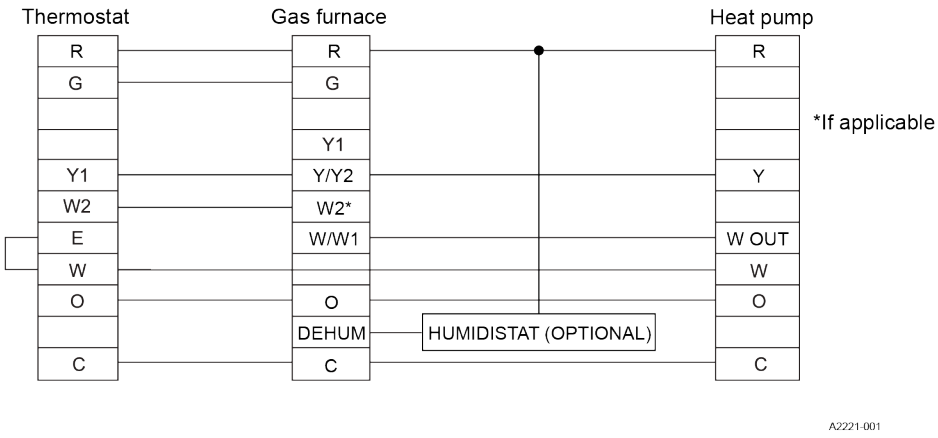


Figure 22: Control wiring - variable ECM multi-stage gas furnace and single-stage heat pump - conventional wiring



NOTICE

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

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

5. Electronic thermostats require a 24V common wire. **Do not** use power-stealing thermostats.
6. Apply strain relief to the thermostat wires passing through the unit cabinet.
7. If air conditioning equipment is installed, use thermostat wiring to connect the **Y** and **C** terminals on the furnace control board to the correct wires on the outdoor unit.
8. 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 furnace 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.
9. If a humidifier is installed, connect the humidifier to the **HUM** and **HUM-N** terminals on the furnace 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.
10. If an electronic air cleaner is installed, connect the electronic air cleaner to the **EAC** and **EAC-N** terminals on the furnace 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 furnace control board. You configure the heat staging settings when you are setting up the furnace 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, you must use the Hx 3 Touch Screen Thermostat (S1-THXU430W).
- If the furnace has an add-on indoor coil to be paired with an outdoor unit using an A2L refrigerant, you must use a refrigerant detection system (RDS).

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

- Hx 3 Touch Screen Thermostat, 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 24. The result is a new level of comfort, versatility, and simplicity.

To use the furnace in full communications (COMM) mode, you must install it with the matching Hx 3 Touch Screen Thermostat and an outdoor air conditioner or heat pump with a fully communicating control.

The furnace 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 furnace 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 furnace 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 furnace 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 Hx 3 Touch Screen Thermostat:

- Float switch: You can connect a float switch to the FLT and R terminals on the furnace 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 furnace control board. Refer to the *Installation Manual* for the Hx 3 Touch Screen Thermostat.

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

1. Connect the furnace control, Hx 3 Touch Screen Thermostat, and non-variable capacity communicating outdoor unit as shown in Figure 23. 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 23 and Figure 24.

Figure 23: Two-stage furnace with communicating AC or HP with no RDS connected

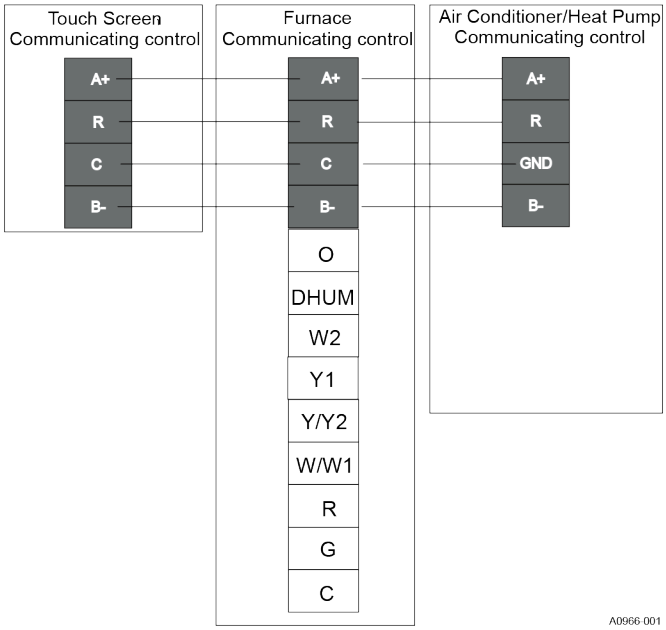
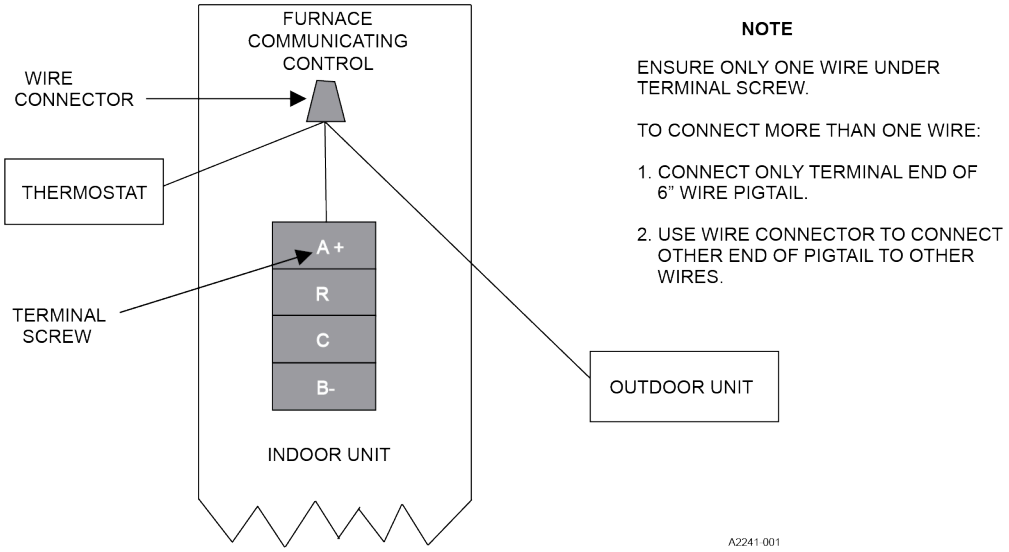


Figure 24: Terminal screw wire connection



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 24.

2. 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, you must use the Hx 3 Touch Screen Thermostat (S1-THXU430W).
- If the furnace has an add-on indoor coil to be paired with an outdoor unit using an A2L refrigerant, you must use a refrigerant detection system (RDS).

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

- Hx 3 Touch Screen Thermostat, a communicating wall thermostat
- Variable speed furnace
- Variable capacity air conditioner or heat pump

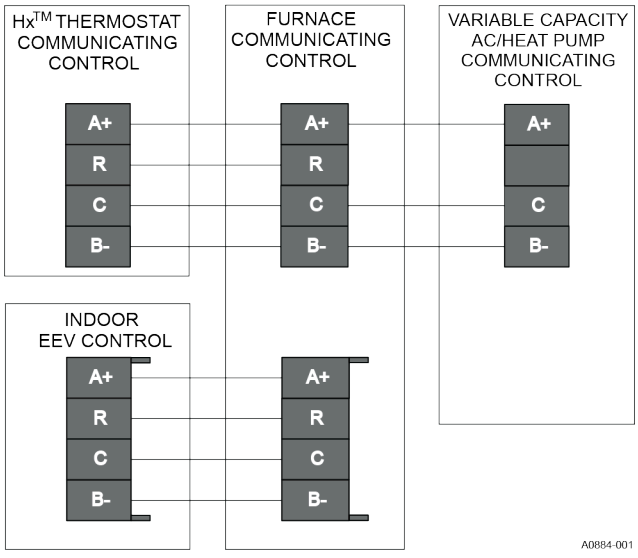
These components continually communicate with each other using the wire connections shown in Figure 25. Commands, operating conditions, and other data are passed continually between components over the A-R-C-B and A-C-B bus. The result is a new level of comfort, versatility, and simplicity.

In order to use a variable capacity outdoor unit with the furnace, 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. Connect the furnace control, Hx 3 Touch Screen Thermostat, and variable capacity communicating outdoor unit as shown in Figure 25. 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 Hx 3 Touch Screen Thermostat to the indoor unit are connected together. **Do not** connect the **R** wire to the outdoor unit. Use the four small screw terminals in the terminal block on the furnace control. See Figure 25 and Figure 24.

Figure 25: Furnace with communicating AC or HP with no RDS connected



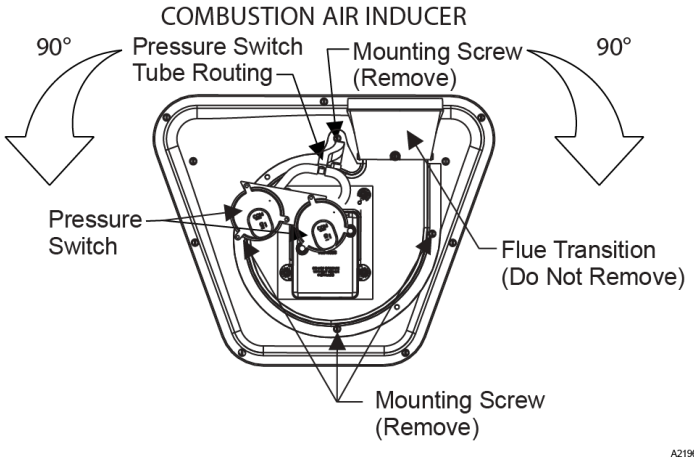
Important: Do not place more than one wire under any single communication terminal screw (there are four communication terminal screws). If more than one wire must be connected to a terminal screw, attach only the terminal end of a one wire pigtail no longer than 6 in. and use a wire connector to connect the other end of the pigtail to the other wires. Failure to do this results in nuisance communication error faults. See Figure 24.

2. Connect a short piece of thermostat wire (18 gauge minimum) to the **ARCB** terminals on the furnace control board. 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 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 vent system

- Be aware that the furnace is provided with a flue transition that is sized for 4 in. diameter vent connections. If a larger size vent connector is required, install that connection external to the furnace.
- Be aware that the furnace is shipped from the factory as shown in Figure 26 and Figure 27. Refer to the *Quick Reference Guide* for all installation configuration options. If you need to convert to a horizontal or downflow position, do the following:
  a. Remove the four screws that secure the inducer assembly and rotate 90° being careful not to damage the gasket. Then, reinstall the four screws.
  b. Remove the cap from the appropriate vent outlet location on the cabinet, cut the insulation in the cabinet to the same size as the hole provided, and reinstall the cap in the hole in the top panel.

Figure 26: Combustion air inducer



Important: In downflow applications, do not block the combustion air inlet. The furnace must be installed on a coil cabinet or a combustible floor base accessory to allow combustion air to enter the burner compartment.

- **Follow all requirements for connecting the vent system** as outlined in relevant codes and standards, Safety, and the following:
  - CATEGORY 1 - 450 F. MAX. VENT TEMP.
  - Venting

- Venting into an existing chimney
- Fan-assisted combustion system, including Ambient combustion air supply , Combustion air source from outdoors, Dampers, louvers and grilles, Air supply openings and ducts (Canada only), Combustion air source from outdoors, Ventilated combustion air, and Vent and supply (outside) air safety check procedure

CATEGORY 1 - 450 F. MAX. VENT TEMP.

The venting system must be installed in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code Z223.1/NFPA 54 (latest edition), or Sections 7.2, 7.3 or 7.4 of CSA B149.1, National Gas and Propane Codes (latest edition) or applicable provisions of the local building code and these instructions.

The furnace shall be connected to any type of B, BW or L vent connector, and shall be connected to 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**.

It is recommended that the appliance is installed in a location where the space temperature is 32°F (0°C) or higher. If the appliance is installed in a location where the ambient temperature is below 32°F (0°C), the combustion byproducts could condense causing damage to the appliance heat exchanger.

This appliance may be common vented with another gas appliance for residential installations as allowed by the codes and standards listed in these instructions.

Non-HUD approved Modular Homes must be vented with an approved roof jack and may not be common vented with other appliances.

Venting

Category I venting consists of vertically venting one or more appliances in B-vent or masonry chimney (as allowed), using single wall metal pipe or B-vent connectors. Type B-vent system extends in a general vertical direction and does not contain offsets exceeding 45°. A vent system having not more than one 60° offset is permitted.

Venting into an existing chimney

For Category I installations, the furnace shall be connected to a factory built chimney or vent complying with a recognized standard, or a masonry or concrete chimney lined with a material acceptable to the authority having jurisdiction. Venting into an unlined masonry chimney or concrete chimney is prohibited.

Where use of an existing chimney is unavoidable, the following rules must be followed:

1. The masonry chimney must be built and installed in accordance with nationally recognized building codes or standards and must be lined with approved fire clay tile flue liners or other approved liner material that will resist corrosion, softening, or cracking from flue gases. **THIS FURNACE IS NOT TO BE VENTED INTO AN UNLINED MASONRY CHIMNEY.**
2. This furnace must be vented into a fire clay tile lined masonry chimney only if a source of dilution air is provided, such as by common venting with a draft hood equipped water heater. If no source of dilution air is available, Type B vent must be used, or masonry chimney vent kit 1CK0604 must be used. Refer to the instructions with the kit to properly apply these masonry chimney kits.
3. The chimney must extend at least 3 ft (0.91 m) above the highest point where it passes through a roof of a building and at least two feet higher than any portion of the building with a horizontal distance of ten feet.
4. The chimney must extend at least 5 ft (1.5 m) above the highest equipment draft hood or flue collar.

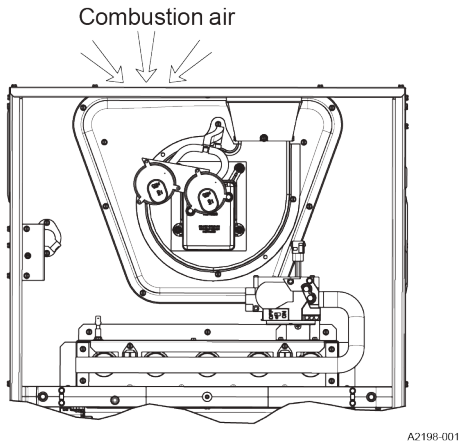
Fan-assisted combustion system

This appliance is equipped with an integral mechanical means to either draw products of combustion through the heat exchanger.

Ambient combustion air supply

This type of installation will draw the air required for combustion from within the space surrounding the appliance and from areas or rooms adjacent to the space surrounding the appliance. This may be from within the space in a non-confined location or it may be brought into the furnace area from outdoors through permanent openings or ducts. A single, properly sized pipe from the furnace vent connector to the outdoors must be provided. Combustion air is brought into the furnace through the unit top panel opening.

Figure 27: Combustion airflow path through the furnace casing to the burner compartment



WARNING

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

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

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

A **confined space** is an area with less than 50 cu ft (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 proper air for combustion and ventilation in confined spaces.

Dampers, louvers and grilles

1. The free area of a supply air opening shall be calculated by subtracting the blockage area of all fixed louvers grilles or screens from the gross area of the opening.
2. Apertures in a fixed louver, a grille, or a screen shall have no dimension smaller than 0.25 in. (0.64 cm).
3. A manually operated damper or a manually adjustable louver are not permitted for use.
4. An automatically operated damper or an automatically adjustable louver shall be interlocked so that the main burner cannot operate unless either the damper or the louver is in the fully open position.

⚠ WARNING

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

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

Table 10: Unconfined space minimum area

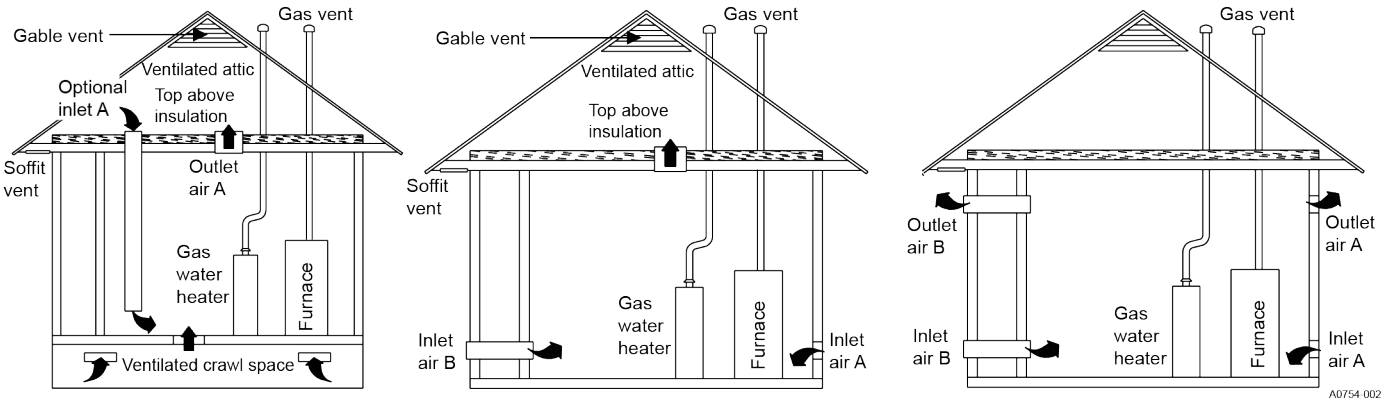
Btu/h input rating	Minimum free area required for each opening - in^2 (cm^2)
60,000	60 (387)
80,000	80 (516)
100,000	100 (645)
120,000	120 (742)

Table 11: Free area

Btu/h input rating	Minimum free area required for each opening		
	Horizontal duct 2,000 Btu/h in^2 (cm^2)	Vertical duct or opening to outside 4,000 Btu/h in^2 (cm^2)	Round duct 4,000 Btu/h in^2 (cm^2)
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 total input 100,000 + 30,000 = (130,000 ÷ 4,000) = 32.5 in^2 vertical Appliance 1 appliance 2 total input 100,000 + 30,000 = (130,000 ÷ 2,000) = 65 in^2 horizontal			

Air supply openings and ducts (Canada only)

Figure 28: Ambient combustion air



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

Combustion air source from outdoors

1. Two permanent openings, one within 12 in. (30.5 mm) of the top and one within 12 in. (30.5 mm) of bottom of the confined space, Two permanent openings, shall communicate directly or by means of ducts with the outdoors, crawl spaces or attic spaces.
2. One permanent opening, commencing within 12 in. (30.5 mm) of the top of the enclosure shall be permitted where the equipment has clearances of at least 1 in. (2.54 cm) from the sides and back and 6 in. (15.24 cm) from the front of the appliance. The opening shall communicate directly with the outdoors and shall have a minimum free area of:
   a. 1 $in.^2$/ 3,000 Btu/h (700 mm^2/kW) of the total input rating of all equipment located in the enclosure.
   b. Not less than the sum of all vent connectors in the confined space.
3. The duct shall be least the same cross-sectional area as the free area of the air supply inlet opening to which it connects.
4. The blocking effects of louvers, grilles and screens must be given consideration in calculating free area. If the free area of a specific louver or grille is not known. Refer to Table 12 to estimate free area.

Table 12: Estimated free area

Wood or Metal Louvers or Grilles	Wood 20-25%* Metal 60-70% *
Screens**	1/4 in. (0.635 cm) mesh or larger 100%
Note: • Do not use less than 1/4”(0.635 cm) mesh • ** Free area of louvers and grille varies widely; the installer should 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 source from outdoors in this instruction or in Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 (latest edition). This type installation requires two properly sized pipes. One brings combustion air from a properly ventilated attic space or crawl space and a second pipe that extends from the furnace vent connection (top right of unit) to the exterior of the building.

Vent and supply (outside) air safety check procedure

For Category I furnaces, vent installations shall be in accordance with Parts 7 and 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and or Section 7 and Appendix B of the CSA B149.1, Natural Gas and Propane Installation Codes, the local building codes, furnace and vent manufacturer's instructions.

Multi-story or common venting systems are permitted and must be installed in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and / or the CSA B149.1, Natural Gas and Propane Installation Codes, local codes, and the manufacturer's instructions.

Vent connectors serving Category I furnaces shall not be connected into any portion of mechanical draft systems operating under positive pressure.

Horizontal portions of the venting system shall be supported to prevent sagging using hangers or perforated straps and must slope upwards not less than ¼ in. per foot (0.635 cm/m) from the furnace to the vent terminal.

It is recommended that you follow the venting safety procedure below. This procedure is designed to detect an inadequate ventilation system that can cause the appliances in the area to operate improperly causing unsafe levels of Carbon Monoxide or an unsafe condition to occur.

⚠ 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 minutes 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 CO2 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.

NOTE: An unsafe condition exists when the CO reading exceeds 40 ppm and the draft reading is not in excess of -0.1 in. W.C. (-25 kPa) with all of the appliance(s) operating at the same time.

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.

Starting up the unit

- **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 furnace 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 furnace, 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 furnace 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 PSI (3.45 kPa).
  - The furnace 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.

NOTICE

Burner orifices are sized to provide proper input rate using natural gas with a heating value of 1030 BTU/Ft3 (38.4 MJ/m3). 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.
2. Run the furnace for a minimum of 3 min in heating operation.

3. Measure the time in seconds for the gas meter to complete 1 revolution and note this measurement.

   ⓘ **Note:** The 2 cubic feet test dial provides a more accurate measurement of gas flow.

4. See Table 13 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 (Btu/cu ft) to calculate the input rate.
6. Check if the input rate matches the input rate on the unit nameplate. If the input rate does not match the input rate on the unit nameplate, adjust the manifold pressure as outlined in Measuring and adjusting manifold gas pressure. 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 13: Gas rate in cubic feet per hour

Seconds for 1 revolution	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

Table 13: Gas rate in cubic feet per hour

Seconds for 1 revolution	Size of test dial		
	1 cu ft	2 cu ft	5 cu ft
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
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

Measuring and adjusting inlet gas pressure

You can measure inlet gas pressure by connecting a U-tube manometer to the inlet pressure port on the gas valve with a piece of tubing. See Figure 14 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 14.
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 U-tube manometer to the **IN P** tap on the gas valve. Do not connect any tubing to the negative side of the U-tube manometer, because it references atmospheric pressure.

   ⓘ **Note:** See Figure 29 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. See Table 14.

Table 14: 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 pressures must be for the furnace to operate safely. The gas line pressure **must be** a minimum of 7 in. W.C. (1.74 kPA) for natural gas 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 nameplate.

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 U-tube manometer to the outlet pressure port on the gas valve with a piece of tubing. See Figure 14 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**.

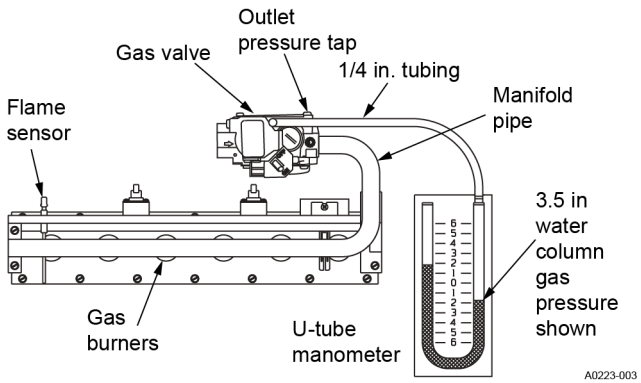
NOTICE

This furnace uses a two stage gas valve. The high-fire and low-fire manifold pressures can be adjusted independently. High-fire manifold pressure must be set properly before setting the low-fire manifold pressure.

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 14.
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 U-tube manometer to the adapter previously installed in the **OUT P** tap on the gas valve. See Figure 29. Do not connect any tubing to the negative side of the U-tube manometer, because it references atmospheric pressure.

Figure 29: Connecting a U-tube manometer to read manifold gas pressure



5. Locate the pressure regulator adjustment cap and adjustment screws on the main gas valve as shown in Figure 14.
6. Remove the cap from the pressure regulator to gain access to the adjustment screw.

   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.

7. Turn on the gas and electrical supplies and follow the operating instructions to place the unit back in operation.
8. Measure the manifold gas pressure. Adjust the manifold gas pressure for the type of gas used if needed by adjusting the gas valve regulator screw so the manifold gas pressure is in accordance with Table 15.

   Table 15: Nominal manifold pressure

Gas type	High fire	Low fire
Natural gas	3.5 in. W.C. (0.87 kPa)	1.5 in. W.C. (0.37 kPa)
Propane (LP) gas	10.0 in. W.C. (2.488 kPa)	4.2 in. W.C. (1.04 kPa)

   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.

9. Re-calculate the unit input rate as outlined in Checking the unit input rate for natural gas to make sure you have not exceeded the specified unit input rate on the nameplate.
10. 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.
11. 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.

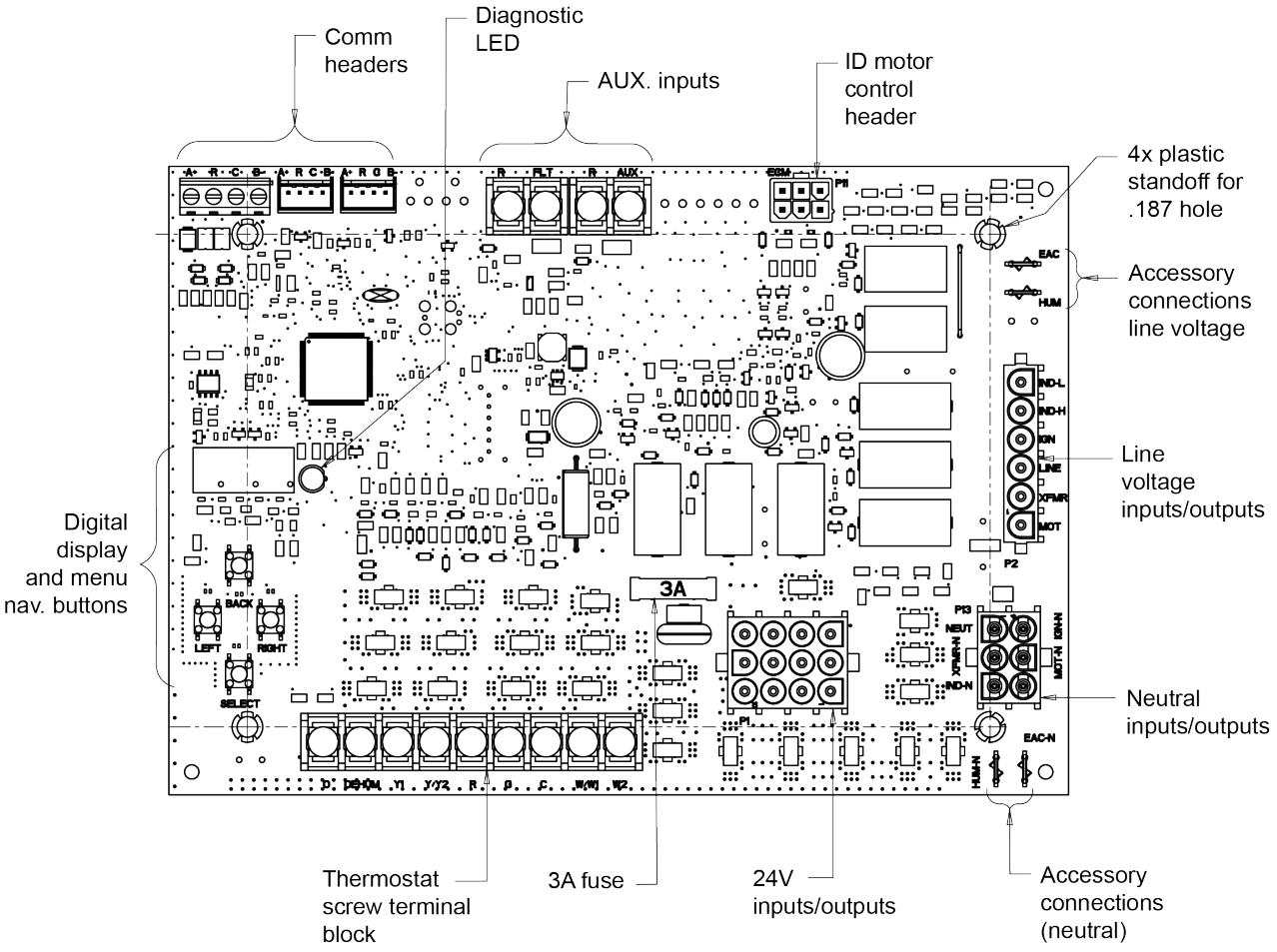
Setting up the control board

Important:

- You must set up the 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 control board has been changed to an incorrect model or you are replacing the main control board. Incorrect configuration of the model ID could lead to equipment failure and damage.**

Setting up the furnace 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 23, Table 24, Table 25, Table 26, and Table 27. Figure 30 shows the control board.

Figure 30: Furnace control board



The control board can interface with the following:

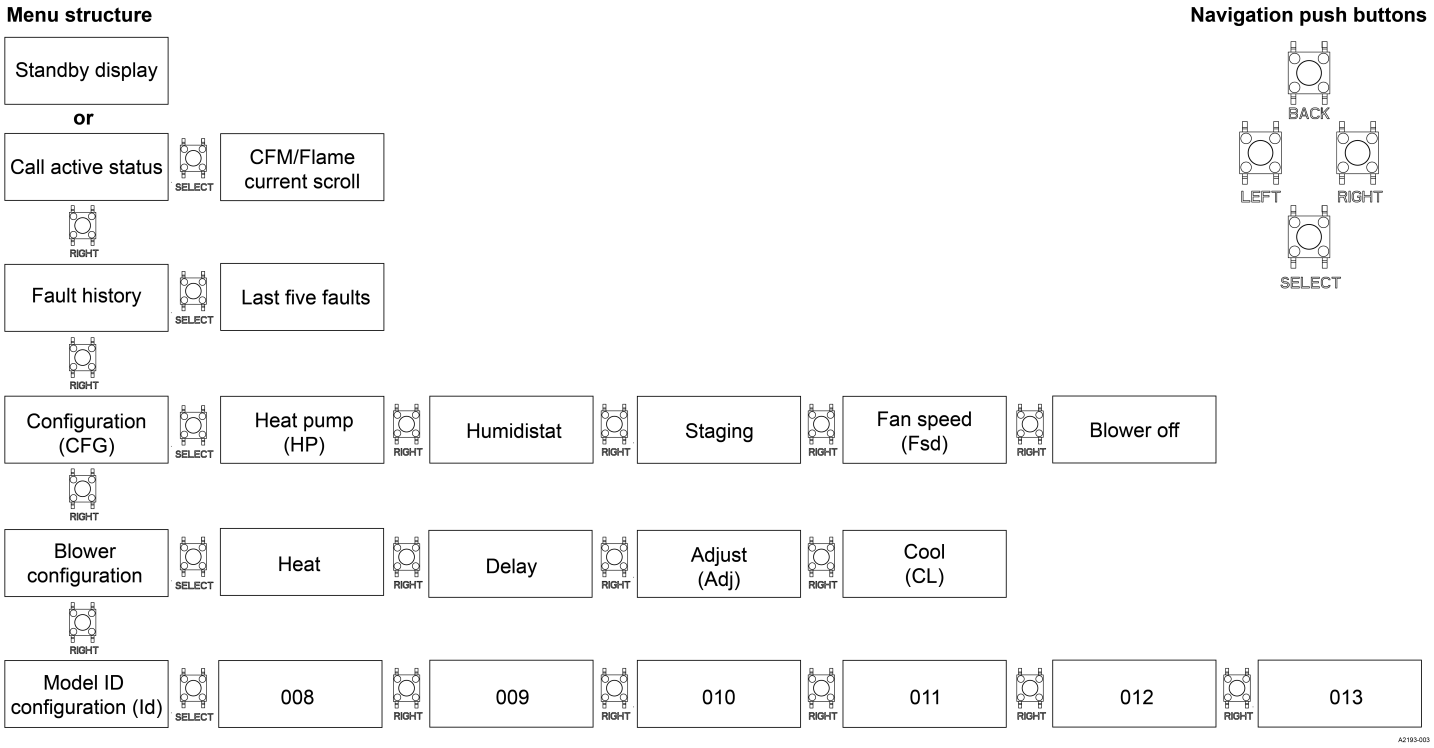
- Conventional room thermostat
- Hx 3 Touch Screen Thermostat (S1-THXU430W), which is a communicating room thermostat

Important: If an Hx 3 Touch Screen Thermostat is used and wired using communications, it must have software version 3.05zn or later.

The 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 furnace 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 31: 7-segment LED displays

Figure 32: 7-segment LED displays - navigation overview



Note: Figure 32 shows how to use the right and select push buttons to navigate the control board menu options. Use the left and back push buttons to scroll back as required.

The 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 furnace settings using the following:

- **Configuration settings menu (CFG)**: The CFG menu has five options as shown in Figure 32:
  - 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 furnace 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 furnace 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 32:
  - 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 furnace model has a specific model ID that identifies the motor horsepower and airflow configuration of the furnace. You use the ID menu to check that the model ID for the furnace is set correctly. For example, for a 060A12 model, the ID menu displays 008. See Figure 32 and Table 22. **Do not change the model ID unless the model ID programmed in the control board has been changed to an incorrect model or you are replacing the main control board. Incorrect configuration of the model ID could lead to equipment failure and damage.**

Activating unlocked mode

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

Figure 33: Unlocked mode

Important: To exit unlocked mode, press the **Left** and **Right** push buttons on the 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 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 furnace using the Staging (Stg) option in the configuration (CFG) menu. The default setting is auto. Table 16 shows the available settings.

Table 16: Stg settings

Setting	Description
OFF	The furnace only operates in low fire.
10	The furnace switches from low fire to high fire after 10 min and stays in high fire until the thermostat is satisfied.
Aut (auto)	The furnace uses the recent heating duty cycle information to determine the optimal time to energize high-stage heating.
20	The furnace 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 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 27. 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 17 and Table 21 show the available settings.

Table 17: Fsd settings

Setting	Description
A	Low - the blower speed is based on 40% of the selected high stage cooling speed (CL setting) and the selected adjust (Adj) setting
B	Medium - the blower speed is based on 70% of the selected high stage cooling speed (CL setting) and the selected adjust (Adj) setting
C	High - the 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 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 furnace 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 furnace, 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 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 18 shows the available settings. See Table 23, Table 24, Table 25 and Table 26 for the expected airflow at different settings. The default gas heating blower speed is A as shown in Table 27. The default blower speed delivers the correct airflow for correct heating operation in most applications.

Table 18: 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 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 furnace 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 19 shows the available settings. The default setting is A.

Table 19: 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.

Table 19: dLy settings

Setting	Description
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 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 20 and Table 21 show the available settings. The default cooling blower speed is A as shown in Table 27. See Table 23, Table 24, Table 25, and Table 26 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 20: 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 21: 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 23, Table 24, or Table 25 and Table 26 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 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 control board is programmed at the factory with the correct model ID for the specific Btu rating of the furnace. The model ID identifies the motor horsepower and airflow configuration of the furnace. Table 22 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 control board has been changed to an incorrect model or you are replacing the control board. Incorrect configuration of the model ID could lead to equipment failure and damage. You can view the model ID when the control board is in locked or unlocked mode.

Table 22: Model IDs

Model	Motor hp	Model ID - displayed on 7-segment LED displays	Description
060A12	1/2	8	80% 2 STG VS ECM 060BTU 1200CFM
080B12	1/2	9	80% 2 STG VS ECM 080BTU 1200CFM
080C16	3/4	10	80% 2 STG VS ECM 080BTU 1600CFM
100C16	3/4	11	80% 2 STG VS ECM 100BTU 1600CFM
100C20	1.2	12	80% 2 STG VS ECM 100BTU 2000CFM
120C20	1.2	13	80% 2 STG VS ECM 120BTU 2000CFM

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 22 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 9.

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 furnace temperature rise. Measure the temperature of both the return air and the heated air in the ducts, about 6 ft (1.83 m) from the furnace where they 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.

High and low speed cooling and heat pump CFM

Table 23: High and low speed cooling and heat pump CFM, 60A12 and 80B12

60A12		80B12		Settings	
High Cool	Low Cool	High Cool	Low Cool	Cool	Adj
1200	775	1200	800	A	B
1100	725	1100	725	A	A
1000	625	1000	650	A	C
925	600	925	600	B	B
850	550	850	550	B	A
775	475	775	500	B	C
700	425	725	475	C	B
600	400	650	425	C	A
550	350	575	375	C	C
500	325	500	325	D	B
450	300	450	300	D	A
400	275	400	275	D	C

Table 24: High and low speed cooling and heat pump CFM, 80C16 and 100C16

80C16		100C16		Settings	
High Cool	Low Cool	High Cool	Low Cool	Cool	Adj
1625	1075	1650	1100	A	B
1575	1025	1575	1025	B	B
1500	975	1525	975	A	A
1425	925	1425	925	B	A
1350	875	1375	900	A	C
1275	825	1300	850	C	B
1300	825	1275	825	B	C
1150	750	1200	750	C	A
1025	650	1050	675	C	C
875	550	875	575	D	B
800	500	800	500	D	A
725	450	725	450	D	C

Table 25: High and low speed cooling and heat pump CFM, 100C20 and 120C20

100C20		120C20		Settings	
High Cool	Low Cool	High Cool	Low Cool	Cool	Adj
2000	1300	1975	1300	A	B
1825	1175	1825	1175	A	A
1750	1150	1750	1125	B	B
1650	1050	1650	1050	A	C
1600	1025	1600	1025	B	A
1450	925	1450	925	B	C
1275	800	1275	800	C	B
1150	725	1150	725	C	A
1025	650	1025	650	C	C
975	600	1000	625	D	B
875	550	900	575	D	A
775	500	800	500	D	C

High and low heat CFM

Table 26: High and low heat CFM

060A12		080B12		080C16		Settings	
High heat	**Low heat**	**High heat**	**Low heat**	**High heat**	**Low heat**	**Heat**	**Adj**
950	725	1225	1025	1300	1075	A	Any
1025	775	1375	1150	1450	1175	B	Any
825	625	1100	900	1075	875	C	Any
700	525	975	800	1000	825	D	Any
100C16		**100C20**		**120C20**		**Settings**	
High heat	**Low heat**	**High heat**	**Low heat**	**High heat**	**Low heat**	**Heat**	**Adj**
1600	1350	1600	1300	1975	1600	A	Any
1750	1475	1775	1450	2200	1800	B	Any
1400	1175	1450	1825	1825	1500	C	Any
1225	1025	1300	1625	1625	1350	D	Any

Default blower speeds

Table 27: Default blower speeds

Model number	Default setting for heat speed	Default setting for cool speed	Default setting for continuous fan speed
060A12	D	A	A
080B12	D	A	A
080C16	D	A	A
100C16	D	A	A
100C20	D	A	A
120C20	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 furnace has the following safety controls:

- **Control circuit fuse**: A 3-amp fuse is provided on the control circuit board to protect the 24 V transformer from overload caused by control circuit wiring errors. This is an ATO 3, automotive type fuse and is located on the control board.
- **Blower door safety switch**: 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 this unit is dependent upon 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 furnace is supplied with pressure switches, which monitor the flow through the combustion air/vent piping system. These switches deenergize the gas valve if any of the following conditions are present:
  - Blockage of vent piping or terminal
  - Failure of combustion air blower motor
- **Limit control**: There is a high temperature limit control located on the furnace vestibule panel near the gas valve. This is an automatic reset control that provides 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

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

Hot surface ignition system

The furnace 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 furnace:

- **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 High and low speed cooling and heat pump CFM and Table 26 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 furnace 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 control board instead if required for the specific installation. See Configuring the blower delay profile. See Table 19 for an overview of how each blower delay profile operates.
- **Continuous blower operation**: You can operate the furnace in continuous fan mode by setting the fan switch on the wall thermostat to the on position. The furnace blower runs in accordance with the selected fan speed (Fsd) setting (low speed, medium speed, or high speed) on the control board. See Configuring continuous fan airflow settings. See Table 17 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 control board. See Configuring cooling airflow settings. The fan off setting is fixed at 60 s for SEER enhancement. The control board can accommodate two-stage cooling. When a two-stage cool thermostat is connected to the Y1 and Y2 terminals on the board, the blower operates on LOW COOL speed when Y1 is energized and on HI COOL speed when Y1 and Y2 are energized.
- **Intermittent blower heating**: On cooling/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 control board. See Configuring heating airflow settings.

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 UPG 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 furnace and the ignition control module is on.
2. Check that the manual shut-off valves in the gas line to the furnace 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 furnace has built-in, self-diagnostic capability. The control board continuously monitors its own operation and the operation of the system. The status LED on the 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 34 illustrates how the 7-segment LED displays show calls for heating, cooling, and heat pump operation.

Figure 34: Viewing active calls on the 7-segment LED displays

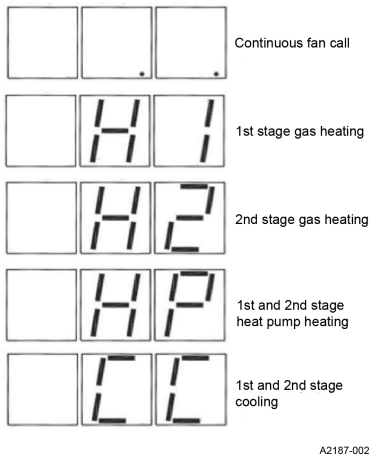


Table 28 provides an overview of the status LED codes and how active calls and faults display on the 7-segment LED displays.

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 28: 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	—
Slow amber flash	—	Normal operation with call for heat	—
Solid amber	..	G call for continuous fan	—
-	H1	Call for first-stage heat	—
-	H2	Call for second-stage heat	—
-	HP	Call for heat pump operation	—
-	CC	Call for cooling	—
Rapid green	FF	Indicates 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 control board or possible control board failure.	If the LED light does not flash at all, check for power to the board and check for an open fuse on the board. If the board is properly powered and the fuse is closed, the control board may need to be replaced.
Steady on any color	—	Possible control failure	Remove and check the control voltage fuse. An open fuse results in a steady on red LED. Turn power to the furnace off and back on. If the fault code returns, the control board must be replaced. The control board is not field repairable.
Continuous amber flash	—	Flame sense current is below 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.

Table 28: Understanding status LED codes and the 7-segment LED displays

Status LED	7-segment LED displays	Condition	Solution
Alternating red and amber flashes	rL	Indicates that a refrigerant leak has been detected near the furnace	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.
2 red flashes	02	Indicates that the pressure switch is closed when it should be open. The control confirms that the pressure switch contacts are open at the beginning of each heat cycle and does not let the ignition sequence continue if the pressure switch contacts are closed when they 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 control turns on the supply air blower and inducer.	Check for a dirty filter, improperly sized duct system, incorrect blower speed setting, incorrect firing rate, loose limit switch wiring or faulty blower motor. If the limit switch has not closed within 5 min, the control operates as if the blower is not functioning. The control starts a hard lockout and the status LED emits 11 red flashes. If, after 15 min, the main limit still has not closed, the control 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.

Table 28: 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 burner problem. The control enters a hard lockout and power must be cycled off and on to reset the control after the problem is corrected.
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 furnace locks out for 1 h and then restarts.
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 furnace locks out for 1 h and then restarts.
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 furnace locks out for 1 h and then restarts.
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 furnace and branch. Check furnace grounding. Check that flame probe is not shorted to chassis. The furnace does not start the ignition sequence until this problem is corrected.
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

Table 28: Understanding status LED codes and the 7-segment LED displays

Status LED	7-segment LED displays	Condition	Solution
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 control enters a hard lockout and power has to be cycled off and on to reset the control 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 control continues to energize any relays that are already energized, but does not energize any additional relays until the voltage level increases.	Verify that the furnace 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 control immediately de-energizes the relay outputs and does not energize any relays until the voltage level increases above approximately 20 VAC.	Verify that the furnace is receiving the proper line voltage. Check the transformer for correct low voltage output.
Rapid red flashes	FUS	Indicates that the fuse on the control has opened	Replace the fuse.
4 amber flashes	44	The control is receiving a Y signal from the thermostat without a G signal. The furnace operates normally in both heating and cooling, but this status code is displayed to alert the user that there is a wiring problem.	Verify that the G wire from the thermostat is connected properly.

Table 28: Understanding status LED codes and the 7-segment LED displays

Status LED	7-segment LED displays	Condition	Solution
Soft lockout	—	The control includes a soft lockout that resets automatically after 1 h. This provides protection to an unoccupied structure if a temporary condition exists causing a furnace malfunction. An example of this is a temporary interruption in gas supply that prevents the furnace from lighting. The control keeps trying to light each hour and resumes normal operation if the gas supply is restored.	—
Hard lockout	—	Some fault conditions result in a hard lockout, which requires power to the control to be turned off and then back on to reset the control. The control does not automatically restart.	—

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)

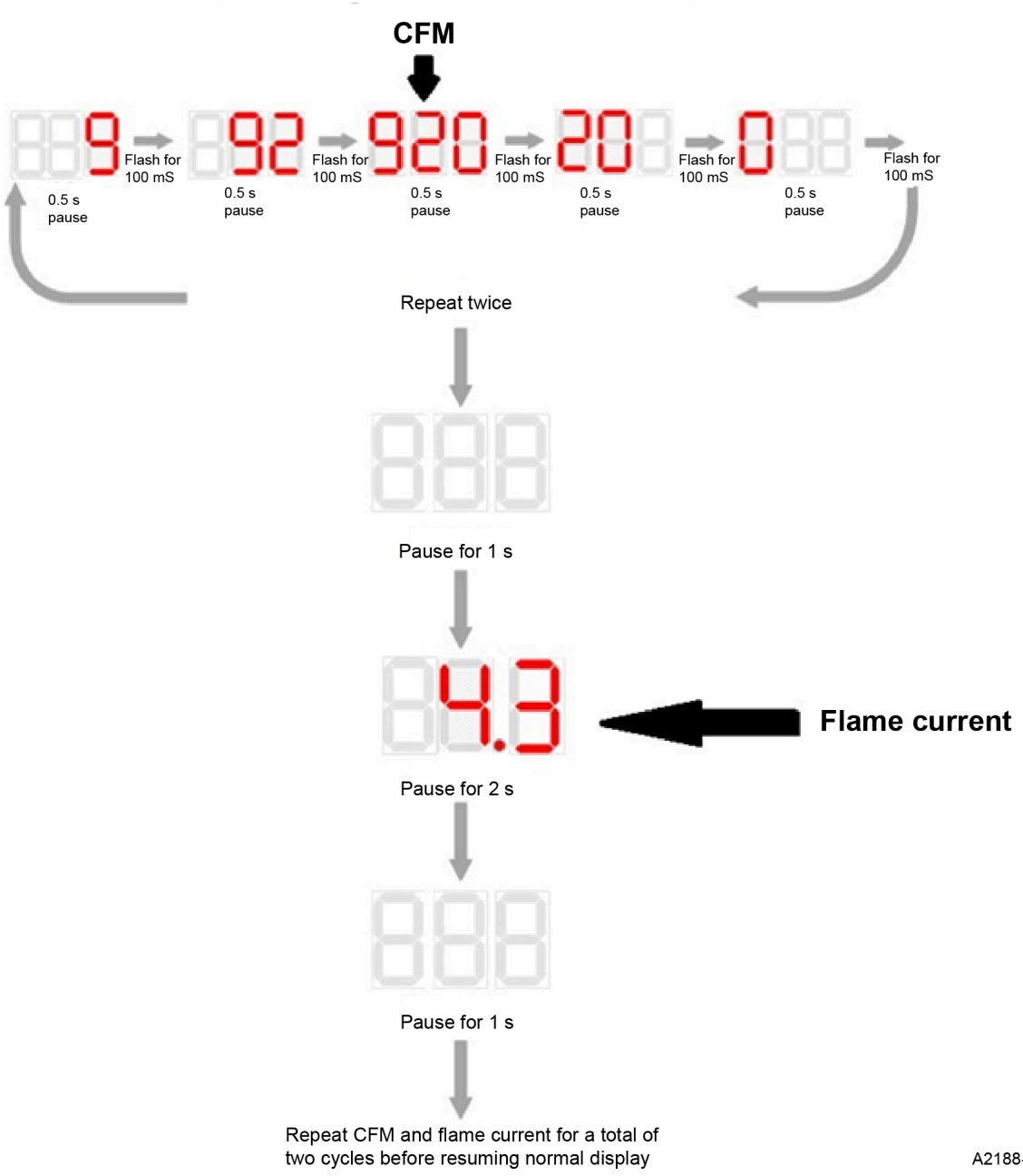
Viewing CFM and flame current during active calls

You can view the CFM of the circulating blower and the flame current on the 7-segment LED displays on the 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 35.

Figure 35: 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 control board indicate active faults. See Using unit control board diagnostics and Table 28. The furnace 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 furnace 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.

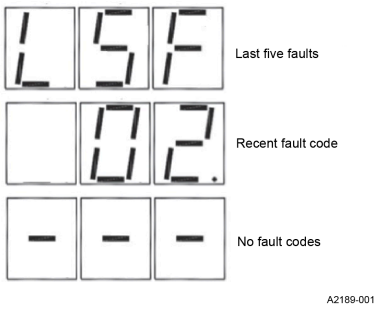
Important: This feature must be used only by a qualified service technician.

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 36.

   Note: If there are no fault codes, the 7-segment LED displays show **---**. See Figure 36.

Figure 36: 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 control board is programmed at the factory with the correct model ID for the specific BTU rating of the furnace. The model ID identifies the motor horsepower and airflow configuration of the furnace. Do not change the model ID unless the model ID programmed in the control board has been changed to an incorrect model or you are replacing the 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 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 22, then navigate the model ID options. When the correct model ID is displayed, press **Select**.

Sourcing replacement parts

Table 29: Replacement parts list

Part type	Description
Motor	Motor, direct drive blower
	Blower, combustion
Electrical	Switch, limit
	Control, furnace
	Igniter
	Sensor, flame
	Switch, pressure
	Switch, door
	Transformer
	Valve, gas
	Control, temperature
Air moving	Housing, blower
	Housing, blower with wheel
	Wheel, blower
Fabricated parts	Baffle, flue
	Burner, main gas
	Bracket, igniter
	Shelf, blower
	Heat exchanger, assembly
	Manifold, gas
	Pan, bottom
	Panel, top
	Panel, door (2 required)
	Vent pan, combustion (with gasket)
	Panel, blockoff
Miscellaneous	Orifice, burner (natural #45)
	Sight glass, oval (2 required)
	Gasket, foam (door) (1.5 ft required)
	Gasket, intake pan
	Plug, vent hole
	Bracket, door
	Wiring harness
	Ferrule (3 required)
	Grommet (3 required)
	Motor mount
	Tubing, silicon
	Diagram, wiring
	Knob, quarter turn (4 required)

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:

BHC Group Heating & Cooling

Customer Relations

5005 York Drive

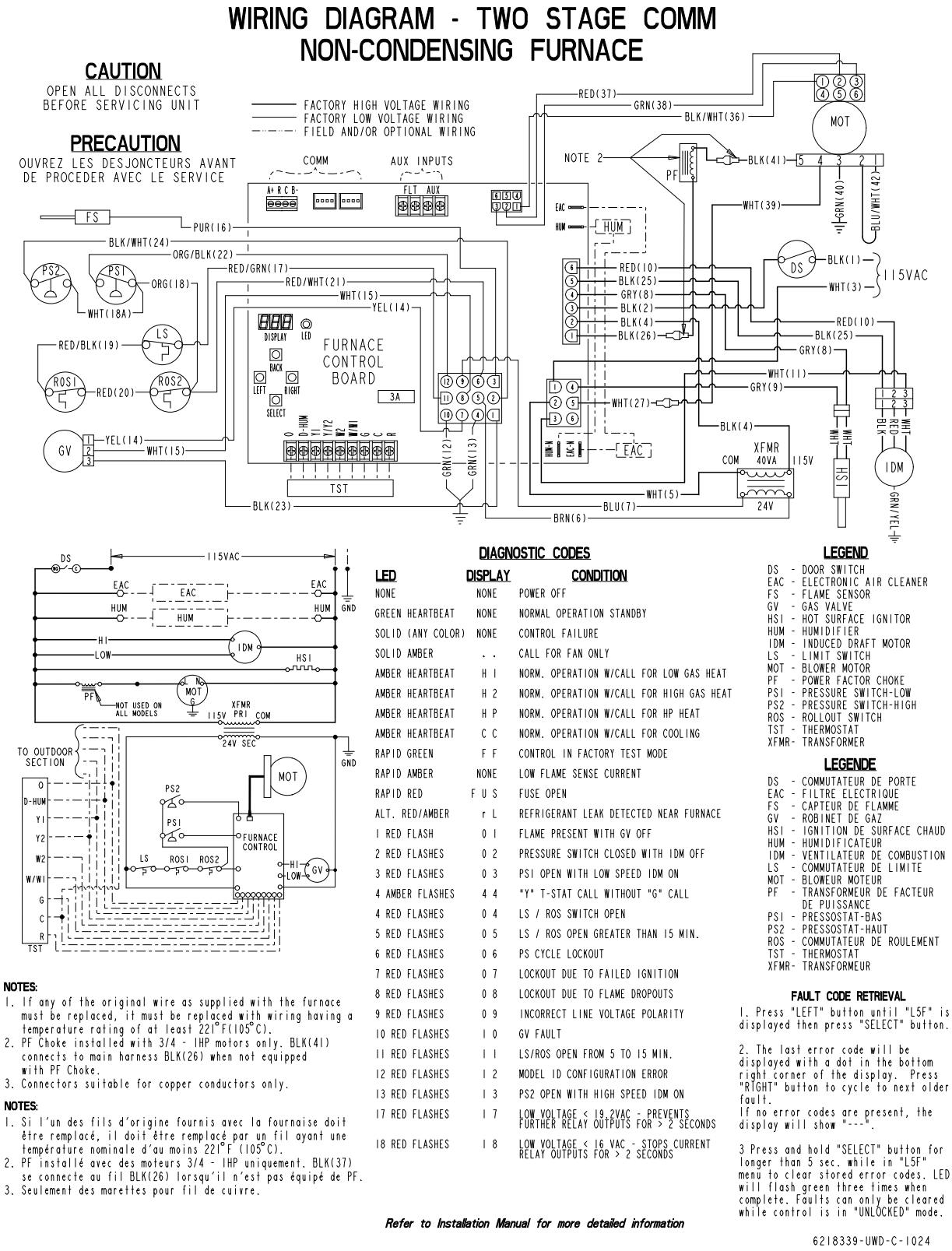
Normal, OK 73069

Third-party trademarks

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

Wiring diagram

Figure 37: Wiring diagram



Start-up sheet

33 in. non-condensing two stage gas furnace start-up sheet

Correct 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, and 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

Venting: B vent

☐ Vertical termination Vent pipe size | Number of 90° ells | Number of 45° ells | Total height

Connector size | Connector length

☐ Horizontal term (with external power vent) Vent pipe size | Number of 90° ells | Number of 45° ells

Venting: Lined masonry chimney

☐ B vent connector ☐ Single wall connector Connector size | Connector length | Chimney height

Number of 90° ells | Number of 45° ells

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

Other appliances in same common vent:

Water heater	☐ BTUH input		Fan assisted? ◯ Y ◯ N
Furnace	☐ BTUH input		Fan assisted? ◯ Y ◯ N
Other	☐ BTUH input		Fan assisted? ◯ Y ◯ N

Electrical: Line voltage

☐ Polarity is correct (black is L1 (hot), white is N (neutral) ☐ Ground wire is connected Line voltage to furnace (AC)

Electrical: Low voltage

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

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

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