INSTALLATION MANUAL

Modulating ECM Residential Gas Furnace

Models:

YPLC, CPLC, LPLC, TPLC Series

(80% AFUE Multi-position / Low NOx)

10 YEAR COMPLETE ASSURANCE LIMITED WARRANTY PLEDGE

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

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

ENERGY STAR

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

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

Section I: Safety

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

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

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

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

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

⚠ WARNING

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

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

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

⚠ WARNING

Unauthorized modifications to Johnson Controls products are prohibited as they:

- may create hazards which could result in death, serious injury or equipment damage.
- will void product warranties.
- may invalidate product regulatory certifications.
- may violate OSHA standards.

⚠ WARNING

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

Specific safety rules and precautions

1. Only Natural Gas or Propane (LP) gas are approved for use with this furnace.
2. Install this furnace only in a location and position as specified in these instructions.
3. A gas-fired furnace for installation in a residential garage must be installed as specified in these instructions.
4. Provide adequate combustion and ventilation air to the furnace space as specified in these instructions.
5. Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in Section VII of these instructions.
6. Test for gas leaks as specified in these instructions.
7. Always install the furnace to operate within the furnace's intended temperature rise range. Only connect the furnace to a duct system which has an external static pressure within the allowable range, as specified on the furnace rating plate.
8. When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by ducts sealed to the furnace casing and terminating outside the space containing the furnace.
9. It is permitted to use the furnace for heating of buildings or structures under construction where the application and use must comply with all manufacturer's installation instructions including:
   - 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 rating plate marking
   - Means for providing outdoor air required for combustion
   - Return air temperature maintained between 55ºF (13ºC) and 80ºF (27ºC)
   - The air filter must be replaced upon substantial completion of the construction process
   - Clean furnace, ductwork and components upon substantial completion of the construction process, and verify furnace-operating conditions including ignition, input rate, temperature rise and venting, according to the manufacturer's instructions
10. When installed in a Non-HUD-Approved Modular Home or building constructed on-site, combustion air shall not be supplied from occupied spaces.
11. 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.
12. When moving or handling this furnace prior to installation, always leave the doors on the furnace to provide support and to prevent damage or warping of the cabinet. When lifting the furnace by the cabinet, support the ends of the furnace rather than lifting by the cabinet flanges at the return air openings found at the bottom, the sides, or the supply air opening.
13. When lifting the furnace, it is acceptable to use the primary heat exchanger tubes as a lifting point provided that the tubes are lifted at the front of the heat exchangers where attached to the vestibule panel. Do not use the top return bend of the heat exchangers as lifting points as the tubes may shift out of position or their location brackets or baffles may move.

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

Safety requirements

⚠ CAUTION

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

- Refer to the unit rating plate for the furnace model number, and then see the *Dimensions* section for return air plenum dimensions in Figure 8. The plenum must be installed according to the instructions.
- Provide clearances from combustible materials as listed in the *Clearances to Combustibles* table.
- Provide clearances for servicing ensuring that service access is allowed for both the burners and the 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 are not to be installed directly on carpeting, tile, or other combustible material other than wood flooring.
- Check the rating plate and power supply to be sure that the electrical characteristics match. All models use nominal 115 VAC, single-phase, 60 Hz power supply. **Do not connect this appliance to a 50 Hz power supply or a voltage above 130 V.**
- The furnace must be installed to ensure that 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.

Combustion air quality (list of contaminants)

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
- Chemical exposure

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

Codes and standards

Follow all national, 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:

Step 1 - Safety

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

Step 2 - General installation

- US: Current edition of the NFGC and NFPA 90B. For copies, contact the
  National Fire Protection Association Inc.
  Batterymarch Park
  Quincy, MA 02269
  or for only the NFGC, contact the
  American Gas Association,
  400 N. Capital, N.W.
  Washington DC 20001
  or www.NFPA.org
- CANADA: NSCNGPIC. For a copy contact:
  Standard Sales, CSA International
  178 Rexdale Boulevard
  Etobicoke, (Toronto) Ontario Canada M9W 1RS

Step 3 -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

Step 4 -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.

Step 5 -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

Step 6 -Gas piping and gas pipe pressure testing

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

Step 7 -Electrical connections

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

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

Inspection

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

Furnace location and clearances

The furnace must be located using the following guidelines:

1. Where a minimum amount of air intake, vent piping, and elbows are required.
2. As centralized with the air distribution as possible.
3. Where adequate combustion air will be available.
4. Where it will not interfere with proper air circulation in the confined space.

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 7 ft above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. **Installation of carbon monoxide detectors.** At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors
   a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
   b. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty days to comply with the above requirements; provided, however, that during said thirty 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 8 ft 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 1/2 in. in size, "**GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS"**.
4. **Inspection.** The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

Inspection

On receiving a unit, inspect the unit for possible damage during transit. If damage is evident, note the extent of the damage on the carrier's freight bill. Make a separate request for inspection by the carrier's agent in writing. Before installation, check the unit for screws or bolts that may have loosened in transit. There are no shipping or spacer brackets that need to be removed from the interior of this unit.

Furnace location and clearances

The furnace must be located using the following guidelines:

- Where a minimum amount of air intake/vent piping and elbows will be required.
- As centralized with the air distribution as possible.
- Where adequate combustion air will be available.
- Where it will not interfere with proper air circulation in the confined space.

Installation in freezing temperatures:

1. Furnace shall be installed in an area where ventilation facilities provide for safe limits of ambient temperature under normal operating conditions.
2. 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.

⚠ WARNING

Improper installation in a room with an ambient temperature below 32ºF (0.0°C) such as a garage or attic, could create a hazard, resulting in damage, injury, or death.

Clearances for access/service:

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

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

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

Installation in a residential garage:

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

Table 1: Unit clearances to combustibles - all surfaces identified with the unit in an upflow configuration

Application	Top	Front	Rear	Left side	Right side	Flue	Floor/ bottom	Closet	Alcove	Attic	Line contact
	in. (cm)	in. (cm)	in. (cm)	in. (cm)	in. (cm)	in. (cm)	in. (cm)				
Upflow B-vent	1 (2.54)	1 (2.54)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.54)	Combustible	Yes	Yes	Yes	No
Downflow B-vent	1 (2.54)	1 (2.54)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.54)	1 (2.54)[1]	Yes	Yes	Yes	No
Horizontal B-vent	1 (2.54)	1 (2.54)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.54)	Combustible	No	Yes	Yes	Yes[2]

1. Special floor base or air conditioning coil required for use on combustible floor.
2. Line contact only permitted between lines formed by the intersection of the rear panel and side panel (top in horizontal position) of the furnace jacket and building joists, studs or framing.

Section II: Ductwork

Ductwork general information

The duct system's design and installation must:

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

⚠ CAUTION

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

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

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

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

Important: The minimum plenum height is 12 in. (30.5 cm). The furnace will not operate properly on a shorter plenum height. The minimum recommended rectangular duct height is 4 in (10 cm) attached to the plenum.

If a matching cooling coil is used, it may be placed directly on the furnace outlet and sealed to prevent leakage. If thermoplastic evaporator 'A' coil drain pans are to be installed in the upflow/horizontal configuration, then extra 2 in. minimum spacing may be needed to ensure against drain pan distortion.

⚠ WARNING

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

Refer to Table 5 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.

Duct flanges

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

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

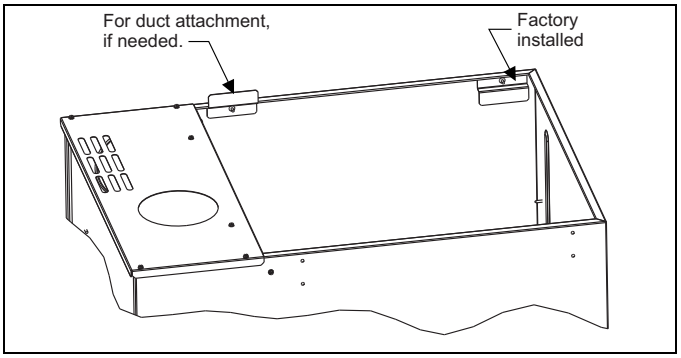


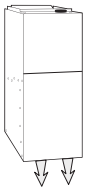
Figure 1: Duct attachment

Ductwork installation and supply plenum connection - upflow/horizontal



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

Floor base and ductwork installation - downflow



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

Downflow air conditioning coil cabinet

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

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

Downflow duct connectors

All downflow installations must use a suitable duct connector approved by the furnace manufacturer for use with this furnace. The duct connectors are designed to be connected to the rectangular duct under the floor and sealed. Refer to the instructions supplied with the duct connector for proper installation.

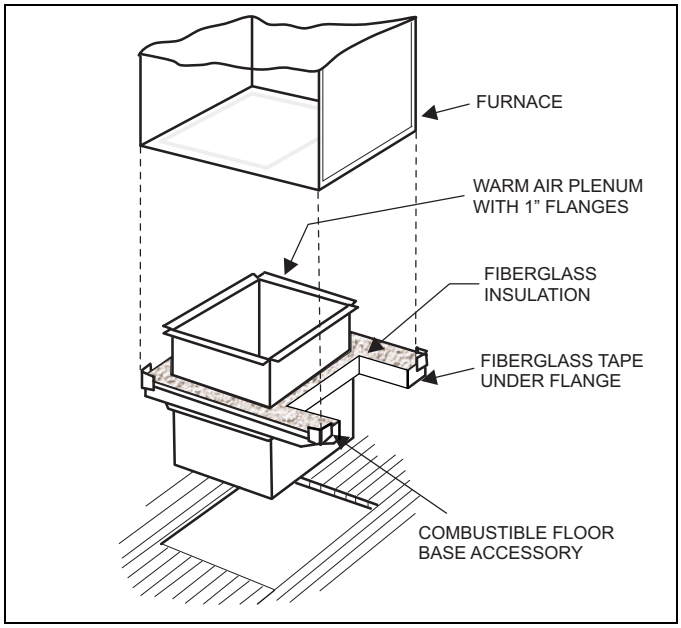


Figure 2: Combustible floor base accessory

Residential and modular home upflow return plenum connection

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

Bottom return and attic installations

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

Remove the internal bottom panel for this application.

Ensure attic installations meet all minimum clearances to combustibles and have floor support with the required clearance for service accessibility.

Horizontal application

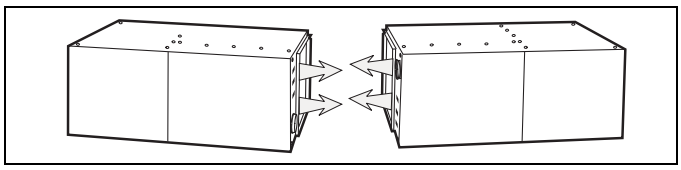


Figure 3: Typical horizontal application

Important: It is possible to install this furnace in a horizontal position on either side as shown above. **Do not install this furance on its back**.

Attic installation

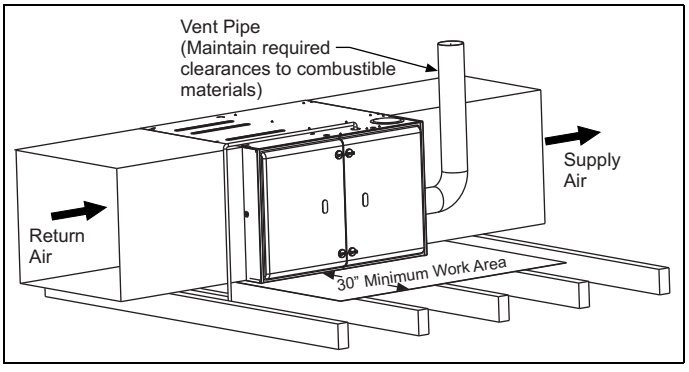


Figure 4: Typical attic installation

This appliance is certified for line contact when the furnace is installed in the horizontal left or right position. The line contact is only permissible between lines that are formed by the intersection of the top and two sides of the furnace and the building joists, studs or framing. This line may be in contact with combustible material. Refer to Figure 4.

⚠ 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 the doors must remain on the furnace when moving or lifting.

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

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

Suspended furnace / crawl space installation

The furnace can be hung from floor joists or installed on suitable blocks or pads. Blocks or pad installations shall provide adequate height to ensure that the unit will not be subject to water damage.

Units may also be suspended from rafters or floor joists using rods, pipe angle supports or straps. In all cases, the furnace should be supported with rods, straps, or angle supports at three locations to properly support the furnace. Place one support at the supply end of the furnace, one support located approximately in the center of the furnace near the blower shelf, and the third support should be at the return end of the furnace. Maintain a 6 in. minimum clearance between the front of the furnace and the support rods or straps.

All six suspension points must be level to ensure proper and quiet furnace operation. When suspending the furnace, use a secure platform constructed of plywood or other building materials secured to the floor or ceiling joists. See Figure 5 for details and additional information.

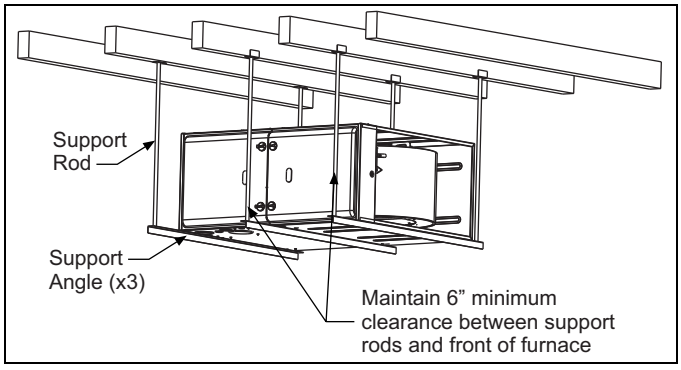


Figure 5: Suspended furnace / crawl space installation

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

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

It is acceptable to use the primary heat exchanger tubes as a lifting point provided that the tubes are lifted at the front of the heat exchangers where attached to the vestibule panel. Do not use the top return

bend of the heat exchangers as lifting points as the tubes may shift out of position or their location brackets/baffles.

Downflow application

To apply the furnace in a downflow position, it is necessary to rotate the vent blower 90° left or right so that the vent pipe passes through the side of the furnace casing rather than the end. See Figure 6.

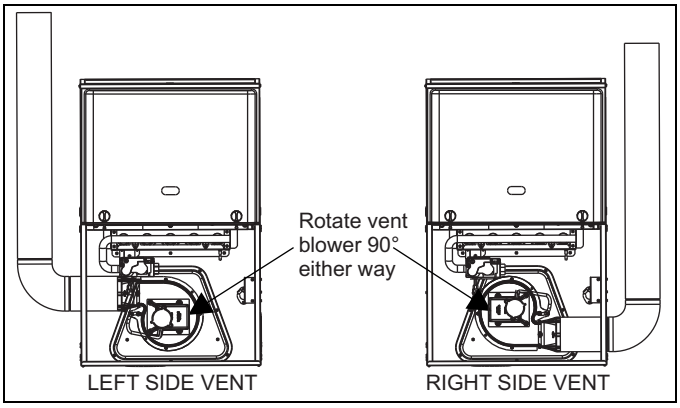


Figure 6: Downflow venting

Coil installation

Important: On all installations without a coil, a removable access panel is recommended in the outlet duct such that smoke or reflected light would be observable inside the casing to indicate the presence of leaks in the heat exchanger. This access cover shall be attached in such a manner as to prevent leaks.

The indoor coil must be mounted on the supply side of the furnace as shown in Figure 7. Refer to the instructions provided in each indoor coil's *Installation Manual*.

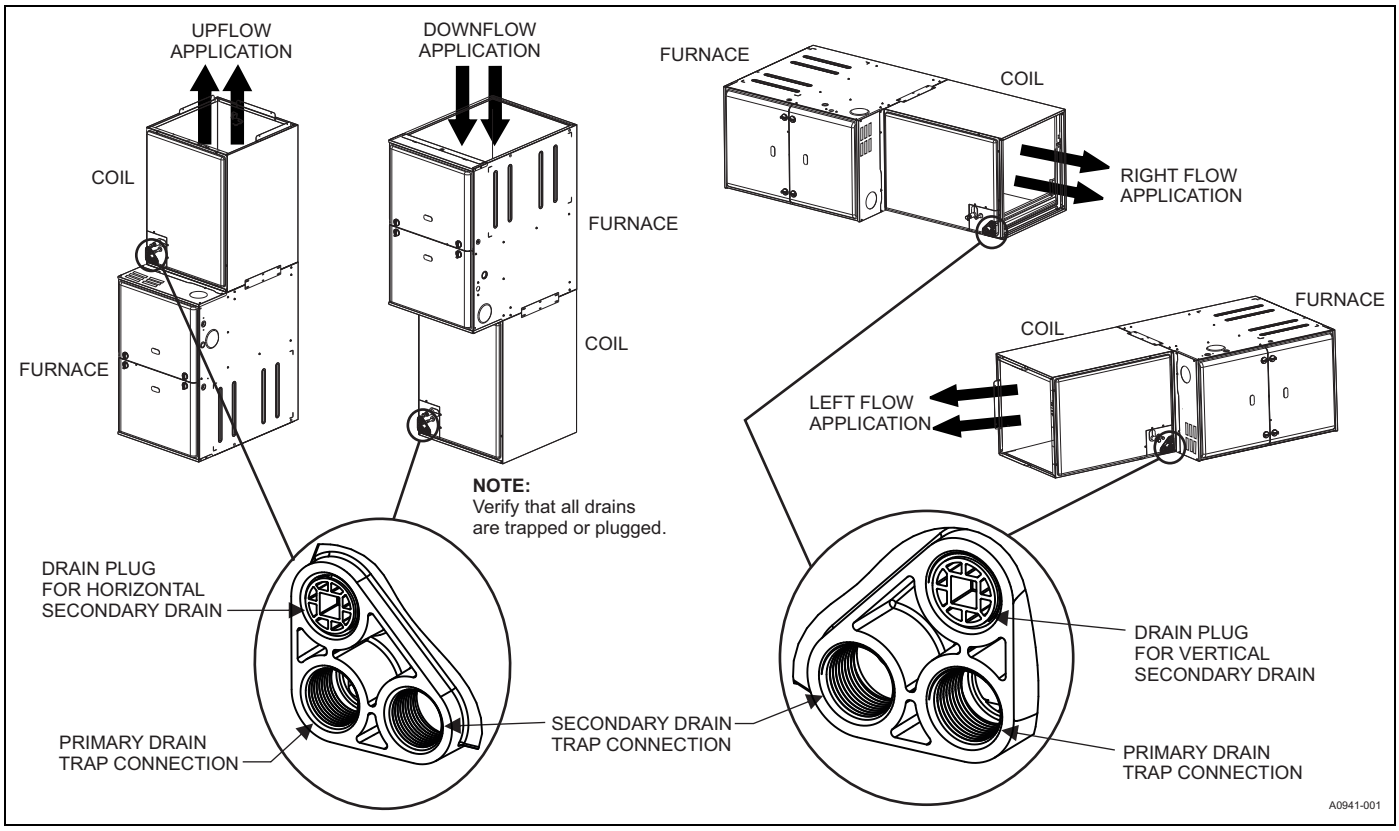


Figure 7: Furnace and coil attachment

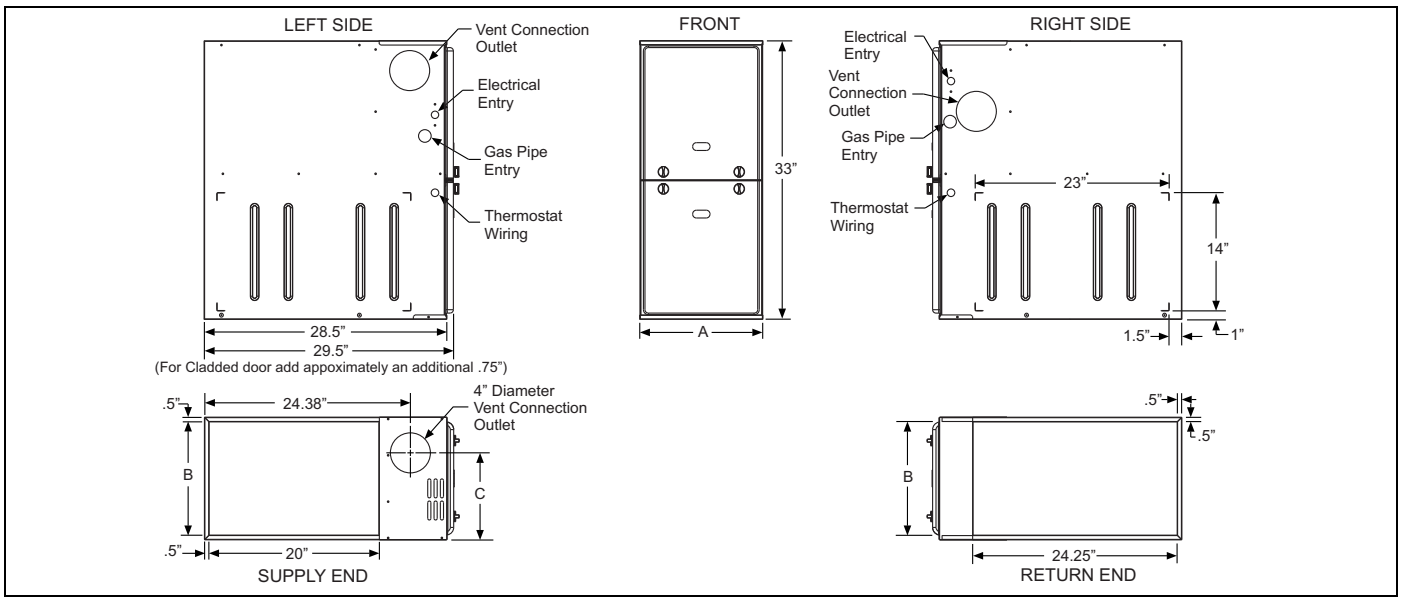


Figure 8: Dimensions

Table 2: Cabinet and duct dimensions

Btu/h (kW) input	Nominal CFM (m^3/min)	Cabinet size	Cabinet dimensions						Approximate operating weights
			A (in.)	A (cm)	B (in.)	B (cm)	C (in.)	C (cm)	lbs
60 (17.6)	1200 (34.0)	A	14.5	36.8	13.5	34.3	10.3	26.2	94
80 (23.4)	1200 (34.0)	B	17.5	44.4	16.5	41.9	11.8	29.9	103
80 (23.4)	1600 (45.3)	C	21	53.3	20	50.8	13.6	34.5	114
100 (29.3)	1600 (45.3)	C	21	53.3	20	50.8	13.6	34.5	118
100 (29.3)	2000 (56.6)	C	21	53.3	20	50.8	13.6	34.5	122
120 (35.1)	2000 (56.6)	C	21	53.3	20	50.8	15.8	40.1	129

Section III: Filters

Filter Installation

⚠ CAUTION

All installations must have a filter installed. All filters and mounting provision must be field-supplied. Unauthorized modifications to Johnson Controls products are prohibited as they may create hazards which could result in equipment damage.

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

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

Table 3: Recommended 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 filters) 16 x 25	20 x 25

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

Side return

Locate the L shaped corner locators. These indicate the size of the cutout to be made in the furnace side panel. See Figure 9.

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

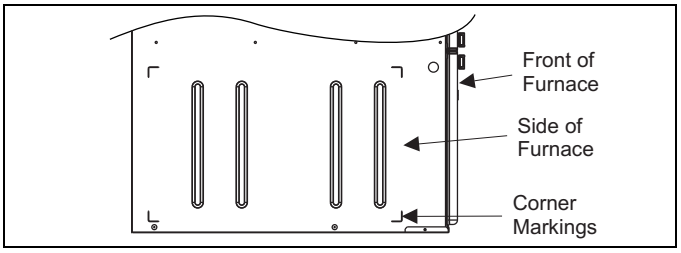


Figure 9: Side return cutout markings

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

Horizontal filters

⚠ CAUTION

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

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

Downflow filters

⚠ CAUTION

In downflow furnace arrangement, the filter must be located a minimum of 36 in. from the return air inlet of furnace.

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

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

Section IV: Gas piping

Gas safety

⚠ DANGER

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

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

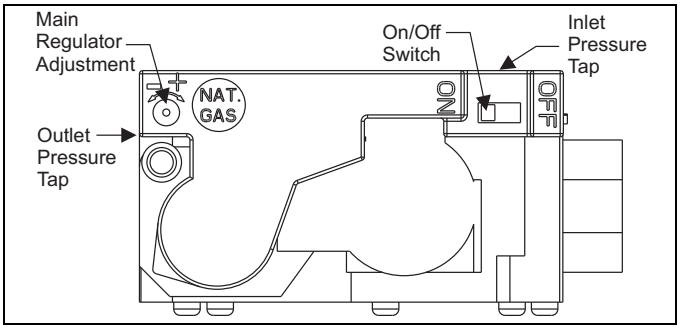


Figure 10: Gas valve

Gas piping installation

Correctly sized wrought iron, approved flexible, or steel piping must be used 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.

Some utility companies or local codes require pipe sizes larger than the minimum sizes listed in these instructions and in the codes. The furnace rating plate and the instructions in this section specify the type of gas approved for this furnace - only use those approved gases. The installation of a drip leg and ground union is required. See Figure 11.

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

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

⚠ CAUTION

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

⚠ CAUTION

Burner ignition may not be satisfactory on first startup due to residual air in the gas line or until gas manifold pressure is adjusted. The ignition control makes three attempts to light before locking out. After three trials for ignition, if the appliance does not operate, follow the instructions Turning off the appliance in the User's Information Manual and call your gas supplier to verify the quality and/or consistency of the gas supply. If the gas supply has been verified and/or other gas appliances are operating properly, and the appliance still does not ignite, call service to properly troubleshoot the unit.

Gas piping may be connected from either side of the furnace using any of the gas pipe entry knockouts on both sides of the furnace. See Figures 8 and 11.

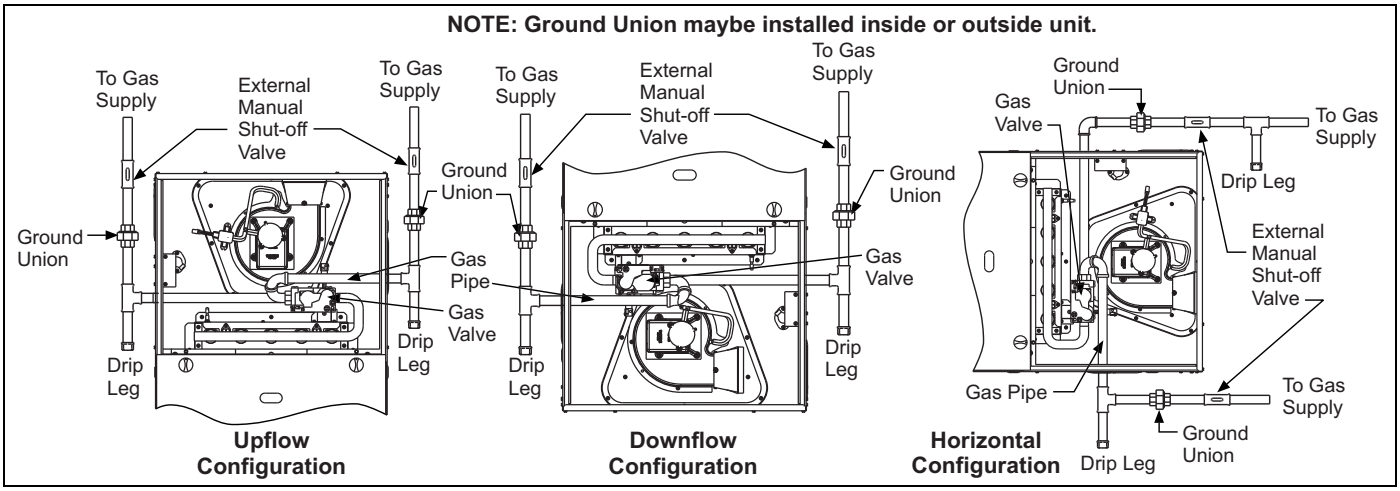


Figure 11: Gas piping

Gas conversion for propane (LP)

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

⚠ WARNING

LoNOx furnaces requiring propane (LP) gas must have the LoNOx screens removed prior to installation and operation. See propane instructions.

⚠ WARNING

Examine the burner flames to make sure they are in good adjustment. Look to a pure blue flame with a light blue cone at its center that burns full, steady and straight. If yellow or orange, or a partial, diverted, or unsteady flame is detected, then turn off gas valves and clean any debris from nozzles and pilot light. If condition still exists, then check airflow, venting, gas pressure, etc. If condition still exists, contact technical service for further instructions.

High altitude natural gas orifice conversion

The National Fuel Gas Code requires that gas appliances installed above 2,000 ft elevation have their inputs de-rated by 4% per 1,000 ft above sea level. The modulating furnaces automatically de-rate for altitude by measuring the inducer blower pressure and using that to determine if there is adequate air to support good combustion. If there is not enough combustion air to properly support 100% of the furnace nameplate input rate, the control will reduce the input to the point that there will be good combustion.

The factory gas orifice sizes are based on a gas heating value of 1030 Btu/Cu ft, so if your gas value is significantly higher or lower than that, it may be necessary to change to smaller or larger gas orifices.

The chart below shows recommended gas orifice sizes to use at various altitudes and at various de-ration levels. To use the chart, follow these instructions:

1. Clock the gas meter and calculate the actual input rate using your local gas heating value. See the *Calculating the furnace input (natural gas)* in this manual.
2. Divide that input rate by the input rate shown on the furnace rating plate to get the actual de-ration percent.
3. Read down the Actual rate column to find the closest number to your actual de-ration percent.
4. Read across that row to the column for the elevation at your location. The number listed there is the orifice size that is proper for your unit.

Example – You have a 100,000 Btu/h furnace installed at an elevation of 6,000 ft. You clock the gas meter and find that the furnace is actually fired at 64,000 Btu/h. Divide 64,000 by 100,000, which gives 0.64 (64%). The closest number to 64% in the left-hand Actual Rate column is 65. Read across that row to the column for 6,000 ft elevation, which shows #43. You should change from the factory #45 orifices to larger #43 orifices, which bring the input rate back up to approximately 76,000 Btu/h, which is what it should be for that furnace at 6,000 ft.

Table 4: High altitude orifices

Actual rate (percent of nameplate)	Elevation in ft above sea level						
	4,000	5,000	6,000	7,000	8,000	9,000	10,000
	84%	80%	76%	72%	68%	64%	60%
	Orifice drill size						
100	48	49	49	50	51	51	52
95	47	48	49	50	50	50	51
90	46	47	48	49	49	49	50
85	45	46	47	48	49	49	50
80	45	45	46	47	48	48	49
75	44	45	45	45	47	47	49
70	43	44	44	45	45	45	48
65	42	43	43	44	45	45	47
60	41	42	42	43	44	45	46
55	40	41	41	32	43	43	44
50	39	40	40	40	43	42	42

⚠ WARNING

PROPANE AND HIGH ALTITUDE CONVERSION KITS

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. 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.

High altitude conversions are required in order for the appliance to satisfactory meet those applications. 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 creates an extremely dangerous condition that results in premature heat exchanger failure, excessive sooting, high levels of carbon monoxide, personal injury, property damage, and potential for fire hazard and/or death.

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.

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

Section V: Electrical power

Electrical power connections

Field wiring to the unit must be grounded. Electric wires that are field installed shall conform to the temperature limitation for 63°F (35°C) rise wire when installed in accordance with instructions. See Table 5 for specific furnace electrical data.

⚠ CAUTION

Use copper conductors only.

Table 5: Ratings and physical / electrical data

Btu/h/ Cabinet/ CFM	Input maximum / minimum*		Output maximum / minimum*		Nominal airflow		Air temperature rise maximum input		Air temperature rise minimum input	
	MBH	kW	MBH	kW	CFM	m^3/min	°F	°C	°F	°C
60A12	60/30	17.6/8.8	47/24	13.8/7.0	1200	34.0	30-60	17-33	20-50	11-28
80B12	80/40	23.5/11.8	62/32	18.2/9.4	1200	34.0	40-70	22-39	20-50	11-28
80C16	80/40	23.5/11.8	62/32	18.2/9.4	1600	45.3	35-65	19-36	20-50	11-28
100C16	100/50	29.3/14.7	78/40	22.8/11.7	1600	45.3	35-65	19-36	20-50	11-28
100C20	100/50	29.3/14.7	78/40	22.8/11.7	2000	56.6	35-65	19-36	20-50	11-28
120C20	120/60	33.7/16.9	95/48	27.8/14.1	2000	56.6	45-75	25-42	25-55	13-31

Table 5: Ratings and physical / electrical data

Btu/h/ Cabinet/ CFM	Maximum outlet air temperature		Blower		Blower wheel size	AFUE %	Fuse or circuit breaker (A)	Total unit amps	Gas pipe connection, NPT
	°F	°C	HP	Amps	in.				
60A12	190	88	1/2	7.7	11 x 8	80.0	15	9.9	1/2 in.
80B12	190	88	1/2	7.7	11 x 8	80.0	15	9.9	1/2 in.
80C16	190	88	3/4	9.6	11 x 10	80.0	15	11.8	1/2 in.
100C16	190	88	3/4	9.6	11 x 10	80.0	15	11.8	1/2 in.
100C20	190	88	1	12.8	11 x 11	80.0	20	15.0	1/2 in.
120C20	190	88	1	12.8	11 x 11	80.0	20	15.0	1/2 in.

*If a chimney kit S1-1CK0605 is installed, minimum inputs and outputs are 65% of maximum, not 50%. See *Chimney kit* instructions and label for more details.
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.

Supply voltage connections

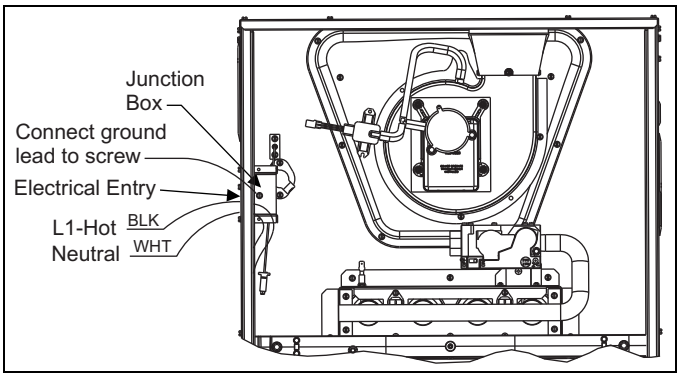


Figure 12: Electrical wiring

1. Provide a power supply separate from all other circuits. Install overcurrent protection and disconnect switch per local/national electrical codes. The switch should be close to the unit for convenience in servicing. With the disconnect or fused switch in the OFF position, check all wiring against the unit wiring label. See the *Wiring Diagram* section.
2. Remove the screws retaining the wiring box cover. Route the power wiring through the opening in the unit into the junction box with a conduit connector or other proper connection. In the junction box there will be two wires, a black wire, a white wire. Connect the power supply as shown on the unit-wiring label on the inside of the blower compartment door or see the *Wiring Diagram* section. The black furnace lead must be connected to the L1 (hot) wire from the power supply. The white furnace screw must be connected to neutral. Connect the power supply ground to the green screw (equipment ground) An alternate wiring method is to use a field provided 2 in. (5.1 cm) x 4 in. (10.2 cm) box and cover on the outside of the furnace. Route the furnace leads into the box using a protective bushing where the wires pass through the furnace panel. After making the wiring connections replace the wiring box cover and screws. See Figure 12.
3. The furnace's control system requires correct polarity of the power supply and a proper ground connection. See Figure 12.

Important: The power connection leads and wiring box may be relocated to the left 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.

Control wiring

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

The Communicating System consists of several intelligent communicating components including the Communicating Thermostat Control (touch-screen wall thermostat), modulating variable speed furnace, air conditioner (15 and 18 SEER premium air conditioners) or heat pump (13, 15 and 18 SEER premium heat pumps), which continually communicate with each other via a four-wire connection called the C-B bus. Commands, operating conditions, and other data are passed continually between components over the C-B bus. See Figure 14. The result is a new level of comfort, versatility, and simplicity.

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

This furnace may also be used along with the Communicating Thermostat Control and a non-communicating outdoor air conditioner through the addition of a communicating Outdoor Aux Control board to the outdoor unit. This system allows full communication between the furnace and thermostat and limited communication to the outdoor unit. See Figure 15.

This furnace may also be used along with the Communicating Thermostat Control and a non-communicating outdoor air conditioner using COMM between the furnace and thermostat and conventional 24 V wiring to the outdoor unit. This system allows full communication between the furnace and thermostat but no digital communication with the outdoor unit.

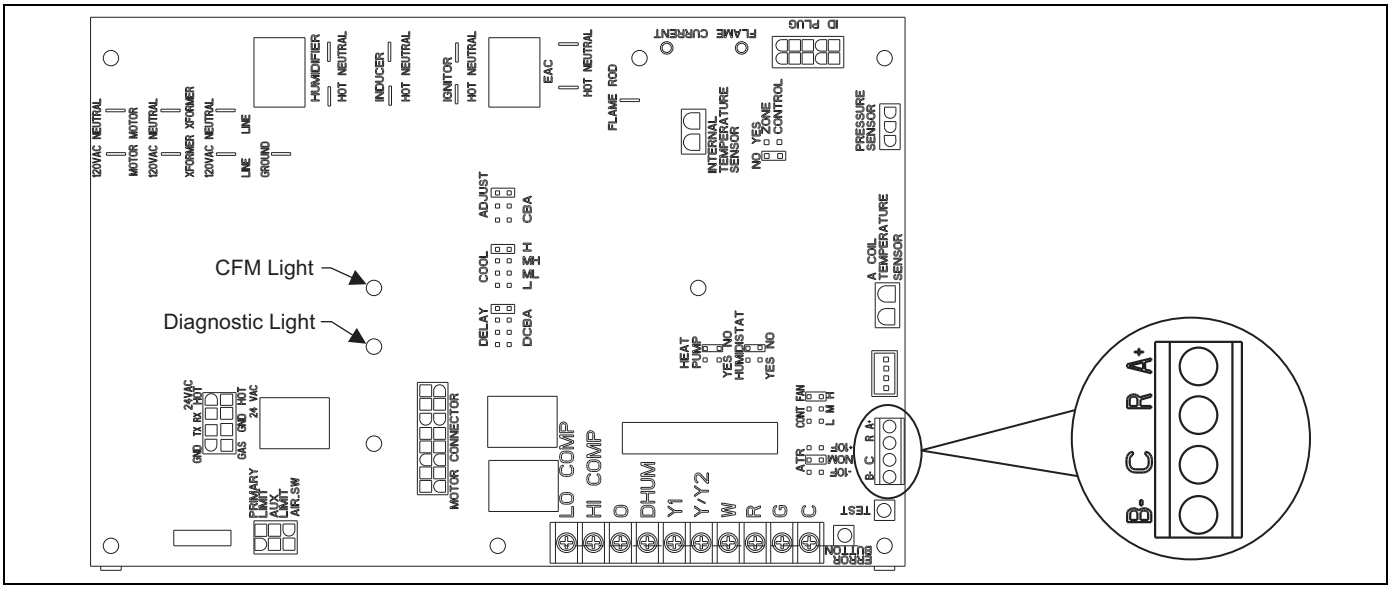


Figure 13: Furnace control board – communications connections

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

Use the wiring diagram below to connect the furnace control, Communicating Control (wall thermostat) and communicating outdoor unit. Be sure that all of the A terminals are connected together, all of the B terminals are connected together, all of the C terminals are connected together and all of the R terminals are connected together. See Figure 14. When using a fully communicating system, the large screw terminals (C, G, R, etc.) on the furnace control are not used. The four small screw terminals in the terminal block on the end of the furnace control should be used.

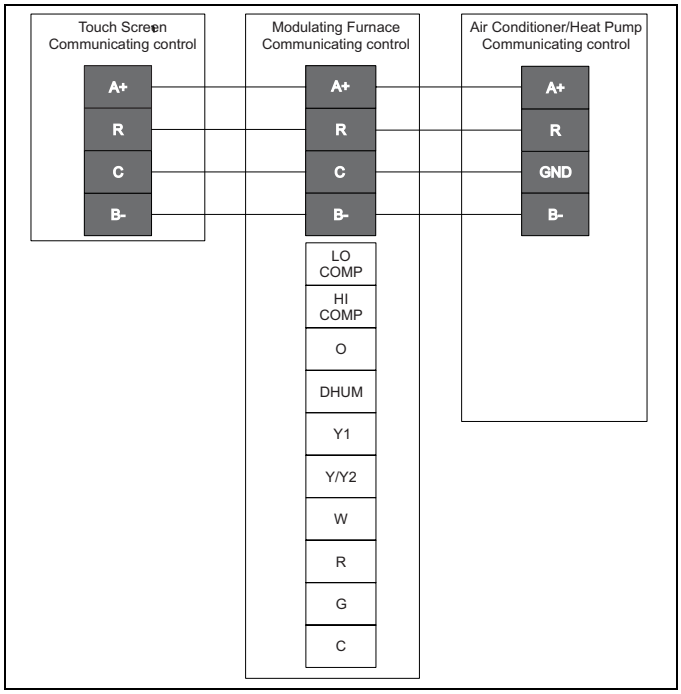


Figure 14: Modulating furnace with communicating AC or HP

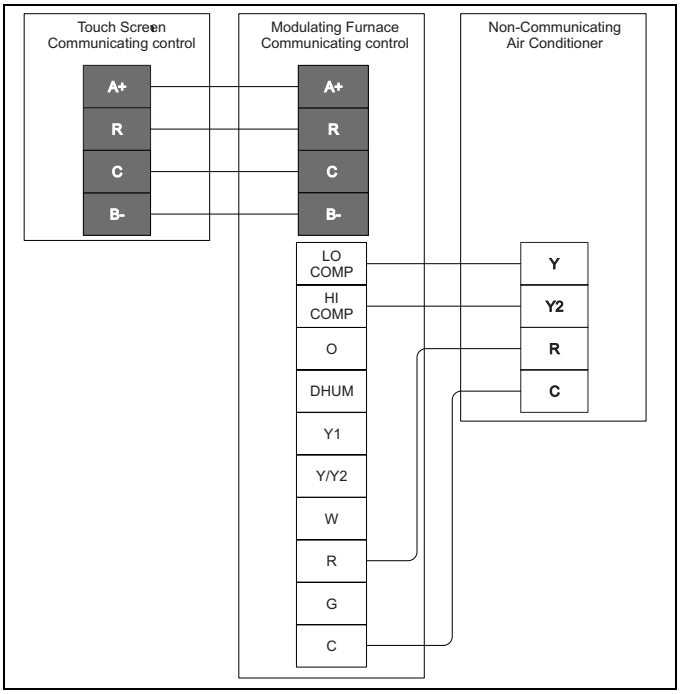


Figure 15: Modulating furnace with communicating thermostat and non-communicating AC

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

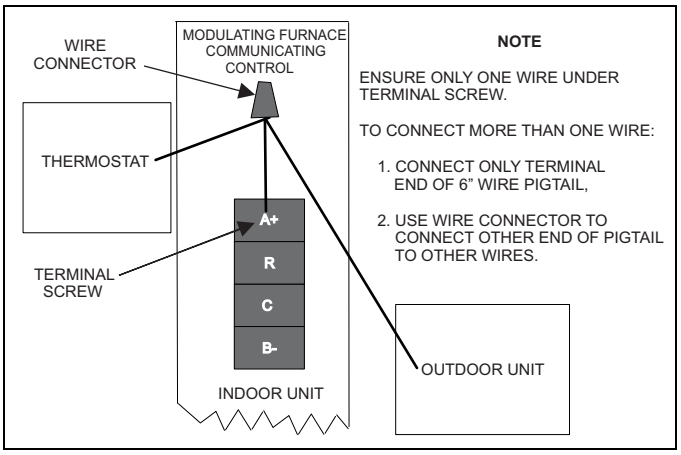


Figure 16: Terminal screw wire connection

When connecting the Communicating Control (wall thermostat) and furnace control to a non-communicating outdoor A/C, use the wiring diagram in Figure 16. The thermostat and furnace are connected exactly as shown above, but the conventional 24 V R, C, LO COMP, and HI COMP terminals will be used to control the outdoor unit.

Control wiring using communicating controls (variable capacity outdoor models)

The Communicating System consists of several intelligent communicating components including the Hx™ Thermostat, the variable speed furnace and the modulating air conditioner or heat pump. These components continually communicate with each other via the wire connections shown in Figure 18. Commands, operating conditions, and other data are passed continually between components over the A-R-C-B and A-C-B bus. The result is a new level of comfort, versatility, and simplicity.

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

Use the wiring diagram in Figure 18 to connect the furnace control and the Hx™ Thermostat (wall thermostat) to the communicating outdoor unit. Be sure that all of the A+ terminals are connected together, all of the B- terminals are connected together, all of the C terminals are connected together and the R terminals from the Hx thermostat to the indoor unit are connected together. Do NOT connect the R wire to the outdoor unit. The four small screw terminals in the terminal block on the furnace control should be used.

Important: Do not place more than one wire under any single communication terminal screw (there are four communication terminal screws). If more than one wire must be connected to a terminal screw, attach only the terminal end of a one wire pigtail no longer than 6 in., and use a wire connector to connect the other end of the pigtail to the other wires. Failure to do this will result in nuisance communication error faults. See Figure 17.

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

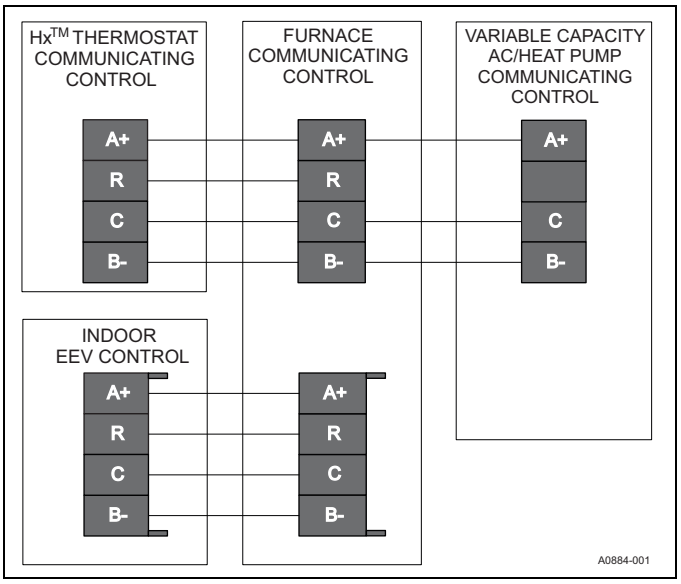


Figure 17: Furnace with variable capacity AC or HP

Conventional low voltage control wiring connections

Install the field-supplied thermostat by following the instructions that come with the thermostat. With the thermostat set in the OFF position and the main electrical source disconnected, connect the thermostat wiring from the wiring connections on the thermostat to the terminal board on the ignition module, as shown in Figure 18 to 22 Thermostat Charts. Electronic thermostats may require the common wire to be connected as shown in Figures 18 to 22. Apply strain relief to thermostat wires passing through cabinet.

Important: Set the heat anticipator in the room thermostat to 0.1 A. Setting it lower will cause short cycles. Setting it higher will cause the room temperature to exceed the set points.

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

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

Air conditioner connections

This furnace may be used with single-stage or two-stage air conditioning units.

For Single-Stage A/C - Connect the low voltage wiring as shown in Figure 18.

For Two-Stage A/C - Use a two-stage thermostat, connect the low voltage wiring as shown in Figure 19.

For Two-Stage A/C using a Single-Stage Thermostat - connect the low voltage wiring as shown in Figure 20.

This furnace control board can control a two-stage A/C using only a single-stage thermostat. In this case, the furnace control switches between high cool and low cool based on the calculated cooling load.

Thermostat charts

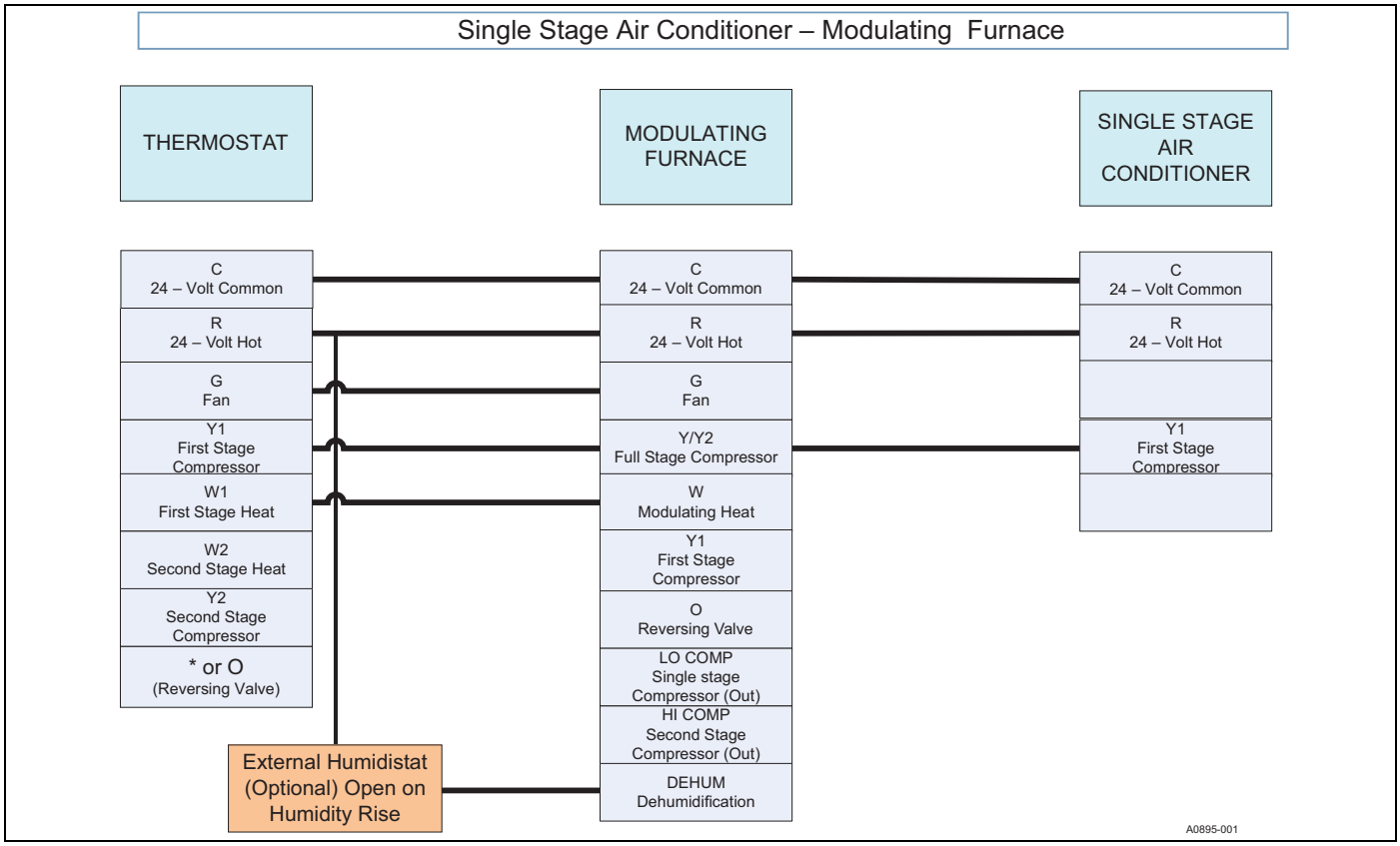


Figure 18: Thermostat chart - single stage air conditioner with modulating furnace

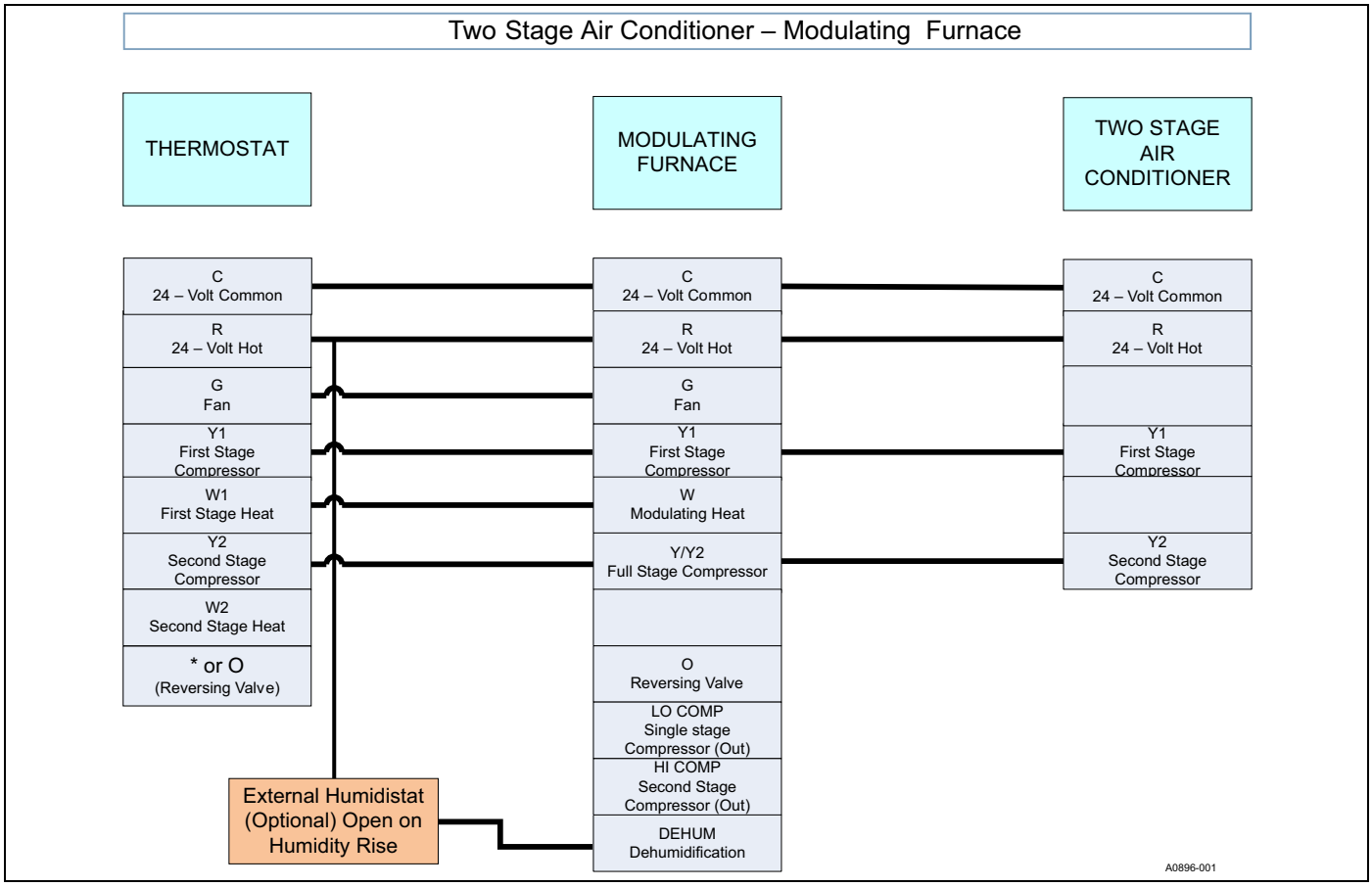


Figure 19: Thermostat chart - two stage air conditioner with modulating furnace (wiring diagram option 1)

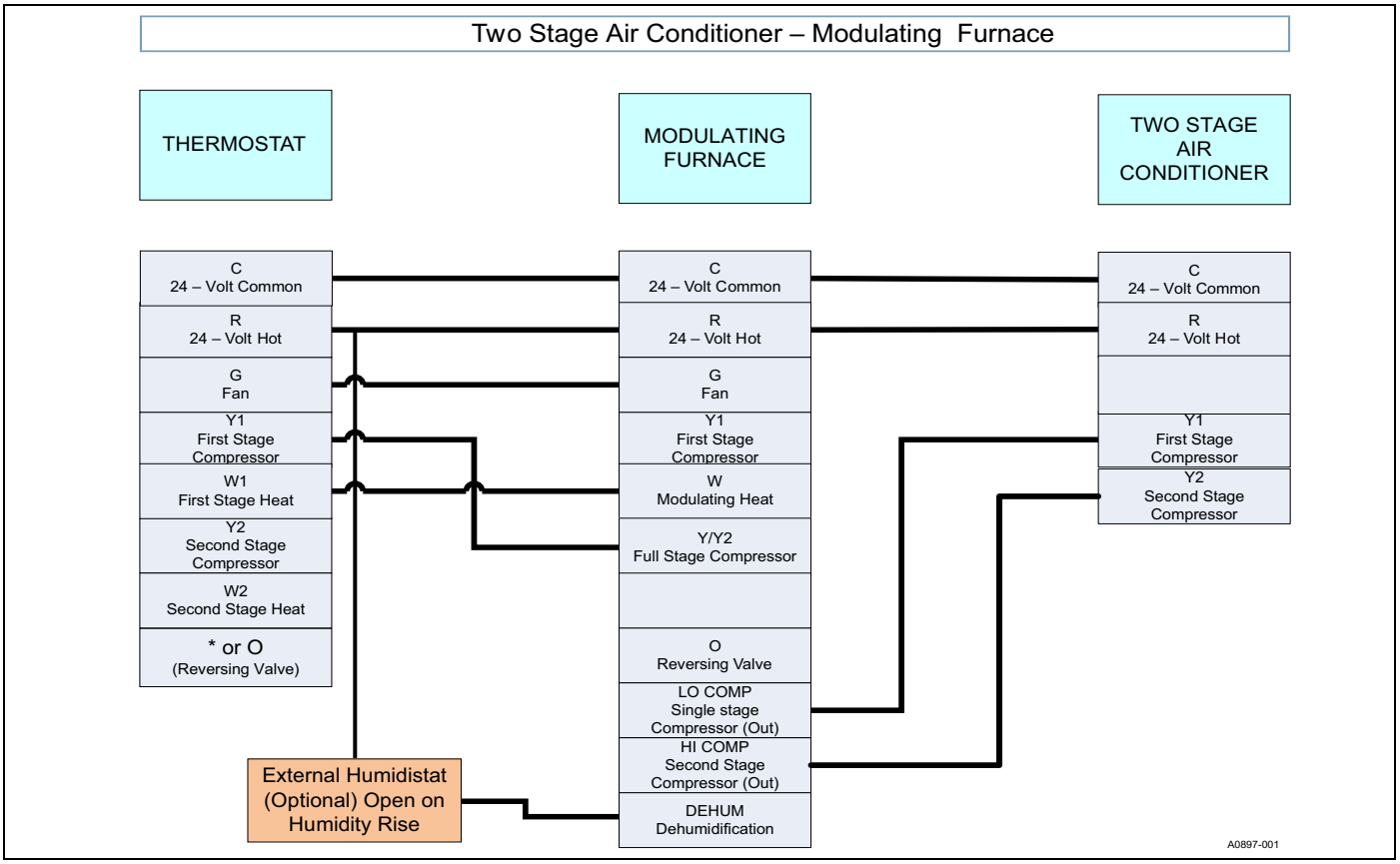


Figure 20: Thermostat chart - two stage air conditioner with modulating furnace (wiring diagram option 2)

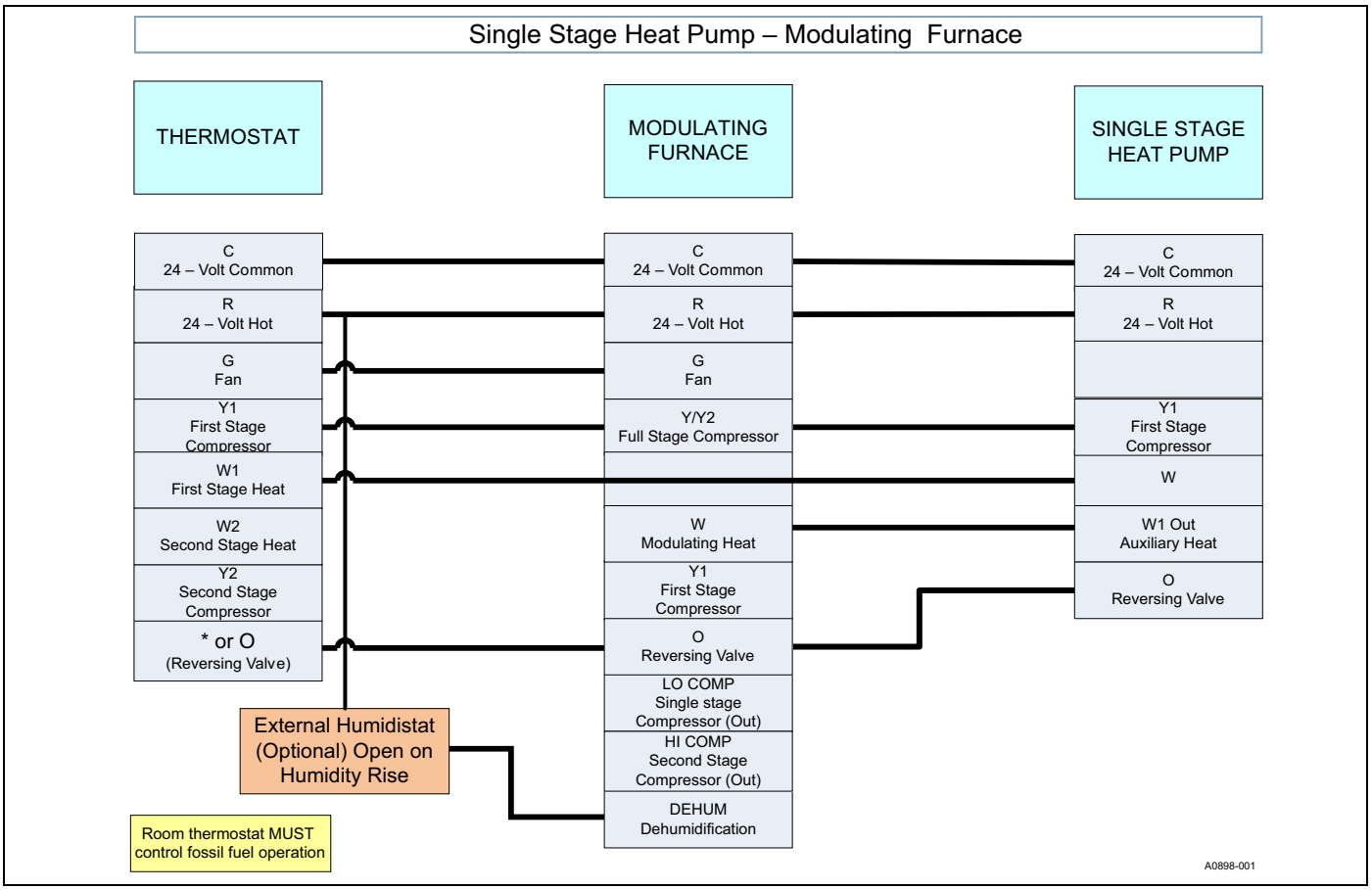


Figure 21: Thermostat chart - single stage heat pump with modulating furnace

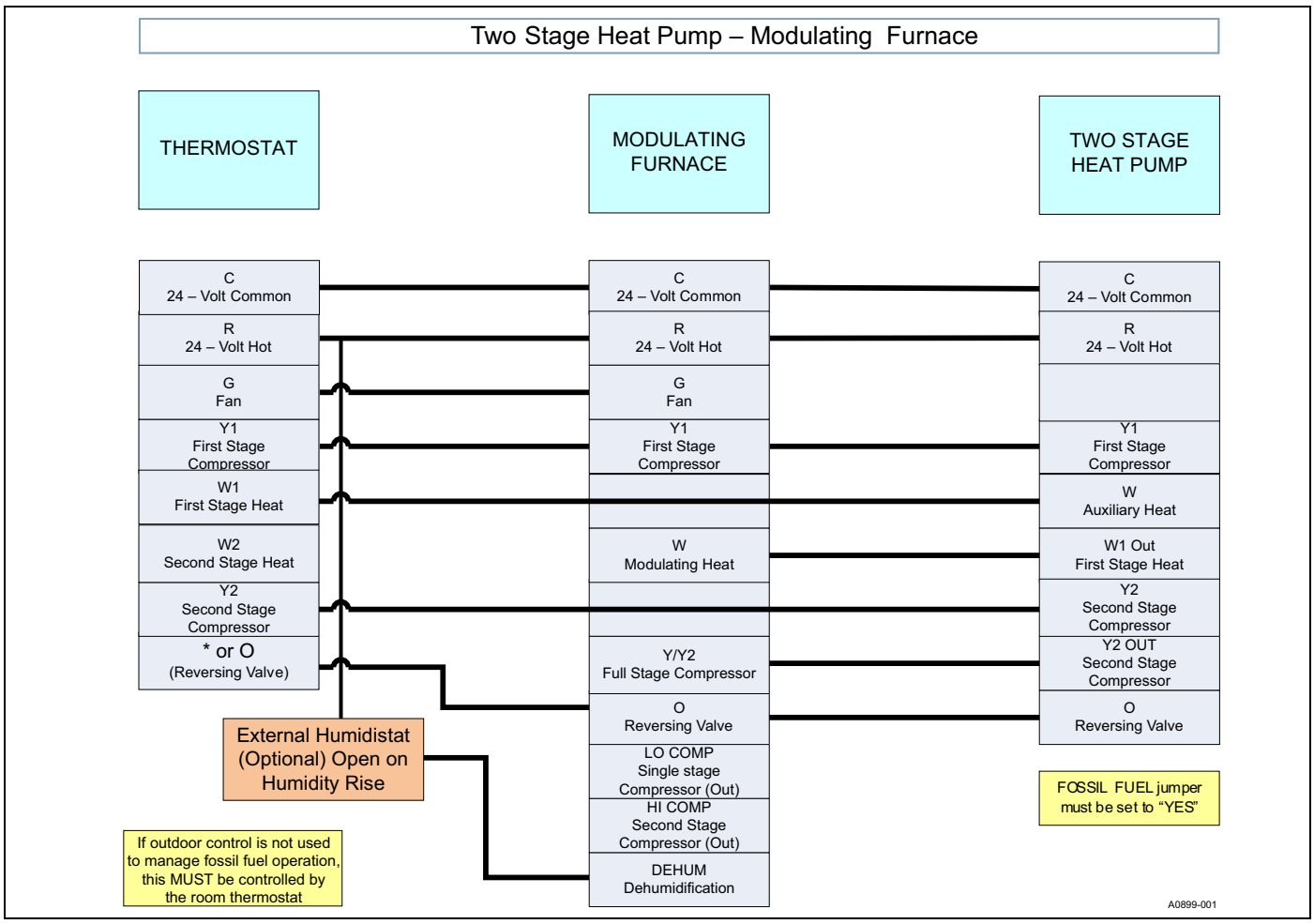


Figure 22: Thermostat chart - two stage heat pump with modulating furnace

Accessory connections

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

Electronic air cleaner connection

Two 1/4 in. (0.64 cm) spade terminals (EAC and NEUTRAL) for electronic air cleaner connections are located on the control board. The terminals provide 115 VAC (1.0 A maximum) during circulating blower operation.

Humidifier connection

Two 1/4 in. (0.64 cm) spade terminals (HUM and NEUTRAL) for humidifier connections are located on the control board. The terminals provide 115 VAC (1.0 amp 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.

Humidistat connection

For better humidity control during cooling operation, an external humidistat may be used. When using a external humidistat, put the HUMIDISTAT jumper in the YES position. Connect the low voltage wiring as shown in Figures 18 to 22.

Zoning operation

This furnace may be used in zoning systems, using a separate after market zoning control. For use in zoned systems, put the ZONE CONTROL jumper on the furnace control board in the YES position.

If the Zone jumper is put in the YES position, the heating load logic switches to a special algorithm for multi-zone homes.

1. This algorithm operates at the low demand firing rate for 10 min and then ramps to high fire within 20 min (30 min maximum to get to 100% firing rate).
2. The special zoning algorithm **does not** have the Run 2 function, so the burners will stop firing as soon as there is no call for heating.

Heat pump operation

This furnace may be used in conjunction with a heat pump in dual fuel applications. For heat pump applications, put the HEAT PUMP jumper on the furnace control board in the YES position. Connect the low voltage wiring as shown in Figures 21 and 22. If a two-stage heat pump is to be used, a two-stage thermostat is required.

If the Heat Pump jumper is in the YES position, it indicates that there is a heat pump present and the furnace is used as a secondary heat source. In addition, the Yes Heat Pump jumper allows the system to read the presence of the O terminal signal. In heat pump operation, the following special algorithm logic applies:

1. Supplemental heating **-** When both a W signal and a Y1 signal are present, the modulating firing rate will operate as normal, except there will be no Run 2 function, so the burners will stop firing as soon as the W signal is removed.
2. Defrost cycle - When both a W signal and a Y2 signal are present, the modulating firing rate will operate at a constant 80% firing rate and there will be no Run 2 function, so the burners will stop firing as soon as the W signal is removed.
3. Hot heat pump - The hot heat pump feature will work when the control is wired to a 2-stage thermostat and a 2-stage heat pump.
4. Hot heat pump - The hot heat pump feature will not work when the control is wired to a single-stage thermostat and a two-stage heat pump.

Twinning

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

Section VI: Vent system

Vent connections

Figure 23 shows the furnace as it is shipped from the factory. To convert to a horizontal or downflow position, remove the four screws that secure the inducer assembly and rotate 90°. Ensure you do not damage the gasket while rotating and reinstall screws. Remove the cap from the appropriate vent outlet location on the cabinet and cut insulation in the cabinet to same size as the hole provided. When complete, reinstall the cap in the hole in the top panel.

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

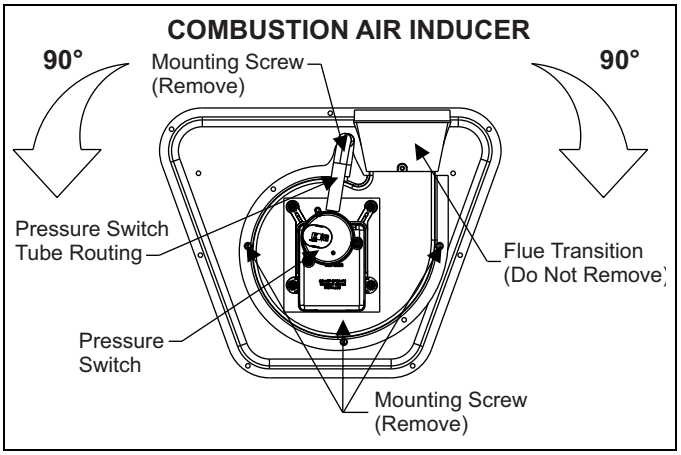


Figure 23: Combustion air inducer

Category 1 - 450°F maximum vent temperature

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 a type B vent connector, and shall be connected to a type B vent only. The furnace shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel. Single-wall vent pipe is not allowed.

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.

Venting

Category I venting consists of vertically venting one or more appliances in B-vent 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

This furnace may not be vented directly into an unlined or clay tile-lined masonry chimney. This furnace may be vented into a masonry chimney if a double-wall metal chimney liner is used and the liner is properly sized according to the requirements of the National Fuel Gas Code or in Canada, the B-149 Installation Codes.

If this furnace is to be vented into a masonry lined chimney without a double-wall chimney liner, chimney kit S1-1CK0605 must be used. Refer to the instructions with that kit for details.

Fan-assisted combustion system

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

Ambient combustion air supply

This type 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. For upflow models combustion air is brought into the furnace through the unit top panel opening.

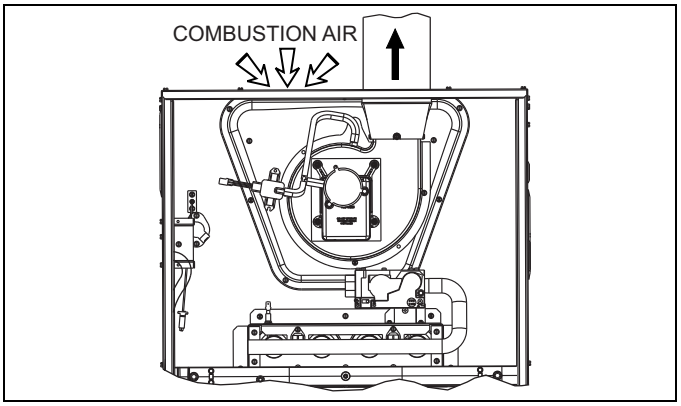


Figure 24: Combustion airflow path through the furnace casing to the burner compartment

⚠ 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.

⚠ WARNING

Examine the heat exchanger, vent pipe, combustion air passages, vent connectors, and chimney to be sure they are clear and free of obstructions.

Note: Proper orientation on the heat exchanger is for the compressed heat transfer blade portion to be up and away from the burner section, towards the air leaving end of the furnace.

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 openings 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.

Combustion air source from outdoors

The blocking effects of louvers, grilles and screens must be given consideration in calculating free area. If the free area of a specific louver or grille is not known, see Table 6 to estimate free area.

Table 6: 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%

* Do not use less than 1/4 in. (0.635 cm) mesh
\+ Free area of louvers and grille varies widely; the installer should follow louver or grille manufacturer's instructions.

Dampers, louvers and grilles (Canada Only)

1. The free area of a supply air opening shall be calculated by subtracting the blockage area of all fixed louvers grilles or screens from the gross area of the opening.
2. Apertures in a fixed louver, a grille, or screen shall have no dimension smaller than 1/4 in. (0.635 cm).
3. A manually operated damper or manually adjustable louvers are not permitted for use.
4. A automatically operated damper or automatically adjustable louvers shall be interlocked so that the main burner cannot operate unless either the damper or the louver is in the fully open position.

⚠ WARNING

Always verify that any pre-existing venting system previously attached to a different Category I furnace is still properly sized for safe use of this furnace. An improperly sized vent system can cause CARBON MONOXIDE to spill into the living space causing personal injury and/or death.

Table 7: Unconfined space minimum area

Btu/h Input rating	Minimum free area required for each opening
60,000	60 in^2 (387 cm^2)
80,000	80 in^2 (516 cm^2)
100,000	100 in^2 (645 cm^2)
120,000	120 in^2 (774 cm^2)

Table 8: Free area

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

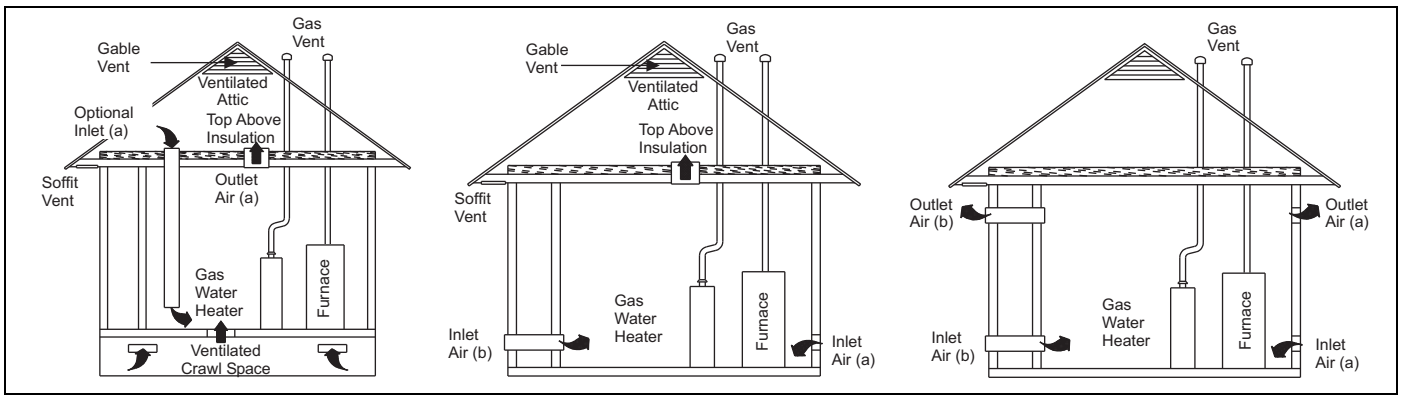


Figure 25: Ambient combustion air

Air supply openings and ducts

1. An opening may be used in lieu of a duct to provide the outside air supply to an appliance unless otherwise permitted by the authority having jurisdiction. The opening shall be located within 12 in. (30.4 cm) horizontally from the burner level of the appliance. See the *Combustion air source from outdoors and vent and supply air safety check* section of these instructions for additional information and the 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. (30.5cm) above the outside grade level.

Combustion air source from outdoors

1. Two permanent openings, one within 12 in. (30.5 cm) of the top and one within 12 in. (30.5 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 openings, commencing within 12 in. (30.4 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 (700mm2/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 a grille is not known. See Table 6 to estimate free area.

Ventilated combustion air

The ventilated attic space or the crawl space from which the combustion air is taken must comply with the requirements specified in the *Air source from outdoors* section of these instructions, or Section 5.3 in the *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 1/4 in. per foot (0.635 cm/m) from the furnace to the vent terminal.

For correct installation 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-monxide poisoning or death.

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

1. Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion or other deficiencies, which could cause an unsafe condition
2. Close all building doors and windows.
3. Turn on clothes dryers and TURN ON any exhaust fans, such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Open the fireplace dampers. Do not operate a summer exhaust fan.
4. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so the appliance shall operate continuously.
5. Test each appliance (such as a water heater) equipped with a draft hood for spillage (down-draft or no draft) at the draft hood relief opening after 5 min of main burner operation. Appliances that do not have draft hoods need to be checked at the vent pipe as close to the appliance as possible. Use a combustion analyzer to check the 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.

Section VII: Start-up and adjustments

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

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

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

NOTICE

In order that this furnace will operate properly, it is required that all of the startup procedures in this section be followed.

NOx screen removal (Lo-NOx models only)

If the furnace is equipped with NOx screens and is to be used with LP (propane) gas, the screens must be removed prior to start-up.

1. Make sure that the electrical power to the unit is turned off and that the gas supply is turned off at the shut-off valve.
2. Remove the blower compartment and burner compartment access doors.
3. Disconnect the gas supply piping at the union to permit removal of the entire burner and gas control assembly from the vestibule panel. Use the wrench boss on the gas valve when removing or installing the piping.
4. Unplug the igniter from the wire harness. Disconnect the flame sensor wires located on top of the air shield. Unplug the gas valve from the wiring harness.
5. Remove the screws holding the burner assembly to the vestibule panel.
6. Remove the burner assembly. It should be possible to swing the burner assembly out of the way without disconnecting the remaining wires.
7. With the burner assembly out of the way, simply slide the NOx screens out of the heat exchanger tubes and discard the screens.
8. Replace all components in reverse order. Reconnect all wiring.

Gas piping leak check

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

When the gas supply is first connected to the furnace, loosen the ground union until the odor of gas is detected. When gas is detected, immediately tighten the union and check for gas leaks. Allow five min for any gas to dissipate before continuing with the startup procedure. Be sure that proper ventilation is available to dilute and carry away any vented gas.

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

The furnace and its equipment shutoff valve must be disconnected from the gas supply during any pressure testing of that system at test pressures in excess of 1/2 PSI (3.45 kPa).

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

Setup test mode

During normal operation, the furnace input rate can vary between 50% and 100% of full nameplate input, making it difficult to check for proper operation. To help with the furnace startup process, the control has a TEST MODE available that allows the furnace input rate to stay at a constant input rate. To access this TEST MODE perform the following sequence:

1. With power to the board on and with no thermostat calls (no call for heating, cooling or continuous fan), push and hold the TEST button on the board for 1 s. The LED on the board will glow red.
2. Release the TEST button. The LED on the board will flash a rapid green signal, indicating that TEST MODE is activated.
3. Turn the thermostat to call for heat (R & W signal).
4. The furnace will light and operate at high (100%) firing rate. The furnace firing rate should be checked at this level to confirm that the furnace is not overfired or underfired.
5. To run the furnace at minimum rate (50%), press the ERROR button once. The LED will flash one green flash to confirm.
6. To run the furnace at a middle rate (70%), press the ERROR button twice within a 5 s period. The LED will flash green two times to confirm.
7. To again operate the furnace at maximum (100%) rate, press the ERROR button three times within a 5 s period. The LED will flash green three times to confirm.
8. If the thermostat call for heat is removed, the LED will flash a rapid green signal, indicating that the furnace is still in TEST MODE.
9. When startup tests are completed, turning off power to the board will take the furnace out of TEST MODE and will restore normal operation. The furnace will automatically return to normal operation after 150 min if power is not cycled.

Calculating the furnace input (natural gas)

⚠ 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.

NOTICE

Burner orifices are sized to provide proper input rate using natural gas with a heating value of 1030 Btu/Ft^3 (38.4 MJ/m^3). If the heating value of your gas is significantly different, it may be necessary to replace the orifices.

NOTICE

DO NOT set manifold pressure less than 3.2 in. w.c. or more than 3.8 in. W.C. for natural gas at sea level. If manifold pressure is outside this range, change main burner orifices.

Verify natural gas input rate by clocking meter.

1. Turn off all other gas appliances and pilots.
2. Run furnace for a minimum of 3 min in heating operation.
3. Measure time (in sec) for gas meter to complete 1 revolution and note reading. The 2 cu ft dial provides a more accurate measurement of gas flow.
4. See Table 9 for cu ft of gas per hour.
5. Multiply cubic ft per hour by heating value (Btu/cu ft) to obtain input.

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

⚠ CAUTION

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

High altitude natural gas orifice conversion

The National Fuel Gas Code requires that gas appliances installed above 2,000 ft elevation have their inputs de-rated by 4% per 1,000 ft above sea level. The modulating furnaces automatically de-rate for altitude by measuring the inducer blower pressure and using that to determine if there is adequate air to support good combustion. If there is not enough combustion air to properly support 100% of the furnace nameplate input rate, the control will reduce the input to the point that there will be good combustion.

Table 9: Gas rate (cu ft/h) at full input

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
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
124	29	58	145
128	28	56	141
133	27	54	135
138	26	52	130
144	25	50	125
150	24	48	120
157	23	46	115
164	22	44	110
171	21	42	105
180	20	40	100

Adjustment of manifold gas pressure

Inlet and manifold gas pressure may be measured by connecting the U-tube manometer to the gas valve with a piece of tubing. Follow the appropriate section in the instructions below. See Figure 26 for a drawing of the locations of the pressure ports on the gas valve.

Table 10: Inlet gas pressure range

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

Important: The inlet gas pressure operating range 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. WC (1.74 kPa) for Natural gas
- 11 in. WC (2.74 kPa) for Propane (LP) gas

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

Important: The cap for the pressure regulator must be removed to gain access to the adjustment screw.

TABLE 11: Nominal manifold pressure

Nominal manifold pressure	
Natural gas (maximum)	3.5 in. WC (0.87 kPa)
Natural gas (minimum)	0.5 in. WC (0.15 kPa)
Propane (LP) gas (maximum)	10.0 in. WC (2.49 kPa)
Propane (LP) gas (minimum)	1.6 in. WC (0.40 kPa)

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.

1. The manifold pressure must be taken at the port marked OUT P.
2. The inlet gas line pressure must be taken at the port marked IN P.
3. Using a 3/16 in. hexhead wrench, remove the plugs from the inlet and outlet pressure ports. Connect a 1/8 in. UPT barbed hose fitting to each pressure port.
4. See Figure 26 for location of pressure regulator adjustment cap and adjustment screws on main gas valve.
5. Turn gas and electrical supplies on and follow the operating instructions to place the unit back in operation.
6. Remove the small plastic cap to gain access to the regulator adjustment screw.
7. Use a small slotted screwdriver to turn the regulator adjustment screw. Adjust the pressure by turning the screw one click at a time until desired pressure is reached. Wait a few seconds after each adjustment to allow the pressure to stabilize before making additional adjustments. This is an electronic adjustment screw that does not require very much force.

Note: Application of excessive force to the adjustment screw will damage the gas valve.

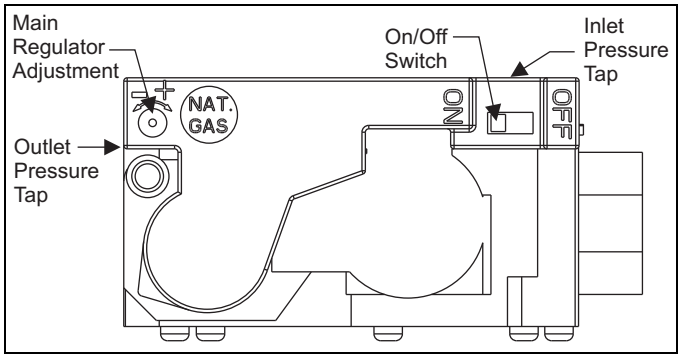


Figure 26: Gas valve

Important: If gas valve regulator is turned clockwise, manifold pressure is increased. If screw is turned counterclockwise, manifold pressure will decrease.

The adjustment screw has a range of 16 clicks (about ±0.5 in. manifold pressure). There is not a hard stop at the ends of the adjustment range. When the limit of the adjustment range is reached, the next click will start over at the other end of the range. For instance, if you are increasing pressure and reach the upper limit of adjustment the next click will drop the pressure to the lower limit.

8. After the manifold pressure has been adjusted, re-calculate the furnace input to make sure you have not exceeded the specified input on the rating plate. Refer to Calculating the furnace input (natural gas).
9. Once the correct Btu (kW) input has been established, turn the gas valve to OFF and turn the electrical supply switch to OFF; then remove the flexible tubing and fittings from the gas valve pressure tap replace the pressure tap plugs.
10. Turn the electrical and gas supplies back on, and with the burners in operation, check for gas leakage around the gas valve pressure port for leakage using an approved gas detector, a non-corrosive leak detection fluid, or other leak detection methods.

Airflow settings

Cooling airflow settings

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

The desired cooling airflow may be selected by placing the COOL jumper on the control board in the desired position A, B, C or D. The A position will give the highest airflow and the D position gives the lowest. Additional fine tuning of the cooling airflow can be done by using the ADJUST jumper. The nominal ADJUST setting is A, while the B jumper position will give approximately a 10% increase in airflow over the A position and the C ADJUST jumper position will give approximately a 10% decrease from the A position. Consult the blower airflow tables in this manual for the expected airflow at each speed setting.

The speed should be selected so as to deliver approximately 350-400 CFM per ton of AC cooling capacity. Use of airflow outside of this range may result in diminished air conditioning performance and may result in lower overall energy efficiency and higher electric utility bills. See Table 12 for default cooling blower settings.

Table 12: Default blower speeds

Model number	Default blower speeds		
	Heat jumper	Cool jumper	Fan speed jumper
60A12	NOM	A	L
80B12	NOM	A	L
80C16	NOM	A	L
100C16	NOM	A	L
100C20	NOM	A	L
120C20	NOM	A	L

Continuous fan airflow settings

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

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

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

The default position is with the FAN SPEED jumper in the L position. In certain circumstances, it may be necessary to move the continuous fan speed to a different speed tap. When the FAN SPEED is set to the L position, the furnace uses higher than normal electrical energy usage and higher than normal electric utility bills.

Gas heating airflow settings

The default heating blower speed is shown in Table 12.

This unit is equipped with an electronically commutated (ECM) blower motor. The motor and blower are capable of delivering airflow over a wide range of operating conditions. The blower speed used for heating is controlled by the furnace control board and is set to deliver the airflow needed for a fixed outlet air temperature. The furnace control board has a jumper with three possible settings (-10, NOM, and +10) to control the heating airflow. The jumper is factory set to the NOM position. Moving the jumper to the -10 position will increase the blower speed during heating operation to a higher speed that will reduce the outlet air temperature by about 10 degrees (-10 degrees). Moving the jumper to the +10 position will decrease the blower speed during heating operation to a lower speed that will increase the outlet air temperature by about 10 degrees (+10 degrees). For the majority of applications, the jumper should be left in the factory NOM position.

In certain circumstances, it may be necessary to move the heating blower speed to a different setting. The use of heating airflow on a speed other than the default speed will result in diminished heating performance.

Measurement of temperature rise

⚠ WARNING

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 for specific furnace ratings and physical/ electrical data as specified in these instructions. The supply air temperature cannot exceed the “Maximum Supply Air Temperature” as it may cause premature heat exchanger failure, high levels of Carbon Monoxide, a fire hazard, personal injury, property damage, and/or death.

After 5 min of operation, determine the furnace temperature rise. Measure the temperature of the return air and the heated air in the ducts from approximately 6 ft (1.83 m) distance from the furnace where they will not be affected by radiant heat. Increase the blower speed to decrease the temperature rise; decrease the blower speed to increase the rise.

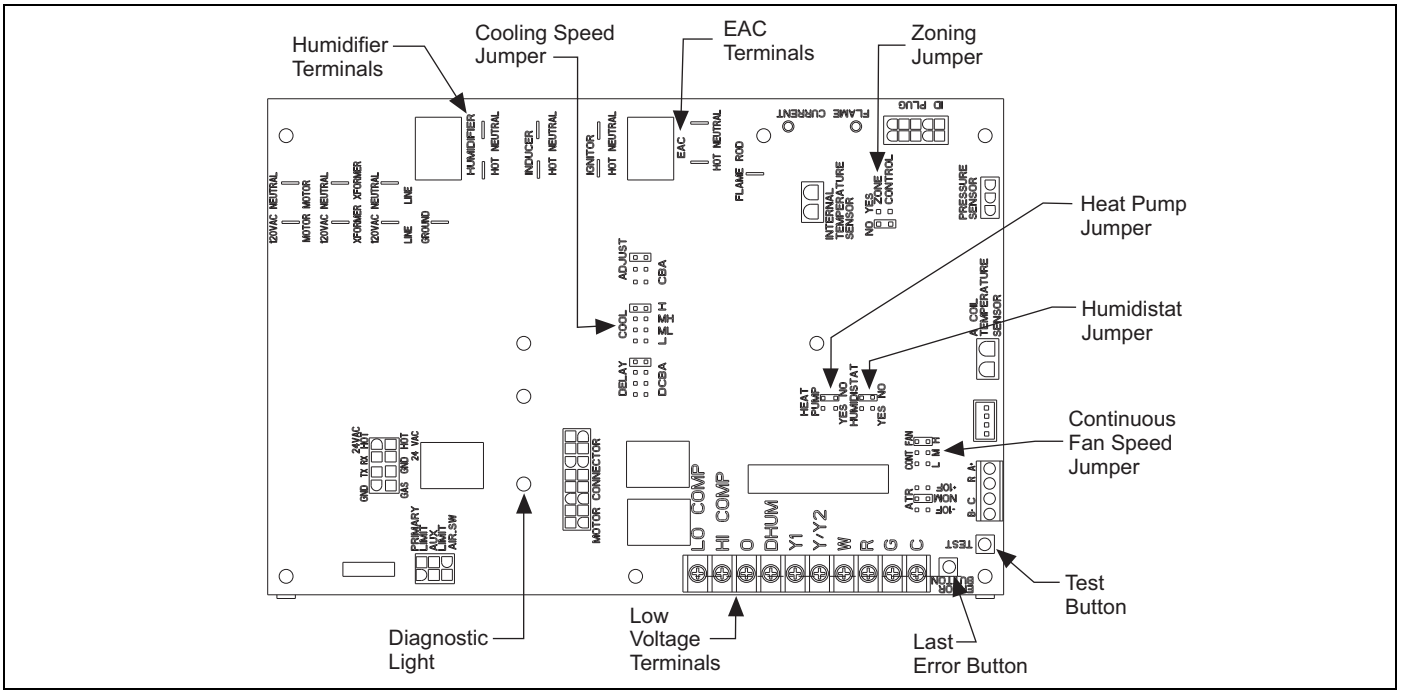


Figure 27: Furnace control board

Table 13: Blower performance CFM - any position

High / low speed cooling CFM							
060A12		080B12		080C16		Jumper settings	
High cool	Low cool	High cool	Low cool	High cool	Low cool	Cool jumper	ADJ jumper
1277	825	1241	834	1644	1054	H	B
1067	709	1064	720	1447	927	MH	B
1162	762	1147	782	1489	955	H	A
972	667	960	678	1321	857	MH	A
1046	699	1043	709	1349	871	H	C
857	615	855	605	1236	815	ML	B
888	615	866	615	1166	787	MH	C
678	499	678	501	1012	703	L	B
783	573	793	563	1096	759	ML	A
625	478	626	459	927	660	L	A
720	531	720	521	998	703	ML	C
583	478	574	459	843	604	L	C
High / low speed cooling CFM							
100C16		100C20		120C20		Jumper settings	
High cool	Low cool	High cool	Low cool	High cool	Low cool	Cool jumper	ADJ jumper
1674	1069	2178	1545	2232	1446	H	B
1463	943	1870	1339	1783	1203	MH	B
1519	971	2126	1459	2026	1334	H	A
1336	858	1716	1254	1615	1091	MH	A
1378	1013	1938	1339	1839	1203	H	C
1238	816	1647	1220	1540	1054	ML	B
1168	788	1562	1168	1446	979	MH	C
1027	690	1459	1100	1353	904	L	B
1111	760	1528	1151	1409	960	ML	A
929	633	1374	1049	1222	848	L	A
1013	676	1425	1066	1297	867	ML	C
844	591	1288	997	1147	773	L	C

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

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

Delay taps selection

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

Tap A is the default profile. This profile has 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 will take 30 s to ramp from one speed to the other.

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

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

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

Humidistat

When a humidistat is installed in the system, the Humidistat jumper on the control board should be moved to the YES position. The cooling airflow will then be reduced by 15% whenever the humidistat indicates high humidity.

Section VIII: Safety controls

Control circuit fuse

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

Blower door safety switch

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

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

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

Pressure controls

Pressure sensor - This furnace is equipped with a pressure sensor in the burner compartment near the combustion blower. This sensor monitors combustion airflow through furnace and piping systems. If any of the conditions listed below are detected by the pressure sensor, the control board will prevent a hazardous condition from occurring by speeding up the combustion blower motor in order to maintain adequate combustion airflow. If the combustion blower is already turning at full speed, the furnace control will then start reducing the input to the furnace in order to maintain proper combustion with the amount of combustion airflow available. If there is not enough combustion air available to give proper combustion even at the minimum input rate (50%), the control will close the gas valve and shut off the burners. The sensor will detect the following conditions.

1. Blockage of vent piping or vent terminal
2. Failure of combustion air blower motor or blower wheel

Pressure switch - This furnace is equipped with a pressure switch mounted on the furnace vestibule panel. This switch monitors the flow through the vent system. The switch will close at the beginning of each cycle when adequate combustion airflow is established. However, this switch may be open under certain conditions when the burners are lit. The pressure sensor is the primary flow sensor.

Limit controls

Limit switch - This furnace is equipped with a high temperature limit control mounted to the left side of the furnace vestibule panel. This limit switch will open and shut off gas to the burners if it detects excessive air temperature in the furnace, which can be caused by any of the following conditions:

1. Dirty filter
2. Failure of the circulating blower motor or wheel
3. Too many supply or return registers closed or blocked

Temperature sensor - This furnace is also equipped with a temperature sensor mounted to the left side of the vestibule panel, near the limit switch. This sensor monitors the temperature of the air being supplied to the home. If the sensor detects air temperature higher than normal, the furnace control will first speed up the circulating blower motor in order to try to increase the amount of airflow being delivered, thereby reducing the air temperature. If the blower motor is already turning at full speed, the control will then start reducing the input to the furnace to try to reduce the air temperature. If the supply air temperature is too high even at the minimum input rate (50%), the control will close the gas valve and shut off the furnace.

Section IX: Normal operation and diagnostics

Normal operation sequence

The furnace control calculates the optimum firing rate each time the wall thermostat R and W contacts close or open (at the beginning and at the end of each call for heat) based on information from the thermostat and past demand. Unlike conventional systems, the wall thermostat does not simply turn the furnace on and off. the furnace control calculates the demand and may continue to fire the furnace during portions of the thermostat off cycle.

When the wall thermostat R and W contacts close, indicating a call for heat, the following sequence occurs:

1. The inducer is energized and ramps up its speed until airflow is proven by the pressure switch and by the pressure sensor on the control board.
2. The hot surface ignitor is energized.
3. After a 17 s to 20 s igniter heat-up, the gas valve opens and the burners light.
4. When the control senses that flame is present, the circulating blower starts at low speed.
5. The furnace fires at 70% of full rate for 30 s to 45 s, then drops to the minimum (50%) firing rate. If chimney kit S1-1CK0605 is used, the minimum firing rate is restricted and adjusted to 65% of full rate.
6. The firing rate is automatically adjusted to meet demand, increasing gradually to maximum (100%) firing rate if the thermostat is not satisfied within a defined time.
7. When the thermostat R and W contacts open (thermostat is satisfied) the furnace control recalculates the demand and a new firing rate.
   a. If demand exceeds the minimum firing rate, the burners will continue to fire at a recalculated reduced firing rate, decreasing if the thermostat remains off for a defined time.
   b. If demand does not exceed the minimum firing rate, the burners will shut off immediately.
8. After the burners shut off, the circulating blower will continue to run until the temperature sensor detects that the supply air temperature has dropped to the desired level, which should take from 30 s to 90 s.

Furnace control diagnostics

This furnace has built-in self-diagnostic capability. If a system problem occurs, a flashing LED shows a fault code. The LED can flash red, green or amber to indicate various conditions. The LED is located on the furnace control board and can be seen through the clear view port in the lower door of the furnace. To indicate an error condition, the LED will turn on for 1/4 s and off for 1/4 s. The pattern will be repeated the number of times equal to the flash code. For instance, a six flash code will be indicated by the LED turning on and off six times. There will be a 2 s off period between each set of flashes. The flash codes and an indication of their likely causes are listed below:

Steady off - No 24 V power to board. Check the 24 V control circuit fuse on the board. Check the circuit breaker or fuse on the 115 V supply power to the furnace. Check that the 24 V transformer.

One green flash - Normal operation with no call for heat.

Two green flashes - Indicator for no error codes in memory. See the *Diagnostic fault code storage and retrieval* section.

Three green flashes - Indicator for error codes cleared from memory. See the *Diagnostic fault code storage and retrieval* section.

Rapid green flash - Control is in factory speed-up mode. This mode is used only during factory run-testing of the furnace. To stop this mode, cycle power to the furnace off and then back on.

One amber flash - Normal operation with call for cooling.

Two amber flashes - Normal operation with call for heat.

Three amber flashes - Normal operation, burner is on at end of heating cycle after wall thermostat has been satisfied.

Four amber flashes - Heating capacity is reduced due to restriction in the circulating air system. Check for dirty filter or closed registers.

Five amber flashes - Heating capacity is reduced due to restriction in the combustion air or vent system. Check for blocked vent/air pipe or clogged condensate drain. Above 4,000 ft altitude, this may also indicate automatic, normal derating for altitude. See the *High altitude natural gas orifice conversion* section for additional information.

Six amber flashes - Applies to Heat Pump applications only. Normal operation with call for heat pump heating.

Seven amber flashes - Normal operation, air conditioning, compressor is on in low cooling after wall thermostat has been satisfied.

Rapid amber flash - Low flame sense current. Check for dirty or mislocated flame sensor rod.

One red flash - Flame is present with no power being supplied to gas valve. This can be caused by a gas valve that is slow to close or that leaks gas through to the burners.

Two red flashes - Pressure switch closed with inducer pressure below pressure switch setpoint (switch is closed when it should be open). Check pressure switch.

Three red flashes - Pressure switch open with inducer pressure above pressure switch setpoint (switch is open when it should be closed). Check pressure switch.

Four red flashes - High limit switch open or defective temperature sensor or 24 V fuse is open. This may be caused by a dirty air filter, improp-

erly sized duct system, faulty blower motor, restricted circulating airflow an open fuse on the control board.

Five red flashes - Rollout switch or condensate pressure switch open. Check the rollout switches on the burner assembly. It is a manual reset switch. To reset, push the small button in the center of the switch. If it cannot be reset or if the switch trips again, contact a qualified serviceman.

Six red flashes - Current failure on modulating gas valve.

Seven red flashes - Lockout due to no ignition. The control will try three times for ignition. If flame cannot be established in three tries, the control will lockout for 1 h and then will try again to light. Check gas supply, ignitor, gas valve, flame sensor.

Eight red flashes - Lockout due to too many flame recycles. This flash code occurs if flame is lost five times during a single heating cycle. This could be caused by a faulty gas valve, low gas pressure, or dirty flame sensor. The control will lock out for 1 h and then will try again.

Nine red flashes - Reversed line polarity or improper grounding. Check polarity of the incoming power to the furnace. Check the grounding of the furnace, including the transformer ground and the L1 and neutral connections.

Ten red flashes - Gas valve circuit shorted. Check gas valve wiring. If correct, replace gas valve.

Eleven red flashes - Main blower failure - This flash code occurs when the main limit opens and fails to reclose within five min, indicating that the blower motor or blower wheel has failed.

Twelve red flashes - ID plug is not present or not connected properly, check for loose plug or loose wires in plug.

Steady on red - Control fault has been detected or there is 115 V present without 24 V. Check whether there is 24 V and 115 V being supplied to the board. If not, correct the voltage problem. If there is both 24 V and 115 V to the board, replace the control board.

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

Diagnostic fault code storage and retrieval

The control in this furnace is equipped with memory that will store up to five error codes to allow a service technician to diagnose problems more easily. This memory will be retained even if power to the furnace is lost. **Only a qualified service technician should use this feature.**

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

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

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

Section X: Replacement parts list

Description
Motor
Motor, direct drive blower
Blower, combustion
Electrical
Capacitor, run
Switch, limit
Control, furnace
Igniter
Sensor, flame
Switch, pressure
Switch, door
Transformer
Valve, gas
Control, temperature
Sensor, pressure
Sensor, thermistor
Air moving
Housing, blower
Wheel, blower
Fabricated parts
Baffle, flue
Burner, main gas
Bracket, igniter
Shelf, blower
Rail, blower (2 required)

Description
Fabricated parts continued
Bracket, blower track (2 required)
Heat exchanger ass'y
Manifold, gas
Pan, bottom
Panel, top
Panel, door (2 required)
Vent pan, combustion (with gasket)
Panel, blockoff
Lo-NOX screen (I-models only)
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
Hose assembly, vacuum
Plug, ID (control board)
Knob, quarter turn (4 required)
Union
Diagram, wiring

Replacement part contact information

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

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

Johnson Controls Unitary Products
Consumer Relations
5005 York Drive
Norman, OK 73069

Section XI: Wiring diagram

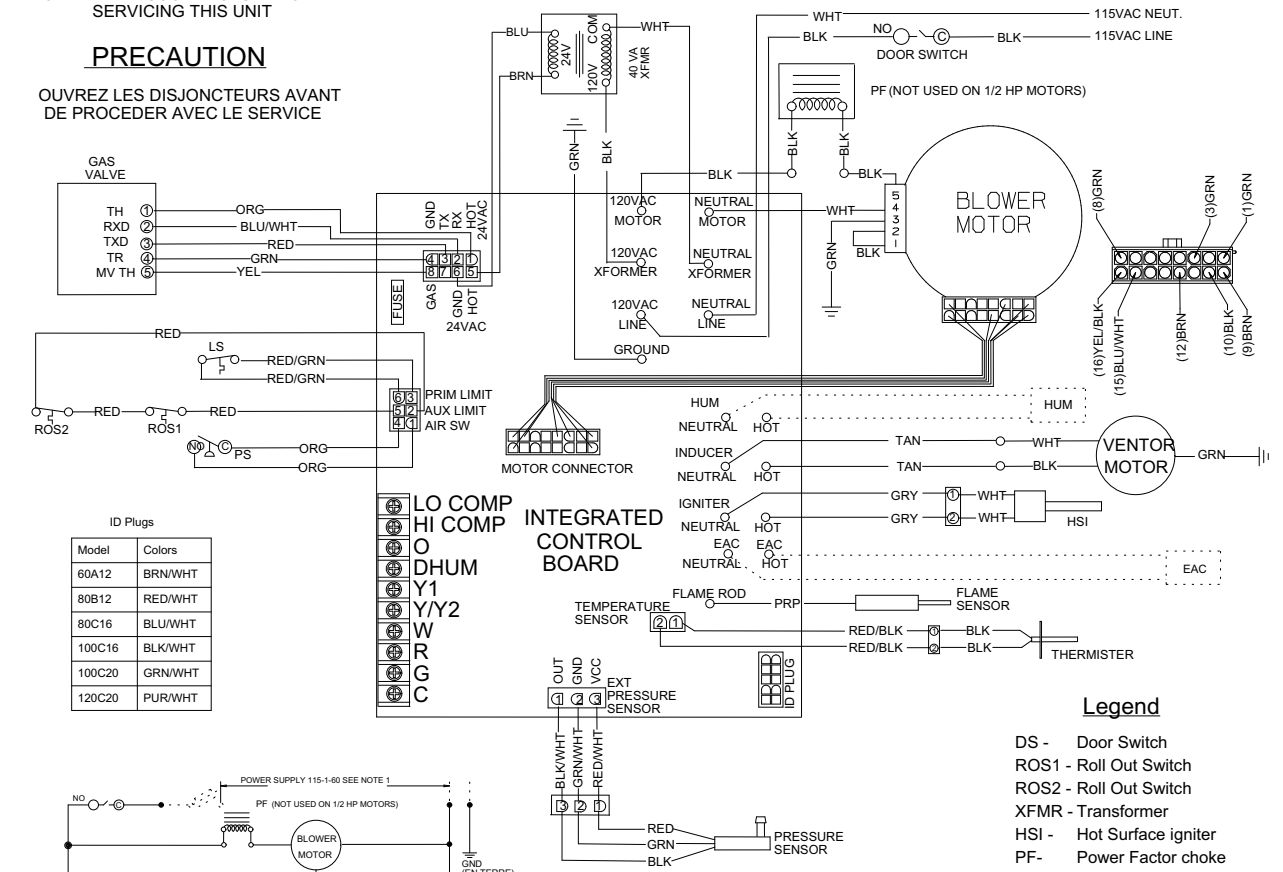
CAUTION

OPEN ALL DISCONNECTS BEFORE SERVICING THIS UNIT

PRECAUTION

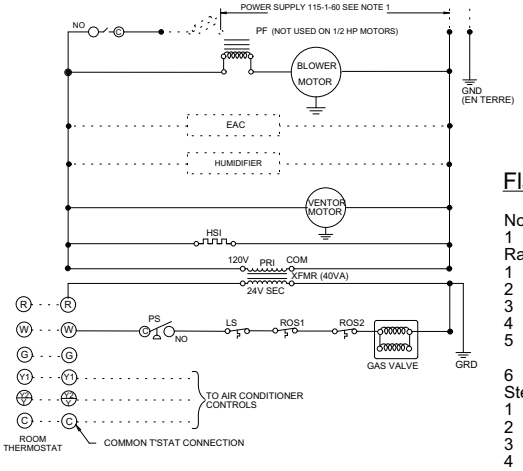
OUVREZ LES DISJONCTEURS AVANT DE PROCEDER AVEC LE SERVICE

Wiring Diagram 80+% Modulating Furnace With ECM Motor



ID Plugs

Model	Colors
60A12	BRN/WHT
80B12	RED/WHT
80C16	BLU/WHT
100C16	BLK/WHT
100C20	GRN/WHT
120C20	PUR/WHT



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

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

Note to Servicers

Unlike conventional systems, the wall thermostat does not simply turn this furnace off and on. The furnace control calculates the demand and THE FURNACE BURNERS MAY CONTINUE TO FIRE DURING PART OF THE THERMOSTAT "OFF" CYCLE. Refer to the furnace instructions for further information.

Diagnostic Fault Codes

Flashes	Fault Condition
None	Power Off
1 Slow Green	Normal Operation
Rapid Amber	Low flame sense current
1 Amber	Normal Operation with call for cooling
2 Amber	Normal Operation with call for heat
3 Amber	Normal Operation, burner on at end of heat cycle
4 Amber	Reduced Airflow problem
5 Amber	High altitude installation OR vent, OR termination problem
6 Amber	Normal Operation with call for heat pump heating
Steady on Red	Control Failure
1 Red	Flame present with gas off
2 Red	Check pressure switch wiring
3 Red	Vent OR termination problem
4 Red	Airflow problem OR open fuse
5 Red	Flame Rollout
6 Red	Check gas valve wiring
7 Red	Failed to light burners
8 Red	Loss of flame during call for heat
9 Red	Hot/Neutral reversed OR poor ground/neutral
10 Red	Gas valve shorted "ON"
11 Red	Check blower motor/wiring
12 Red	ID plug missing or not connected properly

Refer to Installation Manual for more detailed information.

Fault Code Retrieval

Notice - Only a qualified service technician should use this feature.
Fault code retrieval functions will work only if there are no active thermostat signals.
To retrieve fault codes, push and release ERROR button on control board. The LED will flash the last five error codes, beginning with the most recent. If there are no fault codes in memory, the LED will give two green flashes.
To clear thefault code memory, push and hold the ERROR button for at least five seconds.
The LED will give three green flashes when the memory has been cleared.

Legend

DS - Door Switch
ROS1 - Roll Out Switch
ROS2 - Roll Out Switch
XFMR - Transformer
HSI - Hot Surface igniter
PF- Power Factor choke
PS - Pressure Switch
EAC - Electronic Air Cleaner
LS - Limit switch
HUM - Humidifier
——— Factory Wiring and Devices
· · · · · · Field Wiring and Devices

Legende

DS - Commutateur de porte
ROS1 - Commutateur de roulement
ROS2 - Commutateur de roulement
XFMR - Transformeur
HSI - Ignition de surface chaud
PF - Transformeur de facteur de puissance
PS - Commutateur de pression
EAC- Filtre électrique
LS - Commutateur de limite
HUM - Humidificateur
——— Filage de l'usine et appareils
· · · · · · Filage de chantier et appareils

5427813-UWD-B-0319

Figure 28: Wiring diagram

Section XII: Start-up sheet

33" 80% AFUE (ECM/PSC) Modulating Gas Furnace Start Up Sheet

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

Start-Up Date

Technician Performing Start-Up | Installing Contractor Name

Owner Information

Name | Address

City | State or Province | Zip or Postal Code

Equipment Data

Furnace Model | Furnace Serial

Evaporator Coil Model | Evaporator Coil Serial

Outdoor Unit Model | Outdoor Unit Serial

Furnace Configuration

◯ Upflow ◯ Downflow ◯ Horizontal Left ◯ Horizontal Right

Filter, Thermostat, Accessories

Filter Type | Filter Size | Filter Location(s)

Thermostat Type | Other System Equipment and Accessories

Connections -- All Per Installation Instructions and Local Code

☐ Unit is level ☐ Gas piping is connected (including drip leg) ☐ Supply plenum and return air are connected

☐ Vent system is connected

Venting: B Vent

Vent Pipe Size | # of 90 Degree Ells | # 0f 45 Degree Ells | Total Height

Connector Size | Connector Length

Venting: Lined Masonry Chimney with B-Vent Connector

Connector Size | Connector Length | Chimney Height

of 90 Degree Ells | # 0f 45 Degree Ells

☐ Venting system is the proper size, within the limitations of the chart in the installation instructions, properly connected to the furnace, and properly 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 heat anticipator set to .1 (if present)

☐ Thermostat wiring is complete ☐ Thermostat cycle rate set to 6 cycles/hour (if present)

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

Continued on next Page

Gas Side

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

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

Inlet Gas Pressure (in. w.c.") _____ Manifold Gas Pressure (in. w.c.") - furnace must be in TEST Mode for setup _____

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

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

Air Side: System External Static Pressure (Cooling Mode)

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

ATR Setting ◯ NOM ◯ +10F ◯ -10F

Temperature Rise in Degrees F _____

Other Jumpers

De-humidistat	◯ YES	◯ NO
Heat Pump	◯ YES	◯ NO
Zone Control	◯ YES	◯ NO

Air Side: Cooling

COOL Speed Selected	◯ L (Low)	◯ ML (Med Low)	◯ MH (Med High)	◯ H (High)
ADJUST Setting (ECM Models)	◯ C	◯ B	◯ A	
DELAY Setting (ECM Models)	◯ L (Low)	◯ ML (Med Low)	◯ MH (Med High)	◯ H (High)

Air Side: Continuous Fan

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

Cycle Test

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

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

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

Clean Up

☐ Installation debris disposed of and furnace area cleaned up?

Owner Education

☐ Give owner the owner's manual provided

☐ Explain operation of system to equipment owner

☐ Explain the importance of regular filter replacement and equipment maintenance

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

Additional Job Detail

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