INSTALLATION MANUAL

TWO STAGE VARIABLE SPEED ECM RESIDENTIAL GAS FURNACES

MODELS:TM8V*C, TMLV*C

(80% AFUE Multi-position / Low NOx)

ISO 9001 Certified Quality Management System

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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 assure 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.*

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 VI of these instructions.
6. Test for gas leaks as specified in these instructions.

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

7. Always install the furnace to operate within the furnace's intended temperature rise range. Only connect the furnace to a duct system which has an external static pressure within the allowable range, as specified on the furnace rating plate.
8. When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by duct(s) 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, duct work and components upon substantial completion of the construction process, and verify furnace-operating conditions including ignition, input rate, temperature rise and venting, according to the manufacturer's instructions.
10. When installed in a Non-HUD-Approved Modular Home or building constructed on-site, combustion air 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 it is recommended to leave the doors on the furnace to provide support and to prevent damage or warping of the cabinet. When lifting the furnace by the cabinet, support the ends of the furnace rather than lifting by the cabinet flanges at the return air openings (bottom or sides) or supply air opening.
13. When lifting the furnace, it is acceptable to use the primary heat exchanger tubes as a lifting point provided that the tubes are lifted at the front of the heat exchangers where attached to the vestibule panel. Do not use the top return bend of the heat exchangers as lifting points as the tubes may shift out of position or their location brackets/baffles.

IMPORTANT

During installation, doors should 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 page of this instruction for return air plenum dimensions in Figure 12. The plenum must be installed according to the instructions.
- Provide clearances from combustible materials as listed under Clearances to Combustibles.
- Provide clearances for servicing ensuring that service access is allowed for both the burners and blower.
- These models **ARE NOT** CSA listed or approved for installation into a **HUD Approved Modular Home** or a **Manufactured (Mobile) Home**.
- This furnace is not approved for installation in trailers or recreational vehicles.
- Furnaces for installation on combustible flooring shall not 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, 1 Phase, 60-Hertz power supply. DO NOT CONNECT THIS APPLIANCE TO A 50 HZ POWER SUPPLY OR A VOLTAGE ABOVE 130 VOLTS.
- Furnace shall be installed so the electrical components are protected from water.
- Installing and servicing heating equipment can be hazardous due to the electrical components and the gas fired components. Only trained and qualified personnel 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, etc.
- 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.

FOR FURNACES INSTALLED IN THE COMMONWEALTH OF MASSACHUSETTS ONLY

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

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

INSPECTION

As soon as a unit is received, it 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. Also, 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 shall be located using the following guidelines:

1. Where a minimum amount of air intake/vent piping and elbows will be required.
2. As centralized with the air distribution as possible.
3. Where adequate combustion air will be available (particularly when the appliance is not using outdoor combustion air).
4. 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.

⚠WARNING

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

2. Do not allow return air temperature to be below 55º F (13° C) for extended periods. To do so may cause condensation to occur in the main heat exchanger, leading to premature heat exchanger failure.

Clearances for access/service:

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

1. Twenty-four (24) inches (61 cm) between the front of the furnace and an adjacent wall or another appliance, when access is required for servicing and cleaning.
2. Eighteen (18) inches (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 burner(s) and the ignition source are located not less than 18 inches (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 Dimensions in Inches, and 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)					
Upflow	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.2)	Combustible	Yes	Yes	Yes	No
Upflow B-Vent	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.5)	Combustible	Yes	Yes	Yes	No
Downflow	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.2)	1 (25.4)[1]	Yes	Yes	Yes	No
Downflow B-Vent	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.5)	1 (25.4)[1]	Yes	Yes	Yes	No
Horizontal	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.2)	Combustible	No	Yes	Yes	Yes[2]
Horizontal B-Vent	1 (2.5)	1 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.5)	Combustible	No	Yes	Yes	Yes[2]

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 duct(s) 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" (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" (30.5 cm). The furnace will not operate properly on a shorter plenum height. The minimum recommended rectangular duct height is 4 inches (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" minimum spacing may be needed to ensure against drain pan distortion.

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.

⚠WARNING

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

Refer to Table 7 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 4 flanges.

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

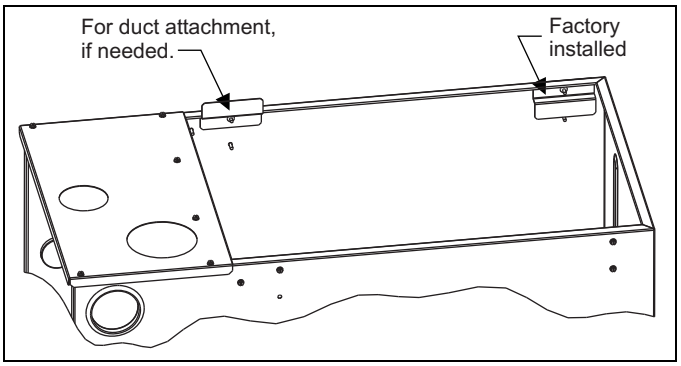


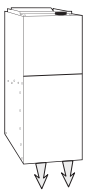
FIGURE 1: Duct Attachment

DUCTWORK INSTALLATION AND SUPPLY PLENUM CONNECTION - UPFLOW/HORIZONTAL



Attach the supply plenum to the furnace outlet. 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 8. 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.

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.

COIL/FURNACE ASSEMBLY - MC/FC/PC SERIES COILS

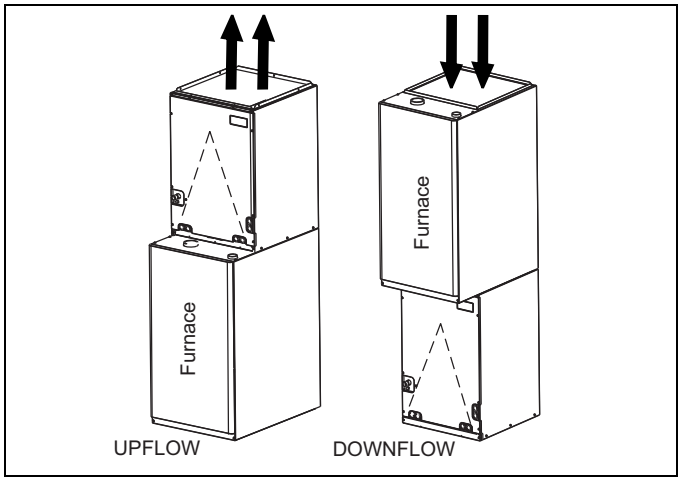


FIGURE 2: Vertical Applications

FURNACE ASSEMBLY - MC & FC SERIES COILS

These coils are factory shipped for installation in either upflow or downflow applications with no conversion.

Position the coil casing over or under the furnace opening as shown in Figure 2 after configuring coil flanges as required see “Coil Flange” section below.

COIL FLANGE INSTALLATION

The coils include removable flanges to allow proper fit up with furnaces having various inlet and outlet flange configurations. The two flanges are attached to the top of the coil in the factory during production. For proper configuration of flanges refer to Figure 3.

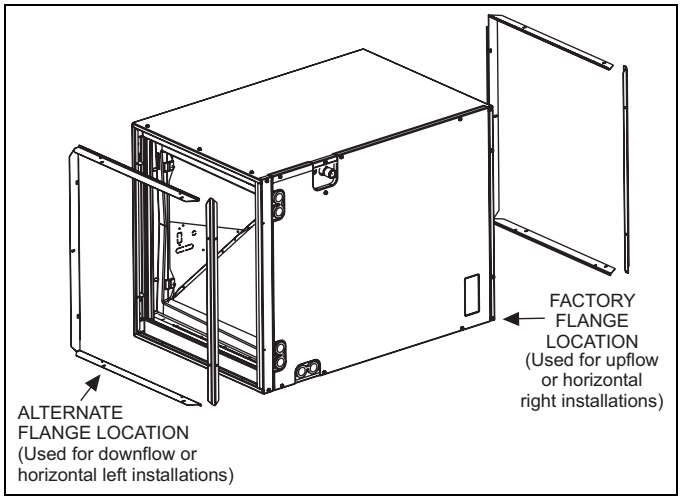


FIGURE 3: Coil Flange

FURNACE ASSEMBLY - MC SERIES COILS ONLY

MC coils are supplied ready to be installed in a horizontal position. A horizontal pan is factory installed. MC coils should be installed in all horizontal applications with the horizontal drain pan side down.

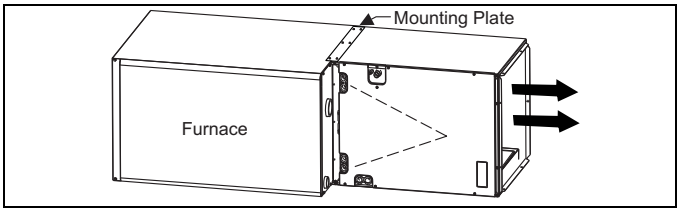


FIGURE 4: Horizontal Right Application

For horizontal left hand applications no conversion is required to an MC coil when used with a downflow/horizontal furnace. A mounting plate, supplied with every coil should always be installed on the side designated as top side. See Figures 4 & 5.

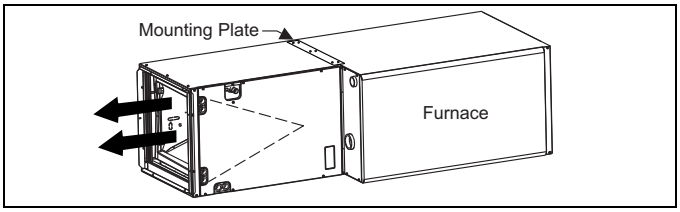


FIGURE 5: Horizontal Left Application

FURNACE ASSEMBLY - PC SERIES COILS

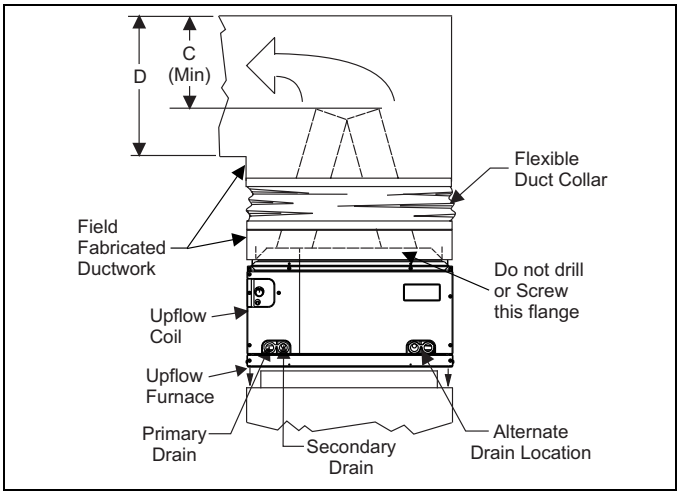


FIGURE 6: PC Series Upflow Coil Installation

Table 2: Coil Projection Dimensions - PC Series Coils

COIL SIZE	DIMENSION “C” INCH
PC18	3-1/2
PC24	4-1/2
PC30, PC32, PC35	4-1/2
PC42, PC43, PC36, PC37	5-1/2
PC48	6-1/2
PC60	9

Dimension “C” should be at least 2/3 of dimension “D”. See Figure 6.

These upflow coils are designed for installation on top of upflow furnaces only.

If the coil is used with a furnace of a different size, use a 45° transition to allow proper air distribution through the coil.

1. Position the coil casing over the furnace opening as shown in Figure 6.
2. Place the ductwork over the coil casing flange and secure.
3. Check for air leakage between the furnace and coil casing and seal appropriately.

⚠CAUTION

Do not drill any holes or drive any screws into the front duct flange on the coil in order to prevent damaging coil tubing. See Figure 6.

CRITICAL COIL PROJECTION

The coil assembly must be located in the duct such that a minimum distance is maintained between the top of the coil and the top of the duct. Refer to Table 2.

COIL / FURNACE ASSEMBLY - HC SERIES COILS

These coils are supplied ready to be installed in a right hand position or a left hand position. When used in conjunction with a horizontal furnace (blow through) application, the coil should be oriented with the opening of the “A” coil closest to the furnace. See Figure 7.

NOTICE

Each coil is shipped with an external tie plate that should be used to secure the coil to the furnace. It should be installed on the back side of the coil using the dimpled pilot holes. See Figure 7.

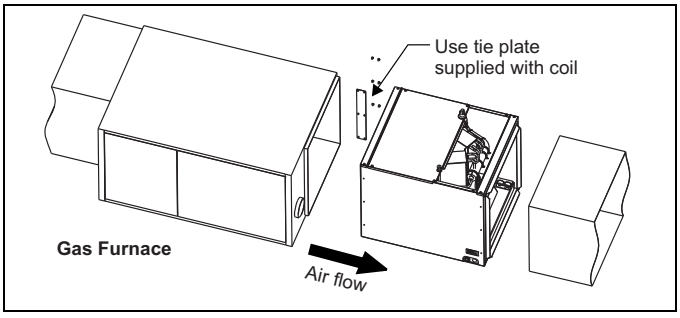


FIGURE 7: Horizontal Left or Right application (Right Shown)

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.

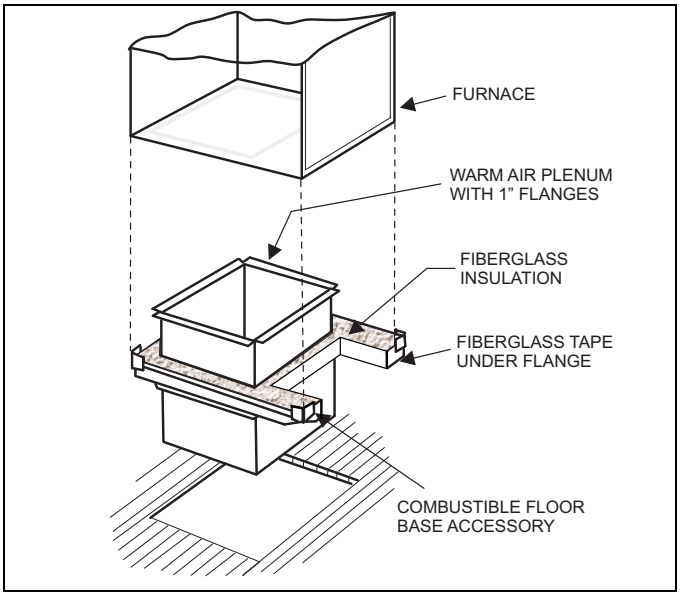


FIGURE 8: Combustible Floor Base Accessory

RESIDENTIAL AND MODULAR HOME UPFLOW RETURN PLENUM CONNECTION

Return air may enter the furnace through the side(s) 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. Be sure the return platform structure or return air plenum is suitable to support the weight of the furnace.

The internal bottom panel must be removed for this application.

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

HORIZONTAL APPLICATION

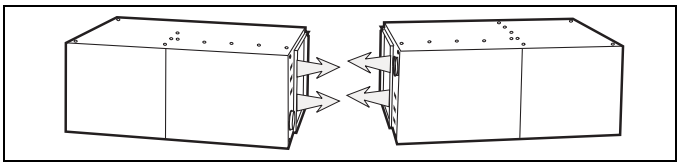


FIGURE 9: Horizontal Application

IMPORTANT

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

ATTIC INSTALLATION

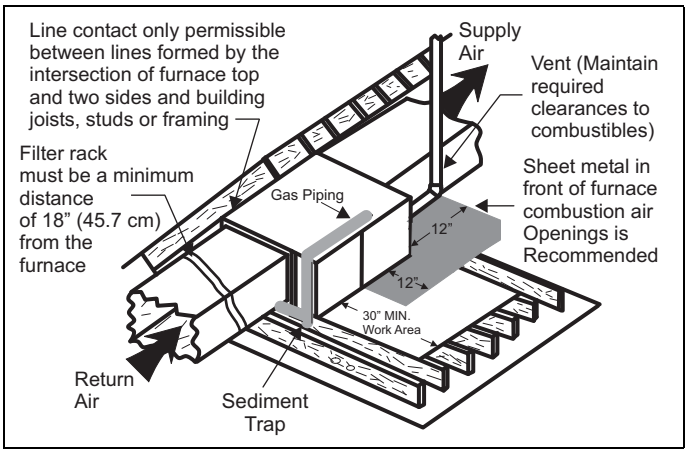


FIGURE 10: Typical Attic Installation

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 10.

⚠WARNING

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

IMPORTANT

During installation, doors should remain on the furnace when moving or lifting.

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

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

SUSPENDED FURNACE / CRAWL SPACE INSTALLATION

The furnace can be hung from floor joists or installed on suitable blocks or 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" (15.2 cm) 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. Refer to Figure 11 for details and additional information.

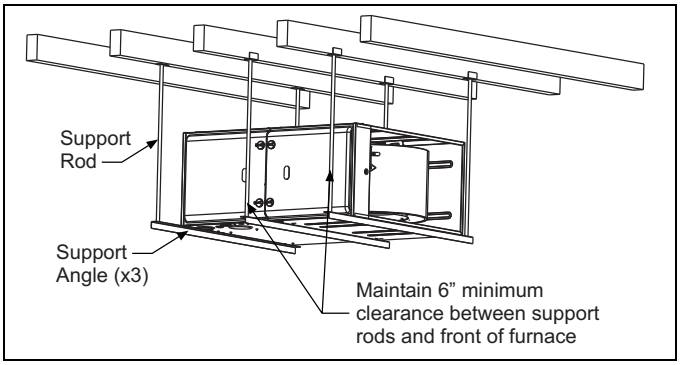


FIGURE 11: Typical Suspended Furnace / Crawl Space Installation

IMPORTANT

During installation, doors should remain on the furnace when moving or lifting.

When moving or handling this furnace prior to installation it is recommended to 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.

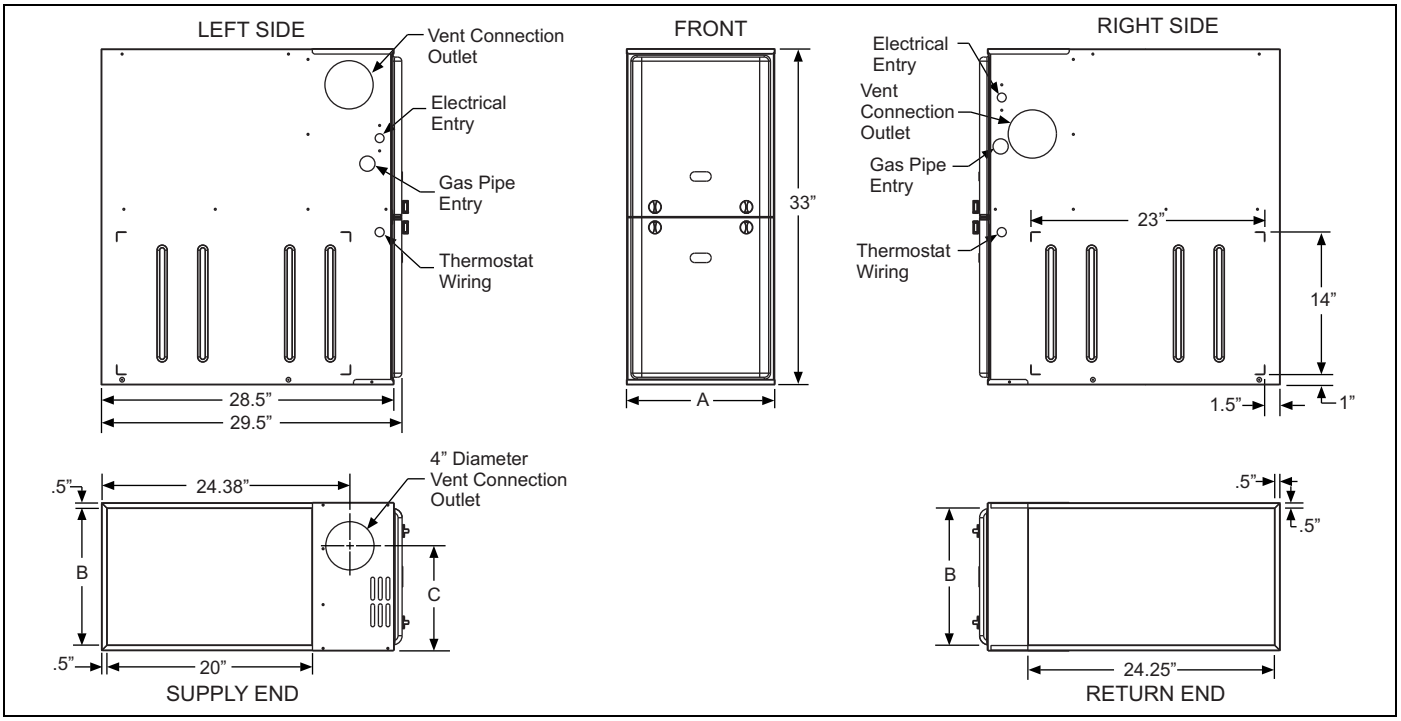


FIGURE 12: Dimensions

Table 3: Cabinet and Duct Dimensions

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

SECTION III: FILTERS

FILTER INSTALLATION

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

Filters must be installed external to the furnace cabinet. **DO NOT attempt to install filters inside the furnace.**

NOTICE

Single side return above 1800 CFM is approved as long as the filter velocity does not exceed filter manufacturer's recommendation.

Table 4: 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) 16 x 25	20 x 25

NOTES:

1. Air velocity through throwaway type filters may not exceed 300 feet per minute (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 16x25 filter. For CFM greater than 1800, you may use two side returns or one side and the bottom or one return with a transition to allow use of a 20x25 filter.

SIDE RETURN

Locate the “L” shaped corner locators. These indicate the size of the cut-out to be made in the furnace side panel. Refer to Figure 13.

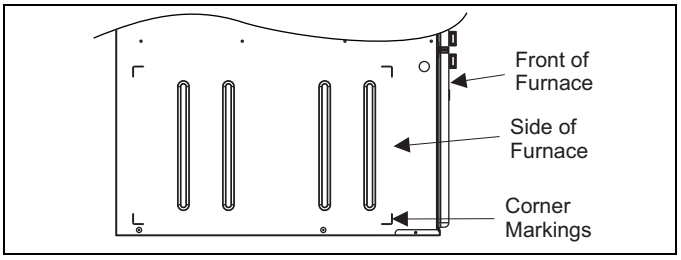


FIGURE 13: Side Return Cutout Markings

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

IMPORTANT

Some accessories such as electronic air cleaners and pleated media may require a larger side opening. Follow the instructions supplied with that accessory for side opening requirements. Do not cut the opening larger than the dimensions shown in Figure 12.

HORIZONTAL APPLICATION

Horizontal Filters

⚠CAUTION

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

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

Downflow Filters

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 duct) attached to the plenum must attach to the vertical plenum above the filter height.

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

SECTION IV: GAS PIPING

GAS SAFETY

⚠DANGER

An overpressure protection device, such as a pressure regulator, must be installed in the gas piping system upstream of the furnace and must act to limit the downstream pressure to the gas valve so it does not exceed 0.5 PSI (14" w.c. (3.48 kPa). Pressures exceeding 0.5 PSI (14" w.c. (3.48 kPa) at the gas valve will cause damage to the gas valve, resulting in a fire or explosion or cause damage to the furnace or some of its components that will result in property damage and loss of life.

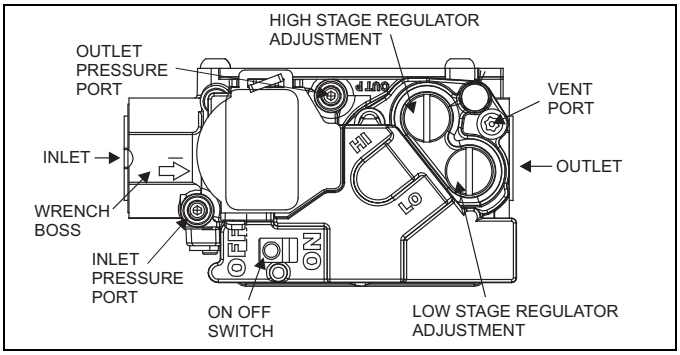


FIGURE 14: Gas Valve

IMPORTANT

Plan your gas supply before determining the correct gas pipe entry. Use 90-degree service elbow(s), or short nipples and conventional 90-degree elbow(s) to enter through the cabinet access holes.

GAS PIPING INSTALLATION

Properly sized wrought iron, approved flexible or steel pipe 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. Refer to Figure 15.

NOTE: Ground Union maybe installed inside or outside unit.

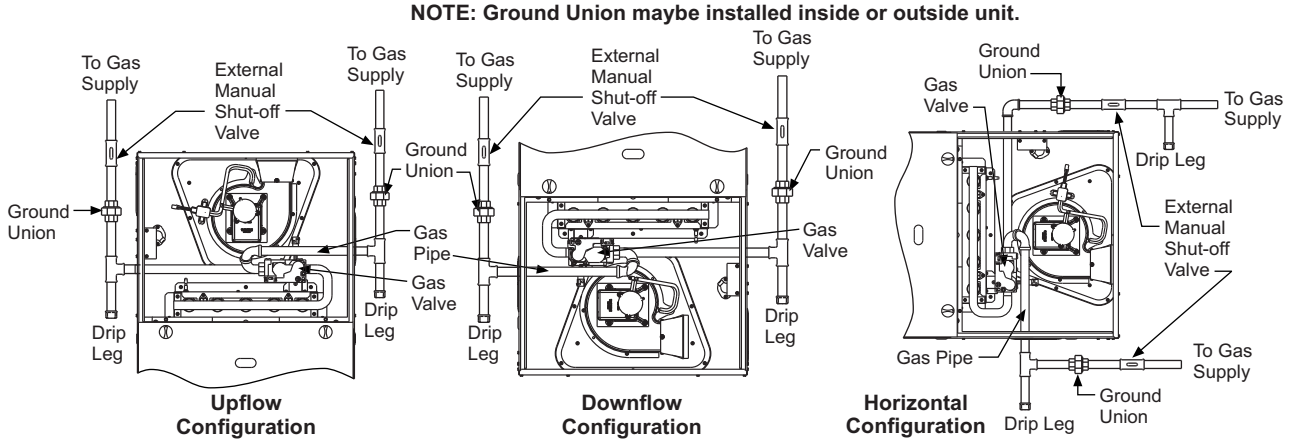


FIGURE 15: Gas Piping

IMPORTANT

An accessible manual shutoff valve must be installed upstream of the furnace gas controls and within 6 feet (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 1/2 psig (3.5 kPa).

⚠CAUTION

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

Gas piping may be connected from either side of the furnace using any of the gas pipe entry on both sides of the furnace. Refer to Figure 12.

GAS ORIFICE CONVERSION FOR PROPANE (LP)

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

⚠WARNING

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

HIGH ALTITUDE GAS ORIFICE CONVERSION

This furnace is constructed at the factory for natural gas-fired operation at 0 –5,000 feet (0-m – 1,524 m) above sea level.

The manifold pressure must be changed in order to maintain proper and safe operation when the furnace is installed in a location where the altitude is greater than 5,000 feet (1,524 m) above sea level. Refer to Tables 5 & 6 for proper manifold pressure settings.

HIGH ALTITUDE PRESSURE SWITCH CONVERSION

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

Table 5: Nominal Manifold Pressure - High Fire

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

TABLE 6: Nominal Manifold Pressure - Low Fire

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

⚠DANGER

PROPANE AND HIGH ALTITUDE CONVERSION KITS

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

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

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

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

An authorized distributor or dealer must make all gas conversions.

In Canada, a certified conversion station or other qualified agency, using factory specified and/or approved parts, must perform the conversion. The installer must take every precaution to insure that the furnace has been converted to the proper gas orifice size when the furnace is installed. Do not attempt to drill out any orifices to obtain the proper orifice size. Drilling out a gas orifice will cause misalignment of the burner flames, causing premature heat exchanger burnout, high levels of carbon monoxide, excessive sooting, a fire hazard, personal injury, property damage and/or death.

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. Refer to Table 7 in these instructions for specific furnace electrical data.

The residential supply must have a bonded neutral.

⚠CAUTION

Use copper conductors only.

Table 7: Ratings & Physical / Electrical Data

High Fire Input		Low Fire Input		High Fire Output		Low Fire Output		Nominal Airflow		Max. Over-current Protect	Max. Outlet Air Temp	
MBH	kW	MBH	kW	MBH	kW	MBH	kW	CFM	m^3/min		°F	°C
60	17.6	39	11.4	47	13.8	31	9.1	1200	34.0	10	160	71.1
80	23.5	52	15.2	63	18.5	42	12.2	1200	34.0	10	160	71.1
80	23.5	52	15.2	63	18.5	42	12.2	1600	45.3	15	160	71.1
100	29.3	65	19.0	80	23.4	52	15.2	1600	45.3	15	160	71.1
100	29.3	65	19.0	80	23.4	52	15.2	2000	56.6	20	160	71.1
120	33.7	78	22.9	96	26.9	62	18.3	2000	56.6	20	160	71.1
High Fire Air Temp. Rise		**Low Fire Air Temp. Rise**		**Blower**		**Blower Size**		**AFUE**	**Total Unit Amps**	**Min. wire Size (awg) @ 75 ft one way**	**Operating weight**	
°F	°C	°F	°C	HP	Amps	In.	cm	%			Lbs.	Kg.
30-60	17-33	15-45	8-25	1/2	7.7	11 x 8	27.9 x 20.3	80.0	9.0	14	94	43
30-60	17-33	20-50	11-28	1/2	7.7	11 x 8	27.9 x 20.3	80.0	9.0	14	103	47
30-60	17-33	20-50	11-28	3/4	9.6	11 x 10	27.9 x 25.4	80.0	12.0	14	114	52
30-60	17-33	20-50	11-28	3/4	9.6	11 x 10	27.9 x 25.4	80.0	12.0	14	118	54
30-60	17-33	20-50	11-28	1	12.8	11 x 11	27.9 x 27.9	80.0	14.0	12	122	55
30-60	17-33	20-50	11-28	1	12.8	11 x 11	27.9 x 27.9	80.0	14.0	12	129	57

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

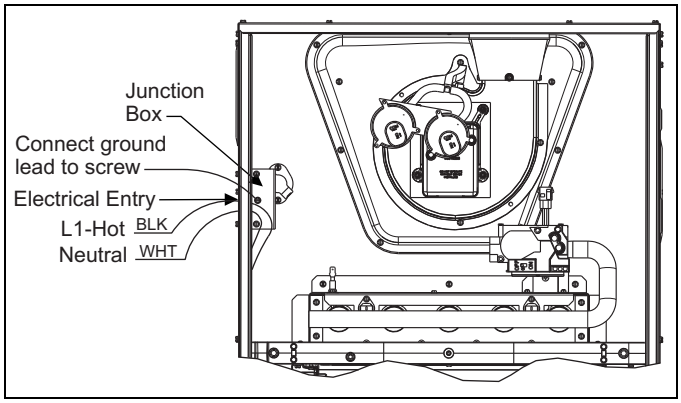


FIGURE 16: Electrical Wiring

1. Provide a power supply separate from all other circuits. Install over-current 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. Refer to the wiring diagram in this instruction.
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 3 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 the wiring schematic in this 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” (5.1 cm) x 4” (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. Refer to Figure 16.
3. The furnace's control system requires correct polarity of the power supply and a proper ground connection. Refer to Figure 16.

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 section below entitled “Conventional Low Voltage Control Wiring”. To use four-wire communications control wiring, see the section below entitled “Control Wiring using Communicating Controls”.

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 A-R-C-B. Commands, operating conditions, and other data are passed continually between components over the A-R-C-B. See Figure 17. The result is a new level of comfort, versatility, and simplicity.

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

This furnace may be used with the Communicating Thermostat Control and a non-communicating outdoor air conditioner by installing the AC Communicating Control Board Kit to the outdoor unit. This system allows full communication between the furnace and thermostat and limited communication to the outdoor unit. See Figure 18.

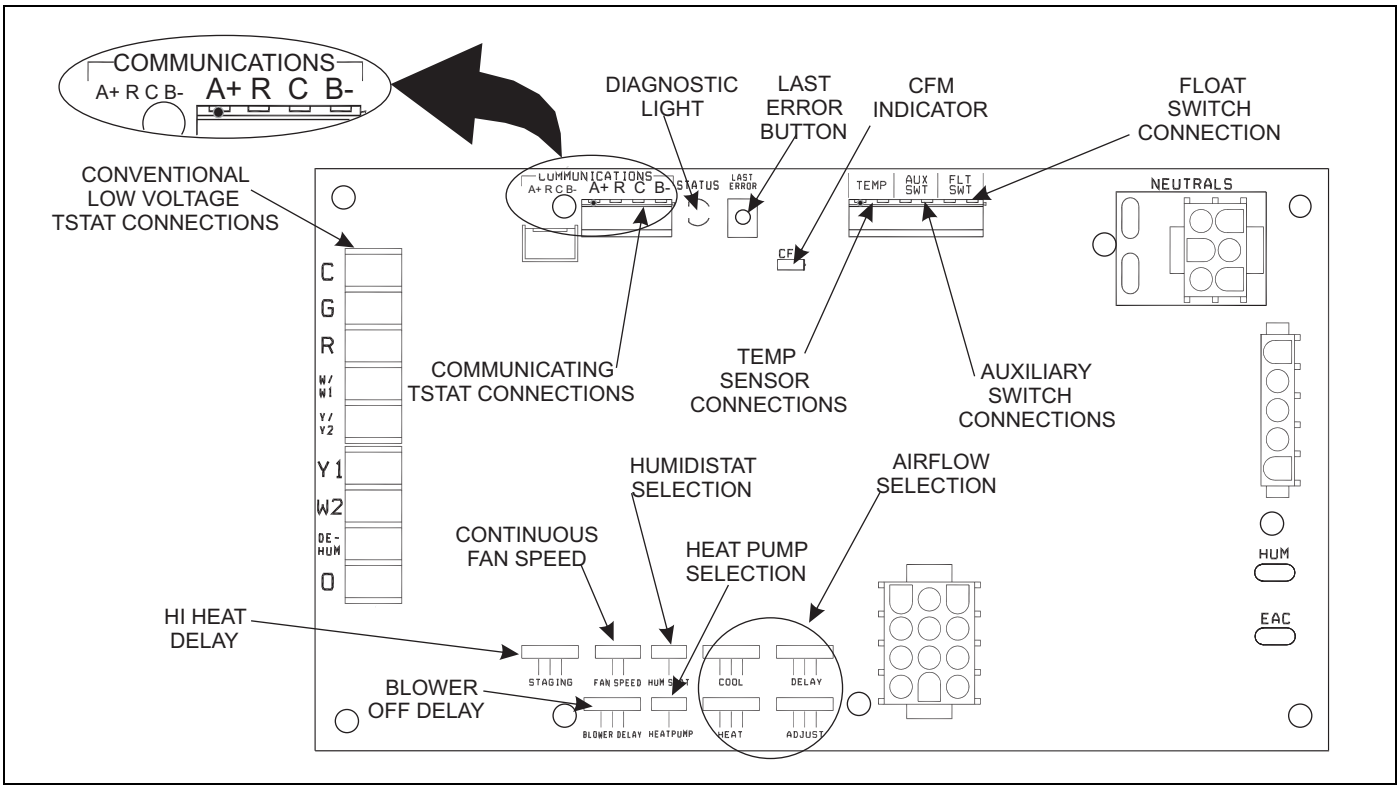


FIGURE 17: Furnace Control Board – Communications Connections

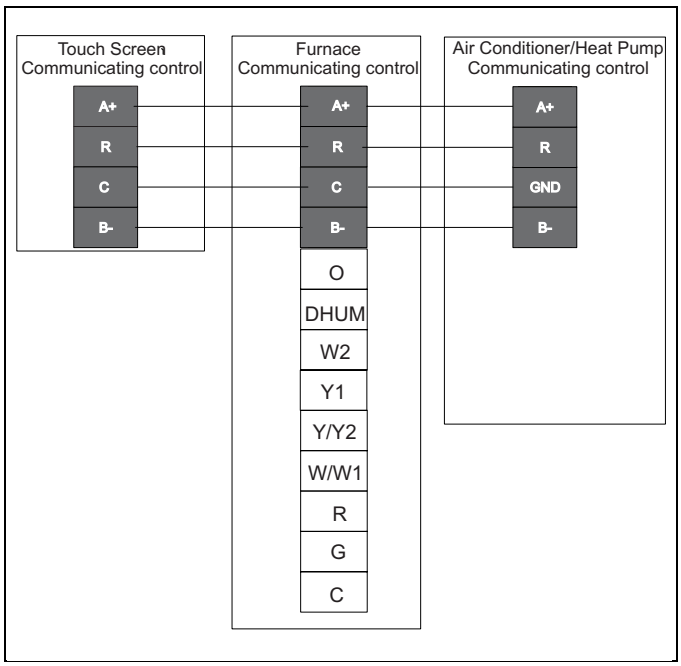


FIGURE 18: Two-stage Furnace with Communicating AC or HP

CONTROL WIRING USING COMMUNICATING CONTROLS

Use the wiring diagram above 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 “GND” or “C” terminals are connected together and all of the “R” terminals are connected together. See Figure 18. 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.

Float Switch Input

An optional switch may be connected to the FLT SWT terminals on the control board. This feature is only functional when used with the Communication Control. It is intended for use with a water overflow switch.

Auxiliary Switch Input

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

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 Figures 20-23. Electronic thermostats may require the common wire to be connected. Apply strain relief to thermostat wires passing through cabinet. If air conditioning equipment is installed, use thermostat wiring to connect the Y and C terminals on the furnace control board to the proper wires on the condensing unit (unit outside).

IMPORTANT

Set the heat anticipator in the room thermostat to 0.4 amps. 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-volt, 40 VA transformer is sized for the furnace components only, and should not be connected to power auxiliary devices such as humidifiers, air cleaners, etc. The transformer may provide power for an air conditioning unit contactor.

For additional connection diagrams for all UPG equipment refer to “Low Voltage System Wiring” document available on-line at www.upgnet.com in the Product Catalog Section.

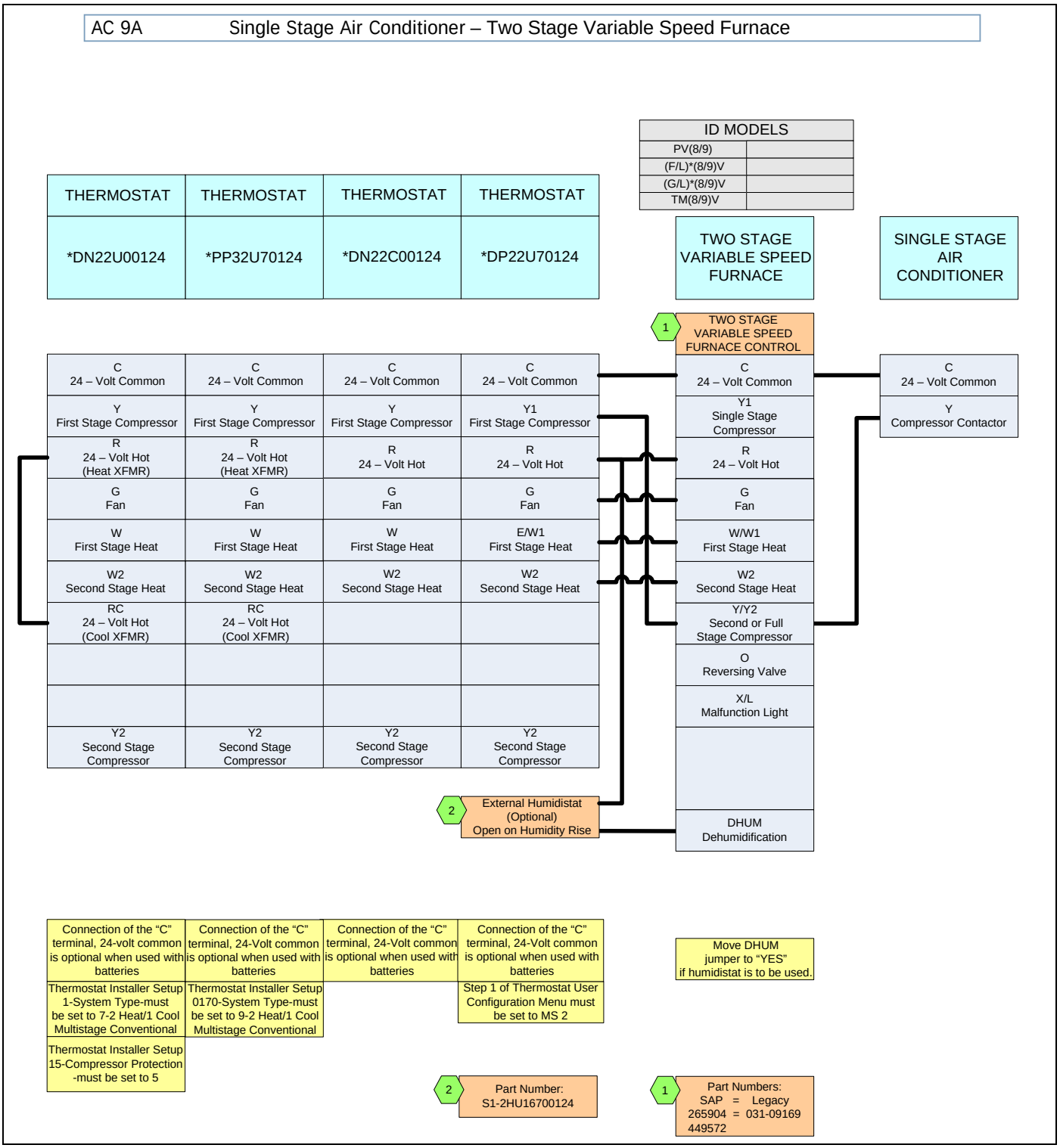


FIGURE 19: Thermostat Chart - Single Stage Air Conditioners with Two Stage Variable Speed Furnaces

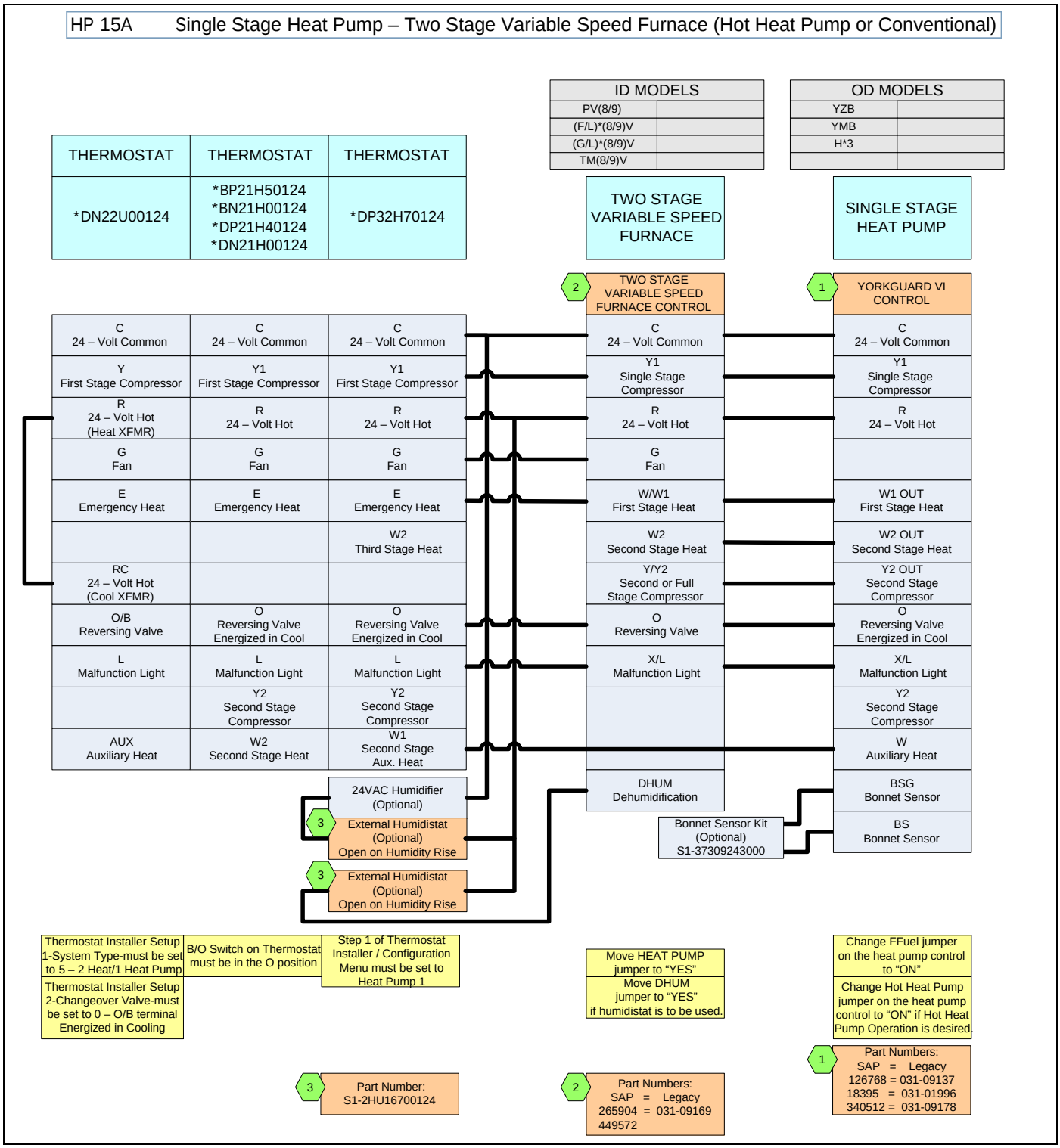


FIGURE 20: Thermostat Chart - Single Stage Heat Pump with Two Stage Variable Speed Furnace (Hot Heat Pump or Conventional)

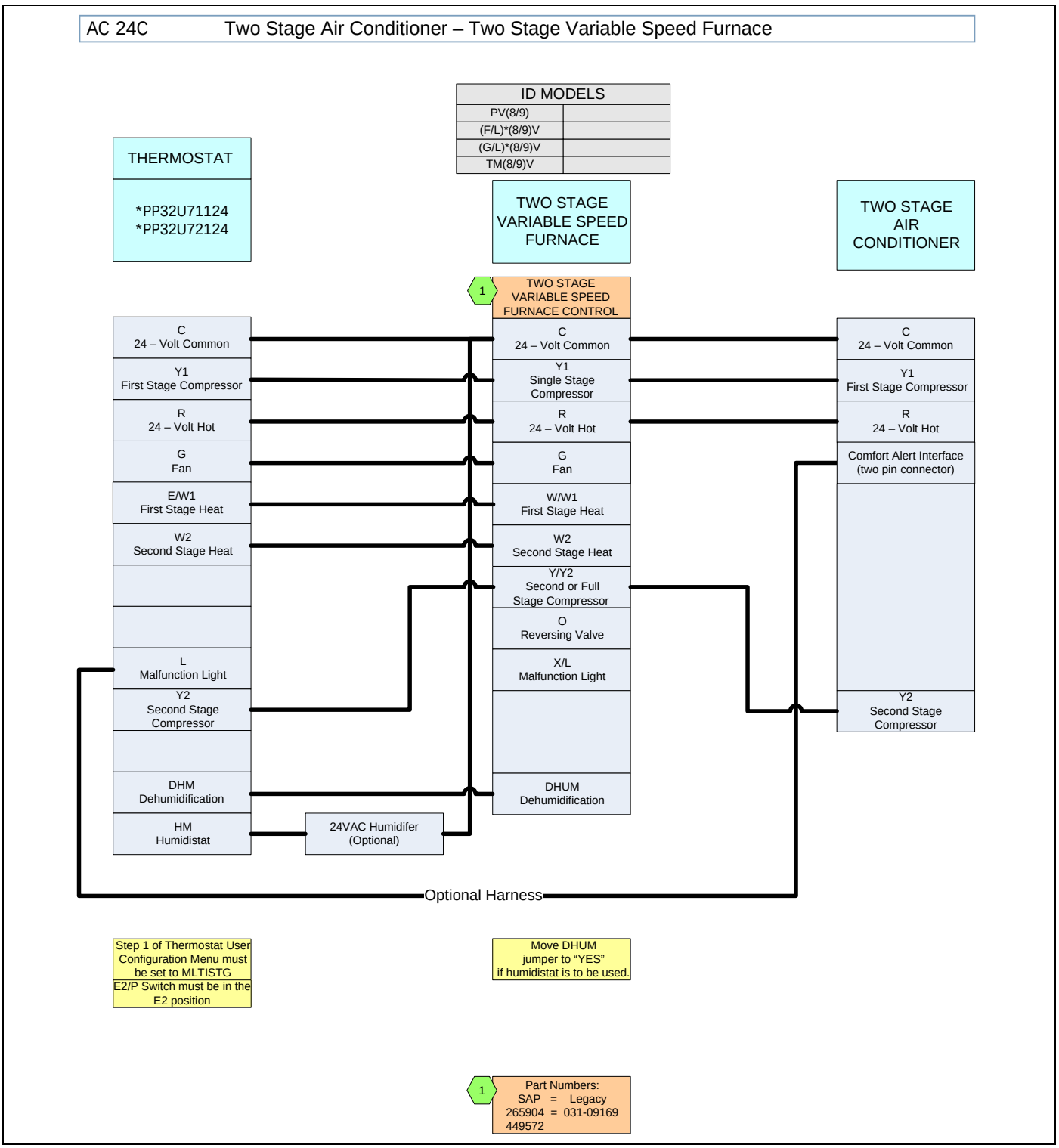


FIGURE 21: Thermostat Chart - Two Stage AC with Two Stage Variable Speed Furnace

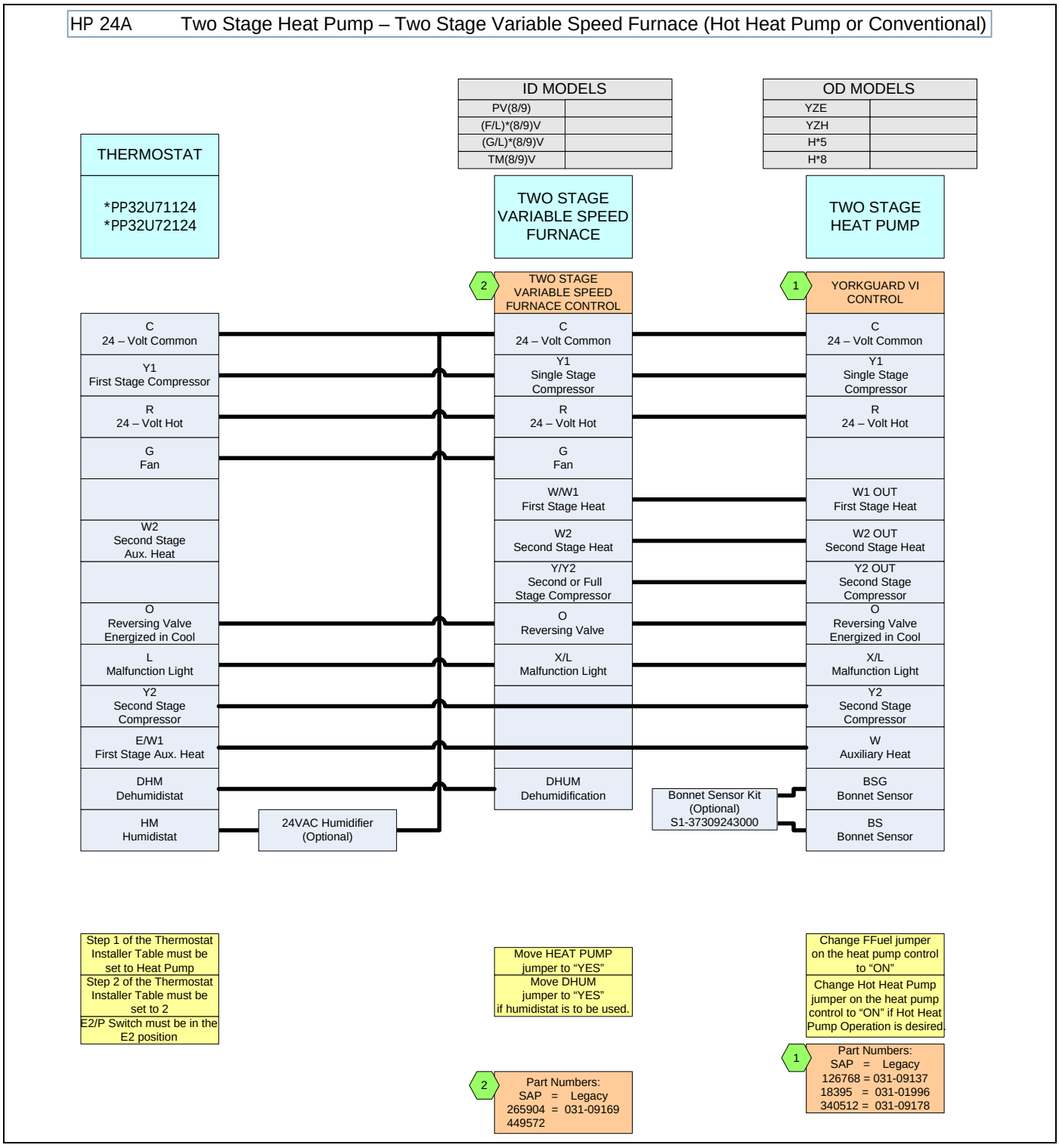


FIGURE 22: Thermostat Chart - Two Stage HP with Two Stage Variable Speed Furnace (Hot Heat Pump or Conventional)

ACCESSORY CONNECTIONS

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

ELECTRONIC AIR CLEANER CONNECTION

Two 1/4" (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 amp maximum) during circulating blower operation.

HUMIDIFIER CONNECTION

Two 1/4" (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.

SINGLE STAGE THERMOSTAT

If a single stage thermostat is used, the high/low input staging will be controlled by the furnace control board, using the staging jumper. If the staging jumper is set to the 10, 15, or 20 position, the furnace will switch from low fire to high fire after 10, 15, or 20 minutes and will stay in high fire until the thermostat is satisfied. If the staging jumper is left in the OFF position and a single stage thermostat is used, the furnace will only operate at low fire.

TWINNING

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

SECTION VI: VENT SYSTEM

VENT CONNECTIONS

All models are provided with a flue transition that is sized for 4" diameter vent connections. If a larger size vent connector is required, that connection must be installed external to the furnace. Figure 24 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° being careful not to damage the gasket. Reinstall screws. Remove cap from appropriate vent outlet location on the cabinet, cut insulation in cabinet to same size as the hole provided and reinstall cap in the hole in the top panel.

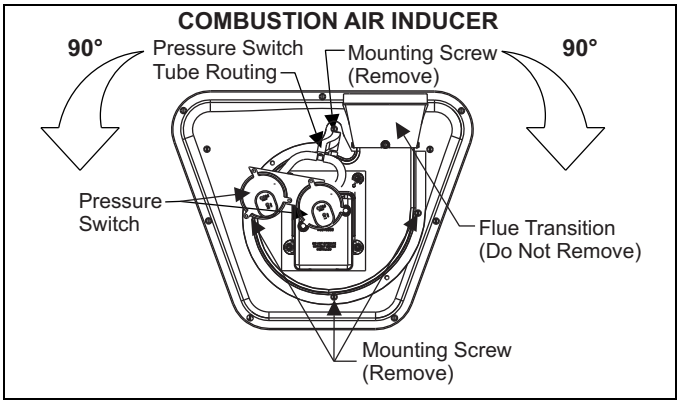


FIGURE 23: Combustion Air Inducer

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.

CATEGORY 1 - 450 F. MAX. VENT TEMP.

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

The furnace shall be connected to any type of B, BW or L vent connector, and shall be connected to a factory-built or masonry chimney. **The furnace shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.**

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

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

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

VENTING

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

VENTING INTO AN EXISTING CHIMNEY

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

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

1. The masonry chimney must be built and installed in accordance with nationally recognized building codes or standards and must be lined with approved fire clay tile flue liners or other approved liner material that will resist corrosion, softening, or cracking from flue gases. **THIS FURNACE IS NOT TO BE VENTED INTO AN UNLINED MASONRY CHIMNEY.**
2. This furnace must be vented into a fire clay tile lined masonry chimney only if a source of dilution air is provided, such as by common venting with a draft hood equipped water heater. If no source of dilution air is available, Type B vent must be used, or masonry chimney vent kit 1CK0603 or 1CK0604 must be used. Refer to the instructions with the kit to properly apply these masonry chimney kits.
3. The chimney must extend at least 3 ft (0.91 m) above the highest point where it passes through a roof of a building and at least two feet higher than any portion of the building with a horizontal distance of ten feet.
4. The chimney must extend at least 5 ft (1.5 m) above the highest equipment draft hood or flue collar.

FAN-ASSISTED COMBUSTION SYSTEM

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

Ambient Combustion Air Supply

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

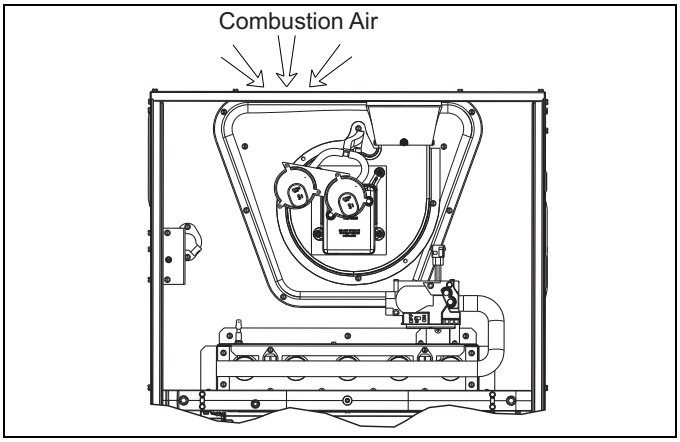


FIGURE 24: Combustion Airflow Path Through The Furnace Casing to the Burner Compartment

⚠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.

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

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

A **confined space** is an area with less than 50 cu.ft (1.42 m^3) per 1,000 Btu/hr (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, refer to Table 8, to estimate free area.

Table 8: Estimated Free Area

Wood or Metal Louvers or Grilles	Wood 20-25%* Metal 60-70% *
Screens+	1/4” (0.635 cm) mesh or larger 100%

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

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 0.25” (0.64 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

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

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

Table 9: Unconfined Space Minimum Area

BTUH 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 (742 cm^2)

Table 10: Free Area

BTUH Input Rating	Minimum Free Area Required for Each Opening		
	Horizontal Duct (2,000 BTUH)	Vertical Duct or Opening to Outside (4,000 BTUH)	Round Duct (4,000 BTUH)
60,000	30 in^2 (193 cm^2)	15 in^2 (97 cm^2)	5” (13 cm)
80,000	40 in^2 (258 cm^2)	20 in^2 (129 cm^2)	5” (13 cm)
100,000	50 in^2 (322 cm^2)	25 in^2 (161 cm^2)	6” (15 cm)
120,000	60 in^2 (387 cm^2)	30 in^2 (193 cm^2)	7” (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			

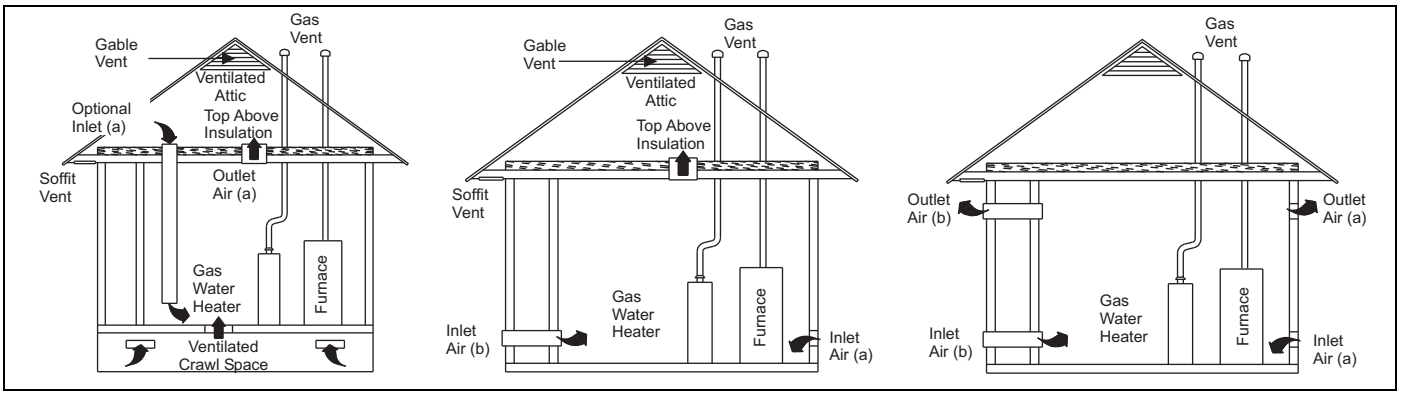


FIGURE 25: Outside and Ambient Combustion Air

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" (30.5 cm) horizontally from, the burner level of the appliance. Refer to "COMBUSTION AIR SOURCE FROM OUTDOORS and VENT AND SUPPLY AIR SAFETY CHECK" in these instructions for additional information and safety check procedure.
2. The duct 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" (30.5 cm) above the outside grade level.

Combustion Air Source from Outdoors

1. Two permanent openings, one within 12 in (30.5 mm) of the top and one within 12 in (30.5 mm) of bottom of the confined space, Two permanent openings, shall communicate directly or by means of ducts with the outdoors, crawl spaces or attic spaces.
2. One permanent openings, commencing within 12 in (30.5 mm) of the top of the enclosure shall be permitted where the equipment has clearances of at least 1 in (2.54 cm) from the sides and back and 6 in (15.24 cm) from the front of the appliance. The opening shall communicate directly with the outdoors and shall have a minimum free area of:
   a. 1 square in per 3000 Btu per hour (7.3 cm^2 per kW) of the total input rating of all equipment located in the enclosure.
   b. Not less than the sum of all vent connectors in the confined space.
3. The duct shall be least the same cross-sectional area as the free area of the air supply inlet opening to which it connects.
4. The blocking effects of louvers, grilles and screens must be given consideration in calculating free area. If the free area of a specific louver or grille is not known. Refer to Table 8 to estimate free area.

Ventilated Combustion Air

The ventilated attic space or a crawl space from which the combustion air is taken must comply with the requirements specified in "AIR SOURCE FROM OUTDOORS" in this instruction or in Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 (latest edition). This type installation requires two properly sized pipes. One brings combustion air from a properly ventilated attic space or crawl space and a second pipe that extends from the furnace vent connection (top right of unit) to the exterior of the building.

Vent and Supply (Outside) Air Safety Check Procedure

For Category I furnaces, vent installations shall be in accordance with Parts 7 and 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and or Section 7 and Appendix B of the CSA B149.1, Natural Gas and Propane Installation Codes, the local building codes, furnace and vent manufacture'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 manufacture'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" per foot (0.635 cm/m) from the furnace to the vent terminal.

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

⚠WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon-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 minutes of main burner operation. Appliances that do not have draft hoods need to be checked at the vent pipe as close to the appliance as possible. Use a combustion analyzer to check the CO2 and CO levels of each appliance. Use a draft gauge to check for a downdraft or inadequate draft condition.
6. After it has been determined that each appliance properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their normal condition.
7. If improper venting is observed during any of the above tests, a problem exists with either the venting system or the appliance does not have enough combustion air (Supply Air from outside) to complete combustion. This condition must be corrected before the appliance can function safely.

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

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

SECTION VII: START-UP AND ADJUSTMENTS

The initial start-up of the furnace requires the following additional procedures:

IMPORTANT

All electrical connections made in the field and in the factory should be checked for proper tightness.

When the gas supply is initially connected to the furnace, the gas piping may be full of air. In order to purge this air, it is recommended that the ground union be loosened until the odor of gas is detected. When gas is detected, immediately retighten the union and check for leaks. Allow five minutes for any gas to dissipate before continuing with the start-up procedure. Be sure proper ventilation is available to dilute and carry away any vented gas.

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

⚠WARNING

FIRE OR EXPLOSION HAZARD

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

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

IMPORTANT

Burner ignition may not be satisfactory on first 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.

It is recommended that when the gas supply is first connected to the furnace, the ground union be loosened until the odor of gas is detected. When gas is detected, immediately tighten the union and check for gas leaks. Allow five minutes for any gas to dissipate before continuing with the start-up procedure. Be sure that proper ventilation is available to dilute and carry away any vented gas.

With 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 shut-off valve must be disconnected from the gas supply during any pressure testing of that system at test pressures in excess of 1/2 PSI (3.45 kPa).

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

IGNITION SYSTEM SEQUENCE

1. Turn the gas supply ON at external valve and main gas valve.
2. Set the thermostat above room temperature to call for heat.
3. System start-up will occur as follows:
   a. The induced draft blower motor will start and come up to speed. Shortly after inducer start-up, the hot surface igniter will glow for about 17 seconds.
   b. After this warm up, the ignition module will energize (open) the main gas valve.
   c. The furnace will light at the high fire input rate. If the thermostat is calling for low fire, the rate will drop to low fire after flame is established.
   d. After flame is established, the supply air blower will start in about 30 seconds.

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 3 attempts to light before locking out.

With 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 steps to stop any leak. If a leak persists, replace the component.

CALCULATING THE FURNACE INPUT (NATURAL GAS)

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 wc or more than 3.8 in wc for natural gas at sea level. If manifold pressure is outside this range, change main burner orifices.*

⚠CAUTION

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

NOTICE

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

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 minutes in heating operation.
3. Measure time (in sec) for gas meter to complete 1 revolution and note reading. The 2 cubic feet dial provides a more accurate measurement of gas flow.
4. Refer to Table 11 for cubic feet of gas per hour.
5. Multiply cubic feet per hour by heating valve (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.

Table 11: Gas Rate (CU FT/HR)

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

Seconds For 1 Revolution	Size of Test Dial		
	1 Cu Ft	2 Cu Ft	5 Cu Ft
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

ADJUSTMENT OF MANIFOLD GAS PRESSURE & INPUT RATE

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. Refer to Figure 27 for a drawing of the locations of the pressure ports on the gas valve.

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 gas line pressure must be taken at the port marked IN P.
3. Using a 3/32” (2.4 mm) Allen wrench, loosen the set screw by turning it 1 turn counter clockwise. DO NOT REMOVE THE SET SCREW FROM THE PRESSURE PORT.

Read the inlet gas pressure

Connect the positive side of the manometer to the IN P Tap on the gas valve. Do not connect any tubing to the negative side of the manometer, as it will reference atmospheric pressure. Refer to Figure 27 for connection details.

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

Table 12: Inlet Gas Pressure Range

INLET GAS PRESSURE RANGE		
	Natural Gas	Propane (LP)
Minimum*	4.5” W.C. (1.12 kPa)	8.0” W.C. (1.99 kPa)
Maximum	10.5” W.C. (2.61 kPa)	13.0” (3.24 kPa) W.C.

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” w.c. (1.74 kPA) for Natural Gas
- 11” w.c. (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.

2. Once the correct gas inlet pressure has been established, see Table 12, turn the gas valve to OFF and turn the electrical supply switch to OFF; then remove the flexible tubing from the gas valve pressure tap and tighten the pressure tap plug using the 3/32” (2.4 mm) allen wrench.
3. Turn the electrical and gas supplies back on, and with the burners in operation, check for gas leakage around the gas valve pressure port for leakage using an approved non-corrosive gas leak detection fluid, or other non-flammable leak detection methods.

Read the manifold gas pressure

Connect the positive side of the manometer to the adapter previously installed in the OUT P Tap on the gas valve. Do not connect any tubing to the negative side of the manometer, as it will reference atmospheric pressure. Refer to Figure 28 for connection details.

IMPORTANT

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

NOTICE

The regulated outlet pressures, both low and high, have been calibrated at the factory. Additional pressure adjustment should not be necessary. If adjustment is necessary, set to the following specifications. After adjustment, check for gas leakage.

1. Refer to Figure 27 for location of pressure regulator adjustment cap and adjustment screws on main gas valve.
2. Turn gas and electrical supplies on and follow the operating instructions to place the unit back in operation.

NOTICE

This furnace uses a two stage gas valve. The high-fire and low-fire manifold pressures can be adjusted independently.

3. Adjust manifold pressure by adjusting gas valve regulator screw for the appropriate gas per the following:

Table 13: Nominal Manifold Pressure

NOMINAL MANIFOLD PRESSURE		
Natural Gas	High Fire	Low Fire
	3.5" w.c. (0.87 kPa)	1.5" w.c. (0.37 kPa)
Propane (LP) Gas	10.0" w.c. (2.488 kPa)	4.2" w.c. (1.04 kPa)

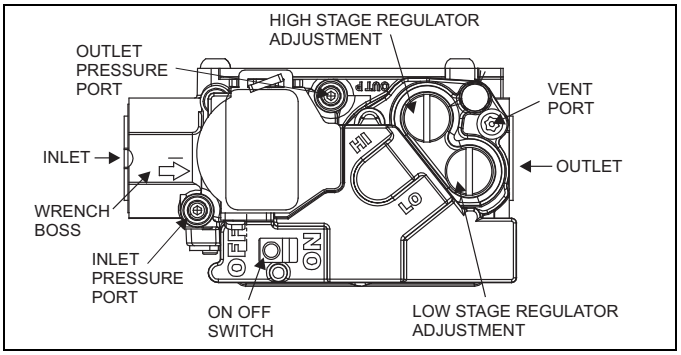


FIGURE 26: Gas Valve

IMPORTANT

If gas valve regulator is turned in (clockwise), manifold pressure is increased. If screw is turned out (counter clockwise), manifold pressure will decrease.

4. After the manifold pressure has been adjusted, re-calculate the furnace input to make sure you have not exceeded the specified input on the rating plate. Refer to “CALCULATING THE FURNACE INPUT (NATURAL GAS)”.
5. Once the correct BTU (kW) input has been established, turn the gas valve to OFF and turn the electrical supply switch to OFF; then remove the flexible tubing from the gas valve pressure tap and tighten the pressure tap plug using the 3/32” (2.4 mm) Allen wrench.
6. Turn the electrical and gas supplies back on, and with the burners in operation, check for gas leakage around the gas valve pressure port for leakage using an approved non-corrosive gas leak detection fluid, or other non-flammable leak detection methods.

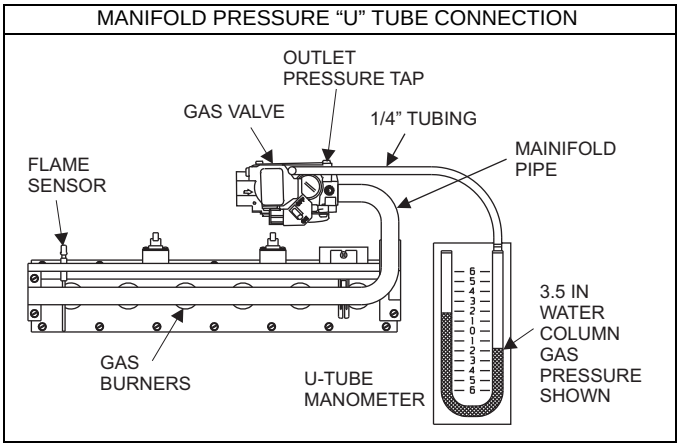


FIGURE 27: Reading Gas Pressure

ADJUSTMENT OF TEMPERATURE RISE

⚠DANGER

The temperature rise, or temperature difference between the return air and the supply (heated) air from the furnace, must be within the range shown on the furnace rating plate and within the application limitations shown in Table 7 "ELECTRICAL AND PERFORMANCE DATA".

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

The temperature rise, or temperature difference between the return air and the heated supply air from the furnace, must be within the range shown on the furnace rating plate and within the application limitations as shown in Table 7.

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts, about six feet (1.83 m) from the furnace where they will not be affected by radiant heat. Increase the blower speed to decrease the temperature rise; decrease the blower speed to increase the rise.

VARIABLE SPEED ECM MOTORS

The variable speed motor must be configured so the blower will provide a sufficient airflow so that the furnace operates with in the temperature rise range on the rating plate and within the application limitations shown in Table 7 in these Instructions.

ADJUSTMENT OF FAN CONTROL SETTINGS

Heating Indoor Fan Off Delay

This furnace is equipped with a time-on/time-off heating fan control. The fan on delay is fixed at 30 seconds. The fan off delay has 4 settings (60, 90, 120 and 180 seconds). The fan off delay is factory set to 120 seconds. The fan-off setting must be long enough to adequately cool the furnace, but not so long that cold air is blown into the heated space. The fan-off timing may be adjusted by positioning the jumper on two of the four pins as shown in Figure 29.

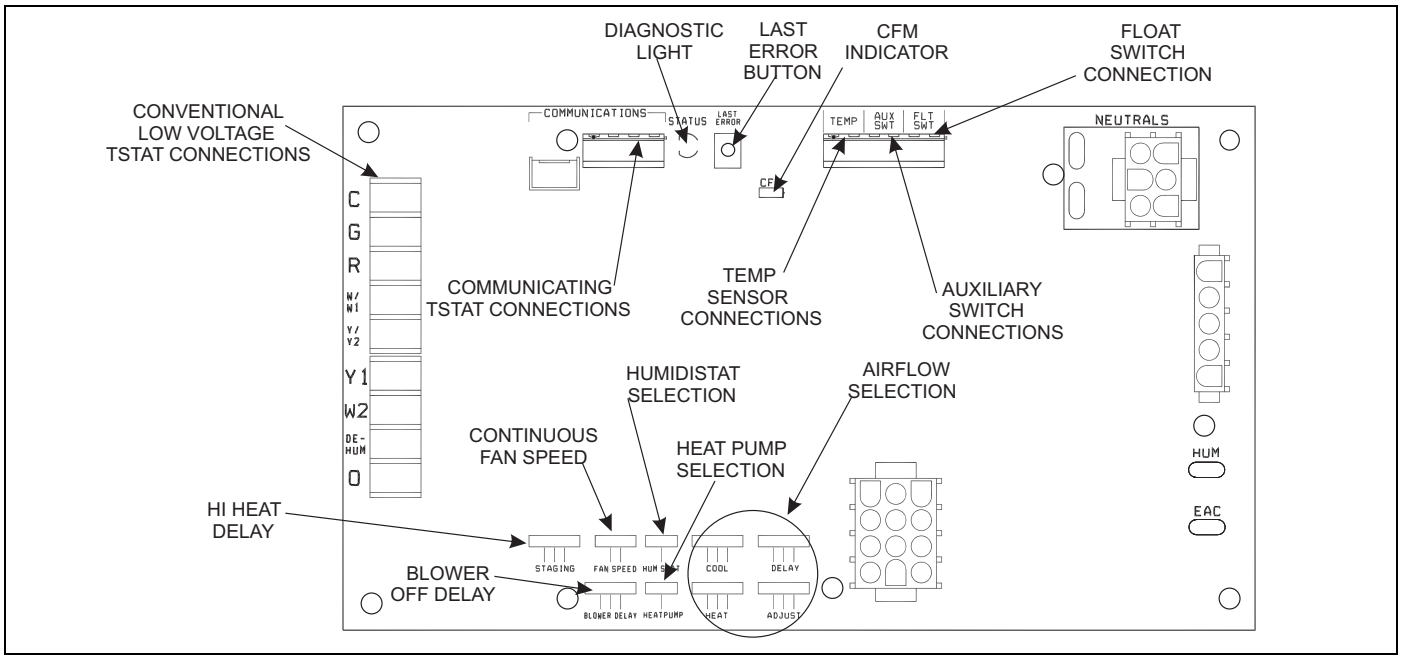


FIGURE 28: Furnace Control Board

SECTION VIII: SAFETY CONTROLS

CONTROL CIRCUIT FUSE

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

BLOWER DOOR SAFETY SWITCH

⚠CAUTION

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

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

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

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

ROLLOUT SWITCH CONTROLS

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

PRESSURE SWITCHES

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

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

LIMIT CONTROLS

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

1. A dirty filter.
2. If the indoor fan motor should fail.
3. Too many supply or return registers closed or blocked off.

The control module will lockout if the limit trips 5 consecutive times. If this occurs, control will reset & try ignition again after 1 hour. SEQUENCE OF OPERATION

Heating and Cooling Airflow

The heating and the cooling airflows are preset at the factory. The heating airflow is set to the maximum CFM. The cooling airflow is set to provide 90 percent of the maximum CFM. The heating and cooling airflows must be field adjusted to match the HVAC system at installation. See Table 14 for the HEAT, COOL and ADJ jumper settings to use for specific airflows.

CFM Board - Delay Taps Selection

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

Tap A is the default profile. It provides a 30-second ramp-up from zero airflow to full capacity and a 30-second 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 seconds 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 minutes, then will ramp up to 82% of full capacity and will stay there for five minutes, 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 seconds 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 seconds. Then it will ramp down to zero. In every case, it will take the motor 30 seconds 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 seconds, 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 seconds, then will ramp down to zero. In every case, it will take the motor 30 seconds to ramp from one speed to another.

Continuous Blower Operation

The blower will run continuously whenever the wall thermostat fan switch is in the ON position. The furnace blower will run at the speed selected on the FAN SPEED jumpers on the main control board (HI COOL, LO COOL, HI HEAT or LO HEAT). When the jumper is in the VS G position, the blower will run at 50% of the high cool speed.

Intermittent Blower Cooling

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

Intermittent Blower Heating

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

Humidistat

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

Hot Surface Ignition System

⚠WARNING

HOT SURFACE IGNITION SYSTEM

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

TROUBLESHOOTING

The following visual checks should be made before troubleshooting:

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

⚠WARNING

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

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

Never adjust pressure switch to allow furnace operation.

FURNACE CONTROL DIAGNOSTICS

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

The SLOW flash speed is two seconds on and two seconds off.

The other flash codes listed below have the following timing: LED light will turn on for 1/3 second and off for 1/3 second. This pattern will be repeated the number of times equal to the code. There will be a two-second pause between codes. For example, the six red flash code will flash the LED light on and off six times, then will be off for two seconds. This pattern will repeat as long as the fault condition remains. The continuous flash codes listed below will flash the LED light on and off continuously, with no breaks or longer pauses.

SLOW GREEN FLASH: Normal operation, no thermostat calls.

SLOW AMBER FLASH: Normal operation with call for heat.

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

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

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

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

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

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

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

If the limit switch has not closed within five minutes, the control will assume that the blower is not functioning, will start a hard lockout and will begin to flash the 11 Red Flashes error code. If, after fifteen minutes, the main limit still has not closed, the control will assume that a manual-reset rollout switch has opened and will begin to flash the 5 Red Flash error code. See the description of “5 Red Flashes” and “11Red Flashes” below.

If the main limit switch opens five times within a single call for heat, the control will indicate 4 Red Flashes and will enter a one-hour soft lockout.

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

6 RED FLASHES: This indicates that while the unit was operating, the pressure switch opened four times during the call for heat. Check for faulty inducer, blocked vent pipe or faulty pressure switch. The furnace will lock out for one hour and then restart.

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

8 RED FLASHES: This fault is indicated if the flame is lost five times (four recycles) during the heating cycle. Check for low gas pressure, dirty or faulty flame sensor or faulty gas valve. The furnace will lock out for one hour and then restart.

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

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

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

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

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

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

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

NOTICE

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

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

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. **This feature should only be used by a qualified service technician.**

If more than five error codes have occurred since the last reset, only the five most recent 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 two-second pause between each flash code. After the error codes have all been displayed, the LED will resume the normal slow green flash after a five second 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 five seconds. The LED will flash three green flashes when the memory has been cleared and the button is released, then will resume the normal slow green flash after a five-second pause.

Table 14: Air Flow Data

HIGH / LOW SPEED COOLING AND HEAT PUMP CFM					
60A12		**80B12**		**Jumper Settings**	
High	Low	High	Low	COOL Tap	ADJ Tap*
1309	851	1331	865	A	B
1108	720	1090	708	B	B
1190	774	1210	786	A	A
1007	655	991	644	B	A
1071	696	1089	708	A	C
901	586	891	579	C	B
906	589	892	580	B	C
686	446	636	413	D	B
819	532	810	526	C	A
624	406	578	410	D	A
737	479	729	474	C	C
553	403	520	410	D	C
80C16 CFM		**100C16 CFM**		**Jumper Settings**	
High	Low	High	Low	COOL Tap	ADJ Tap*
1794	1166	1765	1147	A	B
1570	1020	1568	1019	B	B
1631	1060	1605	1043	A	A
1427	928	1425	926	B	A
1468	954	1444	939	A	C
1351	878	1331	865	C	B
1284	835	1282	833	B	C
1115	725	1086	706	D	B
1228	798	1210	786	C	A
1014	659	987	642	D	A
1105	718	1089	708	C	C
913	593	888	577	D	C
100C20 CFM		**120C20 CFM**		**Jumper Settings**	
High	Low	High	Low	COOL Tap	ADJ Tap*
2230	1450	2200	1430	A	B
1792	1165	1826	1187	B	B
2030	1320	2065	1342	A	A
1629	1059	1660	1079	B	A
1827	1188	1858	1208	A	C
1584	1030	1642	1067	C	B
1466	953	1494	971	B	C
1382	898	1401	911	D	B
1440	936	1493	970	C	A
1256	816	1274	828	D	A
1296	842	1344	874	C	C
1130	734	1147	746	D	C
HIGH / LOW HEAT					
60A12 CFM		**80B12 CFM**		**Jumper Settings**	
High	Low	High	Low	HEAT Tap	ADJ Tap*
1111	963	1480	1284	A	Any
988	825	1317	1100	B	Any
889	722	1185	963	C	Any
808	642	1077	856	D	Any
80C16 CFM		**100C16 CFM**		**Jumper Settings**	
High	Low	High	Low	HEAT Tap	ADJ Tap*
1480	1289	1851	1604	A	Any
1317	1100	1646	1375	B	Any
1185	960	1481	1204	C	Any
1077	855	1347	1070	D	Any
100C20 CFM		**120C20 CFM**		**Jumper Settings**	
High	Low	High	Low	HEAT Tap	ADJ Tap*
1851	1604	2220	1925	A	Any
1646	1375	1975	1651	B	Any
1481	1204	1778	1444	C	Any
1347	1070	1616	1284	D	Any

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

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

* The ADJ "D" tap should not be used.

SECTION IX: 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
AIR MOVING
HOUSING, BLOWER
HOUSING, BLOWER w/WHEEL
WHEEL, BLOWER
FABRICATED PARTS
BAFFLE, FLUE
BURNER, MAIN GAS
BRACKET, IGNITER
SHELF, BLOWER
RAIL, BLOWER (2 Req'd)

DESCRIPTION (Continued)
FABRICATED PARTS
BRACKET, BLOWER TRACK (2 Req'd)
HEAT EXCHANGER ASS'Y
MANIFOLD, GAS
PAN, BOTTOM
PANEL, TOP
PANEL, DOOR (2 Req'd)
VENT PAN, COMBUSTION (w/Gasket)
PANEL, BLOCKOFF
LO-NOX SCREEN (L-Models Only)
MISCELLANEOUS
ORIFICE, BURNER (Natural #45)
SIGHT GLASS, OVAL (2 Req'd)
GASKET, FOAM (Door) (1.5 ft req'd)
GASKET, INTAKE PAN
PLUG, VENT HOLE
BRACKET, DOOR
WIRING HARNESS
FERRULE (3 Req'd)
GROMMET (3 Req'd)
MOTOR MOUNT
TUBING, SILICON
DIAGRAM, WIRING
KNOB, QUARTER TURN (4 Req'd)

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:

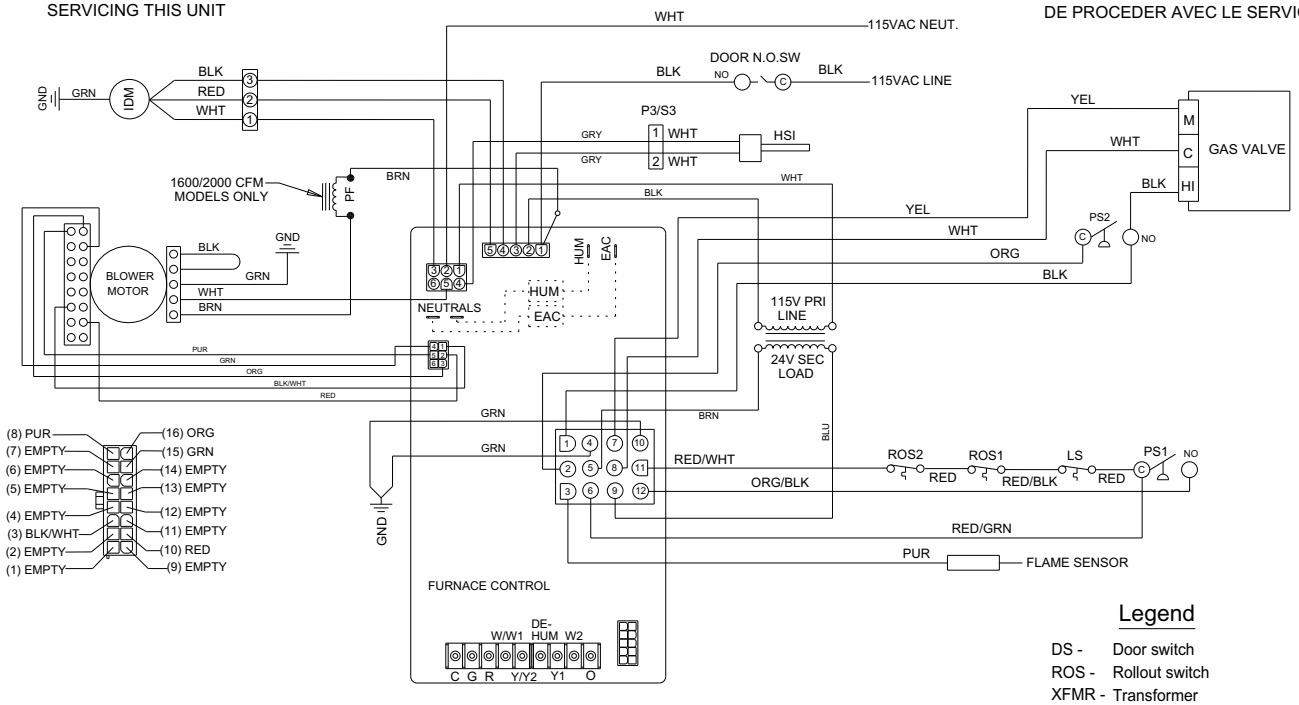
Johnson Controls Unitary Products
Consumer Relations
5005 York Drive
Norman, OK 73069

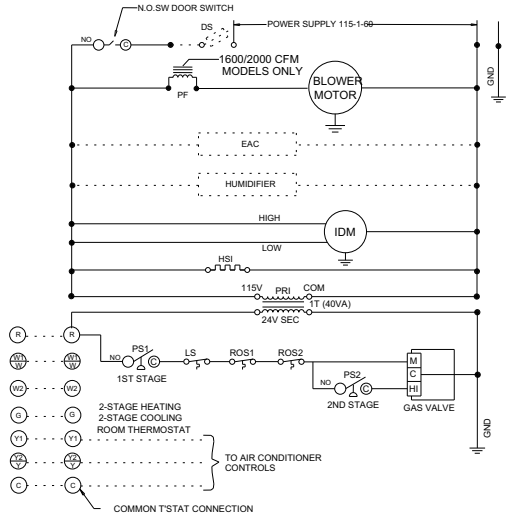
SECTION X: WIRING DIAGRAM

Wiring Diagram 80% Two-Stage COMM Furnace

CAUTION
OPEN ALL DISCONNECTS BEFORE SERVICING THIS UNIT

PRECAUTION
OUVREZ LES DISJONCTEURS AVANT DE PROCEDER AVEC LE SERVICE





Diagnostic Fault Codes

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

Legend

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

Legende

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

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

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

Fault Code Retrieval

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

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

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

1034865-UWD-A-0413

FIGURE 29: Wiring Diagram

NOTES

SECTION XI: START UP SHEET

33" 80% AFUE Two Stage Gas Furnace Start Up Sheet

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

Start-Up Date

Technician Performing Start-Up | Installing Contractor Name

Owner Information

Name | Address

City | State or Province | Zip or Postal Code

Equipment Data

Furnace Model | Furnace Serial

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

☐ Vertical Termination Vent Pipe Size | # of 90 Degree Ells | # of 45 Degree Ells | Total Height

Connector Size | Connector Length

☐ Horizontal Term. (with External Power Vent) Vent Pipe Size | # of 90 Degree Ells | # of 45 Degree Ells

Venting: Lined Masonry Chimney

☐ B Vent Connector ☐ Single Wall Connector Connector Size | Connector Length | Chimney Height

of 90 Degree Ells | # of 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 wiring is complete ☐ Thermostat heat anticipator set to .4 (6 cycle per hour for electronic thermostats)

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

Thermostat:

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

Continued on next Page

Gas Side

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

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

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

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

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

Air Side: System External Static Pressure

Supply static **before** 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 (PSC)

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

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

Temperature rise in degrees F measured in low fire _____

Temperature rise in degrees F measured in high fire _____

Air Side: Heating (Variable Speed ECM)

Heat Speed Selected ◯ A ◯ B ◯ C ◯ D

Temperature rise in degrees F measured in Low fire _____

Temperature rise in degrees F measured in high fire _____

Other Jumpers

De-humidistat ◯ Yes ◯ No

Heat Pump ◯ Yes ◯ No

Air Side: Cooling (PSC)

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

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

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

Air Side: Cooling (Variable Speed ECM)

COOL Speed Selected ◯ A ◯ B ◯ C ◯ D

ADJUST Setting ◯ A ◯ B ◯ C ◯ D

DELAY Setting ◯ A ◯ B ◯ C ◯ D

Air Side: Continuous Fan (PSC)

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

Air Side: Continuous Fan (Variable Speed ECM)

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

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

Cycle Test

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

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

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

Clean Up

☐ Installation debris disposed of and furnace area cleaned up?

Owner Education

☐ Give owner the owner's manual provided

☐ Explain operation of system to equipment owner

☐ Explain the importance of regular filter replacement and equipment maintenance

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

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