# INSTALLATION MANUAL

## MODULATING ECM RESIDENTIAL GAS FURNACE

## MODELS:
## TPLC*C, YPLC*C, CPLC*C, LPLC*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 VII 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, always leave the doors on the furnace to provide support and to prevent damage or warping of the cabinet. When lifting the furnace by the cabinet, support the ends of the furnace rather than lifting by the cabinet flanges at the return air openings (bottom or sides) or supply air opening.
13. When lifting the furnace, it is acceptable to use the primary heat exchanger tubes as a lifting point provided that the tubes are lifted at the front of the heat exchangers where attached to the vestibule panel. Do not use the top return bend of the heat exchangers as lifting points as the tubes may shift out of position or their location brackets/baffles.

**IMPORTANT**

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

## SAFETY REQUIREMENTS

**⚠CAUTION**

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

- Refer to the unit rating plate for the furnace model number, and then see the dimensions page of this instruction for return air plenum dimensions in Figure 13. 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.
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.
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 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 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 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.

**⚠WARNING**

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

*Refer to Table 6 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 should remain in the rotated down position as shipped.

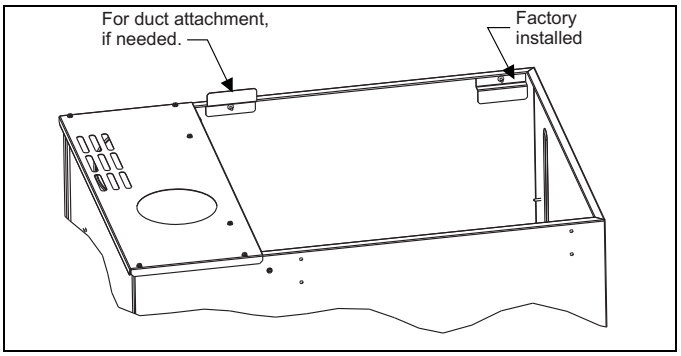


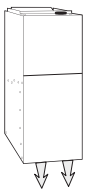

**FIGURE 1:** Duct Attachment

## DUCTWORK INSTALLATION AND SUPPLY PLENUM CONNECTION - UPFLOW/HORIZONTAL



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

## FLOOR BASE AND DUCTWORK INSTALLATION - DOWNFLOW



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

### Downflow Air Conditioning Coil Cabinet

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

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

## DOWNFLOW DUCT CONNECTORS

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

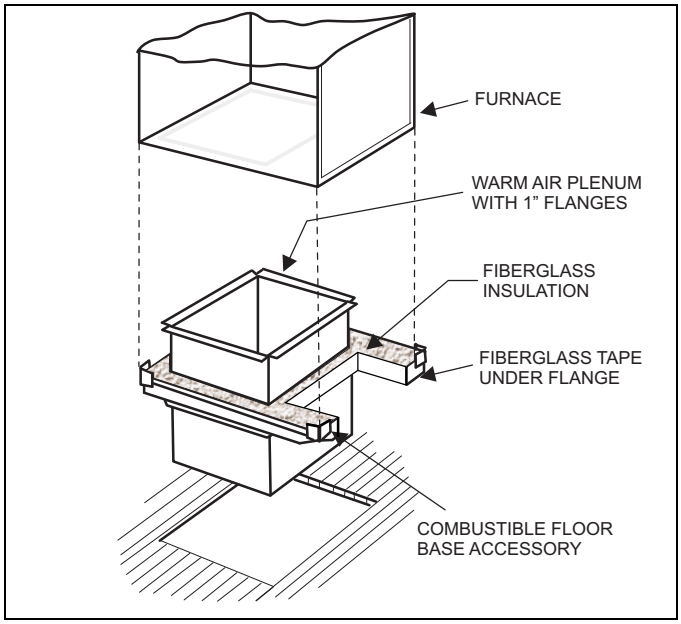



**FIGURE 2:** Combustible Floor Base Accessory

## RESIDENTIAL AND MODULAR HOME UPFLOW RETURN PLENUM CONNECTION

Return air may enter the furnace through the 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

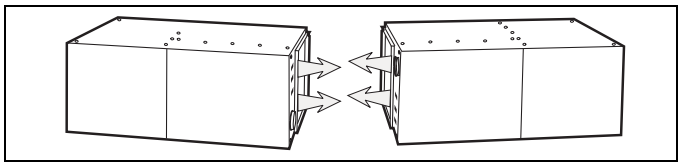


**FIGURE 3:** Horizontal Application (Typical)

**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

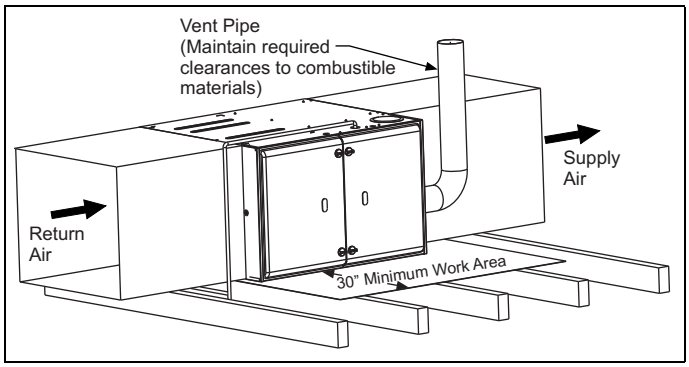



**FIGURE 4:** Typical Attic Installation

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

**⚠WARNING**

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

**IMPORTANT**

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

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

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

## SUSPENDED FURNACE / CRAWL SPACE INSTALLATION

The furnace can be hung from floor joists or installed on suitable blocks or 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” 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 5 for details and additional information.

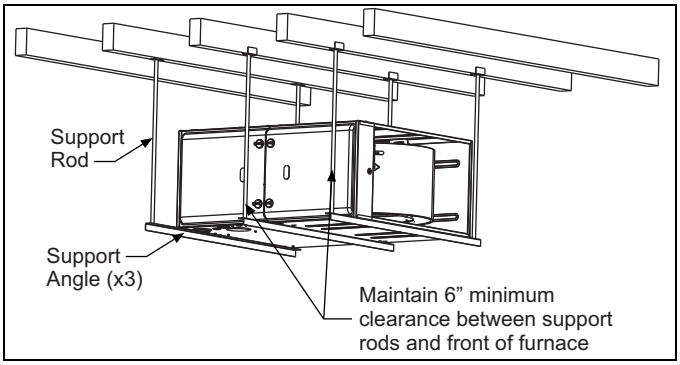



**FIGURE 5:** Typical Suspended Furnace / Crawl Space Installation

**IMPORTANT**

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

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

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

## DOWNFLOW APPLICATION

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

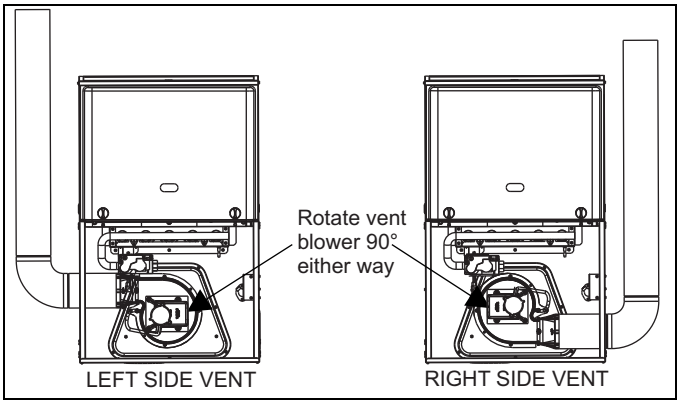



**FIGURE 6:** Downflow Venting

## COIL INSTALLATION

**IMPORTANT**

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

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

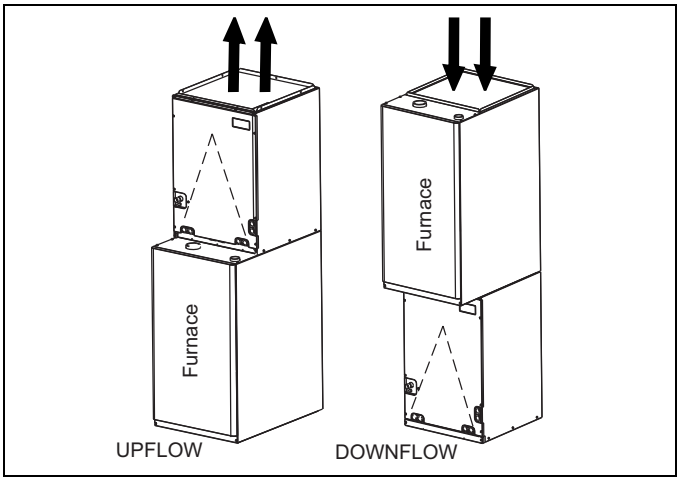



**FIGURE 7:** Vertical Applications (Typical)

## 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 7 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 8.

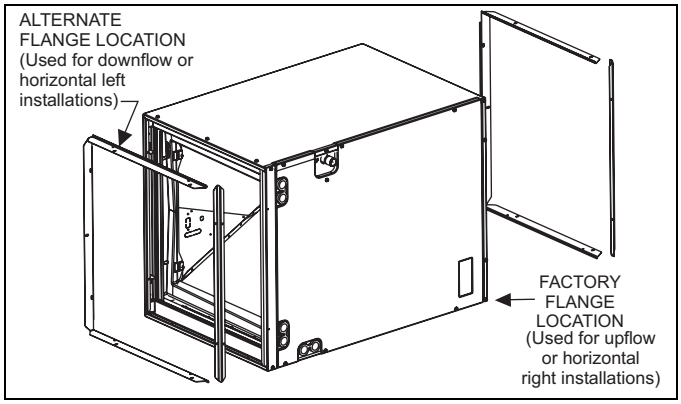



**FIGURE 8:** Coil Flange

## 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.

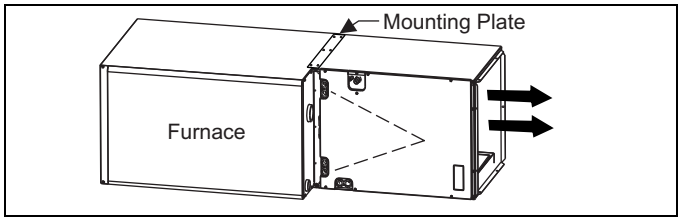



**FIGURE 9:** Horizontal Right Application (Typical)

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 9 & 10.

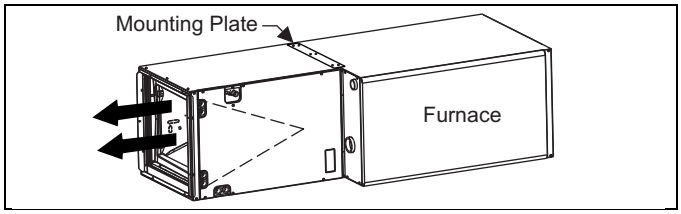



**FIGURE 10:** Horizontal Left Application

## FURNACE ASSEMBLY - PC SERIES COILS

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 11.
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 11.*

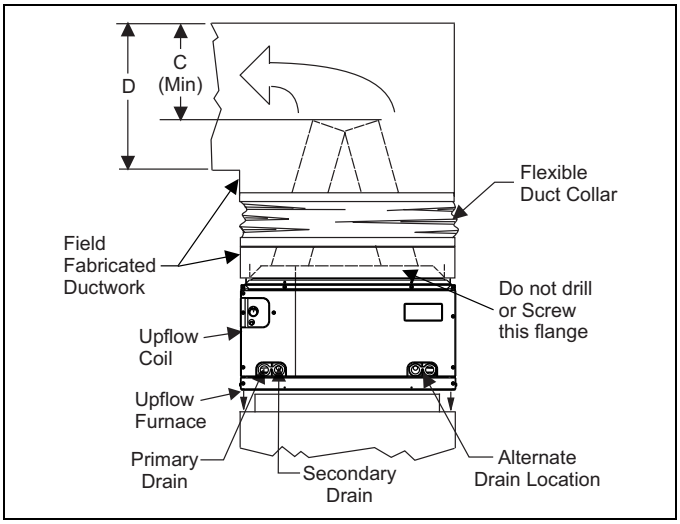



**FIGURE 11:** PC Series Upflow Coil Installation

**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 11.

## 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 12.

**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 12.

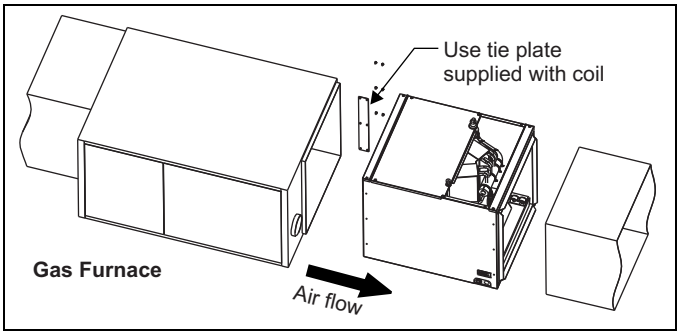



**FIGURE 12:** Horizontal Left or Right application (Right Shown)

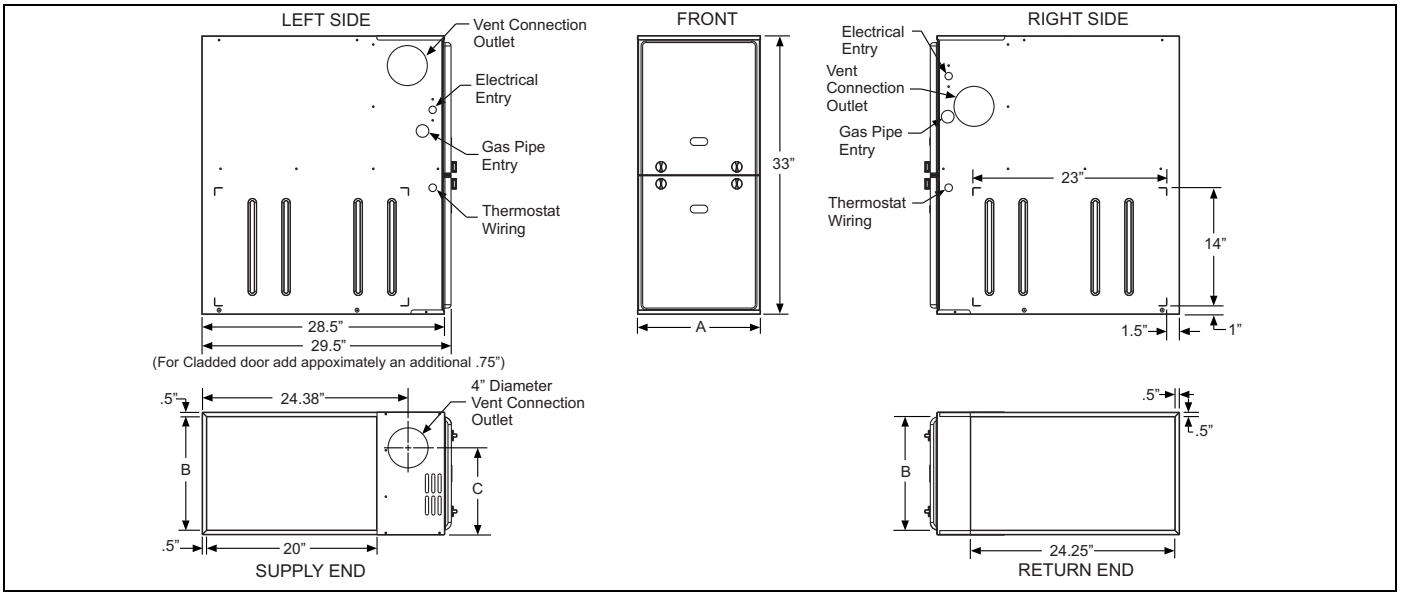



**FIGURE 13:** Dimensions

**Table 3:** Cabinet and Duct Dimensions

| BTUH (kW) Input | Nominal CFM ($m^3$/min) | Cabinet Size | Cabinet Dimensions (Inches) | | | | | | Approximate Operating Weights |
|---|---|---|---|---|---|---|---|---|---|
| | | | A | A (cm) | B | B (cm) | C | C (cm) | Lbs |
| 60 (17.6) | 1200 (34.0) | A | 14 1/2 | 36.8 | 13 1/2 | 34.3 | 10.3 | 26.2 | 94 |
| 80 (23.4) | 1200 (34.0) | B | 17 1/2 | 44.4 | 16 1/2 | 41.9 | 11.8 | 29.9 | 103 |
| 80 (23.4) | 1600 (45.3) | C | 21 | 53.3 | 20 | 50.8 | 13.6 | 34.5 | 114 |
| 100 (29.3) | 1600 (45.3) | C | 21 | 53.3 | 20 | 50.8 | 13.6 | 34.5 | 118 |
| 100 (29.3) | 2000 (56.6) | C | 21 | 53.3 | 20 | 50.8 | 13.6 | 34.5 | 122 |
| 120 (35.1) | 2000 (56.6) | C | 21 | 53.3 | 20 | 50.8 | 15.8 | 40.1 | 129 |

# SECTION III: FILTERS

## FILTER INSTALLATION

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

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

**Table 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 |

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 side 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 14.

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.

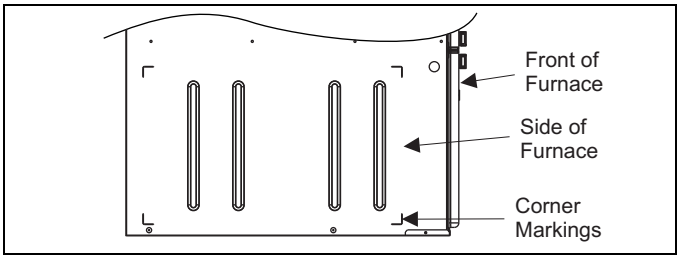



**FIGURE 14:** Side Return Cutout Markings

**IMPORTANT**

*Some accessories such as electronic air cleaners and pleated media may require a larger side opening. Follow the instructions supplied with that accessory for side opening requirements. Do not cut the opening larger than the dimensions shown in Figure 13.*

## 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.*

**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.*

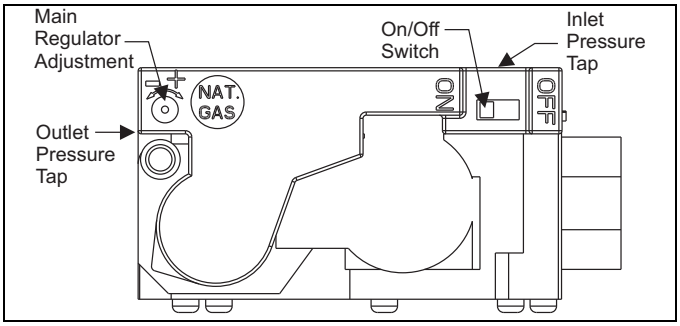



**FIGURE 15:** Gas Valve

### 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 16.

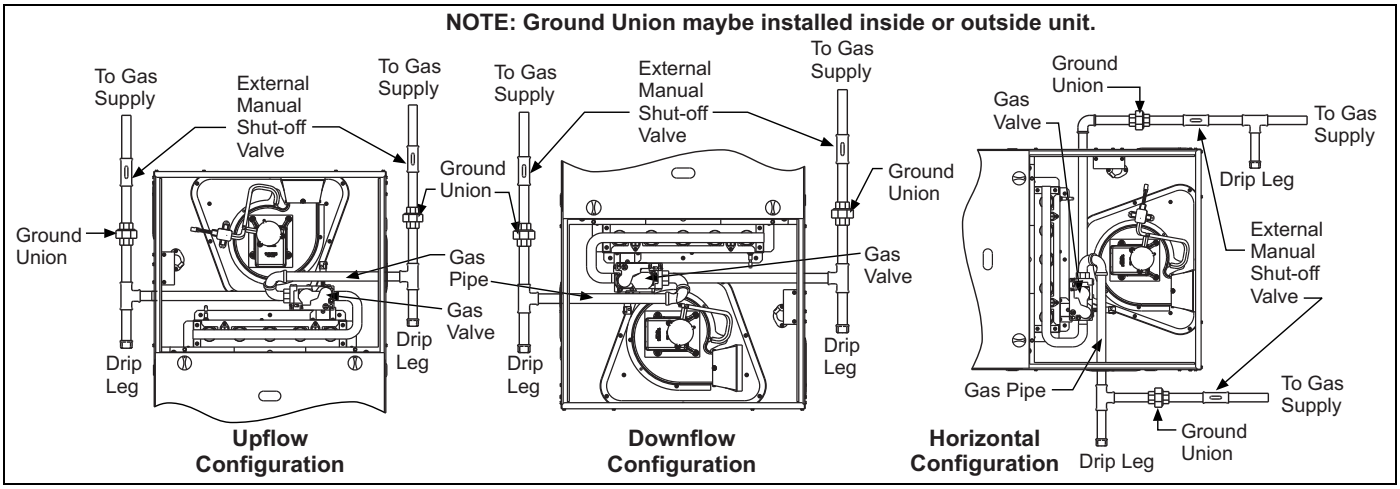



**FIGURE 16:** Gas Piping

**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 13.

### GAS CONVERSION FOR PROPANE (LP)

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

**⚠WARNING**

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

### HIGH ALTITUDE NATURAL GAS ORIFICE CONVERSION

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

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

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

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

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

**Table 5:** High Altitude Orifices

| Actual Rate (percent of nameplate) | Elevation in Feet Above Sea Level | | | | | | |
|---|---|---|---|---|---|---|---|
| | 4,000 | 5,000 | 6,000 | 7,000 | 8,000 | 9,000 | 10,000 |
| | 84% | 80% | 76% | 72% | 68% | 64% | 60% |
| | Orifice Drill Size | | | | | | |
| 100 | 48 | 49 | 49 | 50 | 51 | 51 | 52 |
| 95 | 47 | 48 | 49 | 50 | 50 | 50 | 51 |
| 90 | 46 | 47 | 48 | 49 | 49 | 49 | 50 |
| 85 | 45 | 46 | 47 | 48 | 49 | 49 | 50 |
| 80 | 45 | 45 | 46 | 47 | 48 | 48 | 49 |
| 75 | 44 | 45 | 45 | 45 | 47 | 47 | 49 |
| 70 | 43 | 44 | 44 | 45 | 45 | 45 | 48 |
| 65 | 42 | 43 | 43 | 44 | 45 | 45 | 47 |
| 60 | 41 | 42 | 42 | 43 | 44 | 45 | 46 |
| 55 | 40 | 41 | 41 | 32 | 43 | 43 | 44 |
| 50 | 39 | 40 | 40 | 40 | 43 | 42 | 42 |

**⚠DANGER**

***PROPANE 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.*

*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 6 in these instructions for specific furnace electrical data.

**⚠CAUTION**

*Use copper conductors only.*

**Table 6:** Ratings & Physical / Electrical Data

| **Input Max/Min *** | | **Output Max/Min *** | | **Nominal Airflow** | | **Air Temp. Rise Max Input** | | **Air Temp. Rise Min Input** | |
|---|---|---|---|---|---|---|---|---|---|
| MBH | kW | MBH | kW | CFM | $m^3$/min | °F | °C | °F | °C |
| 60/30 | 17.6/8.8 | 47/24 | 13.8/7.0 | 1200 | 34.0 | 30-60 | 17-33 | 20-50 | 11-28 |
| 80/40 | 23.5/11.8 | 62/32 | 18.2/9.4 | 1200 | 34.0 | 40-70 | 22-39 | 20-50 | 11-28 |
| 80/40 | 23.5/11.8 | 62/32 | 18.2/9.4 | 1600 | 45.3 | 35-65 | 19-36 | 20-50 | 11-28 |
| 100/50 | 29.3/14.7 | 78/40 | 22.8/11.7 | 1600 | 45.3 | 35-65 | 19-36 | 20-50 | 11-28 |
| 100/50 | 29.3/14.7 | 78/40 | 22.8/11.7 | 2000 | 56.6 | 35-65 | 19-36 | 20-50 | 11-28 |
| 120/60 | 33.7/16.9 | 95/48 | 27.8/14.1 | 2000 | 56.6 | 45-75 | 25-42 | 25-55 | 13-31 |
| **Max. Outlet Air Temp** | | **Blower** | | **Blower Wheel size** | **AFUE %** | **Max Over-Current Protect** | **Total Unit Amps** | **Min. wire Size (awg) @ 75 ft one way** | |
| °F | °C | HP | Amps | | | | | | |
| 160 | 71.1 | 1/2 | 4.8 | 11 x 8 | 80.0 | 15 | 7.0 | 14 | |
| 170 | 76.7 | 1/2 | 4.8 | 11 x 8 | 80.0 | 15 | 7.5 | 14 | |
| 165 | 73.9 | 3/4 | 7.5 | 11 x 10 | 80.0 | 15 | 10.0 | 14 | |
| 165 | 73.9 | 3/4 | 7.5 | 11 x 10 | 80.0 | 15 | 10.0 | 14 | |
| 165 | 73.9 | 1 | 14.5 | 11 x 11 | 80.0 | 20 | 12.0 | 12 | |
| 175 | 79.4 | 1 | 14.5 | 11 x 11 | 80.0 | 20 | 12.0 | 12 | |

* If chimney kit S1-1CK0605 is installed, minimum inputs and outputs are 65% of maximum, not 50%. See Chimney kit instructions and label for more details.
Annual Fuel Utilization Efficiency (AFUE) numbers are determined in accordance with DOE Test procedures.
Wire size and over current protection must comply with the National Electrical Code (NFPA-70-latest edition) and all local codes.
The furnace shall be installed so that the electrical components are protected from water.

## SUPPLY VOLTAGE CONNECTIONS

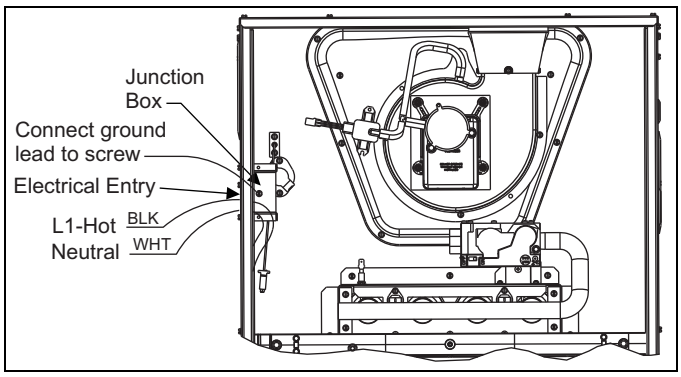



**FIGURE 17:** Electrical Wiring

1. Provide a power supply separate from all other circuits. Install overcurrent protection and disconnect switch per local/national electrical codes. The switch should be close to the unit for convenience in servicing. With the disconnect or fused switch in the OFF position, check all wiring against the unit wiring label. 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 17.
3. The furnace's control system requires correct polarity of the power supply and a proper ground connection. Refer to Figure 17.

**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 C-B bus. Commands, operating conditions, and other data are passed continually between components over the C-B bus. See Figure 19. The result is a new level of comfort, versatility, and simplicity.

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

This furnace may also be used along with the Communicating Thermostat Control and a non-communicating outdoor air conditioner through the addition of a communicating Outdoor Aux Control board to the outdoor unit. This system allows full communication between the furnace and thermostat and limited communication to the outdoor unit. See Figure 20.

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

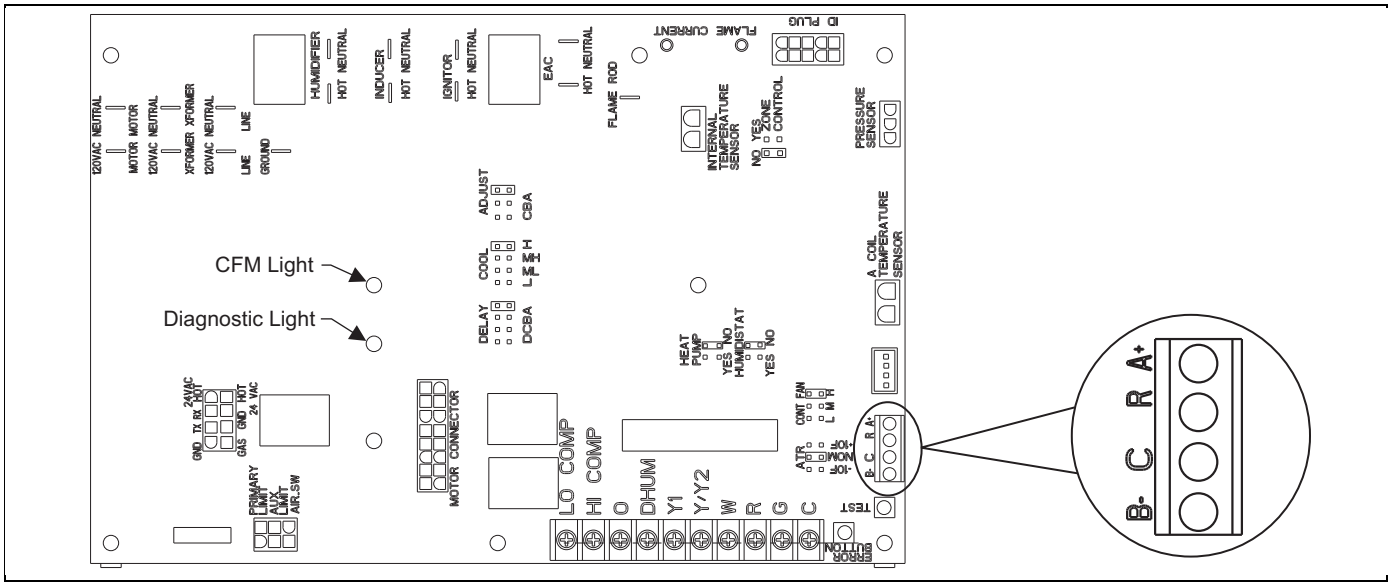



**FIGURE 18:** Furnace Control Board – Communications Connections

## CONTROL WIRING USING COMMUNICATING CONTROLS

Use the wiring diagram below to connect the furnace control, Communicating Control (wall thermostat) and communicating outdoor unit. Be sure that all of the “A” terminals are connected together, all of the “B” terminals are connected together, all of the “C” terminals are connected together and all of the “R” terminals are connected together. See Figure 19. When using a fully communicating system, the large screw terminals (C, G, R, etc.) on the furnace control are not used. The four small screw terminals in the terminal block on the end of the furnace control should be used.

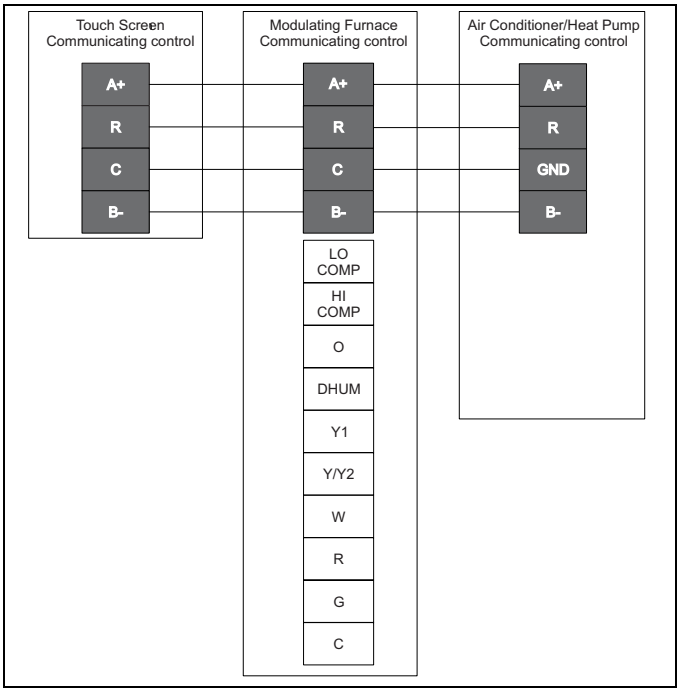



**FIGURE 19:** Modulating Furnace with Communicating AC or HP

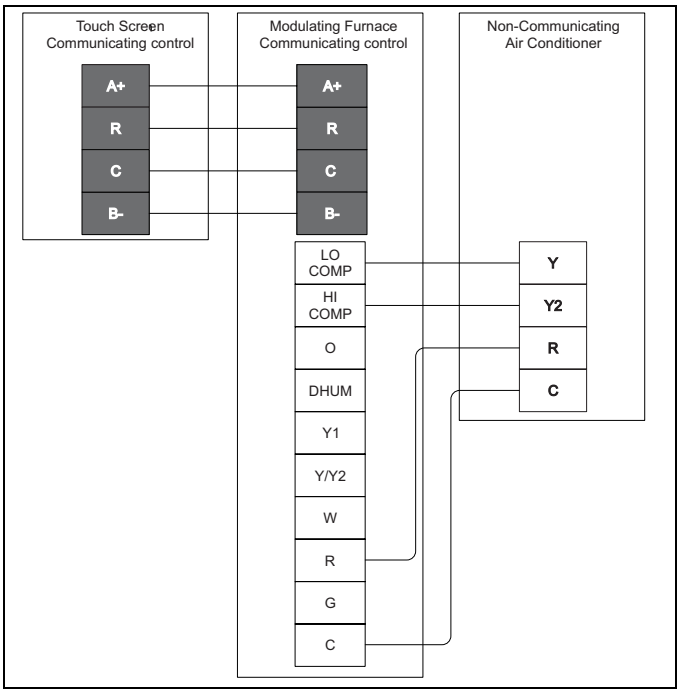



**FIGURE 20:** Modulating Furnace with Communicating Thermostat and non-Communicating AC

When connecting the Communicating Control (wall thermostat) and furnace control to a non-communicating outdoor A/C or heat pump, use the wiring diagram in Figure 20. The thermostat and furnace will be connected exactly as shown above, but the conventional 24 volt R, C and Y/Y2 terminals will be used to control the outdoor unit.

## CONVENTIONAL LOW VOLTAGE CONTROL WIRING CONNECTIONS

Install the field-supplied thermostat by following the instructions that come with the thermostat. With the thermostat set in the OFF position and the main electrical source disconnected, connect the thermostat wiring from the wiring connections on the thermostat to the terminal board on the ignition module, as shown in Figures 21-26, Thermostat Charts. Electronic thermostats may require the common wire to be connected as shown in Figures 22 - 26. Apply strain relief to thermostat wires passing through cabinet.

**IMPORTANT**

*Set the heat anticipator in the room thermostat to 0.1 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.

## AIR CONDITIONER CONNECTIONS

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

**For Single-Stage A/C -** Connect the low voltage wiring as shown in Figure 21, Thermostat Chart.

**For Two-Stage A/C -** Use a two-stage thermostat, connect the low voltage wiring as shown in Figure 22, Thermostat Chart.

**For Two-Stage A/C using a Single-Stage Thermostat -** connect the low voltage wiring as shown in Figure 23, Thermostat Chart.

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

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

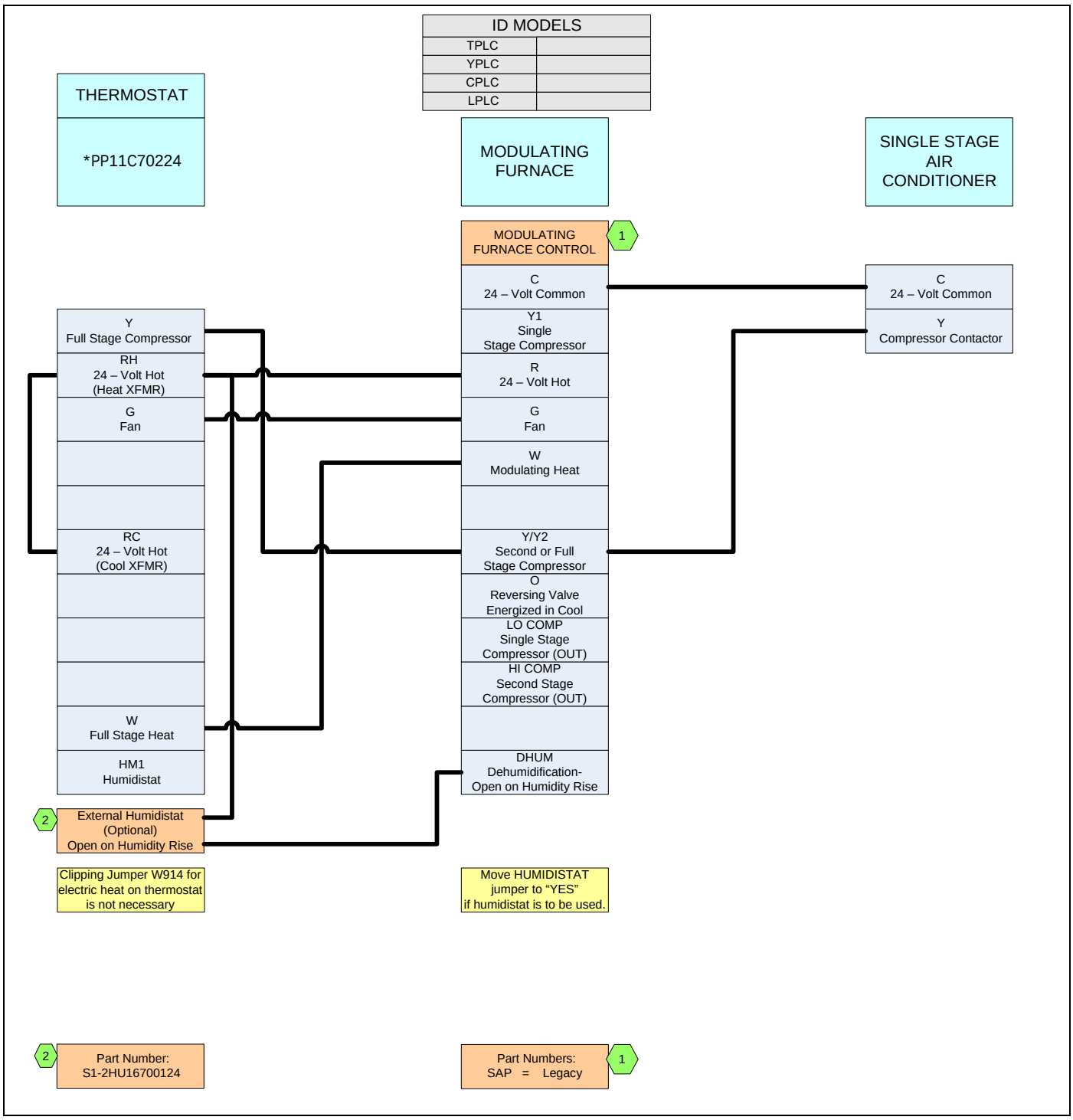



**FIGURE 21:** Thermostat Chart - Single Stage Air Conditioner – Variable Speed or PSC Modulating Furnace

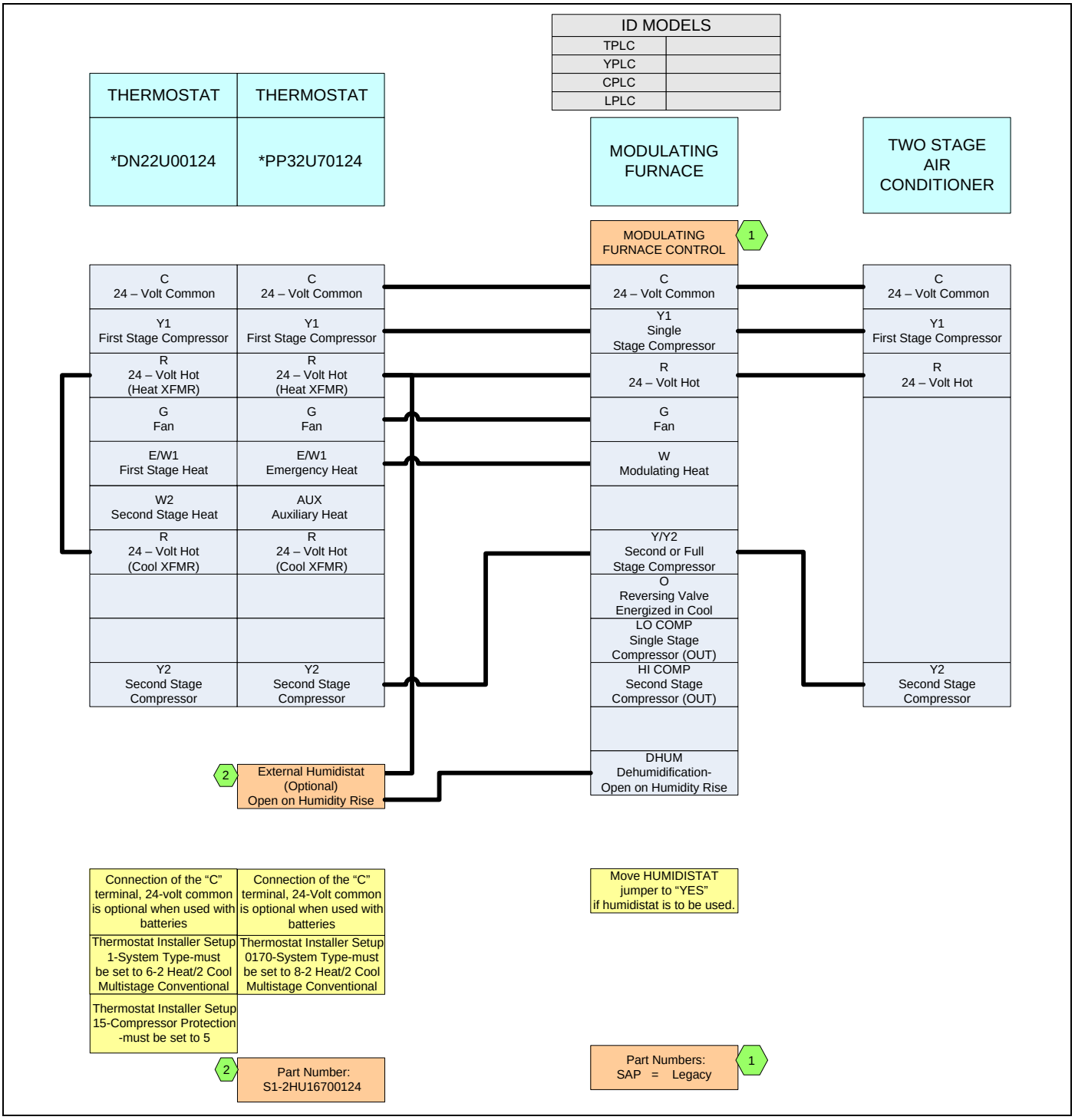



**FIGURE 22:** Thermostat Chart - Two Stage Air Conditioner – Variable Speed or PSC Modulating Furnace

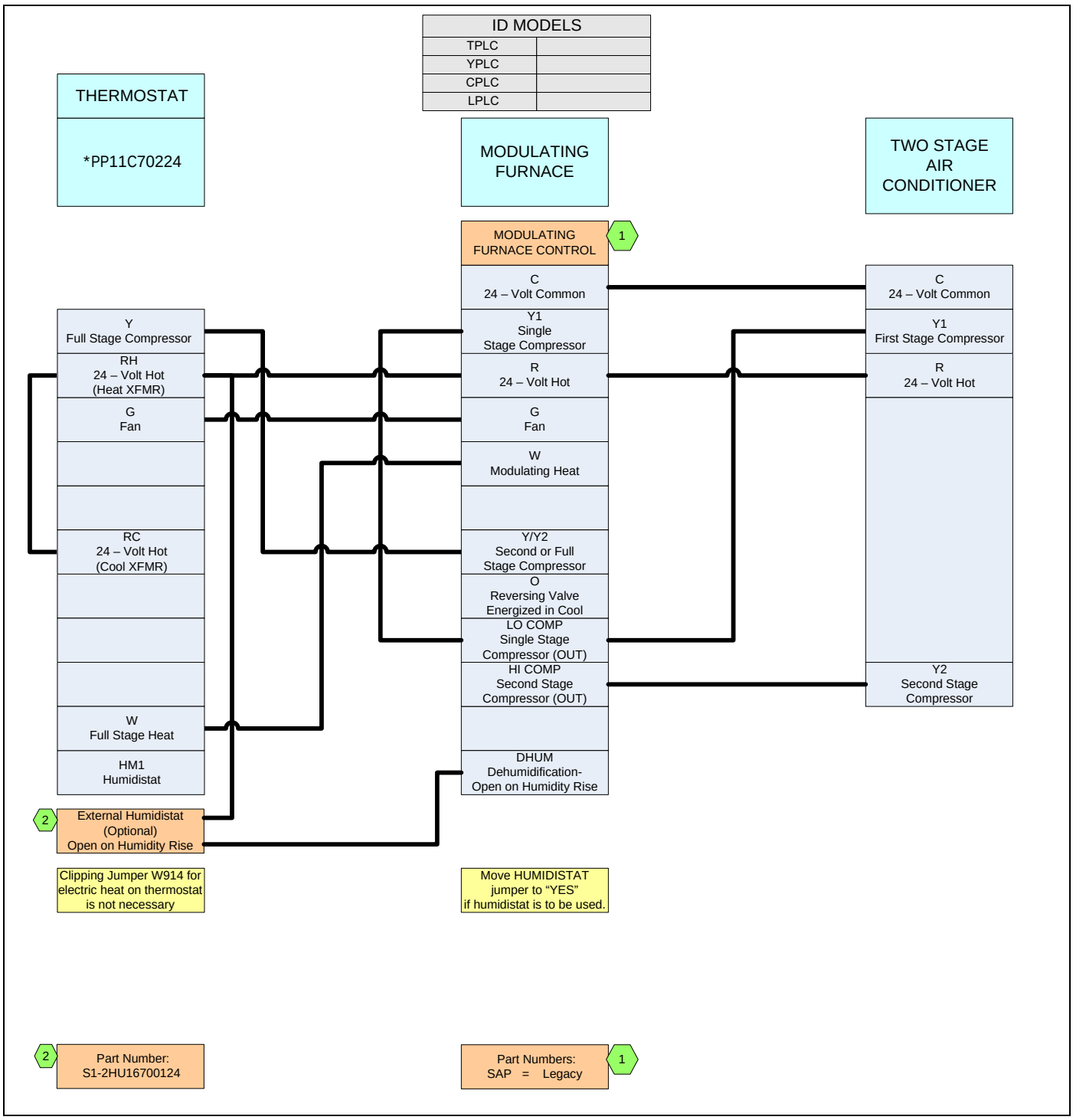



**FIGURE 23:** Thermostat Chart - Two Stage Air Conditioner with Single Stage Thermostat – Variable Speed or PSC Modulating Furnace

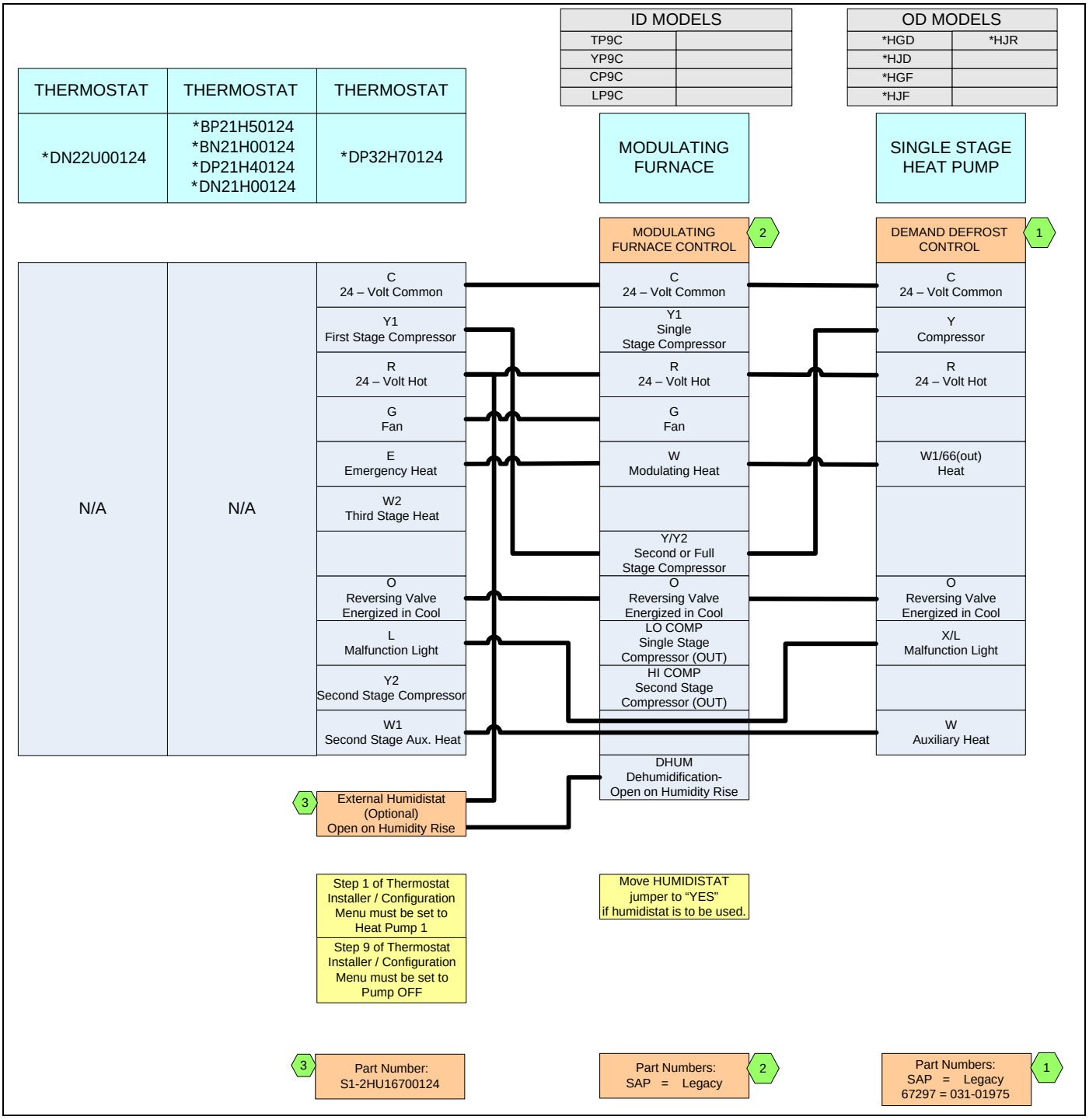



**FIGURE 24:** Thermostat Chart - Single Stage Heat Pump – Variable Speed or PSC Modulating Furnace

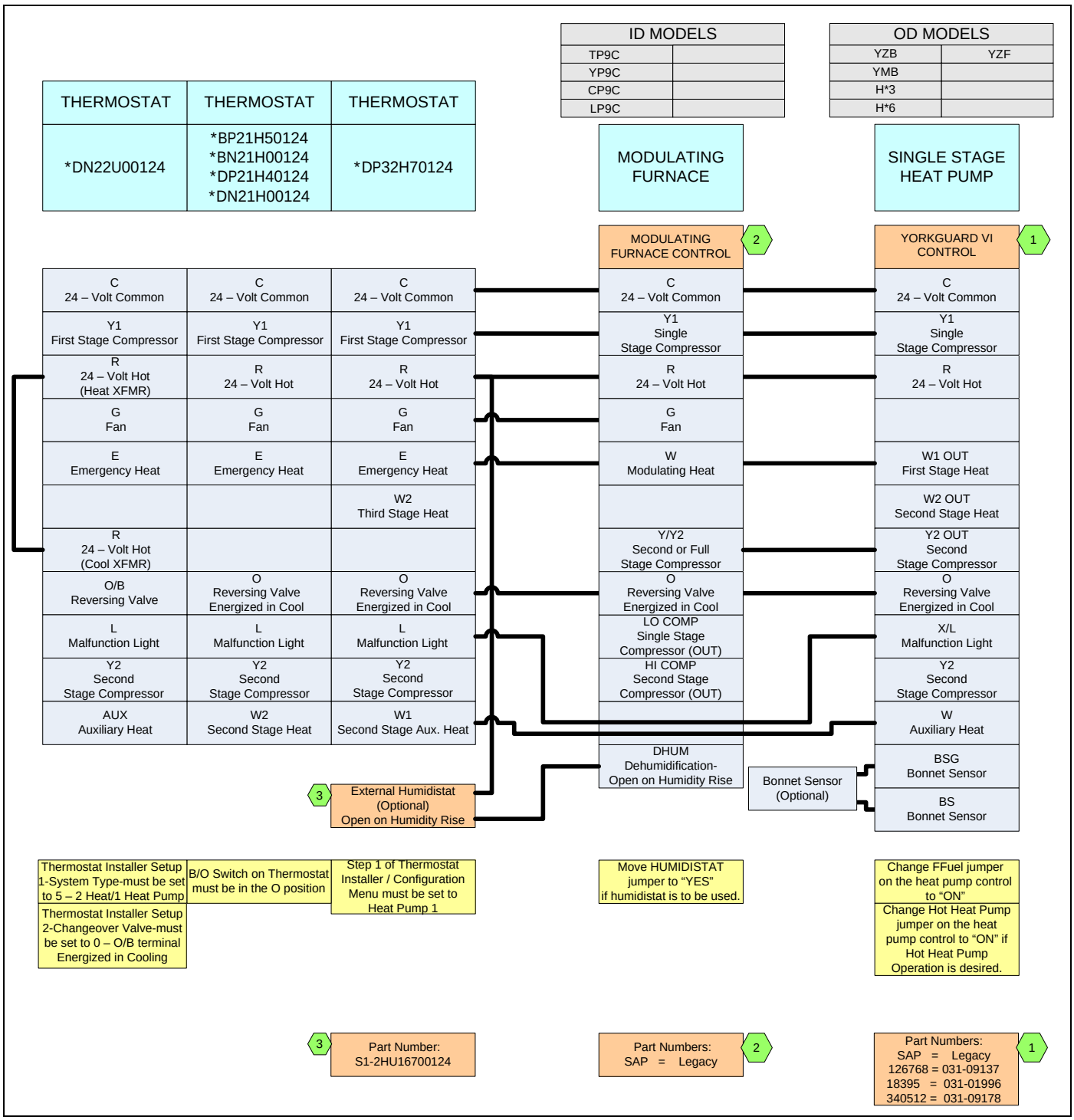



**FIGURE 25:** Thermostat Chart - Single Stage Heat Pump – Variable Speed or PSC Modulating Furnace

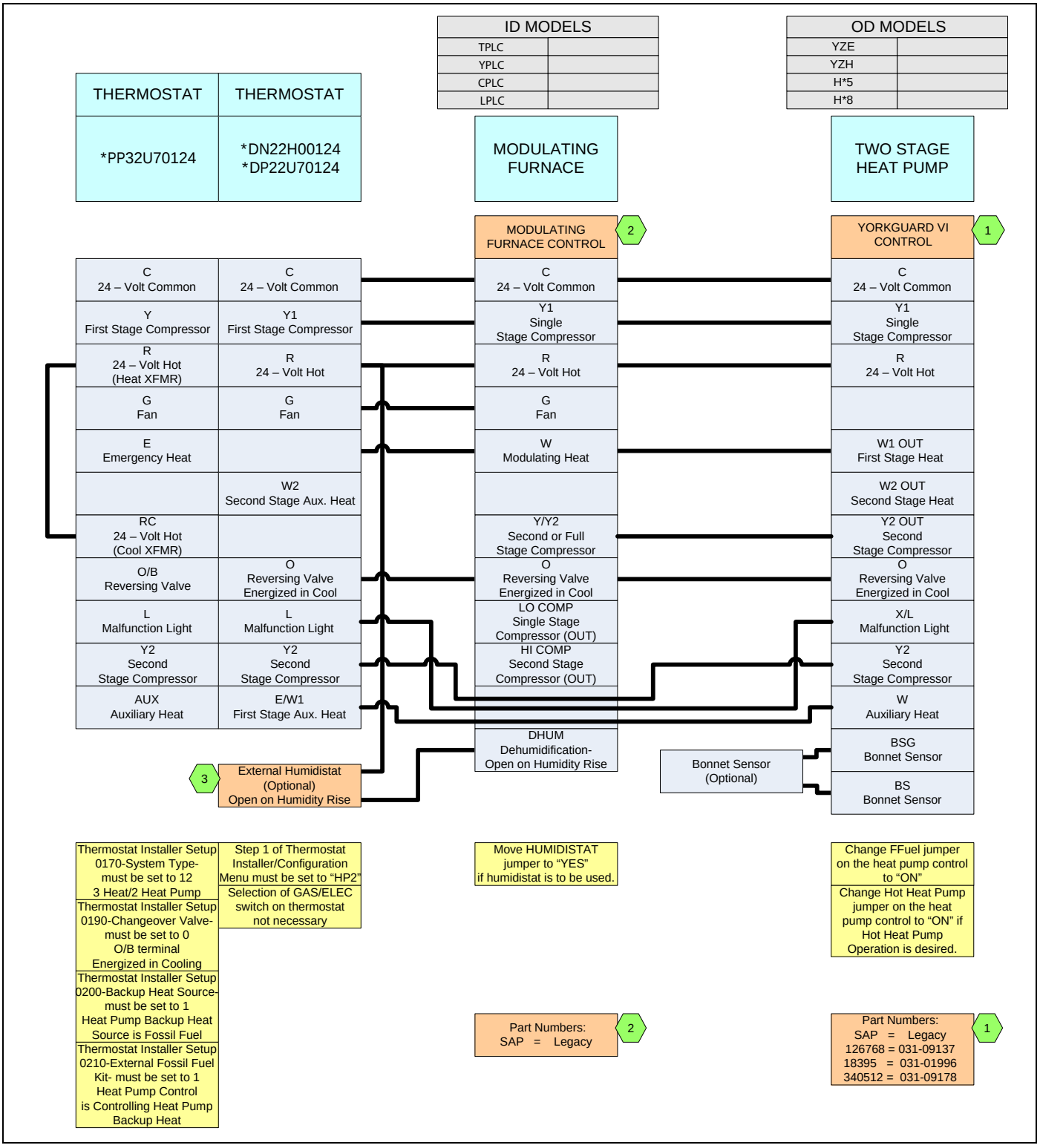



**FIGURE 26:** Thermostat Chart - Two Stage Heat Pump – Variable Speed or PSC Modulating Furnace

### 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.

### HUMIDISTAT CONNECTION

For better humidity control during cooling operation, an external humidistat may be used. When using a external humidistat, put the HUMIDISTAT jumper in the "YES" position. Connect the low voltage wiring as shown in Figures 21-26, Thermostat Charts.

### ZONING OPERATION

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

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

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

### HEAT PUMP OPERATION

This furnace may be used in conjunction with a heat pump in dual fuel applications. For heat pump applications, put the HEAT PUMP jumper on the furnace control board in the "YES" position. Connect the low voltage wiring as shown in Figures 24-26, Thermostat Charts. If a two-stage heat pump is to be used, a two-stage thermostat is required.

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

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

### TWINNING

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

## SECTION VI: VENT SYSTEM

### VENT CONNECTIONS

Figure 27 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.

**IMPORTANT**

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

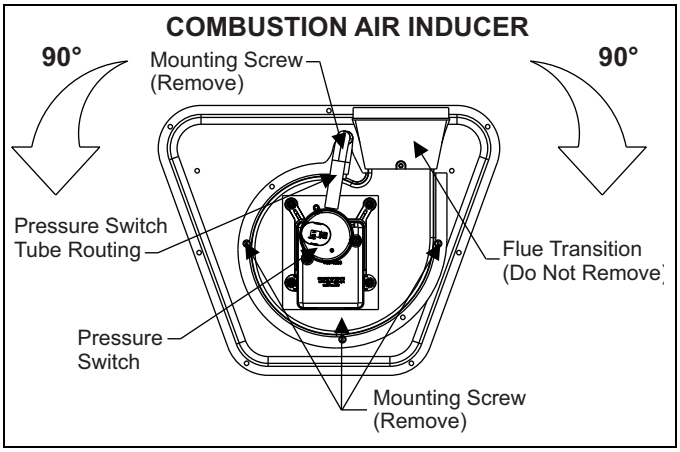



**FIGURE 27:** Combustion Air Inducer

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

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

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

### VENTING

Category I venting consists of vertically venting one or more appliances in B-vent or B-vent connectors. Type B-vent system extends in a general vertical direction and does not contain offsets exceeding 45°. A vent system having not more than one 60° offset is permitted.

### VENTING INTO AN EXISTING CHIMNEY

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

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

## FAN-ASSISTED COMBUSTION SYSTEM

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

### Ambient Combustion Air Supply

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

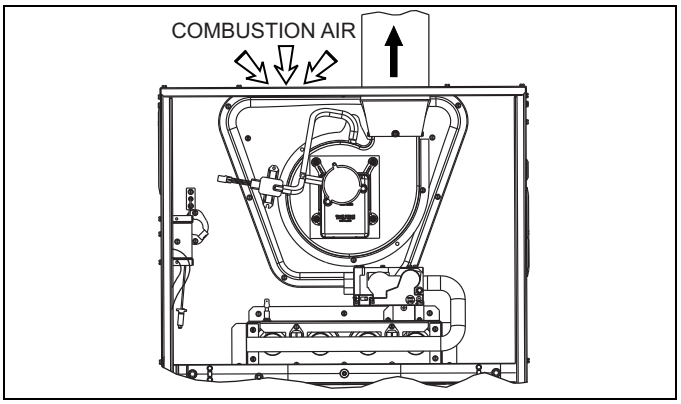



**FIGURE 28:** Combustion Airflow Path Through The Furnace Casing to the Burner Compartment

**⚠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 openings are furnished with openings or louvers.

A **confined space** is an area with less than 50 cu.ft (1.42 $m^3$) per 1,000 Btu/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 7, to estimate free area.

**Table 7:** 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 8:** 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 9:** 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 | | | |

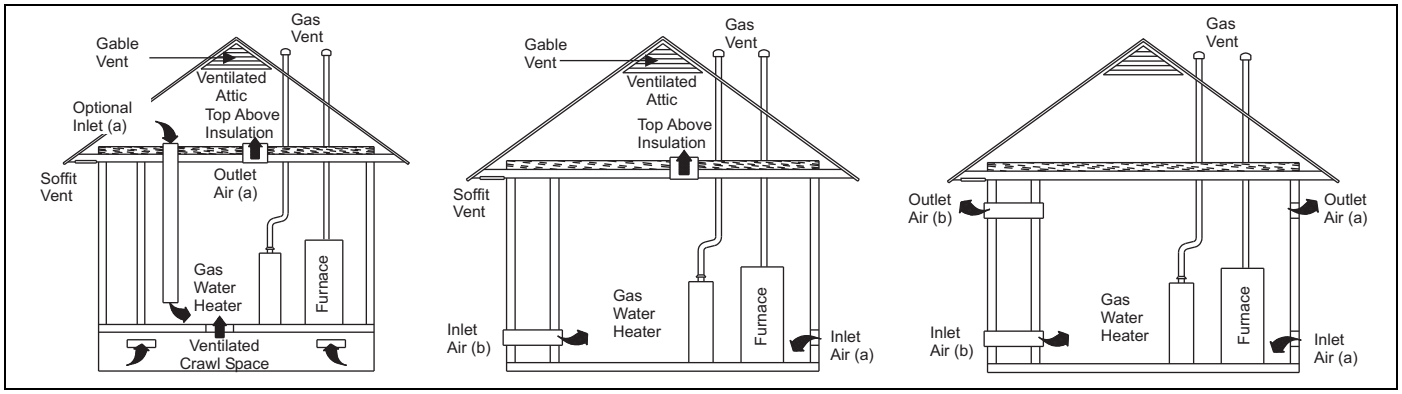



**FIGURE 29:** Outside and Ambient Combustion Air

### 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 (6.45 cm3 per 0.879 kW) of the total input rating of all equipment located in the enclosure.
   b. Not less than the sum of all vent connectors in the confined space.
3. The duct shall be least the same cross-sectional area as the free area of the air supply inlet opening to which it connects.
4. The blocking effects of louvers, grilles and screens must be given consideration in calculating free area. If the free area of a specific louver or a grille is not known. Refer to Table 7 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

**NOTICE**

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

### NOx SCREEN REMOVAL (Lo-NOx Models Only)

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

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

### GAS PIPING LEAK CHECK

**⚠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 startup 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 shutoff valve must be disconnected from the gas supply during any pressure testing of that system at test pressures in excess of 1/2 PSI (3.45 kPa).

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

## SETUP TEST MODE

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

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

## 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 squarely 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 10 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.*

## HIGH ALTITUDE NATURAL GAS ORIFICE CONVERSION

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

**Table 10:** Gas Rate (CU FT/HR) at Full Input

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

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

## ADJUSTMENT OF MANIFOLD GAS PRESSURE

Inlet and manifold gas pressure may be measured by connecting the "U" tube manometer to the gas valve with a piece of tubing. Follow the appropriate section in the instructions below. Refer to Figure 30 for a drawing of the locations of the pressure ports on the gas valve.

**Table 11:** 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" w.c. (3.24 kPa) |

**IMPORTANT**

*The inlet gas pressure operating range table specifies what the minimum and maximum gas line pressures must be for the furnace to operate safely. The gas line pressure* ***MUST BE*** *a minimum of:*

- 7" 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.*

**IMPORTANT**

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

**NOTICE**

*The regulated outlet pressure has 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.*

**TABLE 12:** Nominal Manifold Pressure

| NOMINAL MANIFOLD PRESSURE | |
|---|---|
| Natural Gas (Max) | 3.5" w.c. (0.87 kPa) |
| Natural Gas (Min) | 0.5" w.c. (0.15 kPa) |
| Propane (LP) Gas (Max) | 10.0" w.c. (2.49 kPa) |
| Propane (LP) Gas (Min) | 1.6" w.c. (0.40 kPa) |

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

1. The manifold pressure must be taken at the port marked OUT P.
2. The inlet gas line pressure must be taken at the port marked IN P.
3. Using a 3/16" allen wrench, remove the plugs from the inlet and outlet pressure ports. Connect a 1/8" UPT barbed hose fitting to each pressure port.
4. Refer to Figure 30 for location of pressure regulator adjustment cap and adjustment screws on main gas valve.
5. Turn gas and electrical supplies on and follow the operating instructions to place the unit back in operation.
6. Remove the small plastic cap to gain access to the regulator adjustment screw.
7. Use a small slotted screwdriver to turn the regulator adjustment screw. Adjust the pressure by turning the screw one click at a time until desired pressure is reached. Wait a few seconds after each adjustment to allow the pressure to stabilize before making additional adjustments. This is an electronic adjustment screw that does not require very much force. Application of excessive force to the adjustment screw will damage the gas valve.

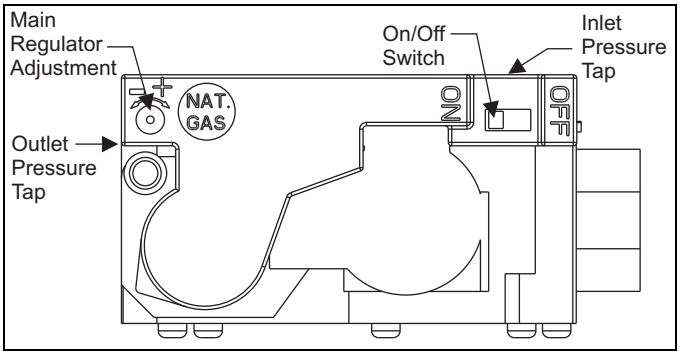



**FIGURE 30:** Gas Valve

**IMPORTANT**

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

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

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

## 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 6.*

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

After about 5 minutes of operation, determine the furnace temperature rise. Take temperature readings of both the return air and the heated air in the ducts about six feet away from the furnace, where they will not be affected by radiant heat. Increase or decrease the temperature rise by changing the ATR jumper on the furnace control board. The jumper is factory-set to deliver an air temperature rise near the midpoint of the nameplate temperature rise range. If more air is desired (lower temperature rise), move the jumper to the -10 position. If less air is desired (higher temperature rise), move the jumper to the +10 position.

## ADJUSTMENT OF FAN CONTROL SETTINGS

**Cooling -** The airflow delivered by the furnace during cooling operation can be adjusted to match the cooling capacity of the A/C condensing unit. This is done by moving the COOL and ADJ jumper on the control board to give the desired airflow.

The COOL jumper has four positions, which will deliver sufficient airflow in cooling mode for the cooling capacities shown in Table 13.

the ADJ jumper has three positions which can be used to make further adjustments to the cooling blower airflow.

**Continuous Fan Operation -** The airflow delivered by the furnace during continuous fan operation can be adjusted as desired. This is done my moving the control fan jumper on the control board to give the desired airflow.

The jumper has three positions. The “H” position delivers maximum airflow, 100% of the blower capacity. Position “M” delivers approximately 70% of the blower capacity. And Position “L” delivers minimum airflow, approximately 40% of the blower capacity.

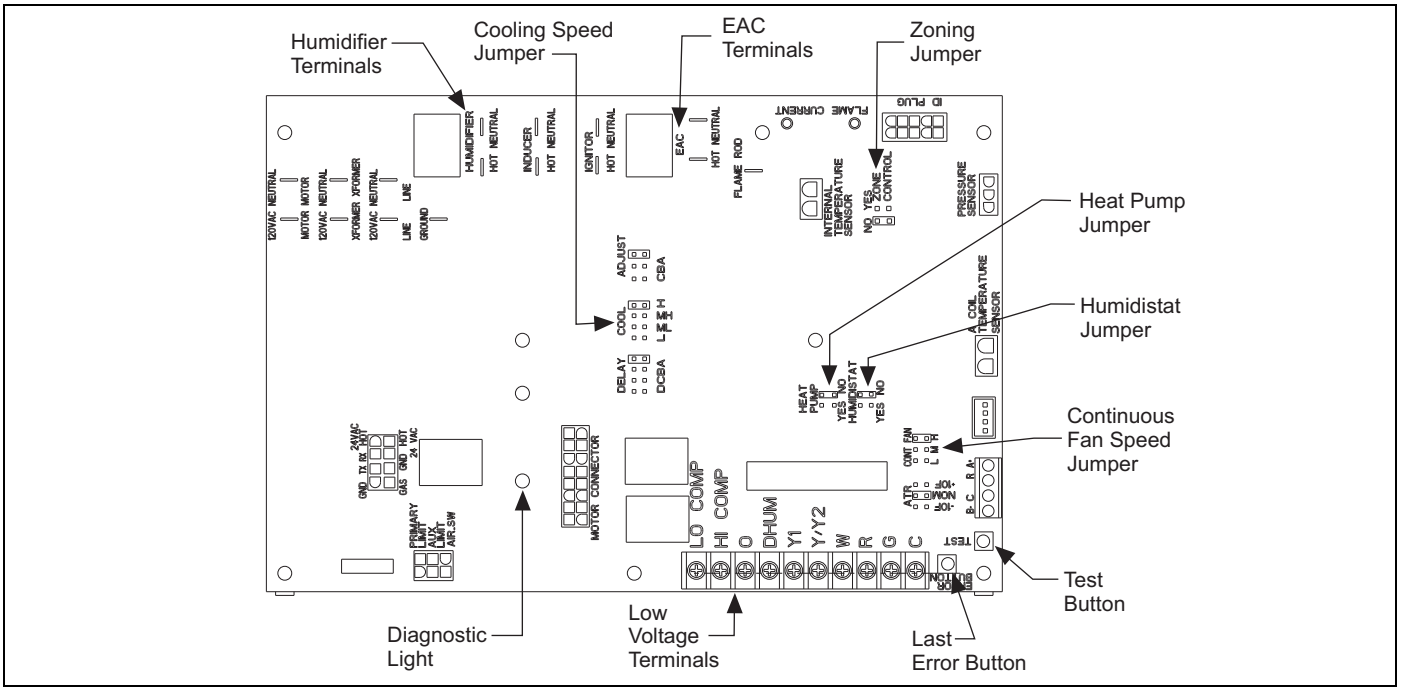



**FIGURE 31:** Furnace Control Board

**Table 13:** Blower Performance CFM - Any Position

| High / Low Speed Cooling CFM | | | | | |
|---|---|---|---|---|---|
| **060A12** | | **080B12** | | **Jumper Settings** | |
| Hi Cool | Lo Cool | Hi Cool | Lo Cool | COOL Jumper | ADJ Jumper |
| 1340 | 900 | 1290 | 790 | H | B |
| 1125 | 750 | 1065 | 660 | MH | B |
| 1225 | 820 | 1165 | 720 | H | A |
| 1050 | 680 | 960 | 600 | MH | A |
| 1100 | 740 | 1050 | 590 | H | C |
| 890 | 600 | 855 | 525 | ML | B |
| 920 | 615 | 875 | 540 | MH | C |
| 675 | 450 | 640 | 395 | L | B |
| 815 | 545 | 775 | 495 | ML | A |
| 600 | 440 | 580 | 380 | L | A |
| 720 | 499 | 700 | 430 | ML | C |
| 540 | 440 | 525 | 380 | L | C |
| **High / Low Speed Cooling CFM** | | | | | |
| **080C16** | | **100C16** | | **Jumper Settings** | |
| Hi Cool | Lo Cool | Hi Cool | Lo Cool | COOL Jumper | ADJ Jumper |
| 1715 | 1165 | 1600 | 1120 | H | B |
| 1520 | 1020 | 1450 | 980 | MH | B |
| 1575 | 1060 | 1500 | 1020 | H | A |
| 1395 | 930 | 1345 | 900 | MH | A |
| 1430 | 950 | 1315 | 930 | H | C |
| 1320 | 875 | 1265 | 845 | ML | B |
| 1260 | 840 | 1210 | 805 | MH | C |
| 1100 | 730 | 1080 | 700 | L | B |
| 1200 | 795 | 1165 | 765 | ML | A |
| 1000 | 665 | 980 | 635 | L | A |
| 1080 | 715 | 1050 | 695 | ML | C |
| 900 | 600 | 885 | 585 | L | C |
| **High / Low Speed Cooling CFM** | | | | | |
| **100C20** | | **120C20** | | **Jumper Settings** | |
| Hi Cool | Lo Cool | Hi Cool | Lo Cool | COOL Jumper | ADJ Jumper |
| 2110 | 1360 | 1990 | 1290 | H | B |
| 1670 | 1085 | 1760 | 1030 | MH | B |
| 1900 | 1235 | 1900 | 1210 | H | A |
| 1515 | 990 | 1510 | 935 | MH | A |
| 1710 | 1130 | 1800 | 1095 | H | C |
| 1465 | 950 | 1540 | 900 | ML | B |
| 1370 | 890 | 1440 | 845 | MH | C |
| 1255 | 815 | 1320 | 790 | L | B |
| 1330 | 865 | 1400 | 835 | ML | A |
| 1140 | 740 | 1200 | 725 | L | A |
| 1195 | 780 | 1260 | 750 | ML | C |
| 1025 | 665 | 1080 | 650 | L | C |

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 airflow may be lower that what is required to operate an airflow switch on certain models of electronic air cleaners. Consult the instructions for the electronic air cleaner for further details.

### Delay Taps Selection

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

**Tap A** is the default profile. 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.

### Humidistat

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

## SECTION VIII: SAFETY CONTROLS

### CONTROL CIRCUIT FUSE

A 3-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

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

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

**⚠CAUTION**

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

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

### ROLLOUT SWITCH CONTROLS

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

### PRESSURE CONTROLS

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

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

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

### LIMIT CONTROLS

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

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

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

# SECTION IX: NORMAL OPERATION AND DIAGNOSTICS

## NORMAL OPERATION SEQUENCE

The furnace control calculates the optimum firing rate each time the wall thermostat R and W contacts close or open (at the beginning and at the end of each call for heat) based on information from the thermostat and past demand. UNLIKE CONVENTIONAL SYSTEMS, THE WALL THERMOSTAT DOES NOT SIMPLY TURN THE FURNACE ON AND OFF. THE FURNACE CONTROL CALCULATES THE DEMAND AND MAY CONTINUE TO FIRE THE FURNACE DURING PORTIONS OF THE THERMOSTAT "OFF" CYCLE.

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

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

## FURNACE CONTROL DIAGNOSTICS

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

**STEADY OFF -** No 24V power to board. Check the 24 volt control circuit fuse on the board. Check the circuit breaker or fuse on the 115 volt supply power to the furnace. Check that the 24 volt transformer.

**One Green Flash -** Normal Operation with no call for heat.

**Two Green Flashes -** Indicator for **"**No error codes in memory**"**. See Diagnostic Fault Code Storage and Retrieval section below.

**Three Green Flashes -** Indicator for **"**Error codes cleared from memory". See Diagnostic Fault Code Storage and Retrieval section below.

**Rapid Green Flash -** Control is in **"**Factory Speed-up**"** mode. This mode is used only during factory run-testing of the furnace. To stop this mode, cycle power to the furnace off and then back on.

**One Amber Flash -** Normal operation with call for cooling.

**Two Amber Flashes -** Normal operation with call for heat.

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

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

**Five Amber Flashes -** Heating capacity is reduced due to restriction in the combustion air or vent system. Check for blocked vent/air pipe or clogged condensate drain. Above 4,000 feet altitude, this may also indicate automatic, normal derating for altitude. See page 7 for additional high altitude information.

**Six Amber Flashes -** (Heat Pump applications only) Normal operation with call for heat pump heating.

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

**Rapid Amber Flash -** Low flame sense current. Check for dirty or mislocated flame sensor rod.

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

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

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

**Four Red Flashes -** High limit switch open or defective temperature sensor or 24 volt fuse is open. This may be caused by a dirty air filter, improperly sized duct system, faulty blower motor, restricted circulating airflow an open fuse on the control board.

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

**Six Red Flashes -** Current failure on modulating gas valve.

**Seven Red Flashes -** Lockout due to no ignition. The control will try three times for ignition. If flame cannot be established in three tries, the control will lockout for one hour and then will try again to light. Check gas supply, ignitor, gas valve, flame sensor.

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

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

**Ten Red Flashes -** Gas valve circuit shorted. Check gas valve wiring. If correct, replace gas valve.

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

**Twelve Red Flashes -** ID plug is not present or not connected properly, check for loose plug or loose wires in plug.

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

| 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. **Only a qualified service technician should use this feature.**

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

To retrieve the error codes, push the **LAST ERROR** button. The **LED** on the control will then flash the error codes that are in memory, starting with the most recent. There will be a 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, then will resume the normal slow green flash after a five-second pause.

## SECTION X: REPLACEMENT PARTS LIST

| DESCRIPTION |
|---|
| **MOTOR** |
| MOTOR, DIRECT DRIVE BLOWER |
| BLOWER, COMBUSTION |
| **ELECTRICAL** |
| CAPACITOR, RUN |
| SWITCH, LIMIT |
| CONTROL, FURNACE |
| IGNITER |
| SENSOR, FLAME |
| SWITCH, PRESSURE |
| SWITCH, DOOR |
| TRANSFORMER |
| VALVE, GAS |
| CONTROL, TEMPERATURE |
| SENSOR, PRESSURE |
| SENSOR, THERMISTOR |
| **AIR MOVING** |
| HOUSING, BLOWER |
| WHEEL, BLOWER |
| **FABRICATED PARTS** |
| BAFFLE, FLUE |
| BURNER, MAIN GAS |
| BRACKET, IGNITER |
| SHELF, BLOWER |
| RAIL, BLOWER (2 Req'd) |

| DESCRIPTION |
|---|
| **FABRICATED PARTS Continued** |
| 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 |
| HOSE ASSY, VACUUM |
| PLUG, ID (Control Board) |
| KNOB, QUARTER TURN (4 Req'd) |
| UNION |
| DIAGRAM, WIRING |

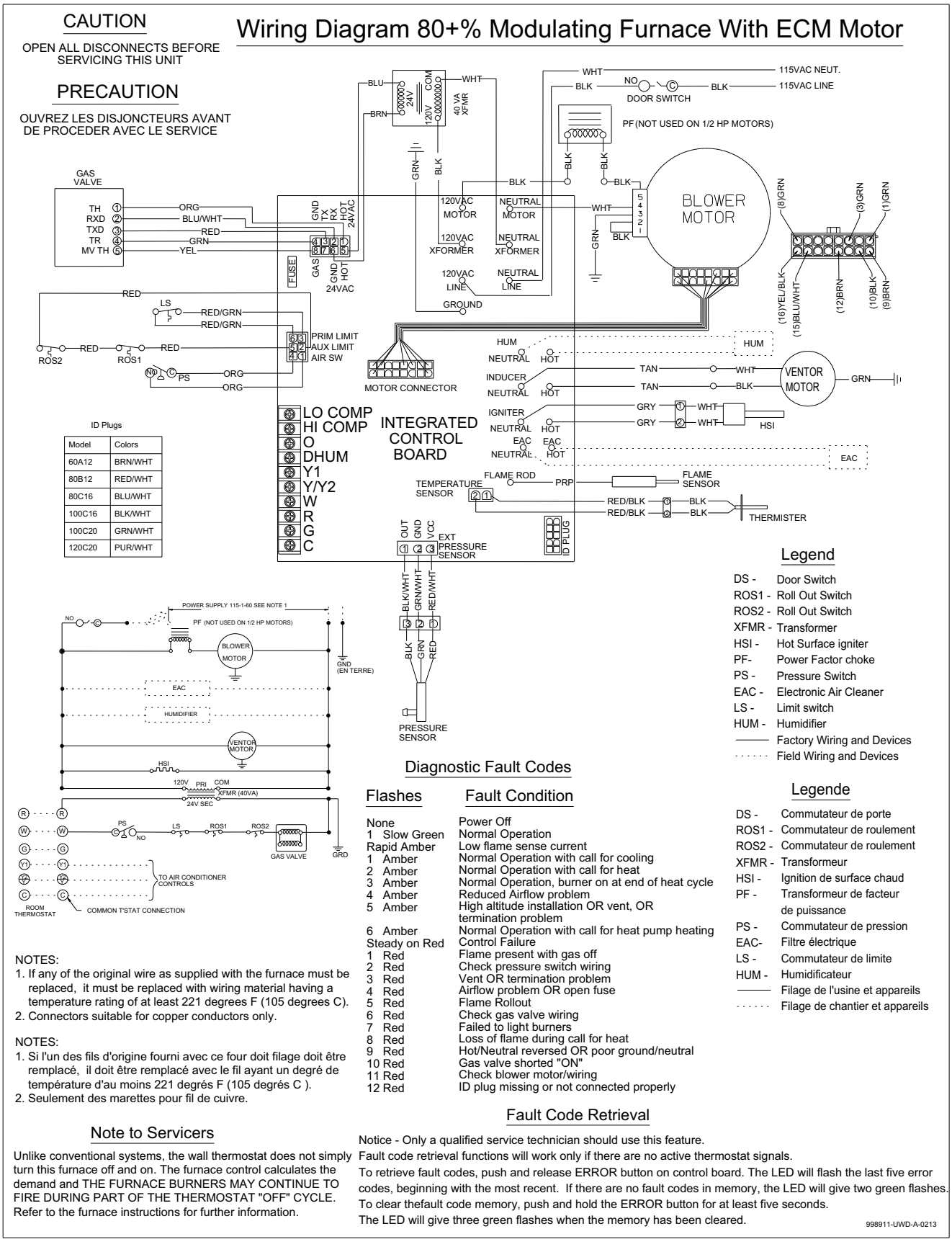
### REPLACEMENT PART CONTACT INFORMATION

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

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

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

## SECTION XI: WIRING DIAGRAM




### Diagnostic Fault Codes

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

### Fault Code Retrieval

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

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

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

### Note to Servicers

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

**FIGURE 32:** Wiring Diagram

## SECTION XII: START UP SHEET

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

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

Start-Up Date

Technician Performing Start-Up | Installing Contractor Name

**Owner Information**

Name | Address

City | State or Province | Zip or Postal Code

**Equipment Data**

Furnace Model | Furnace Serial

Evaporator Coil Model | Evaporator Coil Serial

Outdoor Unit Model | Outdoor Unit Serial

**Furnace Configuration**

◯ Upflow ◯ Downflow ◯ Horizontal Left ◯ Horizontal Right

**Filter, Thermostat, Accessories**

Filter Type | Filter Size | Filter Location(s)

Thermostat Type | Other System Equipment and Accessories

**Connections -- All Per Installation Instructions and Local Code**

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

☐ Vent system is connected

**Venting: B Vent**

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

Connector Size | Connector Length

**Venting: Lined Masonry Chimney with B-Vent Connector**

Connector Size | Connector Length | Chimney Height

# of 90 Degree Ells | # 0f 45 Degree Ells

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

**Other appliances in same common vent:**

| | | | |
|---|---|---|---|
| Water Heater | ☐ BTUH Input | | Fan Assiste◯ Y ◯ N |
| Furnace | ☐ BTUH Input | | Fan Assisted? ◯ Y ◯ N |
| Other | ☐ BTUH Input | | Fan Assisted? ◯ Y ◯ N |

**Electrical: Line Voltage**

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

**Electrical: Low Voltage**

☐ Thermostat heat anticipator set to .1 (if present)

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

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

Continued on next Page

## Gas Side

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

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

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

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

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

## Air Side: System External Static Pressure (Cooling Mode)

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

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

Total External Static Pressure _____

## Air Side: Heating

ATR Setting ◯ NOM ◯ +10F ◯ -10F

Temperature Rise in Degrees F _____

## Other Jumpers

De-humidistat ◯ YES ◯ NO

Heat Pump ◯ YES ◯ NO

Zone Control ◯ YES ◯ NO

## Air Side: Cooling

COOL Speed Selected ◯ L (Low) ◯ ML (Med Low) ◯ MH (Med High) ◯ H (High)

ADJUST Setting (ECM Models) ◯ C ◯ B ◯ A

DELAY Setting (ECM Models) ◯ L (Low) ◯ ML (Med Low) ◯ MH (Med High) ◯ H (High)

## Air Side: Continuous Fan

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

## Cycle Test

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

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

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

## Clean Up

☐ Installation debris disposed of and furnace area cleaned up?

## Owner Education

☐ Give owner the owner's manual provided

☐ Explain operation of system to equipment owner

☐ Explain the importance of regular filter replacement and equipment maintenance

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

## Additional Job Detail

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