

INSTALLATION MANUAL

RESIDENTIAL GAS FURNACE MODELS

YG8S*MP

Single Stage Multi-position for Operation
on 220 Volt 50 Hz Supply Power Only



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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 ANSI Z223.1/NFPA54 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 55°F (13°C) and 80°F (27°C);
 - 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 Modular Home or building constructed on-site, combustion air shall not be supplied from occupied spaces.
11. The size of the unit should be based on an acceptable heat loss calculation for the structure. ACCA, Manual J or other approved methods may be used.

12. When moving or handling this furnace prior to installation it is recommended to leave the doors on the furnace to provide support and to prevent damage or warping of the cabinet. When lifting the furnace by the cabinet, support the ends of the furnace rather than lifting by the cabinet flanges at the return air openings (bottom or sides) or supply air opening.
13. When lifting the furnace, it is acceptable to use the primary heat exchanger tubes as a lifting point provided that the tubes are lifted at the front of the heat exchangers where attached to the vestibule panel. Do not use the top return bend of the heat exchangers as lifting points as the tubes may shift out of position or their location brackets/baffles.

 **IMPORTANT**

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

SAFETY REQUIREMENTS

 **CAUTION**

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

- Refer to the unit rating plate for the furnace model number, and then see the dimensions page of this instruction for return air plenum dimensions in Figure 12. The plenum must be installed according to the instructions.
- Provide clearances from combustible materials as listed under Clearances to Combustibles.
- Provide clearances for servicing ensuring that service access is allowed for both the burners and blower.
- This furnace is not approved for installation in trailers or recreational vehicles or manufactured (mobile) homes.
- 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 220 VAC, 1 Phase, 50-Hertz power supply. **DO NOT CONNECT THIS APPLIANCE TO A 60 HZ POWER SUPPLY OR A VOLTAGE ABOVE 240 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

The furnace described in these instructions are design certified by the American Gas Association to be in compliance with the latest edition of American National Standard Z21.47. In South America, these furnaces are design certified by the Gas Institute of Argentina (IGA).

These furnaces are forced air type and may be utilized for indoor installation in manufactured buildings (modular only), or buildings constructed on site. These furnaces are not certified for installation in mobile homes, trailers or recreational vehicles.

The installer must conform to all state, local and provincial building codes when installing these appliances. In the absence of state, local or provincial codes, these furnaces and related equipment must be installed in accordance with the latest issue of the following:

- NATIONAL FUEL GAS CODE - ANSI Z223.1/NFPA54
- NATIONAL ELECTRICAL CODE, ANSI/NFPA 70.

Applicable codes take precedence over any recommendation made in these instructions.

INSPECTION

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

FURNACE LOCATION AND CLEARANCES

The furnace shall be located using the following guidelines:

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

Installation in freezing temperatures:

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

▲WARNING

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

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

Clearances for access/service:

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

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

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

Installation in a residential garage:

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

Table 1: Unit Clearances to Combustibles (All Dimensions in Inches, and All Surfaces Identified with the Unit in an Upflow Configuration)

Application	Top	Front	Rear	Left Side	Right Side	Flue	Floor/ Bottom	Closet	Alcove	Attic	Line Contact
	In. (cm)	In. (cm)	In. (cm)	In. (cm)	In. (cm)	In. (cm)					
Upflow	1 (2.5)	1 (1.25)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.2)	Combustible	Yes	Yes	Yes	No
Upflow B-Vent	1 (2.5)	1 (1.25)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.5)	Combustible	Yes	Yes	Yes	No
Downflow	1 (2.5)	1 (1.25)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.2)	1 (25.4) ¹	Yes	Yes	Yes	No
Downflow B-Vent	1 (2.5)	1 (1.25)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.5)	1 (25.4) ¹	Yes	Yes	Yes	No
Horizontal	1 (2.5)	1 (1.25)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.2)	Combustible	No	Yes	Yes	Yes ²
Horizontal B-Vent	1 (2.5)	1 (1.25)	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 Modular Home installations, when a furnace is installed so that the supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.
4. Complete a path for heated or cooled air to circulate through the air conditioning and heating equipment and to and from the conditioned space.

⚠ CAUTION

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

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

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

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

IMPORTANT

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

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

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

⚠ WARNING

The duct system must be properly sized to obtain the correct airflow for the furnace size that is being installed. Refer to Table 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 must remain in the rotated down position as shipped.

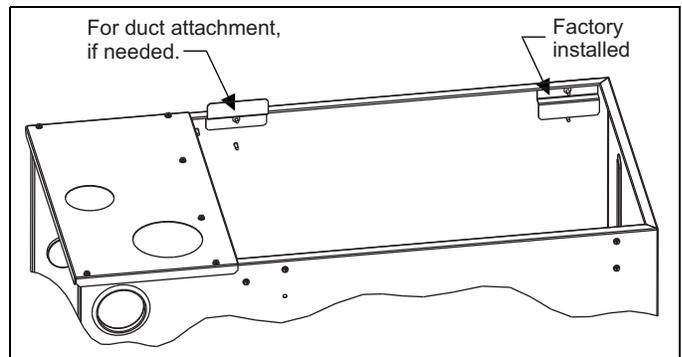


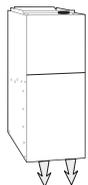
FIGURE 1: Duct Attachment

DUCTWORK INSTALLATION AND SUPPLY PLENUM CONNECTION - UPFLOW/HORIZONTAL



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

FLOOR BASE AND DUCTWORK INSTALLATION - DOWNFLOW



Installations on combustible material or directly on any floors must use a combustible floor base shown in Figure 8. Follow the instructions supplied with the combustible floor base accessory. This combustible floor base can be replaced with a matching cooling coil, properly sealed to prevent leaks. Follow the instructions supplied with the cooling coil cabinet for installing the cabinet to the duct connector. Plug intake and vent pipe holes in bottom panel and move grommet to desired vent side exit.

Downflow Air Conditioning Coil Cabinet

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

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

COIL INSTALLATION

IMPORTANT

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

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

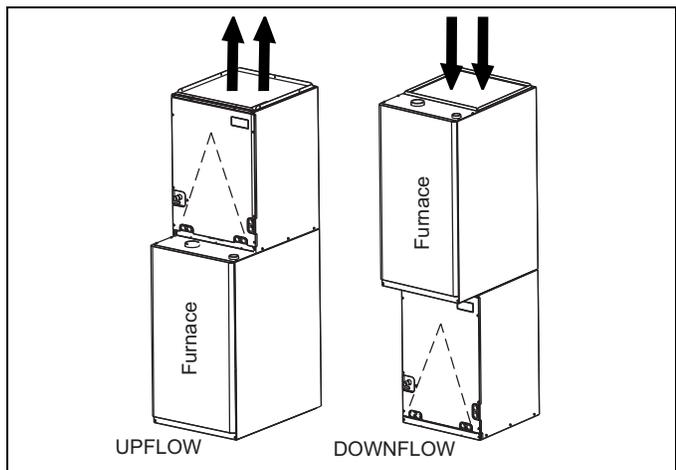


FIGURE 2: Vertical Applications

FURNACE ASSEMBLY - MC & FC SERIES COILS

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

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

COIL FLANGE INSTALLATION

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

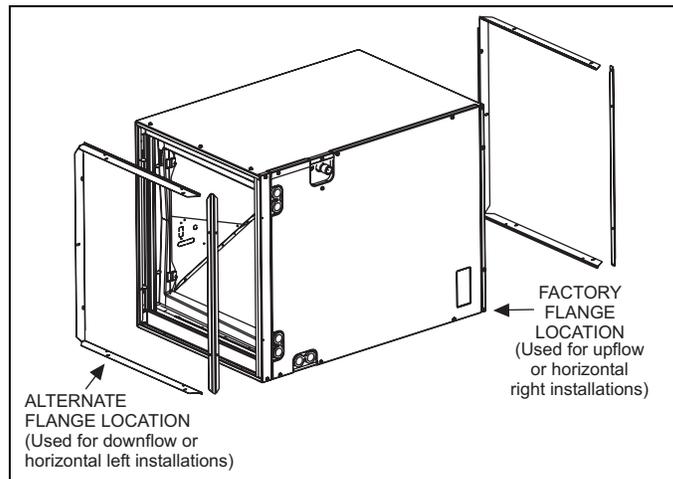


FIGURE 3: Coil Flange

FURNACE ASSEMBLY - MC SERIES COILS ONLY

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

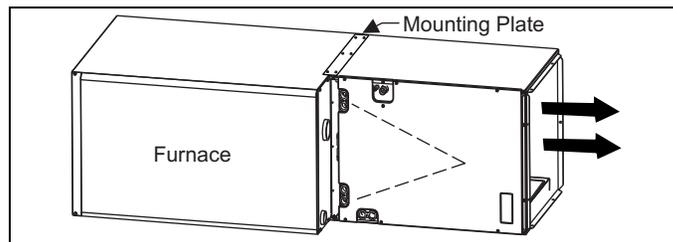


FIGURE 4: Horizontal Right Application

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

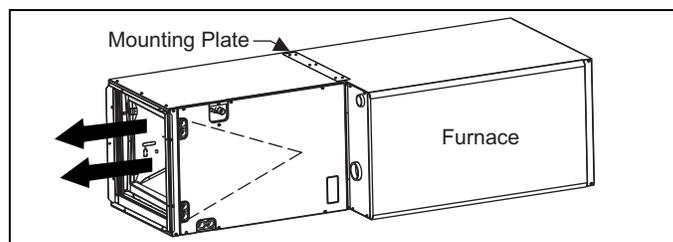


FIGURE 5: Horizontal Left Application

FURNACE ASSEMBLY - PC SERIES COILS

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

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

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

CAUTION

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

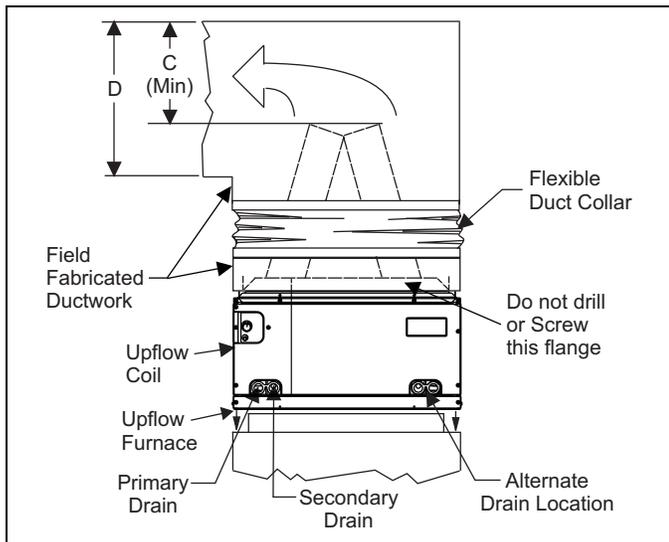


FIGURE 6: PC Series Upflow Coil Installation

Table 2: Coil Projection Dimensions - PC Series Coils

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

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

CRITICAL COIL PROJECTION

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

COIL / FURNACE ASSEMBLY - HC SERIES COILS

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

NOTICE

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

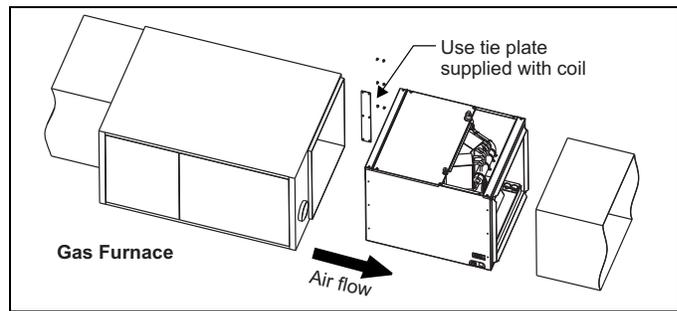


FIGURE 7: Horizontal Left or Right application (Right Shown)

DOWNFLOW DUCT CONNECTORS

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

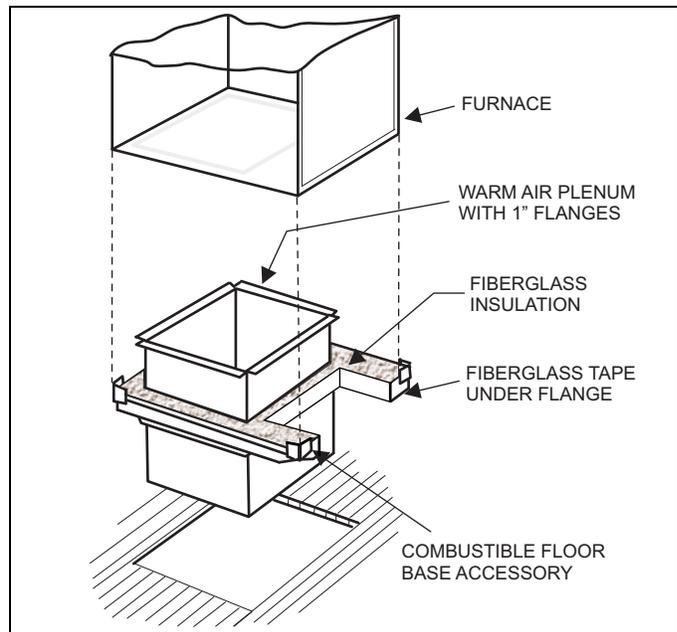


FIGURE 8: Combustible Floor Base Accessory

RESIDENTIAL AND MODULAR HOME UPFLOW RETURN PLENUM CONNECTION

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

BOTTOM RETURN AND ATTIC INSTALLATIONS

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

The internal bottom panel must be removed for this application.

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

HORIZONTAL APPLICATION

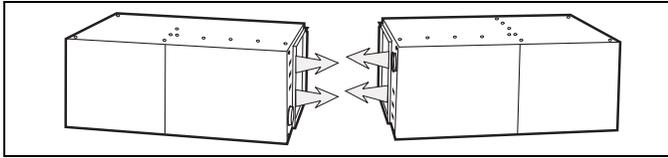


FIGURE 9: Horizontal Application

IMPORTANT

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

ATTIC INSTALLATION

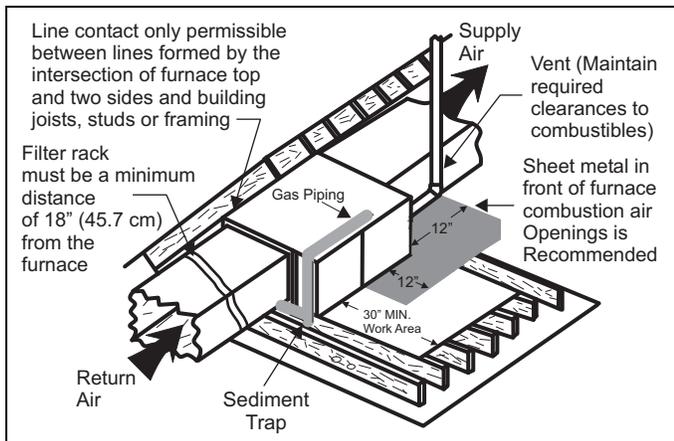


FIGURE 10: Typical Attic Installation

This appliance is certified for line contact when the furnace is installed in the horizontal left or right position. The line contact is only permissible between lines that are formed by the intersection of the top and two sides of the furnace and the building joists, studs or framing. This line may be in contact with combustible material. Refer to Figure 10.

WARNING

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

IMPORTANT

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

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

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

SUSPENDED FURNACE / CRAWL SPACE INSTALLATION

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

Units may also be suspended from rafters or floor joists using rods, pipe angle supports or straps. In all cases, the furnace should be supported with rods, straps, or angle supports at three locations to properly support the furnace. Place one support at the supply end of the furnace, one support located approximately in the center of the furnace near the blower shelf, and the third support should be at the return end of the furnace. Maintain a 6" (15.2 cm) minimum clearance between the front of the furnace and the support rods or straps.

All six suspension points must be level to ensure proper and quiet furnace operation. When suspending the furnace, use a secure platform constructed of plywood or other building materials secured to the floor or ceiling joists. Refer to Table 11 for details and additional information.

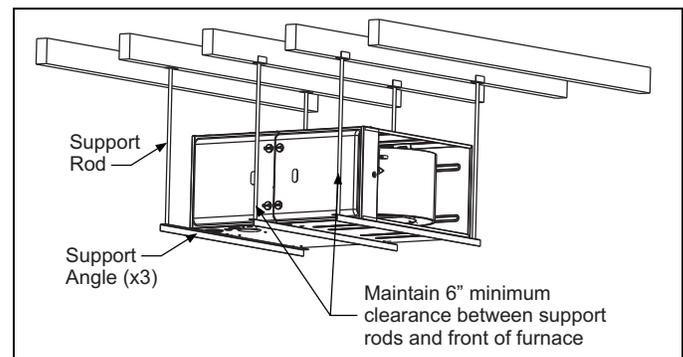


FIGURE 11: Typical Suspended Furnace / Crawl Space Installation

IMPORTANT

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

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

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

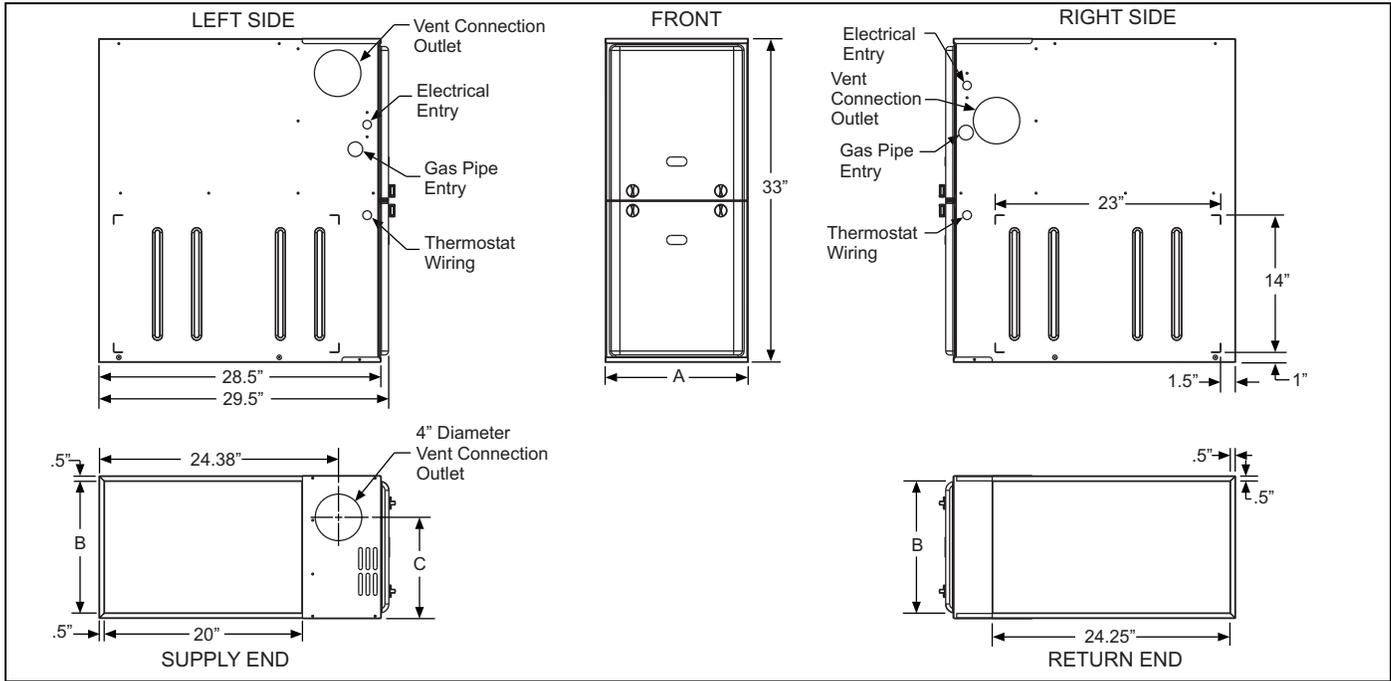


FIGURE 12: Dimensions

Table 3: Cabinet and Duct Dimensions

BTUH (kW) Input	Nominal CFM (m ³ /min)	Cabinet Size	Cabinet Dimensions						Approximate Operating Weights
			A(inches)	A (cm)	B(inches)	B (cm)	C(inches)	C (cm)	Lbs
60 (17.6)	1200 (34.0)	A	14 1/2	36.8	13 3/8	34.0	10.3	26.2	94
80 (23.4)	1200 (34.0)	B	17 1/2	44.4	16 3/8	41.6	11.8	29.9	103
80 (23.4)	1600 (45.3)	C	21	53.3	19 7/8	50.5	13.6	34.5	114
100 (29.3)	1600 (45.3)	C	21	53.3	19 7/8	50.5	13.6	34.5	118
100 (29.3)	2000 (56.6)	C	21	53.3	19 7/8	50.5	13.6	34.5	122
120 (35.1)	2000 (56.6)	C	21	53.3	19 7/8	50.5	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.**

NOTICE

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

Table 4: Recommended Filter Sizes (High Velocity 600 FPM)

CFM (m ³ /min)	Cabinet Size	Side (in)	Bottom (in)
1200 (34.0)	A	16 x 25	14 x 25
1200 (34.0)	B	16 x 25	16 x 25
1600 (45.3)	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

- 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.
- Do not exceed 1800 CFM using a single side return and a 16x25 filter. For CFM greater than 1800, you may use two side returns or one side and the bottom or one return with a transition to allow use of a 20x25 filter.

SIDE RETURN

Locate the "L" shaped corner locators. These indicate the size of the cutout to be made in the furnace side panel. Refer to Figure 13.

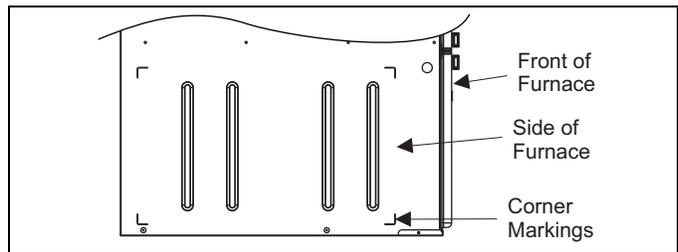


FIGURE 13: Side Return Cutout Markings

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

IMPORTANT

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

HORIZONTAL APPLICATION

Horizontal Filters



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



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

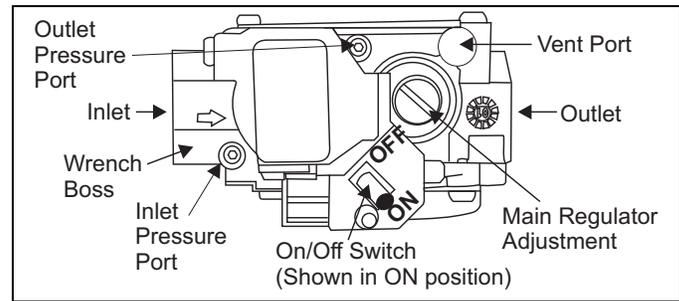


FIGURE 14: Gas Valve



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

GAS PIPING INSTALLATION

Properly sized wrought iron, approved flexible or steel pipe must be used when making gas connections to the unit. If local codes allow the use of a flexible gas appliance connection, always use a new listed connector. Do not use a connector that has previously serviced another gas appliance.

Some utility companies or local codes require pipe sizes larger than the minimum sizes listed in these instructions and in the codes. The furnace rating plate and the instructions in this section specify the type of gas approved for this furnace - only use those approved gases. The installation of a drip leg and ground union is required. Refer to Figure 15.

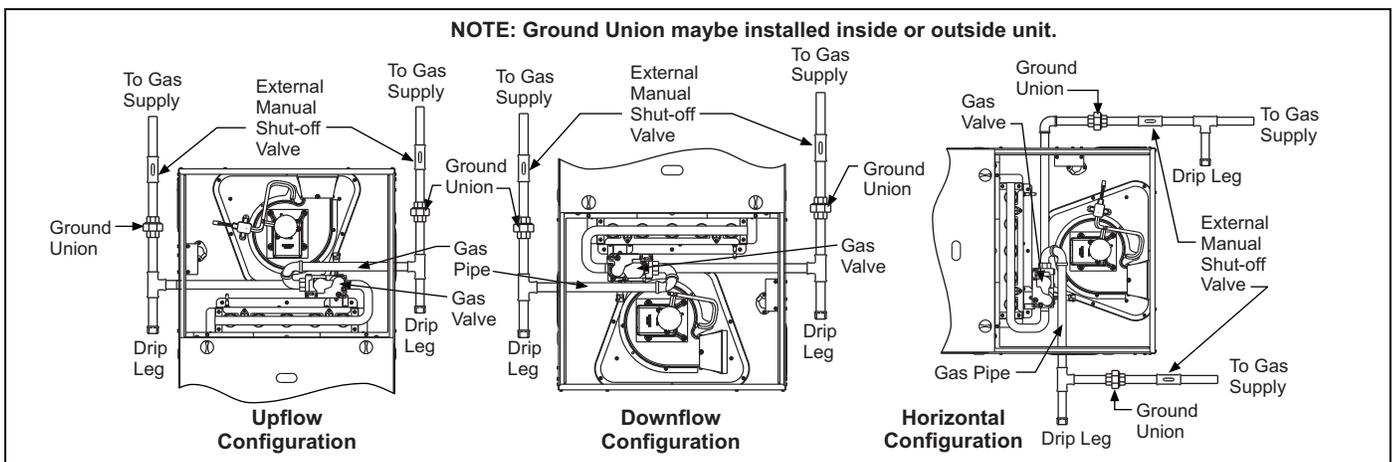


FIGURE 15: Gas Piping

IMPORTANT

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

The furnace must be isolated from the gas supply piping system by closing its individual external manual shutoff valve during any pressure testing of the gas supply piping system at pressures equal to or less than 1/2 psig (3.5 kPa).

CAUTION

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

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

GAS ORIFICE CONVERSION FOR PROPANE (LP)

This furnace is factory equipped for use with natural gas. The furnace has all of the parts necessary to change from natural to LP (propane) gas operation. To convert from natural gas to LP gas, follow the instructions below:

1. Be sure that gas and electricity to the furnace are shut off.
2. Disconnect gas supply pipe from the gas valve.
3. Unplug the two brown wires from the gas valve.

Table 5: Nominal Manifold Pressure

Manifold Pressures (in wc)				
		Altitude (feet)		
		0-7999	8000-8999	9000-9999
Gas Heating Value (BTU/cu ft.)	800	3.5	3.5	3.5
	850	3.5	3.5	3.5
	900	3.5	3.5	3.5
	950	3.5	3.5	3.3
	1000	3.5	3.2	2.9
	1050	3.5	2.9	2.7
	1100	3.2	2.7	2.4
	2500 (LP)	9.8	8.2	7.5

4. Remove the four manifold screws and remove the manifold assembly from the furnace.
5. Remove the brass gas orifices and replace them with the LP orifices in the cloth bag near the gas valve. Torque the new orifices to 15 (+5,--0) in--lbs.
6. Remove the rubber cap from the gas valve regulator.
7. Unscrew the regulator, turn it over and screw it back into the valve. The red end of the regulator screw should be against the valve body. Put the rubber cap back on the regulator.
8. Re-install the manifold assembly in the furnace, making sure that the gas orifices are centered in the burners before tightening the screws.
9. Remove the natural gas tag and replace it with the LP gas tag from the cloth bag.
10. Place the natural gas orifices and natural gas tag back in the cloth bag and hang it from the manifold.
11. Plug the two brown wires back into the gas valve terminals.
12. Reconnect the gas piping and check all gas connections for leaks.

HIGH ALTITUDE GAS ORIFICE CONVERSION

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

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

HIGH ALTITUDE PRESSURE SWITCH CONVERSION

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

Manifold Pressures (kpa)				
		Altitude (m)		
		0-2437	2438-2742	2743-3048
Gas Heating Value (MJ/cu m)	29.8	0.87	0.87	0.87
	31.7	0.87	0.87	0.87
	33.5	0.87	0.87	0.87
	35.4	0.87	0.87	0.81
	37.3	0.87	0.80	0.73
	39.1	0.87	0.73	0.67
	41.0	0.80	0.66	0.61
	93.2 (LP)	2.44	2.03	1.86

DANGER**PROPANE AND HIGH ALTITUDE CONVERSION KITS**

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

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

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

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

The residential supply must have a bonded neutral.

Table 6: Ratings & Physical / Electrical Data

Input		Output		Nominal Airflow		AFUE	Air Temp. Rise		Max. Outlet Air Temp		Blower		Blower Size	Max Over-Current Protect	Total Unit Amps	Min. wire Size (awg) @ 75 ft one way
MBH	kW	MBH	kW	CFM	m ³ /min		°F	°C	°F	°C	HP	Amps				
60	17.6	48	14.1	1200	34.0	80.0	30-60	17-33	170	76.7	1/3	3.0	11 x 8	10	6.0	14
80	23.5	64	18.8	1200	34.0	80.0	35-65	19-36	165	73.9	1/3	3.0	11 x 8	10	6.0	14
80	23.5	64	18.8	1600	45.3	80.0	25-55	14-31	155	68.3	1/2	6.0	11 x 10	15	8.0	14
100	29.3	80	23.4	1600	45.3	80.0	35-65	19-36	165	73.9	1/2	6.0	11 x 10	15	8.0	14
100	29.3	80	23.4	2000	56.6	80.0	25-55	14-31	155	68.3	1	10.0	11 x 11	20	12.0	12
120	33.7	96	26.9	2000	56.6	80.0	30-60	17-33	160	71.1	1	10.0	11 x 11	20	12.0	12

Annual Fuel Utilization Efficiency (AFUE) numbers are determined in accordance with DOE Test procedures.

Wire size and over current protection must comply with the National Electrical Code (NFPA-70-latest edition) and all local codes.

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

SUPPLY VOLTAGE CONNECTIONS

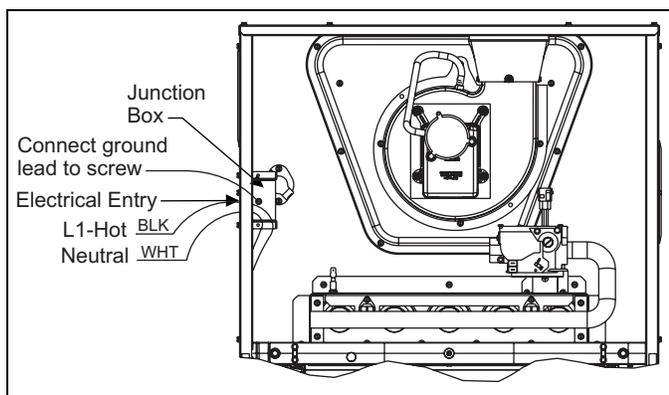


FIGURE 16: Electrical Wiring

1. Provide a power supply separate from all other circuits. Install 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 16.
3. The furnace's control system requires correct polarity of the power supply and a proper ground connection. Refer to Figure 16.

CAUTION

Use copper conductors only.

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.

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 17 or 18. Electronic thermostats may require the common wire to be connected. Apply strain relief to thermostat wires passing through cabinet. If air conditioning equipment is installed, use thermostat wiring to connect the Y and C terminals on the furnace control board to the proper wires on the condensing unit (unit outside).

IMPORTANT

Set the heat anticipator in the room thermostat to 0.4 amps. Setting it lower will cause short cycles. Setting it higher will cause the room temperature to exceed the set points.

IMPORTANT

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

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

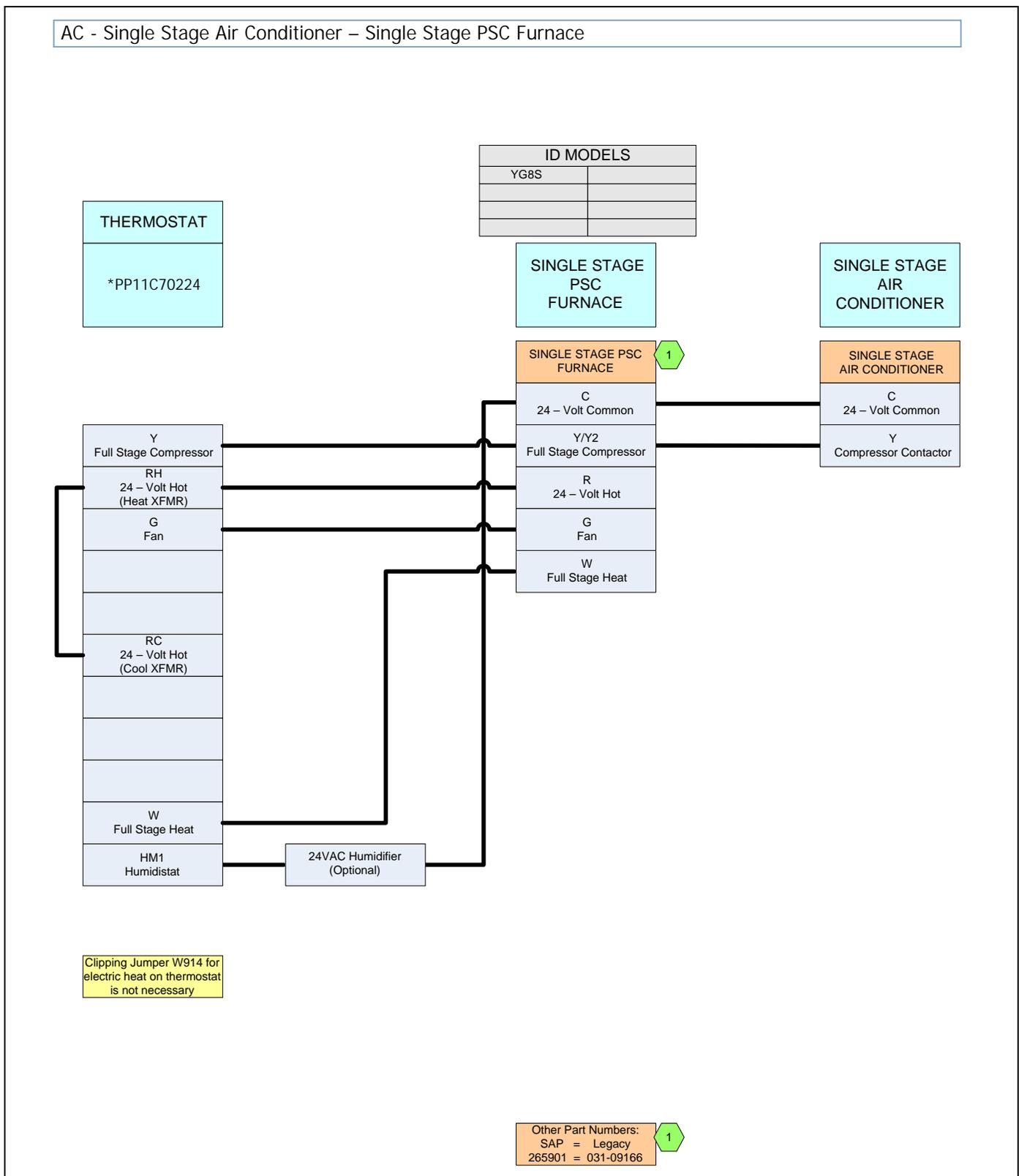


FIGURE 17: Thermostat Chart - Single Stage AC with Single Stage PSC Furnaces

HP - Single Stage Heat Pump – Single Stage PSC Furnace

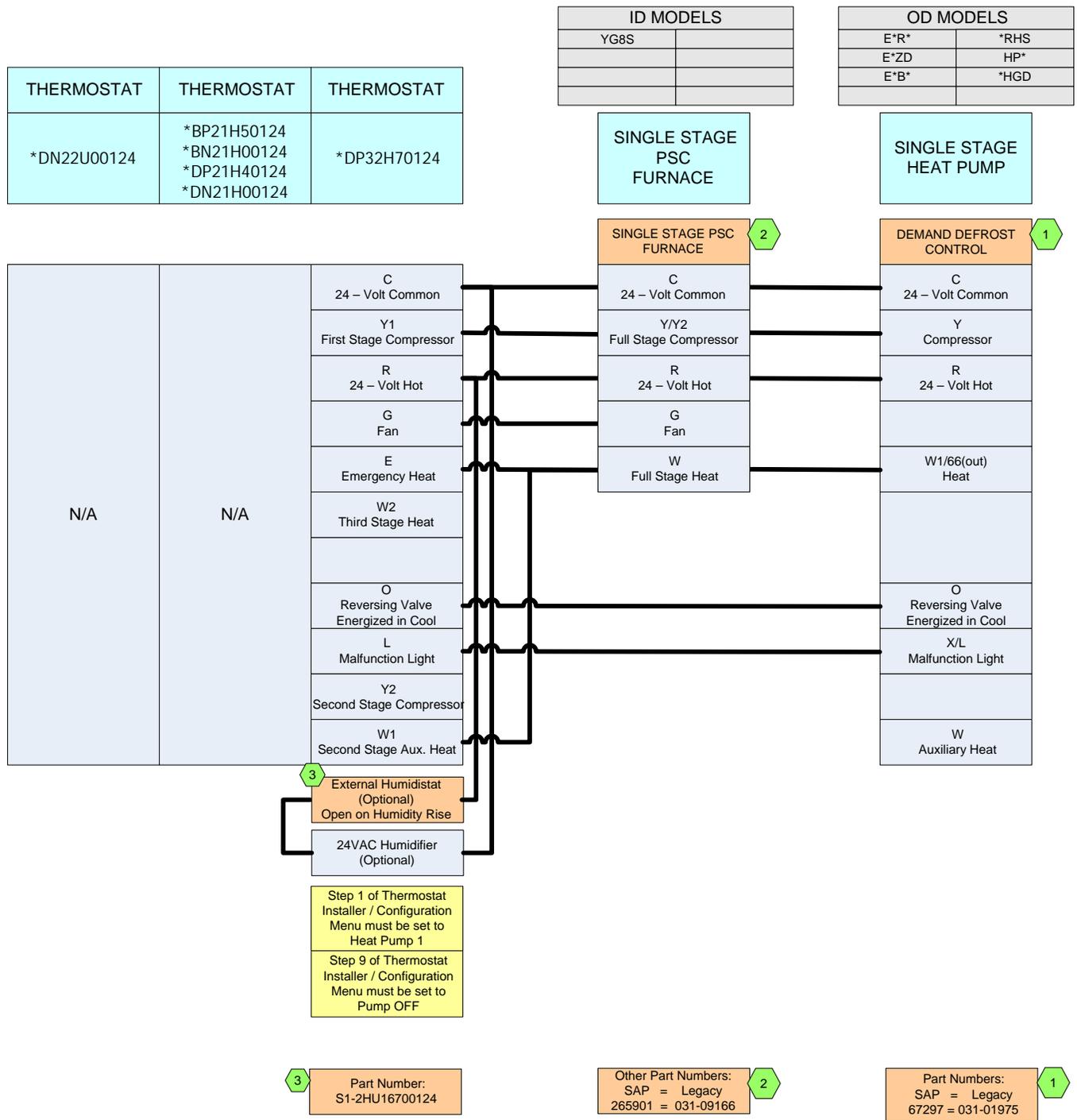


FIGURE 18: Thermostat Chart - Single Stage HP with Single Stage PSC Furnaces

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.

SECTION VI: TWINNING AND STAGING

In applications where more heating capacity or more airflow capacity is needed than what one furnace can deliver, twinning can be used to make two furnaces operate in tandem. When two furnaces are installed using the same duct system, it is very important that the two furnace circulating air blowers operate in unison. If one blower starts before the second blower, the duct system will become pressurized and the blower on the second furnace will turn backwards causing the second furnace to overheat, resulting in damage to the furnace. Twinning is used to make two furnaces operate in tandem, using one duct system, one room thermostat and causing both furnaces to turn on and off simultaneously.

WARNING

Before installing the relay and wiring, disconnect electrical power to both furnaces. Failure to cut power could result in electrical shock or equipment damage.

CAUTION

The relay must not be installed in any location where it could be exposed to water. If the relay has been exposed to water in any way, it must not be used.

TWINNING DUCT SYSTEM

Twinning furnaces must only be applied on a common duct system. A single air supply plenum must be used for both furnaces and coil(s). Separate plenums and supply ducts systems cannot be utilized. A single return air plenum, common to both furnaces must be used. It is suggested that a return platform be utilized, with bottom air entrance into each furnace. If a side entrance returns system is used, the common return duct must be divided equally so as to supply each furnace with an equal amount of return air.

Both furnaces must be identical models in both heating capacity and CFM capacity. Both furnaces must be operated on the same motor speed tap. See typical application, Figure 19.

If furnace staging is desired with two single stage furnaces on a common duct, where the gas burner on the first furnace operates on W1 and the gas burner on the second furnace operates on W2, then the use of an air-mixing device in the plenum to mix the air from both furnaces is strongly recommended. The mixing device must be installed before any ducts that supply air to occupied spaces. Twinning causes both indoor fans to operate simultaneously. If a mixing device is not used, any ducts that are connected down stream from the furnace that operates on W2, will be supplying cold air in the Heating mode to the occupied spaces unless W2 is energized.

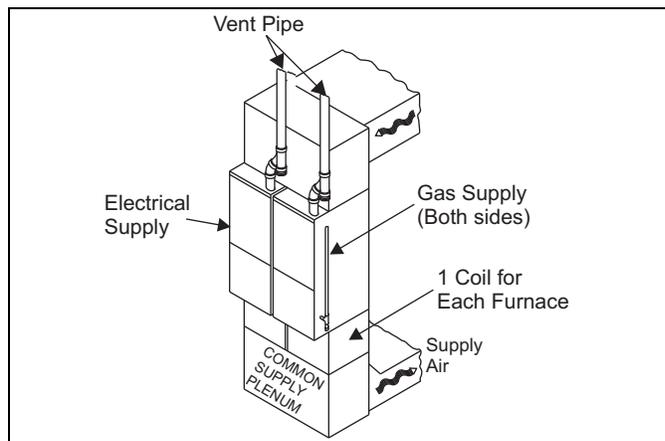


FIGURE 19: Typical Twinned Furnace Application

IMPORTANT

When two furnaces are twinned, typical system total airflow will be approximately 85% of additive individual furnaces, i.e., two 2000 CFM units will yield a total 3400 CFM.

CAUTION

If a return duct is connected to only one furnace (with a connection between the two furnaces) an imbalance in the airflow will occur and the furnace furthest from the return plenum will overheat.

GAS PIPING

Furnace gas supplies must be provided as specified with these instructions. Since the furnaces are side by side, with no space between, gas supplies must enter on the right and left respectively. All gas piping must be in accordance with the national fuel gas code, ANSI Z223.1, latest edition, and/or all local code or utility requirements.

TWINNING

In applications where more heating capacity or more airflow capacity is needed than what one furnace can deliver, twinning can be used to make two furnaces operate in tandem, using one duct system and one room thermostat. When one duct system is used for two furnaces, it is necessary that the two blowers operate in unison. The twinning function of the board in this furnace ensures that both blowers turn on and off simultaneously, and operate on the same blower speed.

Single-Wire Twinning

The control in the furnace has the single-wire twinning feature. With this feature, a single wire is connected between the TWIN terminal on one furnace board to the TWIN terminal on the second furnace board. The board then communicates the blower status from one furnace to the other along this wire. This communication makes the second furnace blower come on at the same time, and on the same speed, as the first furnace blower.

Single-Wire Twinning Instructions

Connect the control wiring as shown in Figure 20.

1. Connect the low voltage wiring from the wall thermostat to the terminal strip on the control board of Furnace #1.
2. Connect a wire from the TWIN terminal of Furnace #1 to the TWIN terminal of Furnace #2.
3. Install a separate 24V relay as shown in the diagram below. Use of this relay is required, as it ensures that the transformers of the two furnaces are isolated, thus preventing the possibility of any safety devices being bypassed.

Single-Wire Twinning Operation

Heating - On a call for heat (W signal) from the wall thermostat, both furnaces will start the ignition sequence and the burners on both furnaces will light. About thirty seconds after the burners light, the blowers on both furnaces will come on in heating speed. When the thermostat is satisfied, the burners will all shut off and, after the selected blower off delay time, both blowers will shut off at the same time. The twinning control ensures that both blowers come on and shut off at the same time.

Cooling - On a call for cooling (Y signal) from the wall thermostat, both furnace blowers will come on at the same time in cooling speed. When the thermostat is satisfied, both blowers will stay on for 60 seconds, then will shut off at the same time.

Continuous Fan - On a thermostat call for continuous fan (G signal), both furnace blowers will come on at the same time in cooling speed and will stay on until the G signal is removed.

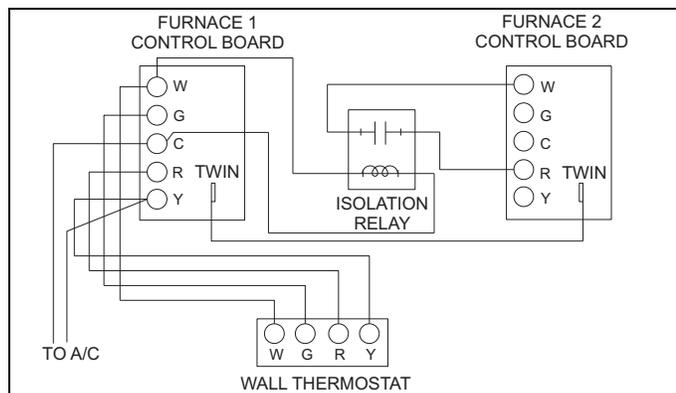


FIGURE 20: Single Stage Twinning Wiring Diagram

STAGING

This control can also be used along with a two-stage wall thermostat to stage two twinned furnaces, making them operate like a single two-stage furnace. This allows only one furnace to supply heat during times when the heat output from one furnace is sufficient to satisfy the demand. When one duct system is used for two furnaces, it is necessary that the two blowers operate in unison. The twinning function of this board ensures that both blowers turn on and off simultaneously, and operate on the same blower speed. Even when only one furnace is supplying heat, both furnace blowers must run.

Single-Wire Staging

The single-wire twinning feature of this board can also be used for staging of two furnaces. With this feature, a single wire is connected between the TWIN terminal on one furnace board to the TWIN terminal on the second furnace board. The board then communicates the blower status from one furnace to the other along this wire. This communication makes the second furnace blower come on at the same time, and on the same speed, as the first furnace blower.

Single-Wire Staging Instructions

Connect the control wiring as shown in Figure 21.

1. Connect the low voltage wiring from the wall thermostat to the terminal strip on the control board of Furnace #1. For staging applications, the wire from thermostat W1 is connected to the W connection on the board on Furnace #1. The wire from thermostat W2 is connected to Furnace #2 through a separate relay, as described below.
2. Connect a wire from the TWIN terminal of Furnace #1 to the TWIN terminal of Furnace #2.
3. Install a separate 24V relay as shown in the diagram below. Use of this relay is required, as it ensures that the transformers of the two furnaces are isolated, thus preventing the possibility of any safety devices being bypassed.

Single-Wire Staging Operation

Heating - On a call for first-stage heat (W1 signal) from the wall thermostat, Furnace #1 will start the ignition sequence and the burners will light. About thirty seconds after the burners light, the blowers on both furnaces will come on in heating speed. When the thermostat is satisfied, the burners will shut off and, after the selected blower off delay time, both blowers will shut off at the same time. On a call for second stage of heat, the burners of Furnace #2 will also light and both blowers will run. The twinning control ensures that both blowers come on and shut off at the same time.

Cooling - On a call for cooling (Y signal) from the wall thermostat, both furnace blowers will come on at the same time. When the thermostat is satisfied, both blowers will stay on for 60 seconds, then will shut off at the same time.

Continuous Fan - On a thermostat call for continuous fan (G signal), both furnace blowers will come on at the same time in cooling speed and will stay on until the G signal is removed.

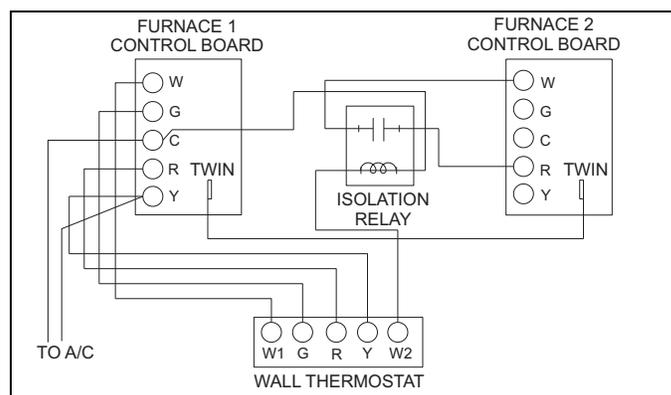


FIGURE 21: Two-Stage Twinning Wiring Diagram

SECTION VII: VENT SYSTEM

VENT CONNECTIONS

All models are provided with a flue transition that is sized for 4" diameter vent connections. If a larger size vent connector is required, that connection must be installed external to the furnace. Figure 22 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.

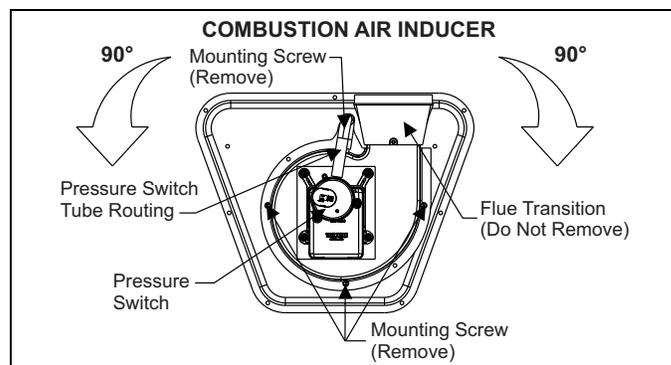


FIGURE 22: Combustion Air Inducer

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 applicable provisions of the local building code and these instructions.

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

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

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

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

VENTING

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

VENTING INTO AN EXISTING CHIMNEY

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

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

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

FAN-ASSISTED COMBUSTION SYSTEM

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

Ambient Combustion Air Supply

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

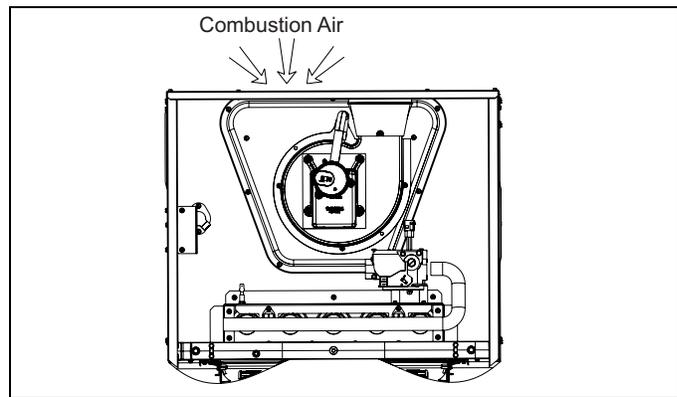


FIGURE 23: Combustion Airflow Path Through The Furnace Casing to the Burner Compartment

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 m³) per 1,000 Btu/hr (0.2928 kW) input rating for all of the appliances installed in that area.

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

A **confined space** is an area with less than 50 cu.ft (1.42 m³) 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	

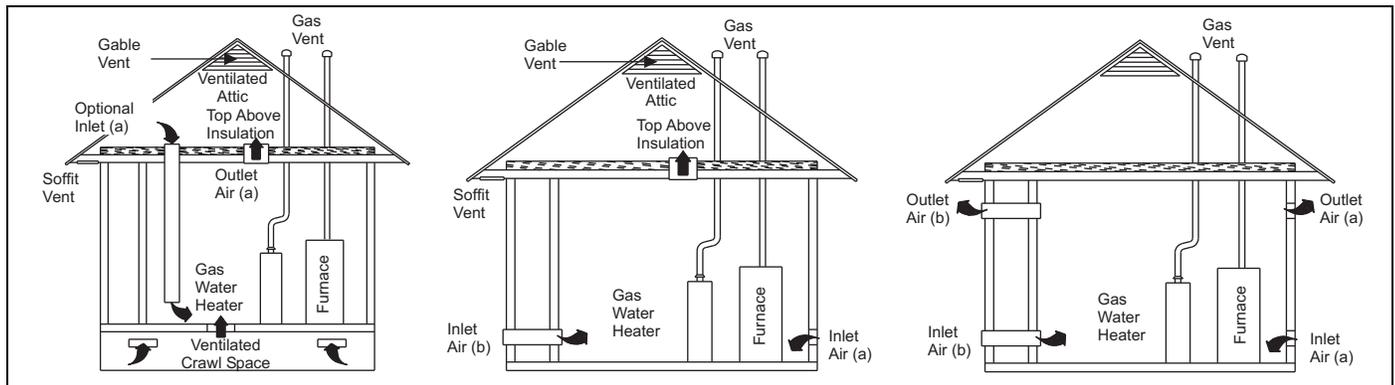


FIGURE 24: Outside and Ambient Combustion Air

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 in² (58.06 cm²) 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 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 the local building codes, furnace and vent manufacturer's instructions.

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

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

Horizontal portions of the venting system shall be supported to prevent sagging using hangers or perforated straps and must slope upwards not less than 1/4" per foot (0.635 cm/m) from the furnace to the vent terminal.

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

WARNING

CARBON MONOXIDE POISONING HAZARD

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

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

1. Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion or other deficiencies, which could cause an unsafe condition
2. Close all building doors and windows.
3. Turn on clothes dryers and TURN ON any exhaust fans, such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Open the fireplace dampers. Do not operate a summer exhaust fan.
4. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so the appliance shall operate continuously.
5. Test each appliance (such as a water heater) equipped with a draft hood for spillage (down-draft or no draft) at the draft hood relief opening after 5 minutes of main burner operation. Appliances that do not have draft hoods need to be checked at the vent pipe as close to the appliance as possible. Use a combustion analyzer to check the CO₂ and CO levels of each appliance. Use a draft gauge to check for a downdraft or inadequate draft condition.
6. After it has been determined that each appliance properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their normal condition.
7. If improper venting is observed during any of the above tests, a problem exists with either the venting system or the appliance does not have enough combustion air (Supply Air from outside) to complete combustion. This condition must be corrected before the appliance can function safely.

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

8. Any corrections to the venting system and / or to the supply (outside) air system must be in accordance with the National Fuel Gas Code Z223.1 (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 VIII: START-UP AND ADJUSTMENTS

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

IMPORTANT

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

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

GAS PIPING LEAK CHECK

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

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

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

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

⚠ 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.

IGNITION SYSTEM SEQUENCE

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

IMPORTANT

Burner ignition may not be satisfactory on first startup due to residual air in the gas line or until gas manifold pressure is adjusted. The ignition control will make 3 attempts to light before locking out.

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

**CALCULATING THE FURNACE INPUT
(NATURAL GAS)****NOTICE**

Burner orifices are sized to provide proper input rate using natural gas with a heating value of 1030 BTU/Ft³ (38.4 MJ/m³). If the heating value of your gas is significantly different, it may be necessary to replace the orifices.

NOTICE

DO NOT set manifold pressure less than 3.2 in 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 over-fire 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.

Table 10: Gas Rate (CU FT/HR)

Seconds For 1 Revolution	Size of Test Dial			Seconds For 1 Revolution	Size of Test Dial		
	1 Cu Ft	2 Cu Ft	5 Cu Ft		1 Cu Ft	2 Cu Ft	5 Cu Ft
10	360	720	1800	50	72	144	360
11	327	655	1636	51	71	141	355
12	300	600	1500	52	69	138	346
13	277	555	1385	53	68	136	340
14	257	514	1286	54	67	133	333
15	240	480	1200	55	65	131	327
16	225	450	1125	56	64	129	321
17	212	424	1059	57	63	126	316
18	200	400	1000	58	62	124	310
19	189	379	947	59	61	122	305
20	180	360	900	60	60	120	300
21	171	343	857	62	58	116	290
22	164	327	818	64	56	112	281
23	157	313	783	66	54	109	273
24	150	300	750	68	53	106	265
25	144	288	720	70	51	103	257
26	138	277	692	72	50	100	250
27	133	267	667	74	48	97	243
28	129	257	643	76	47	95	237
29	124	248	621	78	46	92	231
30	120	240	600	80	45	90	225
31	116	232	581	82	44	88	220
32	113	225	563	84	43	86	214
33	109	218	545	86	42	84	209
34	106	212	529	88	41	82	205
35	103	206	514	90	40	80	200
36	100	200	500	92	39	78	196
37	97	195	486	94	38	76	192
38	95	189	474	96	38	75	188
39	92	185	462	98	37	74	184
40	90	180	450	100	36	72	180
41	88	176	439	102	35	71	178
42	86	172	429	104	35	69	173
43	84	167	419	106	34	68	170
44	82	164	409	108	33	67	167
45	80	160	400	110	33	65	164
46	78	157	391	112	32	64	161
47	76	153	383	116	31	62	155
48	75	150	375	120	30	60	150
49	73	147	367				

ADJUSTMENT OF - MANIFOLD GAS PRESSURE & INPUT RATE

Inlet and manifold gas pressure may be measured by connecting the "U" tube manometer to the gas valve with a piece of tubing. Follow the appropriate section in the instructions below. Refer to Figure 25 for a drawing of the locations of the pressure ports on the gas valve.

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

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

Read the inlet gas pressure

Connect the positive side of the manometer to the IN P Tap on the gas valve. Do not connect any tubing to the negative side of the manometer, as it will reference atmospheric pressure. Refer to Figure 26 for connection details.

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

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" (3.24 kPa) W.C.

IMPORTANT

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

- 7" w.c. (1.74 kPa) for Natural Gas
- 11" w.c. (2.74 kPa) for Propane (LP) Gas

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

2. Once the correct gas inlet pressure has been established, see Table 11, turn the gas valve to OFF and turn the electrical supply switch to OFF; then remove the flexible tubing from the gas valve pressure tap and tighten the pressure tap plug using the 3/32" (2.4 mm) allen wrench.
3. Turn the electrical and gas supplies back on, and with the burners in operation, check for gas leakage around the gas valve pressure port for leakage using an approved non-corrosive gas leak detection fluid, or other non-flammable leak detection methods.

Read the manifold gas pressure

Connect the positive side of the manometer to the adapter previously installed in the OUT P Tap on the gas valve. Do not connect any tubing to the negative side of the manometer, as it will reference atmospheric pressure. Refer to Figure 26 for connection details.

IMPORTANT

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

NOTICE

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

1. Refer to Figure 25 for location of pressure regulator adjustment cap and adjustment screws on main gas valve.
2. Turn gas and electrical supplies on and follow the operating instructions to place the unit back in operation.
3. Adjust manifold pressure by adjusting gas valve regulator screw for the appropriate gas per the following:

Table 12: Nominal Manifold Pressure

NOMINAL MANIFOLD PRESSURE	
Natural Gas	3.5" w.c. (0.87 kPa)
Propane (LP) Gas	10.0" w.c. (2.488 kPa)

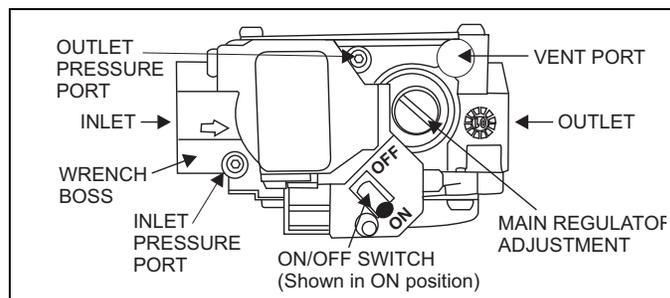


FIGURE 25: Gas Valve

IMPORTANT

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

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

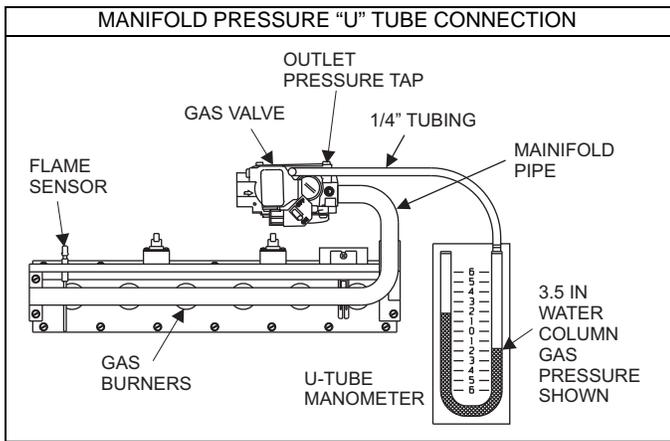


FIGURE 26: Reading Gas Pressure

ADJUSTMENT OF TEMPERATURE RISE

DANGER

The temperature rise, or temperature difference between the return air and the supply (heated) air from the furnace, must be within the range shown on the furnace rating plate and within the application limitations shown in SECTION 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 readings of both the return air and the heated air in the ducts, about six feet (1.83 m) from the furnace where they will not be affected by radiant heat. Increase the blower speed to decrease the temperature rise; decrease the blower speed to increase the rise.

All direct-drive blowers have multi-speed motors. The blower motor speed taps are located on the furnace control board in the blower compartment. Refer to Figure 28, and the unit-wiring label to change the blower speed. To use the same speed tap for heating and cooling, the heat terminal and cool terminal must be connected using a jumper wire and connected to the desired motor lead. Place all unused motor leads on park terminals. Two park terminals are provided.

CAUTION

Do not energize more than one motor speed at a time or damage to the motor will result.

BLOWER TIMINGS

The electronic furnace control supplied on this furnace controls the blower delay timings.

The heating on delay, from when the gas valve opens to when the circulating blower comes on, is fixed at 30 seconds and is not adjustable.

The heating off delay, from when the gas valve closes to when the circulating blower shuts off, is factory set at 180 seconds. This timing may be adjusted to 60, 90, 120 or 180 seconds on the electronic furnace control. The furnace control has four pins and a small jumper plug which is used to adjust the blower off delay. See Table 28.

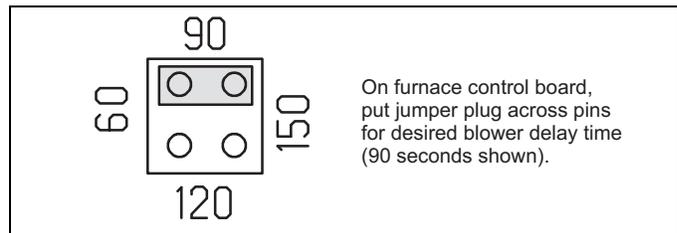


FIGURE 27: Blower Timing Change

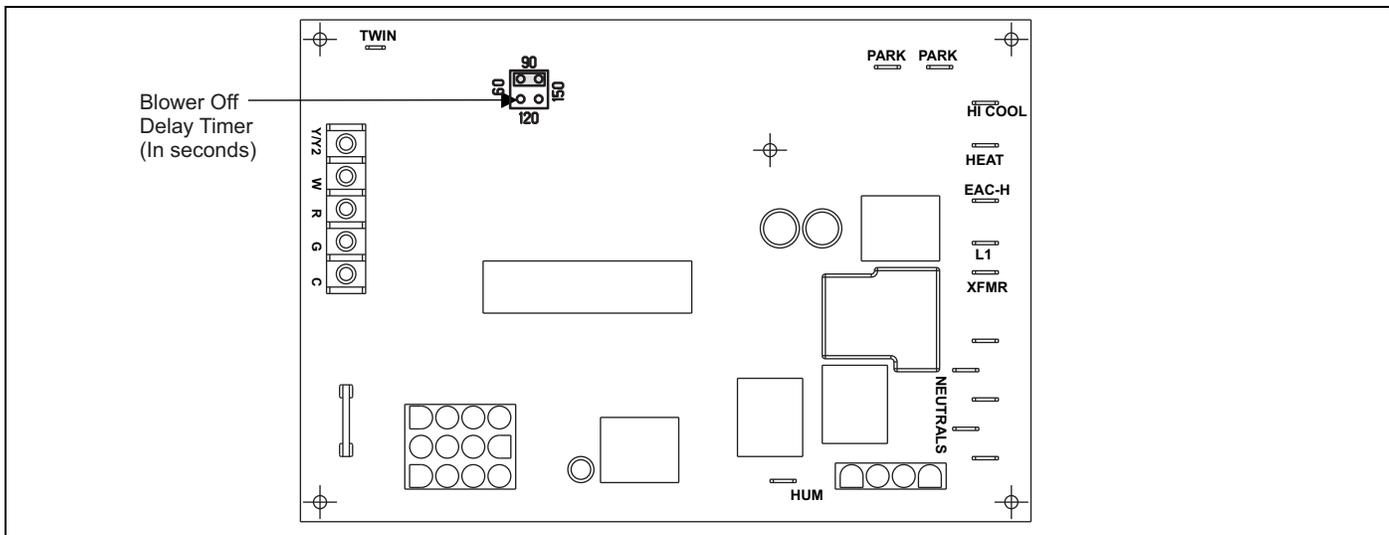


FIGURE 28: Furnace Control Board

Table 13: Blower Performance CFM - Any Position (without filter) - Bottom Return

Models	Speed	Bottom Airflow Data (SCFM)										Bottom Airflow Data (m ³ /min)									
		Ext. Static Pressure (in. H2O)										Ext. Static Pressure (in. H2O)									
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
040A08	High	966	923	874	804	717	566	386	121	NA	NA	27.4	26.1	24.7	22.8	20.3	16.0	10.9	3.4	NA	NA
	Medium High	813	782	743	687	605	464	280	118	NA	NA	23.0	22.1	21.0	19.5	17.1	13.1	7.9	3.3	NA	NA
	Medium Low	745	706	667	619	545	413	205	NA	NA	NA	21.1	20.0	18.9	17.5	15.4	11.7	5.8	NA	NA	NA
	Low	684	655	614	565	489	342	171	NA	NA	NA	19.4	18.5	17.4	16.0	13.8	9.7	4.8	NA	NA	NA
060A10	High	1292	1230	1160	1088	1004	891	760	476	129	129	36.6	34.8	32.8	30.8	28.4	25.2	21.5	13.5	3.7	3.7
	Medium High	1203	1157	1105	1035	942	846	728	485	133	129	34.1	32.8	31.3	29.3	26.7	24.0	20.6	13.7	3.8	3.7
	Medium Low	1043	1010	962	905	823	705	491	305	124	123	29.5	28.6	27.2	25.6	23.3	20.0	13.9	8.6	3.5	3.5
	Low	869	845	811	772	708	579	438	178	145	125	24.6	23.9	23.0	21.9	20.0	16.4	12.4	5.0	4.1	3.5
060A12	High	1358	1341	1319	1303	1275	1238	1190	1130	1062	943	38.5	38.0	37.3	36.9	36.1	35.1	33.7	32.0	30.1	26.7
	Medium High	1097	1083	1075	1064	1042	1024	997	962	906	821	31.1	30.7	30.4	30.1	29.5	29.0	28.2	27.2	25.7	23.2
	Medium Low	935	928	920	899	872	840	809	771	731	659	26.5	26.3	26.1	25.5	24.7	23.8	22.9	21.8	20.7	18.7
	Low	800	779	763	736	711	687	657	622	584	529	22.7	22.1	21.6	20.8	20.1	19.5	18.6	17.6	16.5	15.0
080B12	High	1329	1307	1285	1247	1195	1143	1091	1027	927	806	37.6	37.0	36.4	35.3	33.8	32.4	30.9	29.1	26.2	22.8
	Medium High	994	1004	1008	984	970	941	893	839	773	669	28.1	28.4	28.5	27.9	27.5	26.6	25.3	23.8	21.9	18.9
	Medium Low	786	790	782	781	761	743	726	685	630	540	22.3	22.4	22.1	22.1	21.5	21.0	20.6	19.4	17.8	15.3
	Low	655	654	647	629	620	594	560	524	469	399	18.5	18.5	18.3	17.8	17.6	16.8	15.9	14.8	13.3	11.3
080C16	High	1881	1822	1783	1696	1602	1539	1465	1394	1267	1130	53.3	51.6	50.5	48.0	45.4	43.6	41.5	39.5	35.9	32.0
	Medium High	1553	1535	1492	1456	1408	1343	1279	1226	1113	1014	44.0	43.5	42.2	41.2	39.9	38.0	36.2	34.7	31.5	28.7
	Medium Low	1312	1286	1288	1260	1205	1143	1091	1029	966	841	37.2	36.4	36.5	35.7	34.1	32.4	30.9	29.1	27.4	23.8
	Low	1169	1166	1128	1098	1069	1032	987	909	835	747	33.1	33.0	31.9	31.1	30.3	29.2	27.9	25.7	23.6	21.2
080C22	High	2811	2725	2638	2540	2448	2339	2224	2111	1974	1831	79.6	77.2	74.7	71.9	69.3	66.2	63.0	59.8	55.9	51.8
	Medium High	2234	2233	2147	2092	2042	1974	1907	1820	1705	1575	63.3	63.2	60.8	59.2	57.8	55.9	54.0	51.5	48.3	44.6
	Medium Low	1722	1716	1690	1681	1603	1553	1489	1426	1335	1241	48.8	48.6	47.9	47.6	45.4	44.0	42.2	40.4	37.8	35.1
	Low	1396	1375	1348	1325	1263	1200	1150	1120	1052	965	39.5	38.9	38.2	37.5	35.8	34.0	32.6	31.7	29.8	27.3
100B12	High	1314	1318	1292	1265	1223	1177	1119	1051	971	890	37.2	37.3	36.6	35.8	34.6	33.3	31.7	29.8	27.5	25.2
	Medium High	1010	1004	1003	995	992	956	914	857	798	721	28.6	28.4	28.4	28.2	28.1	27.1	25.9	24.3	22.6	20.4
	Medium Low	812	805	796	786	777	754	727	685	626	560	23.0	22.8	22.5	22.3	22.0	21.4	20.6	19.4	17.7	15.9
	Low	661	659	644	623	614	605	568	532	482	399	18.7	18.7	18.2	17.6	17.4	17.1	16.1	15.1	13.6	11.3
100C16	High	2069	2014	1956	1885	1820	1748	1668	1577	1468	1362	58.6	57.0	55.4	53.4	51.5	49.5	47.2	44.7	41.6	38.6
	Medium High	1662	1656	1639	1608	1586	1544	1491	1421	1338	1204	47.1	46.9	46.4	45.5	44.9	43.7	42.2	40.2	37.9	34.1
	Medium	1368	1371	1377	1376	1367	1334	1295	1250	1188	1104	38.7	38.8	39.0	39.0	38.7	37.8	36.7	35.4	33.6	31.3
	Low	1016	1014	1018	1030	1012	996	975	944	898	852	28.8	28.7	28.8	29.2	28.7	28.2	27.6	26.7	25.4	24.1
100C20	High	2893	2774	2687	2589	2478	2376	2255	2120	1978	1824	81.9	78.6	76.1	73.3	70.2	67.3	63.9	60.0	56.0	51.6
	Medium High	2272	2243	2204	2169	2086	2018	1940	1842	1743	1602	64.3	63.5	62.4	61.4	59.1	57.1	54.9	52.2	49.4	45.4
	Medium Low	1765	1752	1737	1718	1674	1619	1561	1493	1437	1312	50.0	49.6	49.2	48.6	47.4	45.8	44.2	42.3	40.7	37.2
	Low	1425	1380	1409	1378	1307	1274	1226	1180	1113	1025	40.4	39.1	39.9	39.0	37.0	36.1	34.7	33.4	31.5	29.0
120C16	High	1752	1724	1702	1664	1600	1542	1454	1372	1264	1119	49.6	48.8	48.2	47.1	45.3	43.7	41.2	38.9	35.8	31.7
	Medium High	1469	1449	1453	1420	1382	1344	1269	1197	1118	1022	41.6	41.0	41.1	40.2	39.1	38.1	35.9	33.9	31.7	28.9
	Medium Low	1248	1235	1226	1207	1179	1133	1077	992	922	841	35.3	35.0	34.7	34.2	33.4	32.1	30.5	28.1	26.1	23.8
	Low	1076	1076	1046	1025	1002	968	927	869	784	707	30.5	30.5	29.6	29.0	28.4	27.4	26.2	24.6	22.2	20.0
120C20	High	2701	2620	2533	2429	2338	2227	2112	1993	1861	1706	76.5	74.2	71.7	68.8	66.2	63.1	59.8	56.4	52.7	48.3
	Medium High	2125	2083	2046	1994	1955	1901	1857	1737	1621	1497	60.2	59.0	57.9	56.5	55.4	53.8	52.6	49.2	45.9	42.4
	Medium Low	1664	1664	1647	1619	1580	1555	1468	1392	1332	1226	47.1	47.1	46.6	45.8	44.7	44.0	41.6	39.4	37.7	34.7
	Low	1358	1339	1330	1318	1286	1235	1185	1141	1060	938	38.5	37.9	37.7	37.3	36.4	35.0	33.6	32.3	30.0	26.6
130D20	High	2823	2714	2613	2507	2399	2282	2170	2042	1908	1761	79.9	76.9	74.0	71.0	67.9	64.6	61.4	57.8	54.0	49.9
	Medium High	2242	2188	2154	2102	2045	1970	1887	1792	1673	1537	63.5	62.0	61.0	59.5	57.9	55.8	53.4	50.7	47.4	43.5
	Medium Low	1805	1791	1738	1725	1675	1623	1567	1487	1394	1256	51.1	50.7	49.2	48.8	47.4	46.0	44.4	42.1	39.5	35.6
	Low	1425	1427	1403	1335	1324	1280	1236	1176	1103	996	40.4	40.4	39.7	37.8	37.5	36.2	35.0	33.3	31.2	28.2

NOTES:

- Airflow expressed in standard cubic feet per minute (CFM).
- Motor voltage at 115 V.

Table 14: Blower Performance CFM - Any Position (without filter) - Left Side Return

Models	Speed	Left Side Airflow Data (SCFM)										Left Side Airflow Data (m ³ min)									
		Ext. Static Pressure (in. H ₂ O)										Ext. Static Pressure (in. H ₂ O)									
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
040A08	High	994	971	942	899	829	725	419	120	NA	NA	28.1	27.5	26.7	25.5	23.5	20.5	11.9	3.4	NA	NA
	Medium High	824	804	777	739	675	489	350	361	NA	NA	23.3	22.8	22.0	20.9	19.1	13.8	9.9	10.2	NA	NA
	Medium Low	757	733	694	659	575	444	399	NA	NA	NA	21.4	20.8	19.7	18.7	16.3	12.6	11.3	NA	NA	NA
	Low	707	684	641	604	495	397	282	NA	NA	NA	20.0	19.4	18.2	17.1	14.0	11.2	8.0	NA	NA	NA
060A10	High	1371	1323	1251	1169	1086	971	843	521	NA	NA	38.8	37.5	35.4	33.1	30.8	27.5	23.9	14.8	NA	NA
	Medium High	1249	1207	1158	1098	1018	921	669	503	NA	NA	35.4	34.2	32.8	31.1	28.8	26.1	18.9	14.2	NA	NA
	Medium Low	1059	1026	997	949	889	793	582	420	NA	NA	30.0	29.1	28.2	26.9	25.2	22.5	16.5	11.9	NA	NA
	Low	854	836	809	775	717	576	464	216	NA	NA	24.2	23.7	22.9	21.9	20.3	16.3	13.1	6.1	NA	NA
060A12	High	1406	1401	1394	1379	1338	1304	1261	1202	1135	1040	39.8	39.7	39.5	39.0	37.9	36.9	35.7	34.0	32.1	29.4
	Medium High	1129	1126	1107	1094	1076	1047	1010	966	921	843	32.0	31.9	31.3	31.0	30.5	29.6	28.6	27.4	26.1	23.9
	Medium Low	970	947	933	916	890	863	827	789	741	668	27.5	26.8	26.4	25.9	25.2	24.4	23.4	22.3	21.0	18.9
	Low	834	809	797	768	740	710	677	634	586	534	23.6	22.9	22.6	21.7	21.0	20.1	19.2	18.0	16.6	15.1
080B12	High	1274	1285	1255	1239	1207	1158	1111	1049	979	830	36.1	36.4	35.5	35.1	34.2	32.8	31.5	29.7	27.7	23.5
	Medium High	975	974	968	960	948	923	879	823	756	672	27.6	27.6	27.4	27.2	26.8	26.1	24.9	23.3	21.4	19.0
	Medium Low	777	771	772	762	752	734	695	651	604	529	22.0	21.8	21.9	21.6	21.3	20.8	19.7	18.4	17.1	15.0
	Low	647	634	623	610	602	588	552	506	457	381	18.3	18.0	17.6	17.3	17.0	16.7	15.6	14.3	12.9	10.8
080C16	High	1825	1781	1746	1695	1641	1587	1521	1429	1330	1184	51.7	50.4	49.4	48.0	46.5	44.9	43.1	40.5	37.7	33.5
	Medium High	1516	1493	1482	1464	1442	1411	1343	1275	1192	1035	42.9	42.3	42.0	41.5	40.8	40.0	38.0	36.1	33.8	29.3
	Medium	1294	1297	1271	1238	1187	1120	1083	1028	979	851	36.6	36.7	36.0	35.1	33.6	31.7	30.7	29.1	27.7	24.1
	Low	1126	1115	1095	1049	1027	996	957	929	840	742	31.9	31.6	31.0	29.7	29.1	28.2	27.1	26.3	23.8	21.0
080C22	High	2972	2863	2769	2671	2571	2465	2352	2227	2095	1950	84.2	81.1	78.4	75.6	72.8	69.8	66.6	63.1	59.3	55.2
	Medium High	2173	2146	2103	2082	2036	1966	1904	1827	1738	1621	61.5	60.8	59.6	59.0	57.7	55.7	53.9	51.7	49.2	45.9
	Medium Low	1670	1667	1647	1618	1585	1549	1492	1408	1350	1238	47.3	47.2	46.6	45.8	44.9	43.9	42.2	39.9	38.2	35.1
	Low	1371	1339	1317	1284	1259	1199	1147	1085	1024	928	38.8	37.9	37.3	36.4	35.7	34.0	32.5	30.7	29.0	26.3
100B12	High	1258	1278	1283	1259	1240	1204	1149	1073	1015	897	35.6	36.2	36.3	35.7	35.1	34.1	32.5	30.4	28.7	25.4
	Medium High	986	995	1011	1003	962	935	913	861	808	738	27.9	28.2	28.6	28.4	27.2	26.5	25.9	24.4	22.9	20.9
	Medium Low	793	786	786	783	780	750	733	702	627	567	22.5	22.3	22.3	22.2	22.1	21.2	20.8	19.9	17.8	16.1
	Low	667	653	640	629	604	583	558	519	469	427	18.9	18.5	18.1	17.8	17.1	16.5	15.8	14.7	13.3	12.1
100C16	High	2009	1994	1933	1893	1836	1763	1691	1606	1508	1389	56.9	56.5	54.7	53.6	52.0	49.9	47.9	45.5	42.7	39.3
	Medium High	1523	1506	1521	1490	1466	1435	1393	1326	1241	1119	43.1	42.6	43.1	42.2	41.5	40.6	39.4	37.5	35.1	31.7
	Medium Low	1230	1249	1245	1230	1218	1195	1161	1120	1039	949	34.8	35.4	35.3	34.8	34.5	33.8	32.9	31.7	29.4	26.9
	Low	1126	1115	1095	1049	1027	996	957	929	840	742	31.9	31.6	31.0	29.7	29.1	28.2	27.1	26.3	23.8	21.0
100C20	High	2964	2886	2794	2707	2623	2522	2415	2281	2149	2012	83.9	81.7	79.1	76.7	74.3	71.4	68.4	64.6	60.9	57.0
	Medium High	2192	2178	2150	2109	2098	2007	1956	1888	1795	1671	62.1	61.7	60.9	59.7	59.4	56.8	55.4	53.5	50.8	47.3
	Medium Low	1699	1695	1706	1632	1612	1568	1519	1460	1392	1293	48.1	48.0	48.3	46.2	45.6	44.4	43.0	41.3	39.4	36.6
	Low	1361	1356	1337	1304	1267	1243	1191	1149	1077	994	38.5	38.4	37.9	36.9	35.9	35.2	33.7	32.5	30.5	28.1
120C16	High	1789	1774	1738	1702	1665	1608	1514	1431	1343	1205	50.7	50.2	49.2	48.2	47.1	45.5	42.9	40.5	38.0	34.1
	Medium High	1451	1445	1431	1413	1394	1362	1312	1235	1149	1037	41.1	40.9	40.5	40.0	39.5	38.6	37.2	35.0	32.5	29.4
	Medium	1202	1210	1266	1252	1226	1191	1082	1028	950	852	34.0	34.3	35.8	35.5	34.7	33.7	30.6	29.1	26.9	24.1
	Low	1063	1050	1033	1010	1007	982	941	889	845	778	30.1	29.7	29.3	28.6	28.5	27.8	26.6	25.2	23.9	22.0
120C20	High	2828	2768	2699	2612	2524	2423	2308	2219	2118	1982	80.1	78.4	76.4	74.0	71.5	68.6	65.4	62.8	60.0	56.1
	Medium High	2085	2073	2042	2029	1967	1896	1893	1816	1717	1635	59.0	58.7	57.8	57.5	55.7	53.7	53.6	51.4	48.6	46.3
	Medium Low	1620	1631	1636	1593	1567	1557	1520	1476	1407	1263	45.9	46.2	46.3	45.1	44.4	44.1	43.0	41.8	39.8	35.8
	Low	1322	1311	1302	1271	1241	1201	1162	1101	1042	979	37.4	37.1	36.9	36.0	35.1	34.0	32.9	31.2	29.5	27.7
130D20	High	2958	2862	2758	2662	2553	2447	2328	2203	2056	1893	83.8	81.0	78.1	75.4	72.3	69.3	65.9	62.4	58.2	53.6
	Medium High	2191	2182	2157	2092	2085	1997	1932	1844	1741	1608	62.0	61.8	61.1	59.2	59.0	56.5	54.7	52.2	49.3	45.5
	Medium Low	1737	1738	1713	1691	1675	1590	1531	1467	1389	1276	49.2	49.2	48.5	47.9	47.4	45.0	43.4	41.5	39.3	36.1
	Low	1404	1394	1380	1355	1327	1276	1220	1163	1095	1013	39.8	39.5	39.1	38.4	37.6	36.1	34.5	32.9	31.0	28.7

NOTES:

1. Airflow expressed in standard cubic feet per minute (CFM).
2. Return air is through side opposite motor (left side).
3. Motor voltage at 115 V.
4. Airflow through across motor side (right side) may be slightly less than the data shown above.

SECTION IX: SAFETY CONTROLS

CONTROL CIRCUIT FUSE

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

BLOWER DOOR SAFETY SWITCH

CAUTION

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

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

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

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

ROLLOUT SWITCH CONTROLS

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

PRESSURE SWITCHES

This furnace is supplied with a pressure switch, which monitors the flow through the combustion air/vent piping system. This switch de-energizes the gas valve if any of the following conditions are present. Refer to Figure 12 for tubing connections.

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

LIMIT CONTROLS

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

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

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

SEQUENCE OF OPERATION

These furnaces are equipped with an electric hot surface burner ignition system. In response to a call for heat by the room thermostat, the burners are lighted by a hot glowing ignitor at the beginning of each operation cycle. The burners will continue to operate until the thermostat is satisfied at which time all burner flame is extinguished. During the off cycle no gas is consumed. With the room thermostat set below room temperature, and with the electrical power and gas supply to the furnace on, the normal sequence of operation is as follows:

1. When the room temperature falls below the setting of the room thermostat, the thermostat energizes the furnace control board.

2. When the furnace control board is activated, the vent blower is turned on. A circuit is also made through the normally open pressure switch contacts.
3. As the vent blower increases in speed, the contacts of the pressure switch will close and complete the electrical circuit to the ignitor.
4. During the next 15 to 20 seconds, the vent blower will bring fresh air into the heat exchanger and the ignitor will begin to glow. At the end of this period, the gas valve will open and the burners will light.
5. After the burners light, a separate sensor acts as a flame probe to check for the presence of flame. As long as flame is present, the system will monitor it and hold the gas valve open.
6. If the burners fail to light within 6--8 seconds after the gas valve opens, the gas valve will close and the ignitor will be turned off. After a short pause, the system will recycle and try again for ignition. If the burners fail to light after three tries, the ignition system will lock out. The system will remain in lock-out mode until one hour has passed, or until the room thermostat is cycled off then back on. The furnace will then try for ignition again.
7. The lapsed time from the room thermostat closes to when the burners light may be 20--35 seconds. This delay is caused by the time required for the vent blower to come to full speed, the time required for the ignitor to heat up and the time required for fresh air to be brought into the heat exchanger.
8. About thirty seconds after the burners have lighted, the fan switch will close and the furnace air circulation blower will run.
9. When room thermostat is satisfied the circuit to the furnace control board is broken. The circuit to the gas valve is broken and the burners are extinguished. The vent blower will continue to run for a few seconds. Then the furnace control board will keep the circulating blower running for a period of time to allow additional heat to be drawn from the heat exchanger.

Hot Surface Ignition System

WARNING

HOT SURFACE IGNITION SYSTEM

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

TROUBLESHOOTING

The following visual checks should be made before troubleshooting:

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

WARNING

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

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

Never adjust pressure switch to allow furnace operation.

FURNACE CONTROL DIAGNOSTICS

The electronic furnace control supplied on this furnace is equipped with a diagnostic light which flashes when there is a service problem with the furnace. The number of times the light flashes indicates the location of the problem, as listed below:

One flash - Ignition failure -- Check for proper gas flow and gas pressure, gas valve operation and flame sensor operation. Check for proper location of ignitor.

Two flashes - Pressure switch stuck closed. Check for shorted wires, bad pressure switch.

Three flashes - Pressure switch failed to close -- Check vent blower, pressure switch, vent blockage, disconnected pressure hose.

Four flashes - Limit switch open -- Check for open limit switch, open rollout switch, loose connections in limit circuit.

Five flashes - False flame sense -- Check for stuck open gas valve.

Six flashes - Reversed polarity -- Check polarity.

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

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

REPLACEMENT PART CONTACT INFORMATION

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

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

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

SECTION XI: WIRING DIAGRAM

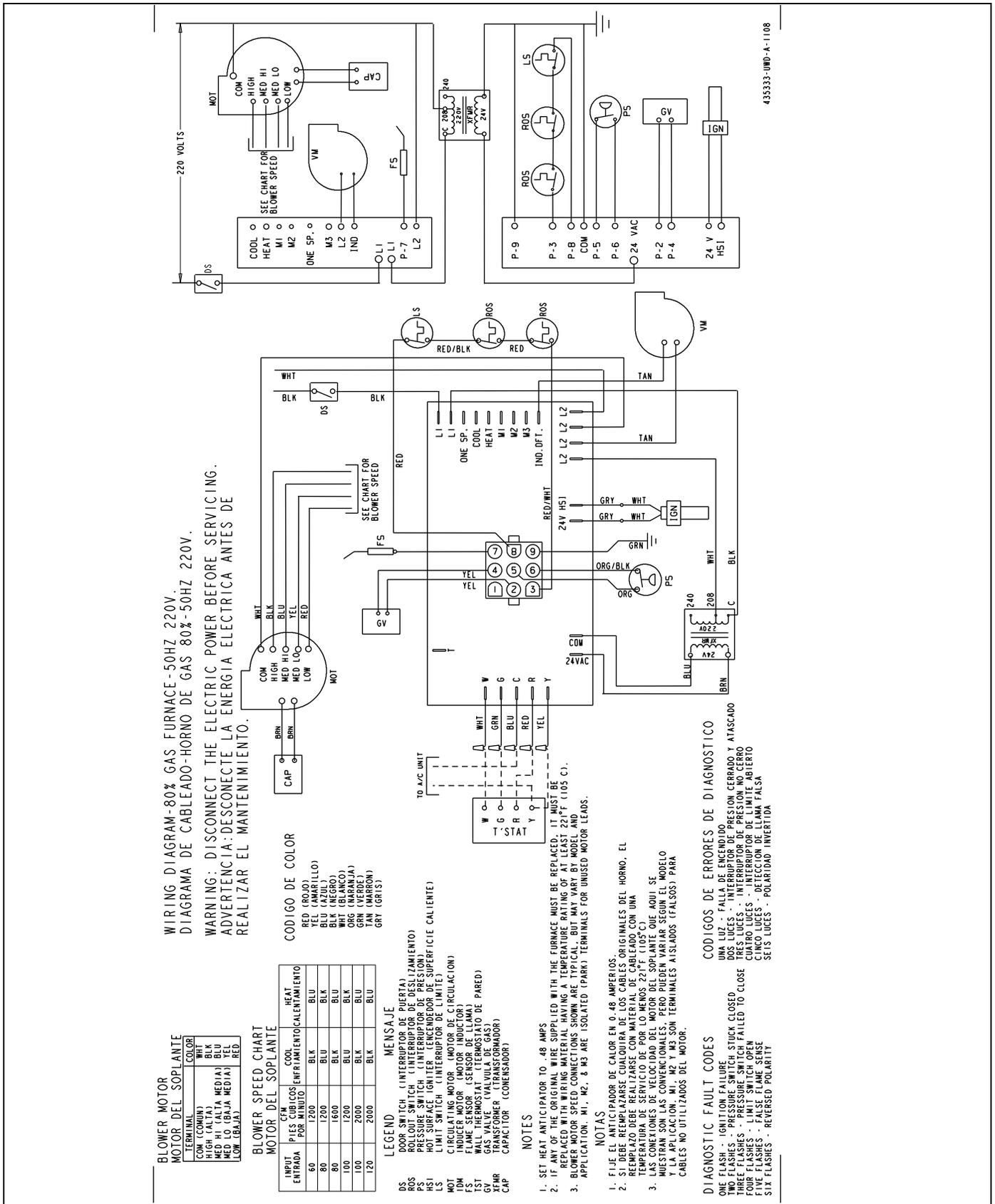


FIGURE 29: Wiring Diagram

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