Installation Instructions

80+ GAS FURNACE
Category I Furnace
*8MPT Two-*Stage Heating*
*8MPV *Variable Speed, Two-Stage Heating & Supports Two-Stage Cooling Units*

*** Denotes Brands (C, H, T)**

See Section 5 for Category I definition.

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes, the current editions of the National Fuel Gas Code (NFCG) NFPA 54/ANSI Z223.1, and the National Electrical Code (NEC) NFPA 70.

In Canada refer to the current editions of the National standards of Canada CAN/CSA-B149.1 and .2 Natural Gas and Propane Installation Codes, and Canadian Electrical Code CSA C22.1.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand these signal words; DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

CERTIFIED ®

EFFICIENCY RATING CERTIFIED Gama

DESIGN CERTIFIED ®

INSTALLER: Affix these instructions on or adjacent to the furnace.

CONSUMER: Retain these instructions for future reference.

International Comfort Products, LLC
Lewisburg, TN. 37091

Table of Contents

⚠ WARNING

ELECTRIC SHOCK HAZARD

Failure to follow this warning could result in personal injury and/or death.

Turn Off All Power Before Servicing.

⚠ WARNING

CARBON MONOXIDE POISONING AND FIRE HAZARD.

Failure to follow this warning could result in personal injury, death and/or property damage.

This furnace is not designed for use in mobile homes, trailers or recreational vehicles.

START-UP CHECK SHEET
For PSC Models *8MPT

(This sheet is optional. Keep for future reference.)

Date of Start-Up:_____

Dealer Name:_____

Address:_____

City, State(Province), Zip or Postal Code:_____

_____

Phone:_____

Owner Name:_____

Address:_____

City, State(Province), Zip or Postal Code:_____

_____

Model Number:_____

Serial Number:_____

Setup Checks

Check the box when task is complete.

All Electrical Connections Tight? ☐

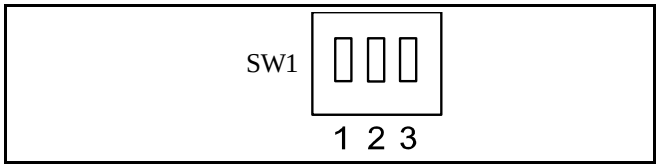
Manual Gas Shut-off Upstream of Furnace/Drip Leg ☐

Gas Valve turned ON? ☐

Type of Gas: Natural: ☐ LP: ☐

Filter Type and Size:_____

Shade in Heating Fan "Time **OFF**" Setting and Thermostat Type setting:



Calculated Input (BTU) Rate: (See *Checks and Adjustments* Section).

Heating Check

Measured Line Pressure During High Heat: _____

Measured Manifold Pressure: High Heat _____

Low Heat _____

Temperature of Supply Air: High Heat _____

Low Heat _____

Temperature of Return Air: _____

Temperature Rise (Supply - Return): High Heat _____

Low Heat _____

In Rise Range (see furnace rating plate)? ☐

Static Pressure (Ducts) High Heat: Supply _____

Return _____

The Blower Speed Tap used for: High Heat _____

Low Heat _____

Optional Check: CO? _____

CO2? _____

Cooling Check

Temperature of Supply Air: _____

Temperature of Return Air: _____

Temperature Difference: _____

Static Pressure (Ducts) Cooling: Supply _____

Return _____

The Blower Speed Tap used for: Cooling _____

Dealer Comments:_____

_____

_____

_____

_____

_____

_____

_____

START-UP CHECK SHEET
For Variable Speed Models *8MPV

(This sheet is optional. Keep for future reference.)

Date of Start-Up:_____

Dealer Name:_____

Address:_____

City, State(Province), Zip or Postal Code:_____

_____

Phone:_____

Owner Name:_____

Address:_____

City, State(Province), Zip or Postal Code:_____

_____

Model Number:_____

Serial Number:_____

Setup Checks

Check the box when task is complete.

All Electrical Connections Tight? ☐

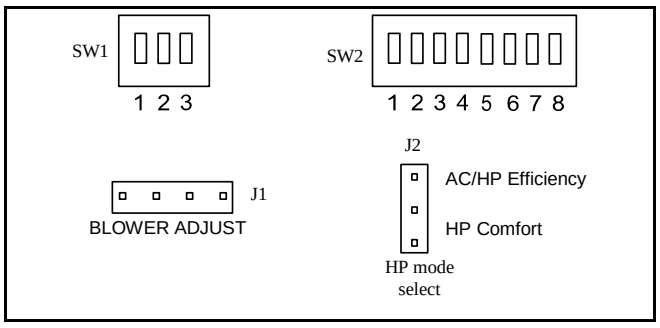
Manual Gas Shut-off Upstream of Furnace/Drip Leg ☐

Gas Valve turned ON? ☐

Type of Gas: Natural: ☐ LP: ☐

Filter Type and Size:_____

Shade in Final Furnace Settings Below:



Calculated Input (BTU) Rate: (See *Checks and Adjustments* Section).

Heating Check

Measured Line Pressure During High Heat: _____

Measured Manifold Pressure: High Heat_____

Low Heat _____

Temperature of Supply Air: High Heat _____

Low Heat _____

Temperature of Return Air: _____

Temperature Rise (Supply - Return): High Heat _____

Low Heat _____

In Rise Range (see furnace rating plate)? ☐

Static Pressure (Ducts) High Heat: Supply _____

Return _____

Optional Check: CO? _____

CO2? _____

Cooling Check

Temperature of Supply Air: _____

Temperature of Return Air: _____

Temperature Difference: _____

Static Pressure (Ducts) Cooling: Supply _____

Return _____

Dealer Comments:_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

1. Safe Installation Requirements

⚠ WARNING

FIRE, EXPLOSION, AND CARBON MONOXIDE POISONING HAZARD

Improper adjustment, alteration, service, maintenance or installation could result in personal injury, death and/or property damage.

Installation or repairs made by unqualified persons could result in hazards to you and others. Installation MUST conform with local codes or, in the absence of local codes, with codes of all governmental authorities having jurisdiction.

The information contained in this manual is intended for use by a qualified service agency that is experienced in such work, is familiar with all precautions and safety procedures required in such work, and is equipped with the proper tools and test instruments.

NOTE: This furnace is design–certified by the CSA International (formerly AGA and CGA) for installation in the United States and Canada. Refer to the appropriate codes, along with this manual, for proper installation.

- Use only the Type of gas approved for this furnace (see **Rating Plate** on unit). Overfiring will result in failure of heat exchanger and cause dangerous operation. (Furnaces can be converted to Propane gas with approved kit.)
- Install this furnace only in a location and position as specified in "*Installation"* of these instructions.
- Provide adequate combustion and ventilation air to the furnace as specified in "*Combustion and Ventilation Air"* of these instructions.
- Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in "*Combustion and Ventilation Air, Horizontal Venting and Chimney Adapter Venting"* of these instructions.
- 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, as specified in "*Gas Supply and Piping, Final Gas Piping Check"* of these instructions.
- Always install furnace to operate within the furnace's intended temperature–rise range with a duct system which has an external static pressure within the allowable range, as specified in "*Technical Support Manual"* of these instructions. See furnace rating plate.
- 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 a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.
- A gas–fired furnace for installation in a residential garage must be installed as specified in "*Installation"* of these instructions.
- This furnace is not to be used for temporary heating of buildings or structures under construction. See "*Installation"*, item 10.
- **This furnace is NOT approved for installation in mobile homes, trailers or recreation vehicles.**
- Seal around supply and return air ducts.
- Install correct filter type and size.
- Unit **MUST** be installed so electrical components are protected from direct contact with water.

Safety Rules

Your unit is built to provide many years of safe and dependable service providing it is properly installed and maintained. However, abuse and/or improper use can shorten the life of the unit and create hazards for you, the owner.

A. The U.S. Consumer Product Safety Commission encourages installation of carbon monoxide alarms. There can be various sources of carbon monoxide in a building or dwelling. The sources could be gas–fired clothes dryers, gas cooking stoves, water heaters, furnaces, gas–fired fireplaces, wood fireplaces.

Carbon monoxide can cause serious bodily injury and/or death. Carbon monoxide or "CO" is a colorless and odorless gas produced when fuel is not burned completely or when the flame does not receive sufficient oxygen.

Therefore, to help alert people of potentially dangerous carbon monoxide levels, you should have a commercially available carbon monoxide alarm that is listed by a nationally recognized testing agency in accordance with Underwriters Laboratories Inc. Standard for Single and Multiple Station Carbon Monoxide Alarms, ANSI/UL 2034 or the CSA 6.19–01 Residential Carbon Alarming Devices installed and maintained in the building or dwelling concurrently with the gas–fired furnace installation (see Note below). The alarm should be installed as recommended by the alarm manufacturer's installation instructions.

B. There can be numerous sources of fire or smoke in a building or dwelling. Fire or smoke can cause serious bodily injury, death, and/or property damage. Therefore, in order to alert people of potentially dangerous fire or smoke, you should have fire extinguisher and smoke alarms listed by Underwriters Laboratories installed and maintained in the building or dwelling (see Note below).

Note: The manufacturer of your furnace does not test any alarms and makes no representations regarding any brand or type of alarms.

C. To ensure safe and efficient operation of your unit, you should do the following:

1. **Thoroughly read this manual and labels on the unit.** This will help you understand how your unit operates and the hazards involved with gas and electricity.

2. **Do not use this unit if any part has been under water.** Immediately call a qualified service technician to inspect the unit and to replace any part of the control system and any gas control which has been under water.

3. **Never obstruct the vent grilles, or any ducts that provide air to the unit.** Air must be provided for proper combustion and ventilation of flue gases.

Frozen Water Pipe Hazard

⚠ CAUTION

WATER DAMAGE TO PROPERTY HAZARD

Failure to protect against the risk of freezing could result in property damage.

Do not leave your home unattended for long periods during freezing weather without turning off water supply and draining water pipes or otherwise protecting against the risk of frozen pipes and resultant damage.

Your furnace is designed solely to provide a safe and comfortable living environment. The furnace is NOT designed to ensure that water pipes will not freeze. It is equipped with several safety devices that are designed to turn the furnace off and prevent it from restarting in the event of various potentially unsafe conditions.

If your furnace remains off for an extended time, the pipes in your home could freeze and burst, resulting in serious water damage.

If the structure will be unattended during cold weather you should take these precautions.

1. Turn off the water supply to the structure and drain the water lines if possible and add an antifreeze for potable water to drain traps and toilet tanks. Open faucets in appropriate areas.

   –or–

2. Have someone check the structure frequently during cold weather to make sure it is warm enough to prevent pipes from freezing. Instruct them on a service agency to call to provide service, if required.

   –or–

3. Install a reliable remote sensing device that will notify somebody of freezing conditions within the home.

2. Installation

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to properly vent this furnace or other appliances could result in personal injury or death.

If this furnace is replacing a previously common-vented furnace, it may be necessary to resize the existing vent system to prevent oversizing problems for the other remaining appliances(s). See *Venting and Combustion Air Check* in the *Gas Vent Installation* section of this instruction.

Location and Clearances

If furnace is a replacement, it is usually best to install the furnace where the old one was. Choose the location or evaluate the existing location based upon the minimum clearance and furnace dimensions **(Figure 1)**.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury or death.

Do NOT operate furnace in a corrosive atmosphere containing chlorine, fluorine or any other damaging chemicals, which could shorten furnace life.

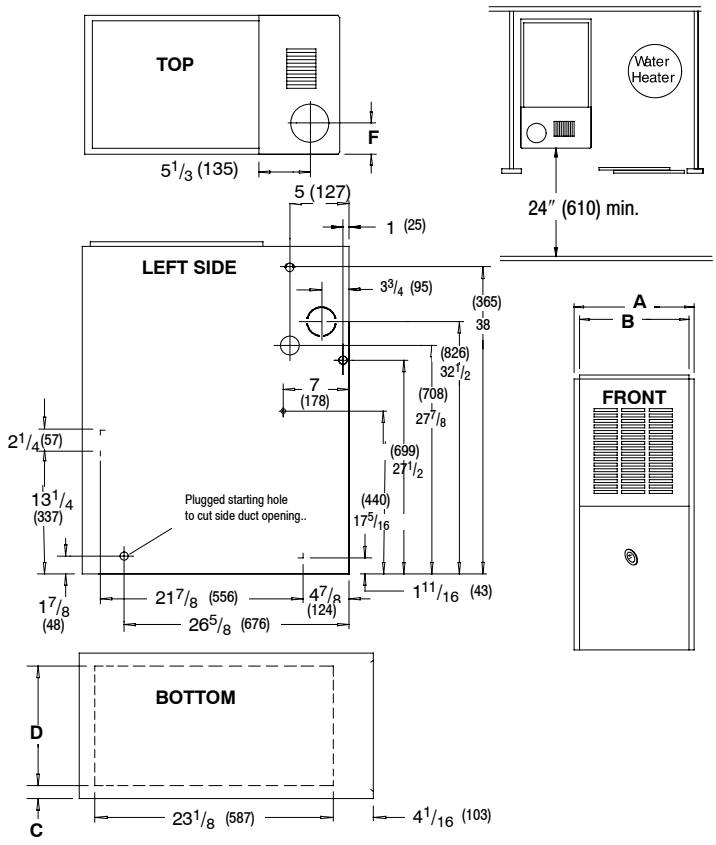
Refer to *Combustion & Ventilation Air* section, Contaminated Combustion Air for combustion air evaluation and remedy.

Installation Requirements

1. Install furnace level.
2. This furnace is **NOT** to be used for temporary heat of buildings or structures under construction.
3. Install furnace as centralized as practical with respect to the heat distribution system.
4. Install the vent pipes as short as practical. (See **Gas Vent Installation** section).
5. Do **NOT** install furnace directly on carpeting, tile or other combustible material other than wood flooring.
6. Maintain clearance for fire safety and servicing. A front clearance of 24″ (610 mm) is minimum for access to the burner, controls and filter. See clearance requirements in **Figure 1.**
7. Use a raised base if the floor is damp or wet at times.
8. Residential garage installations require:
   - Burners and ignition sources installed at least 18″ (457 mm) above the floor.
   - Furnace must be located or physically protected from possible damage by a vehicle.
9. If the furnace is to be suspended from the floor joists in a basement or a crawl space or the rafters in an attic, it is necessary to use steel pipe straps or an angle iron frame to rigidly attach the furnace to prevent movement. These straps should be attached to the furnace with sheet metal screws and to the rafters or joists with bolts. The preferred method is to use an angle iron frame bolted to the rafters or joists.
10. This furnace may be used for construction heat provided that:
    - The furnace is permanently installed with all electrical wiring, piping, venting and ducting installed according to these installation instructions. A return air duct is provided, sealed to the furnace casing, and terminated outside the space containing the furnace. This prevents a negative pressure condition as created by the circulating air blower, causing a flame rollout and/or drawing combustion products into the structure.
    - The furnace is controlled by a thermostat. It may not be “hot wired” to provide heat continuously to the structure without thermostatic control.
    - Clean outside air is provided for combustion. This is to minimize the corrosive effects of adhesives, sealers and other construction materials. It also prevents the entrainment of drywall dust into combustion air, which can cause fouling and plugging of furnace components.
    - The temperature of the return air to the furnace is maintained between 55° F (13° C) and 80° F (27° C) , with no evening setback or shutdown. The use of the furnace while the structure is under construction is deemed to be intermittent operation per our installation instructions.
    - The air temperature rise is within the rated rise range on the furnace rating plate, and the firing rate has been set to the rating plate value.

- The filters used to clean the circulating air during the construction process must be either changed or thoroughly cleaned prior to occupancy.
- The furnace, ductwork and filters are cleaned as necessary to remove drywall dust and construction debris from all HVAC system components after construction is completed.
- After construction is complete,verify proper furnace operating conditions including ignition, gas input rate, air temperature rise, and venting according to these installation instructions.

Figure 1 **Dimensions and Clearances (*8MPT/*8MPV) in(mm)**

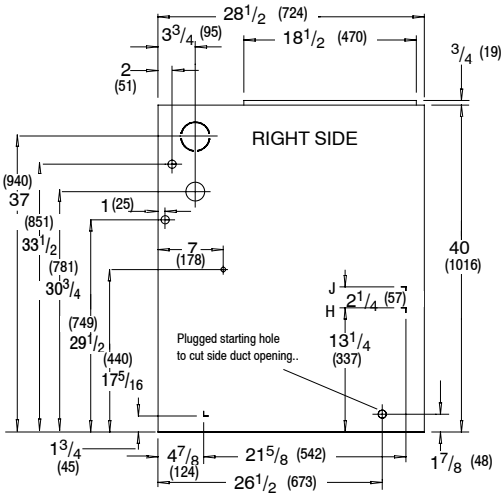


ALL DIMENSIONS - IN(MM)
1 in = 25.4 mm

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS FOR ALL UNITS	
REAR	0
FRONT (combustion air openings in furnace and in structure)	3″ (76 mm)
Required For Service	*24″ (610 mm)
ALL SIDES Of SUPPLY PLENUM	1″ (25 mm)
SIDES	0
VENT	
Single Wall Vent	6″ (152 mm)
Type B-1 Double Wall Vent	1″ (25 mm)
TOP OF FURNACE	1″ (25 mm)

*30″ (762 mm) clearance recommended for furnace removal.

Horizontal position: Line contact is permissible only between lines formed by intersections of top and two sides of furnace jacket, and building joists, studs or framing.



NOTE: Evaporator "A" coil drain pan dimensions may vary from furnace duct opening size. Always consult evaporator specifications for duct size requirements.

Furnace is designed for bottom return or side return.

Return air through back of furnace is NOT allowed.

DIMENSIONAL INFORMATION

Furnace Capacity	Cabinet		Top	Bottom		Return Air Opening
	A	B	F	C	D	
*8MPT/V050B	15 1/2 (76)	14 (356)	6 (152)	1 3/8 (1.4)	12 5/8 (321)	H
*8MPT/V075F14 *8MPT100F14	19 1/8 (486)	17 1/2 (445)	7 3/4 (197)	2 1/8 (54)	14 3/4 (15)	J
*8MPT/V100J20 *8MPT/V125J20	22 3/4 (578)	21 1/4 (540)	9 1/2 (241)	1 15/16 (49)	18 3/4 (476)	J

* Denotes Brand

Drawing is representative, but some models may vary

Installation Positions

This furnace can be installed in an upflow, horizontal (either left or right) or downflow airflow position. DO NOT install this furnace on its back. For the upflow position, the return air ductwork can be attached to either the left or right side panel and/or the bottom. For horizontal and downflow positions, the return air ductwork must be attached to the bottom. The return air ductwork must **never** be attached to the back of the furnace.

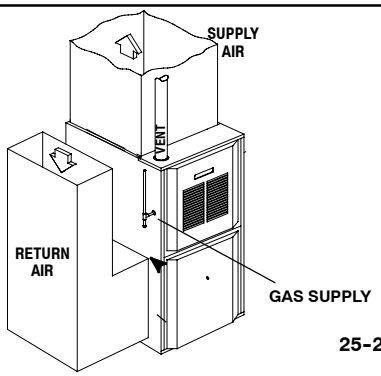
Furnace Installation

Inspect the rating plate to be certain the model number begins with "***8MPV"** or **"*8MPT"**. This identifies the unit as a multi-position furnace and can be installed in a Upflow, Horizontal Right, Horizontal Left or Downflow position.

Upflow

No modifications are required for upflow installation. (See **Figure 2**)

Figure 2 **Typical Upflow Installation**



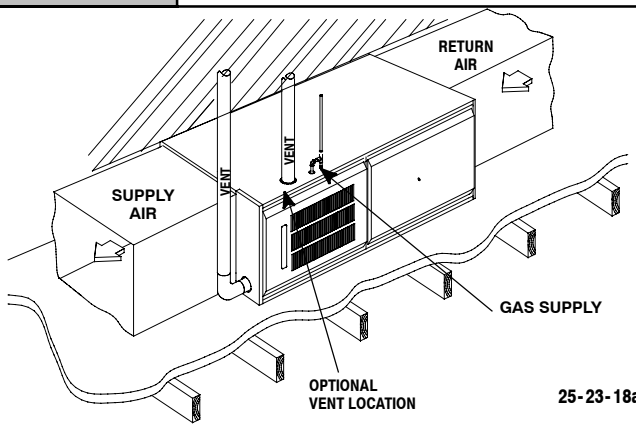
Horizontal

If you purchased a multi-position furnace, it can be installed horizontally in an attic, basement, crawl space, alcove, or suspended from a ceiling in a basement or utility room in either a right or left airflow position. (see **Figure 3**)

Horizontally installed furnaces may be vented out the top of the unit or out the side facing up. See "**Side Venting"** for instructions to rotate the vent to the side.

The minimum clearances to combustibles **MUST** be maintained between the furnace and adjacent construction, as shown in **Figure 1**. **ONLY** the corner of the cabinet is allowed to contact the rafters **Figure 3**. All other clearances **MUST** be observed as shown in **Figure 1.**

Figure 3 **Typical Horizontal Installation**



If the furnace is to be suspended from the floor joists in a crawl space or the rafters in an attic, it is necessary to use steel pipe straps or an angle iron frame to attach the furnace. These straps should be attached to the furnace bottom side with sheet metal screws and to the rafters or joists with bolts. The preferred method is to use an angle iron frame bolted to the rafters or joists.

If the furnace is to be installed ground level in a crawl space, consult local codes. A concrete pad 1″ to 2″ (25.4 to 50.8mm) thick is recommended.

24″ (610 mm) is recommended between the front of the furnace and adjacent construction or other appliances. This should be maintained for service clearance. 30″ (762mm) is required to remove furnace.

Keep all insulating materials clear from louvered door. Insulating materials may be combustible.

The horizontal furnaces may be installed directly on combustible wood flooring or supports, however, it is recommended for further fire protection cement board or sheet metal is placed between the furnace and the combustible wood floor and extend 12″ (305 mm) beyond the front of the furnace louver door. (This is a recommendation only, not a requirement).

This furnace **MUST NOT** be installed directly on carpeting, tile or other combustible material other than wood flooring or supports.

Downflow

⚠ WARNING

FIRE HAZARD

Failure to install furnace on noncombustible subbase could result in personal injury, death and/or property damage.

Place furnace on noncombustible subbase on downflow applications, unless installing on noncombustible flooring.

The Multi-position furnace (*8MPT or *8MPV) may be installed in a downflow configuration, (see **Figure 4**)**.** The minimum clearances to combustion **MUST** be maintained between the furnace and adjacent constructions, as shown in **Figure 1**.

In addition to clearances in **Figure 1**, clearance for the vent pipe must be considered.

A subbase for combustible floors **MUST** be used when the furnace is installed as a downflow on combustible material. See "*Ductwork and Filter"* (Downflow Section). The outlet flange must be bent flat for downflow installation.

When installing a four-position furnace in the downflow position, the logo is to be repositioned so that it is right side-up as follows:

T8MPT and T8MPV Model Numbers

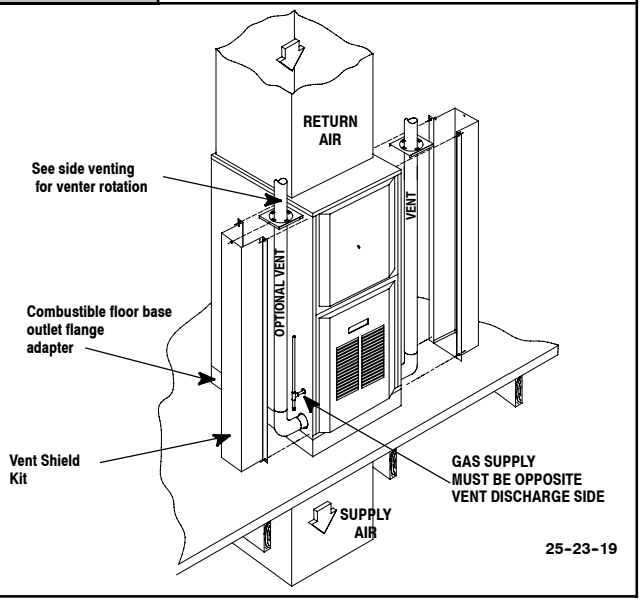
1. Find the door hardware kit that is stored in the furnace and save it.
2. Carefully remove logo from the outside of burner compartment door and save it.
3. Carefully remove two small plug buttons from outside of blower compartment door and save them.
4. Remove two thumbscrews from blower compartment door. Save the two thumbscrews.
5. Install two thumbscrews in holes at other end of blower compartment door from where thumbscrews were removed.
6. Install new strip of rubber gasket on inside of blower compartment door on edge that does not already have a gasket.
7. Install logo retainer pins into holes in blower compartment door from which plug buttons were removed.
8. Install plug buttons into holes in burner compartment door from which logo was removed.
9. Install blower compartment door on furnace with bevel edge and logo at top.
10. Install burner compartment door on furnace with bevel edge at bottom.

C8MPT, C8MPV, H8MPT, and H8MPV Model Numbers

1. Carefully remove logo from burner compartment door and save it.
2. Turn the logo rightside-up, and install the logo retainer pins into holes in burner compartment door

3. New labels for rightside–up application on outside of blower compartment door may be purchased in a kit from your distributor to cover upside–down labels.

Figure 4 **Typical Downflow Installation**



Downflow Venting: The combustion venter **MUST** be rotated to vent out the side for all downflow installations, (see **Figure 4**)**.** Bottom venting is not permitted. See "**Side venting"** for instructions to rotate the vent to the side. In addition to rotating the vent to the side, a **Vent Pipe Shield** (NAHA002VC) is required to shield the hot vent pipe.

⚠ WARNING

BURN HAZARD

Vent pipe is HOT and could result in personal injury.

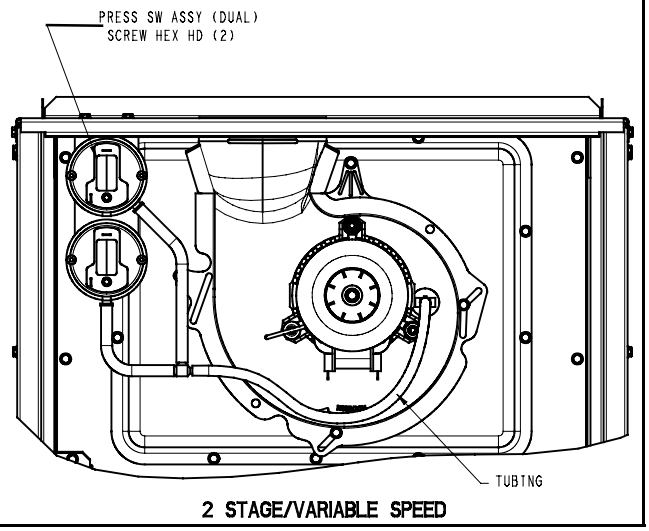
Hot vent pipe is in reach of small children when installed in downflow position.

Install vent pipe shield NAHA002VC.

Pressure Switch Relocation

If the furnace is installed in the upflow position, the pressure switch will remain in the same position as installed by the factory unless the inducer is rotated. If the furnace is installed in an orientation that places the pressure switch below the pressure tap on the inducer housing, then the switch **MUST** be relocated. In order to relocate the switch, locate 2 mounting holes or drill above the inducer pressure tap. When drilling the 2 holes make sure to keep the switch and tubing far enough away from the burners or hot surfaces as to not melt the hose, switch, or wires. To prevent possible kinking of the pressure switch hose, trim the hose to remove excess length (see **Figure 5**). If additional wire length is needed, cut the wire tie.

Figure 5 **Pressure Switch Tube Routing**



Note: When drilling new holes make sure metal shavings do not fall on or in components, as this can shorten the life of the furnace.

3. Side Venting

This furnace is shipped from the factory with the venter assembly in an upflow configuration (top vent). The venter assembly can easily be rotated to a side vent configuration for use in upflow, horizontal–flow, or downflow application.

When using a side vent configuration (side outlet instead of top outlet), it may be necessary to relocate the pressure switch to the alternate position on the opposite side of the top panel. Two screw holes are provided at the alternate position. Route the pressure switch tubing so the tubing is not kinked and not touching the hot collector box, venter housing, or motor. It may be necessary to shorten the length of the tubing to properly route the tubing and eliminate kinks.

Rotating the Venter Assembly

1. If gas and electrical power has already been connected to unit, shut off gas and remove power from unit. Unscrew screws on burner compartment door and remove burner compartment door. (See **Figure 6**.)
2. Disconnect power leads to the venter motor and hose to pressure switch. Remove four(4) screws which secure the venter to the collector box. (See **Figure 7.**)
3. Cut webbing with a pair of snips holding the vent plate to the cabinet on either the left or right side of unit depending on right or left venting as desired. Discard vent plate, (see **Figure 6**).

Figure 6 **Furnace with Screws**

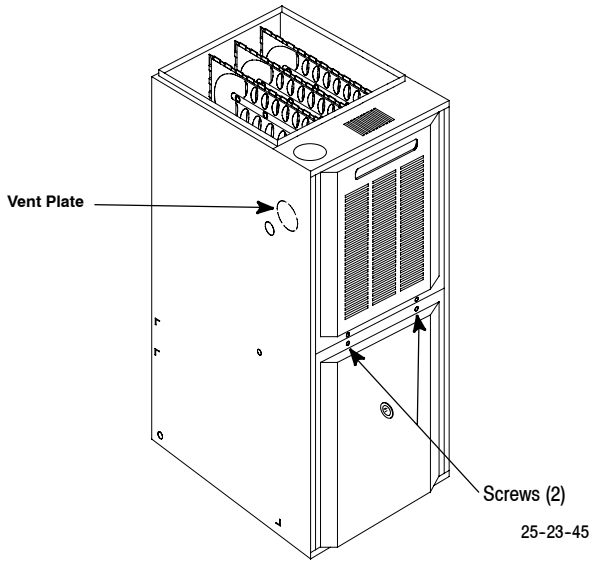
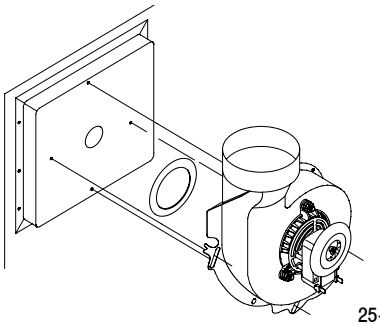


Figure 7 **Venter Gasket**



4. Replace venter gasket (part # 1013540, if needed) to venter assembly with adhesive in the same location as the old one.
5. Rotate venter assembly 90° right or left from original location depending on venting configurations.
6. Tighten the four(4) screws that secure the venter assembly to the collector box. Do not overtighten. Do tighten screws enough to compress venter gasket.
7. Replace power leads to venter motor and reconnect hose to pressure switch.

NOTE: Unused open vent hole must be covered. A Vent Cover is supplied with Vent Pipe Shield Kit NAHA002VC. A $5^{5}/_{16}$″ (135mm) diameter Vent Cover can be fabricated with sheet metal for all side vent installations.

4. Combustion & Ventilation Air

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to provide adequate combustion and ventilation air could result in personal injury or death.

Use methods described here to provide combustion and ventilation air.

Furnaces require ventilation openings to provide sufficient air for proper combustion and ventilation of flue gases. All duct or openings for supplying combustion and ventilation air must comply with the gas codes, or in the absence of local codes, the applicable national codes.

Combustion and ventilation air must be supplied in accordance with one of the following:

1. Section 9.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, National Fuel Gas Code (NFGC), NFPA 54/ANSI Z223.1–2006 in the U.S.,
2. Sections 8.2, 8.3, 8.5, 8.6, 8.7, and 8.8 of National Standard of Canada, Natural Gas and Propane Installation Code (NSCNGPIC), CSA B149.1–05 in Canada,
3. Applicable provisions of the local building code.

When the installation is complete, check that all appliances have adequate combustion air and are venting properly. See *Venting And Combustion Air Check* in "*Gas Vent Installation"* Section in this manual.

Contaminated Combustion Air

Installations in certain areas or types of structures could cause excessive exposure to contaminated air having chemicals or halogens that will result in safety and performance related problems and may harm the furnace. These instances must use only outdoor air for combustion.

The following areas or types of structures may contain or have exposure to the substances listed below. The installation must be evaluated carefully as it may be necessary to provide outdoor air for combustion.

- Commercial buildings.
- Buildings with indoor pools.
- Furnaces installed in laundry rooms.
- Furnaces installed in hobby or craft rooms.
- Furnaces installed near chemical storage areas.
- Permanent wave solutions for hair.
- 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.
- Sulfuric Acid.
- Solvent cements and glues.
- Antistatic fabric softeners for clothes dryers.
- Masonry acid washing materials.

Outdoor Combustion Air Method

A space having less than 50 cubic feet per 1,000 BTUH (4.8 cubic meters per kW) input rating for all gas appliances installed in the space requires outdoor air for combustion and ventilation.

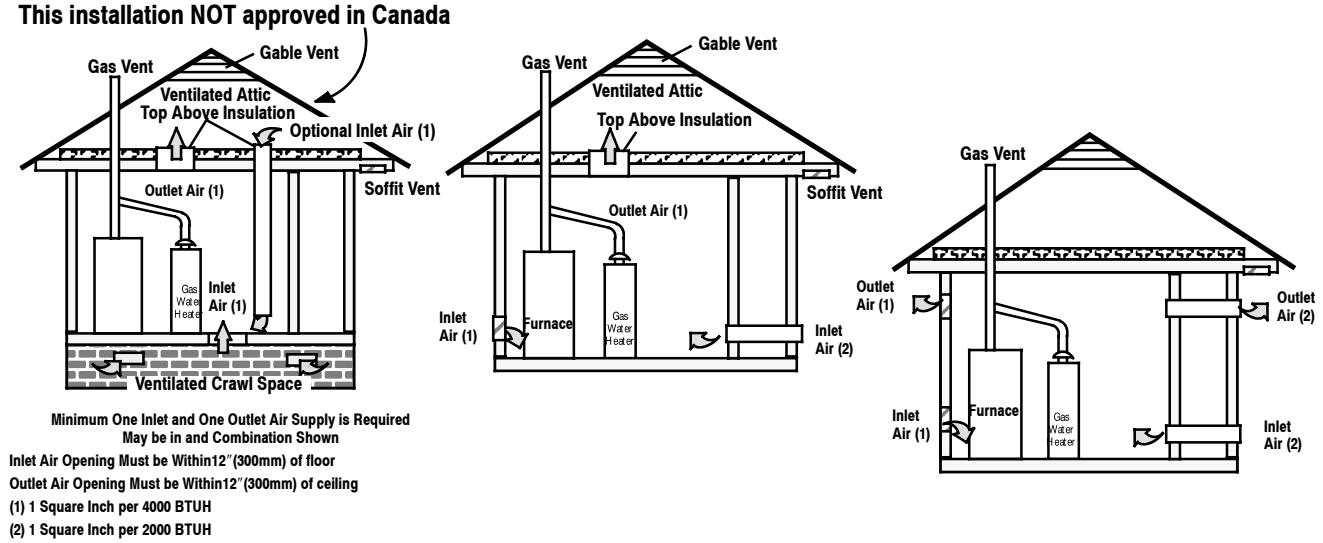
Air Openings and Connecting Ducts

1. Total maximum input ratings for all gas appliances in the space **MUST** be considered when determining free area of openings.
2. Connect ducts or openings directly to the outdoors.
3. When screens are used to cover openings, the openings **MUST** be no smaller than $^1/_4$″ (6.4 mm) mesh.
4. The minimum dimension of air ducts **MUST NOT** be less than 3″ (76 mm).
5. When sizing grille, louver or screen, use the free area of opening. If free area is **NOT** stamped or marked on grill or louver, assume a 20% free area for wood and 60% for metal. Screens shall have a mesh size not smaller than $^1/_4$″ (76mm).

Requirements

1. Provide confined space with sufficient air for proper combustion and ventilation of flue gases using horizontal or vertical ducts or openings.
2. **Figure 8** illustrates how to provide combustion and ventilation air when two permanent openings, one inlet and one outlet, are used.
   a. One opening **MUST** commence within 12″ (305 mm) of the floor and the second opening **MUST** commence within 12″ (305 mm) of the ceiling.
   b. Size openings and ducts per **Table 1**.

Figure 8 **Outdoor Air (This is ONLY a guide. Subject to codes of country having jurisdiction.)**



   c. Horizontal duct openings require 1 square inch of free area per 2,000 BTUH (11 cm^2/kW) of combined input for all gas appliances in the space **(**see **Table 1)**.
   d. Vertical duct openings or openings directly communicating with the outdoors require 1 square inch of free area per 4,000 BTUH (5.5 cm^2/kW) for combined input of all gas appliances in the space **(**see **Table 1).**
3. When one permanent outdoor opening is used, the opening requires:
   a. 1 sq. in of free area per 3,000 BTUH (7 cm^2/kW) for combined input of all gas appliances in the space (see **Table 1**) and
   b. not less than the sum of the areas of all vent connectors in the space.

The opening shall commence within 12″ (305 mm) of the top of the enclosure. Appliances shall have clearances of at least 1″ (25 mm) from the sides and back and 6″ (152.4mm) from the front. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

4. Combination of Indoor and Outdoor Air shall have:
   a. Indoor openings that comply with the **Indoor Combustion Air** Method below and
   b. Outdoor openings located as required in the **Outdoor Combustion Air** Method above and
   c. Outdoor openings sized as follows.
      1) Calculate the **Ratio** of all Indoor Space volume divided by required volume for **Indoor Combustion Air** Method.
      2) Outdoor opening size reduction **Factor** is **1** minus the **Ratio** in 1) above.
      3) Minimum size of Outdoor openings shall be the size required in **Outdoor Combustion Air** Method above multiplied by reduction **Factor**.

Table 1	Free Area			
BTUH (kW) Input Rating	Minimum Free Area Required for Each Opening or Duct to Outdoors			
	Two Horizontal Ducts BTUH (kW) sq. in./2,000(1 cm^2/.09)	Single Opening BTUH (kW) sq. in./3,000 (1 cm^2/.135)	Two Vertical Ducts or Openings BTUH (kW) sq. in./4,000(1 cm^2/.18)	Round Duct BTUH (kW) sq. in./4,000(6.5cm^2/.18)
50,000 (14.65)	25 sq. in. (161 cm^2)	16.7 sq. in. (108 cm^2)	12.5 sq. in. (81 cm^2)	4″ (101.6mm)
75,000 (21.98)	37.5 sq. in. (242 cm^2)	25 sq. in. (161 cm^2)	18.75 sq. in. (121 cm^2)	5″ (127mm)
100,000 (29.31)	50 sq. in. (322 cm^2)	33.3 sq. in. (215 cm^2)	25 sq. in. (161 cm^2)	6″ (152.4mm)
125,000 (36.63)	62.50 sq. in. (403 cm^2)	41.7 sq. in. (269 cm^2)	31.25 sq. in. (202 cm^2)	7″ (177.8mm)
150,000	75 sq. in.	50 sq. in.	37.5 sq. in.	7″ (177.8mm)

EXAMPLE: Determining Free Area

Furnace		Water Heater		Total Input		
100,000	+	30,000	=	(130,000 ÷ 4,000)	=	32.5 Sq. In. Vertical
29.31		8.8		(38.11 ÷ .18)	=	210 cm^2 Vertical
Furnace		Water Heater		Total Input		
100,000	+	30,000	=	(130,000 ÷ 2,000)	=	65 Sq. In. Horizontal
29.31		8.8		(38.11 ÷ .09)	=	423 cm^2 Horizontal

Indoor Combustion Air

Standard and Known-Air-Infiltration Rate Methods

Indoor air is permitted for combustion and ventilation, if the **Standard** or **Known-Air-Infiltration Rate** Method is used.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to supply adequate combustion air could result in personal injury or death.

Most homes will require additional air from outdoors for combustion and ventilation. A space with at least 50 cubic feet per 1,000 BTUH (4.8 cubic meters per kW) input rating or homes with tight construction may need outdoor air, supplied through ducts, to supplement air infiltration for proper combustion and ventilation of flue gases.

The **Standard** Method may be used, if the space has no less volume than 50 cubic feet per 1,000 BTUH (4.8 cubic meters per kW) of the maximum input ratings for all gas appliances installed in the space. The **standard** method permits indoor air to be used for combustion and ventilation air.

The **Known Air Infiltration Rate** Method shall be used if the infiltration rate is known to be less than 0.40 air changes per hour (ACH) and equal to or greater than 0.10 ACH. Infiltration rates greater than 0.60 ACH shall not be used. The minimum required volume of the space varies with the number of ACH and shall be determined per **Table 2** or **Equations 1 and 2**. Determine the minimum required volume for each appliance in the space, and add the volumes together to get the total minimum required volume for the space.

Table 2	MINIMUM SPACE VOLUME FOR 100% COMBUSTION AND VENTILATION AIR FROM INDOORS							
	Other Than Fan-Assisted Total			Fan-assisted Total				
ACH	30,000 BTU (8,790 kW)	40,000 BTU (11,720 kW)	50,000 BTU (14,650 kW)	50,000 BTU (14,650 kW)	75,000 (21,975 kW)	100,000 BTU (29,300 kW)	125,000 BTU (36,625 kW)	150,000 BTU (43,950 kW)
	ft^3 (m^3)							
0.60	1,050 (29.7)	1,400 (39.2)	1,750 (49)	1,250 (35)	1,875 (52.5)	2,500 (70)	3,125 (87.5)	3,750 (105)
0.50	1,260 (35.3)	1,680 (47.04)	2,100 (58.8)	1,500 (42)	2,250 (63)	3,000 (84)	3,750 (105)	4,500 (126)
0.40	1,575 (44.1)	2,100 (58.8)	2,625 (73.5)	1,875 (52.5)	2,813 (78.8)	3,750 (105)	4,688 (131.3)	5,625 (158)
0.30	2,100 (58.8)	2,800 (78.4)	3,500 (98)	2,500 (70)	3,750 (105)	5,000 (140)	6,250 (175)	7,500 (210.6)
0.20	3,150 (88.2)	4,200 (117.6)	5,250 (147)	3,750 (105)	5,625 (157.5)	7,500 (210)	9,375 (262.5)	11,250 (316)
0.10	6,300 (176.4)	8,400 (235.2)	10,500 (294)	7,500 (210)	11,250 (315)	15,000 (420)	18,750 (525)	22,500 (632)
0.00	NP	NP	NP	NP	NP	NP	NP	NP

NP = Not Permitted

Table 2 Minimum Space Volumes were determined by using the following equations from the National Fuel Gas Code NFPA 54/ANSI Z223.1-2006, 9.3.2.2:

1. For **other than fan-assisted appliances** such as a draft hood-equipped water heater,

$$\text{Required Volume}_{\text{other}} \geq \frac{21\ ft^3}{ACH} \left(\frac{I_{\text{other}}}{1000\ BTUH} \right)$$

$$\text{Required Volume}_{\text{other}} \geq \frac{59\ m^3}{ACH} \left(\frac{I_{\text{other}}}{.293\ kW} \right)$$

2. For **fan-assisted appliances** (such as this furnace), calculate using the following equation:

$$\text{Required Volume}_{\text{fan}} \geq \frac{15\ \text{ft}^3}{\text{ACH}} \left(\frac{I_{\text{fan}}}{1000\ \text{BTUH}} \right)$$

$$\text{Required Volume}_{\text{fan}} \geq \frac{.42\ \text{m}^3}{\text{ACH}} \left(\frac{I_{\text{fan}}}{.293\ \text{kW}} \right)$$

2. For **fan-assisted appliances** such as this furnace,

If:

I_{other} = combined input of all **other than fan-assisted appliances** in BTUH

I_{fan} = combined input of all **fan-assisted appliances** in BTUH

ACH = air changes per hour (ACH shall not exceed 0.60)

The following requirements apply to the **Standard** Method and to the **Known Air Infiltration** Rate Method.

- Adjoining rooms can be considered part of a space, if there are no closable doors between rooms.
- An attic or crawl space may be considered a space that freely communicates with the outdoors provided there are adequate ventilation openings directly to outdoors. Openings **MUST** remain open and **NOT** have any means of being closed off. Ventilation openings to outdoors **MUST** be at least 1 square inch of free area per 4,000 BTUH of total input rating for all gas appliances in the space.
- In spaces that use the **Indoor Combustion Air** Method, infiltration should be adequate to provide air for combustion, ventilation and dilution of flue gases. **However, in buildings with unusually tight construction, additional air MUST be provided using the methods described in section titled *Outdoor Combustion Air Method***:
- Unusually tight construction is defined as Construction with
  1. Walls and ceilings exposed to the outdoors have a continuous, sealed vapor barrier. Openings are gasketed or sealed and
  2. Doors and openable windows are weather stripped and
  3. Other openings are caulked or sealed. These include joints around window and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, etc.

Ventilation Air

Some provincial codes and local municipalities require ventilation or make-up air be brought into the conditioned space as replacement air. Whichever method is used, the mixed return air temperature across the heat exchanger **MUST** not fall below 60° continuously, or 55° on an intermittent basis so that flue gases will not condense excessively in the heat exchanger. Excessive condensation will shorten the life of the heat exchanger and possibly void your warranty.

5. Gas Vent Installation

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to properly vent this furnace could result in personal injury or death.

Use methods described here to provide combustion and ventilation air.

Install the vent in compliance with codes of the country having jurisdiction, local codes or ordinances and these instructions.

This Category I furnace is fan-assisted.

Category I furnace definition: A central furnace which operates with a non-positive vent static pressure and with a flue loss not less than 17 percent. These furnaces are approved for common-venting and multi-story venting with other fan-assisted or draft hood-equipped appliances in accordance with the NFGC or NSCNGPIC.

Category I Safe Venting Requirements

Category I furnace vent installations shall be in accordance with Parts 10 and 13 of the National Fuel Gas Code (NFGC), NFPA 54/ANSI Z223.1-2006; and/or Section 8 and Appendix C of the CSA B149.1-05, National Standard of Canada, Natural Gas and Propane Installation Code; the local building codes; furnace and vent manufacturer's instructions.

NOTE: The following instructions comply with the NFPA 54/ANSI Z223.1-2006 National Fuel Gas Code and CSA B149.1 Natural Gas and Propane Installation code, based on the High-Heat input rate on the furnace rating plate.

1. If a Category I vent passes through an attic, any concealed space or floor, use **ONLY** Type B or Type L double wall vent pipe. If vent pipe passes through interior wall, use type B vent pipe with ventilated thimble **ONLY**.
2. Do **NOT** vent furnace into any chimney serving an open fireplace or solid fuel burning appliance.
3. Use the same diameter Category I connector or pipe as permitted by:
   - by the **National Fuel Gas Code** Code (NFGC) NFPA 54/ANSI Z223.1-2006 Sections 12 and 13 venting requirements in the United States

     or
   - the National Standard of Canada **Natural Gas and Propane Installation Code** (NSCNGPIC) CSA B149.1-05 Section 8 and appendix C venting requirements in Canada.
4. Push the vent connector onto the furnace flue collar of the venter assembly until it touches the bead (at least $^5/_8$″ overlap) and fasten with at least two field-supplied, corrosion-resistant, sheet metal screws located at least 140° apart.
5. Keep vertical Category I vent pipe or vent connector runs as short and direct as possible.
6. Vertical outdoor runs of Type-B or **ANY** single wall vent pipe below the roof line are **NOT** permitted.
7. Slope all horizontal runs upwards from furnace to the vent terminal a minimum of $^1/_4$″ per foot (21 mm/m).
8. Rigidly support all horizontal portions of the venting system every 6′ (1.8m)or less using proper clamps and metal straps to prevent sagging and ensure there is no movement after installation.
9. Check existing gas vent or chimney to ensure they meet clearances and local codes. See **Figure 1**
10. The furnace **MUST** be connected to a factory built chimney or vent complying with a recognized standard, or a masonry or concrete chimney lined with a lining material acceptable to the authority having jurisdiction. **Venting into an unlined masonry chimney or concrete chimney is prohibited. See the *Masonry Chimney Venting* section in these instructions.**
11. Fan-assisted combustion system Category I furnaces shall not be vented into single-wall metal vents.
12. Category I furnaces must be vented vertically or nearly vertically, unless equipped with a listed mechanical venter.
13. Vent connectors serving Category I furnaces shall not be connected into any portion of mechanical draft systems operating under positive pressure.

Venting and Combustion Air Check

NOTE: When an existing Category I furnace is removed or replaced, the original venting system may no longer be sized to properly vent the attached appliances, and to make sure there is adequate combustion air for all appliances, **MAKE THE FOLLOWING CHECK**.

⚠ WARNING

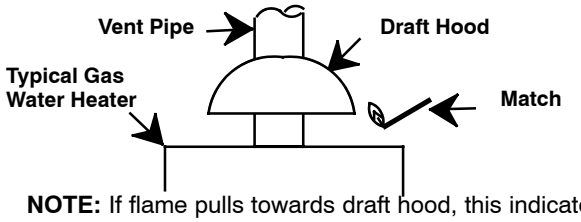
CARBON MONOXIDE POISONING HAZARD

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. Seal any unused openings in the venting system.
2. Inspect the venting system for proper size and horizontal pitch, as required in the *National Fuel Gas Code, NFPA 54/ANSI Z223.1-2006* or *CSA B149.1, Natural Gas and Propane Installation Code* and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. As far as practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building.
4. Close fireplace dampers.
5. Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they are operating at maximum speed. Do not operate a summer exhaust fan.
6. Follow the lighting instructions. Place the appliance being inspected into operation. Adjust the thermostat so appliance is operating continuously.
7. Test for spillage from draft hood equipped appliances at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle. (**Figure 9**)
8. If improper venting is observed, during any of the above tests, the venting system must be corrected in accordance with the *National Fuel Gas Code, NFPA 54/ANSI Z223.1-2006* and/or *CSA B149.1, Natural Gas and Propane Installation Code*.
9. After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-fired burning appliance to their previous conditions of use.

Figure 9 **Vent Check**



NOTE: If flame pulls towards draft hood, this indicates sufficient infiltration air.

Venting to Existing Masonry Chimney

NOTE: The tables and notes referred to below are found in the most recent printing of the **NFGC** venting tables.

Use the NFGC or NSCNGPIC Tables to size the chimney or vent. **Dedicated venting of one fan assisted furnace into any masonry chimney is restricted**. A chimney must first be lined with either Type-B vent sized in accordance with NFPA 54/ANSI Z223.1-2006 tables 13.1 or13.2 or a listed, metal lining system, sized in accordance with the NFPA 54/ANSI Z223.1-2006 section 13.1.7 for a single appliance or 13.2.19 for multiple appliances or CSA B149.1-05 Annex C; or venting into a masonry chimney is permitted as outlined with use of an optional listed masonry chimney kit. (See Section 7. *Masonry Chimney Venting* of these instructions)

Listed, corrugated metallic chimney liner systems in masonry chimneys shall be sized by using NFPA 54/ANSI Z223.1-2006 **or** CSA B149.1-05 tables for dedicated and common venting with the maximum capacity reduced by 20% (0.80 X maximum capacity) and the minimum capacity as shown in the applicable table. Corrugated metal vent systems installed with bends or offsets require additional reduction of 5% of the vent capacity for each bend up to 45° and 10% of the vent capacity for each bend from 45° up to 90°.

NOTE: Two(2) 45° elbows are equivalent to one (1) 90° elbow.

Combined Venting into a Masonry Chimney

Venting into a masonry or concrete chimney is only permitted as outlined in the NFGC or NSCNGPIC venting tables. Follow all safe venting requirements.

NOTE: See Masonry Chimney Venting section.

6. Horizontal Venting

Category I Furnaces With External Power Venters

In order to maintain a Category I classification of fan-assisted furnaces when vented horizontally with sidewall termination, a power venter is **REQUIRED** to maintain a negative pressure in the venting system.

In the U.S.: Per the NFPA 54/ANSI Z223.1-2006, a listed power venter may be used, when approved by the authority having jurisdiction.

In Canada: Only power venters approved by the power ventor manufacturer and where allowed by the authority having jurisdiction may be used

Please consult the Fields Controls Co. or Tjernlund Products, Inc. for power venters certified for use with this furnace.

Vent Termination

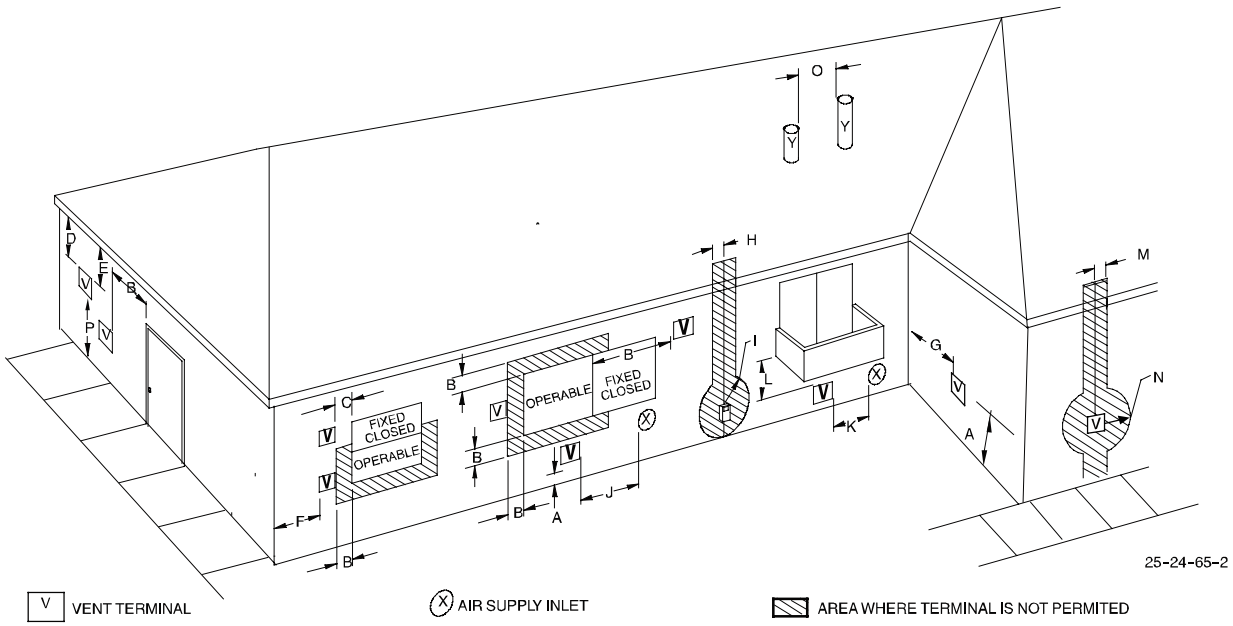
Venting Through a Non-Combustible and Combustible Wall

Consult External Power Venter manufacturer instructions. Select the power venter to match the Btuh input of the furnace being vented. Follow all of the manufacturer's installation requirements included with the power venter for:

- venting installation,
- vent terminal location,
- preventing blockage by snow,
- protecting building materials from degradation by flue gases,
- see **Figure 10** for required vent termination.

NOTE: It is the responsibility of the installer to properly terminate the vent and provide adequate shielding. This is essential in order to avoid water/ice damage to building, shrubs and walkways.

Figure 10 Other than Direct Vent Termination Clearance



Item	Clearance Descriptions	Canadian Installation (1)	U.S. Installation (2)
A	Clearance above grade, veranda, porch, deck, balcony, or anticipated snow level	12 inches (30cm) #	12 inches (30 cm)
B	Clearance to a window or door that may be opened	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW) 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW0) and ≤ 100,000 Btuh (30 kW), 36 inches (91 cm) for appliances > 100,000 Btuh (30 kW)	4 feet(1.2 m) below or to the side of the opening. 1 foot(30 cm) above the opening.
C	Clearance to a permanently closed window	*	*
D	Vertical clearance to a ventilated soffit located above the terminal within a horizontal distance of 2´(61cm) from the centerline of the terminal	*	*
E	Clearance to an unventilated soffit	*	*
F	Clearance to an outside corner	*	*
G	Clearance to an inside corner	*	*
H	Clearance to each side of the centerline extended above electrical meter or gas service regulator assembly	3 feet (91 cm) within 15 feet(4.5 m) above the meter/regulator assembly	3 feet (91 cm) within 15 feet (4.5 m) above the meter/regulator assembly
I	Clearance to service regulator vent outlet	3 feet (91 cm)	*
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW) 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW0) and ≤ 100.000 Btuh (30 kW) 36 inches (91 cm) for appliances > 100,000 Btuh (30 kW)	4 feet(1.2 m) below or to the side of opening: 1 foot (30 cm) above opening.
K	Clearance to a mechanical air supply inlet	6 feet(1.83 m)	3 feet(91 cm) above if within 10 feet (3 m horizontally)
L	Clearance under a veranda, porch, deck, or balcony	12 inches(30 cm) +	*
M	Clearance to each side of the centerline extended above or below vent terminal of the furnace to a dryer or water heater vent, or other appliance's direct vent intake or exhaust.	*	*
N	Clearance to the vent terminal of a dryer vent, water heater vent, or other appliances direct vent intake or exhaust.	*	*
O	Clearance from a plumbing vent stack	*	*
P	Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.13m)**	7 feet (2.13m)

(1.) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

(2.) In accordance with the current **NFPA 54/ANSI Z223.1** , National Fuel Gas Code

18˝ (46 cm) above roof surface

\+ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

* For clearances not specified in **NFPA 54/ANSI Z223.1** or CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier and the Manufacturer's installation instructions.

** A vent shall not terminate above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

Notes:

1. The vent for this appliance shall not terminate
   a. Over public walkways; or
   b. Near soffit vents or crawl space vents or other areas where condensate or vapor could create a nusiance or hazard or property damage; or
   c. Where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.
2. When locating vent terminations, consideration must be given to prevailing winds, location, and other conditions which may cause recirculation of the combustiob products of adjacent vents. Recirculation can cause poor combustion, inlet condensate problems, and accelerated corrosion of the heat exchangers.
3. Avoid venting under a deck or large overhang. Recirculation could occur and cause performance or system problems.

A05013

7. Masonry Chimney Venting

Chimney Inspection

All masonry chimney construction must conform to Standard NFPA 211-2006 and to any state or local codes applicable. The chimney must be in good condition and a complete chimney inspection must be conducted prior to furnace installation. If the inspection reveals damage or abnormal conditions, make necessary repairs or seek expert help. See "The Chimney Inspection Chart" **Figure 11**. Measure inside area of tile-liner and exact height of chimney from the top of the chimney to the highest appliance flue collar or drafthood outlet.

Connector Type

To reduce flue gas heat loss and the chance of condensate problems, the vent connector must be double-wall Type B vent except as specified in the listed kit.

Venting Restrictions for Chimney Types

Interior Chimney - has no sides exposed to the outdoors below the roofline. All installations can be single furnace or common vented with another draft hood equipped Category I appliance.

Exterior Chimney - has one or more sides exposed to the outdoors below the roof line. All installations with a 99% Winter Design Temperature* below 17°F (-8°C) must be common vented only with a draft hood equipped Category I appliance.

* The 99% Winter Design Dry-Bulb (db) temperatures are found in the 2005 ASHRAE Fundamentals Handbook CD and Chapter 28.

⚠ WARNING

CARBON MONOXIDE POISONING, FIRE AND EXPLOSION HAZARD

Failure to properly vent this furnace could result in personal injury, death and/or property damage.

These furnaces are CSA (formerly AGA and CGA) design-certified for venting into exterior clay tile-lined masonry chimneys with a factory accessory Chimney Adapter Kit. Refer to the furnace rating plate for correct kit usage. The Chimney Adapter Kits are for use with ONLY furnaces having a Chimney Adapter Kit number marked on the furnace rating plate.

If a clay tile-lined masonry chimney is being used and it is exposed to the outdoors below the roof line, relining might be required. Chimneys shall conform to the Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances NFPA 211-2006 in the United States and to a Provincial or Territorial Building Code in Canada (in its absence, the National Building Code of Canada) and must be in good condition.

U.S.A.-Refer to Sections 13.1.8 and 13.2.20 of the NFPA 54/ANSI Z223.1-2006 or the authority having jurisdiction to determine whether relining is required. If relining is required, use a properly sized listed metal liner, Type-B vent, or a listed alternative venting design.

NOTE: See the NFPA 54/ANSI Z223.1-2006, 13.1.8 and 13.2.20 regarding alternative venting design and the exception, which cover installations such as the Chimney Adapter Kits NAHA001DH and NAHA002DH, which are listed for use with these furnaces.

The Chimney Adapter Kit are listed alternative venting design for these furnaces. See the kit instructions for complete details.

Canada (and U.S.A.)-This furnace is permitted to be vented into a clay tile-lined masonry chimney that is exposed to the outdoors below the roof line, provided:

1. Vent connector is Type-B double-wall, and
2. This furnace is common vented with at least 1 draft hood-equipped appliance, and
3. The combined appliance input rating is less than the maximum capacity given in Table A, and
4. The input rating of each space-heating appliance is greater than the minimum input rating given in Table B for Masonry Chimneys for the local 99% Winter Design Temperature. Chimneys having internal areas greater than 38 square inches require furnace input ratings greater than the input ratings of these furnaces. See footnote at bottom of Table B, and
5. The authority having jurisdiction approves.

If all of these conditions cannot be met, an alternative venting design shall be used, such as the listed chimney adapter kit with a furnace listed for use with the kit, a listed chimney-lining system, or a Type-B vent.

Exterior Masonry Chimney, FAN+NAT Installations with Type-B Double-Wall Vent Connectors

Table A- Combined Appliance Maximum Input Rating in Thousands of Btu per Hr

VENT HEIGHT FT(m)	INTERNAL AREA OF CHIMNEY SQ IN.(cm)			
	12(77.4)	19(122.6)	28(180.6)	38(245.2)
6(1.8)	74	119	178	257
8(2.4)	80	130	193	279
10(3)	84	138	207	299
15(4.6)	NR	152	233	334
20(6.1)	NR	NR	250	368
30(9.1)	NR	NR	NR	404

Table B- Minimum Allowable Input Rating of Space- Heating Appliance in Thousands of Btu per Hr

VENT HEIGHT FT(m)		INTERNAL AREA OF CHIMNEY sq. in(cm)			
		12(77.4)	19(122.6)	28(180.6)	38(245.2)
17 to 26°F (-8 to -3°C)		Local 99% Winter Design Temperature: 17 to 26°F (-8 to -3°C)*			
	6(1.8)	0	55	99	141
	8(2.4)	52	74	111	154
	10(3)	NR	90	125	169
	15(4.6)	NR	NR	167	212
	20(6.11)	NR	NR	212	258
	30(9.1)	NR	NR	NR	362
5 to 16°F (-15 to -9°C)		Local 99% Winter Design Temperature: 5 to 16°F (-15 to -9°C)*			
	6(1.8)	NR	78	121	166
	8(2.4)	NR	94	135	182
	10(3)	NR	111	149	198
	15(4.6)	NR	NR	193	247
	20(6.11)	NR	NR	NR	293
	30(9.1)	NR	NR	NR	377
-10 to 4°F (-23 to -16°C)		Local 99% Winter Design Temperature: -10 to 4°F (-23 to -16°C)*			
	6(1.8)	NR	NR	145	196
	8(2.4)	NR	NR	159	213
	10(3)	NR	NR	175	231
	15(4.6)	NR	NR	NR	283
	20(6.11)	NR	NR	NR	333
	30(9.1)	NR	NR	NR	NR
-11°F (-24°C) or lower		Local 99% Winter Design Temperature: -11°F (-24°C) or lower* **Not recommended for any vent configuration**			

* The 99% Winter Design Dry-Bulb (db) temperatures are found in the 2005 ASHRAE Fundamentals Handbook CD and Chapter 28.

Inspections before the sale and at the time of installation will determine the acceptability of the chimney or the need for repair and/or (re)lining. Refer to "The Chimney Inspection Chart" to perform a chimney inspection.

If the inspection of a previously used tile-lined chimney:

a. Shows signs of vent gas condensation, the chimney should be relined in accordance with local codes and the authority having jurisdiction. The chimney should be relined with a listed metal liner, Type-B vent, or a listed chimney adapter kit to reduce condensation. If a condensate drain is required by local code, refer to the NFPA 54/ANSI Z223.1-2006 Section 12.10 for additional information on condensate drains.

b. Indicates the chimney exceeds the maximum permissible size in the tables, the chimney should be rebuilt or relined to conform to the requirements of the equipment being installed and the authority having jurisdiction.

A chimney without a clay tile liner, which is otherwise in good condition, shall be rebuilt to conform to NFPA 211 or be lined with a UL listed (ULC listed in Canada) metal liner or UL listed Type-B vent. Relining with a listed metal liner or Type-B vent is considered to be a vent-in-a-chase.

If a metal liner or Type-B vent is used to line a chimney, no other appliance shall be vented into the annular space between the chimney and the metal liner.

Appliance Application Requirements

Appliance operation has a significant impact on the performance of the venting system. If the appliances are sized, installed, adjusted, and operated properly, the venting system and/or the appliances should not suffer from condensation and corrosion. The venting system and all appliances shall be installed in accordance with applicable listings, standards, and codes.

The furnace should be sized to provide 100% of the design heating load requirement plus any margin that occurs because of furnace model size capacity increments. Heating load estimates can be made using approved methods available from Air Conditioning Contractors of America (Manual J); American Society of Heating, Refrigerating, and Air-Conditioning Engineers; or other approved engineering methods. Excessive oversizing of the furnace could cause the furnace and/or vent to fail prematurely.

When a metal vent or metal liner is used, the vent or liner must be in good condition and be installed in accordance with the vent or liner manufacturer's instructions.

To prevent condensation in the furnace and vent system, the following precautions must be observed:

1. The return-air temperature must be at least 60°F db except for brief periods of time during warm-up from setback at no lower than 55°F db or during initial start-up from a standby condition.
2. Adjust the gas input rate per the installation instructions. Low gas input rate causes low vent gas temperatures, causing condensation and corrosion in the furnace and/or venting system. Derating is permitted only for altitudes above 2000′ (609.6m).
3. Adjust the air temperature rise to the midpoint of the rise range or slightly above. Low air temperature rise can cause low vent gas temperature and potential for condensation problems.
4. Set the thermostat heat anticipator or cycle rate to reduce short cycling.

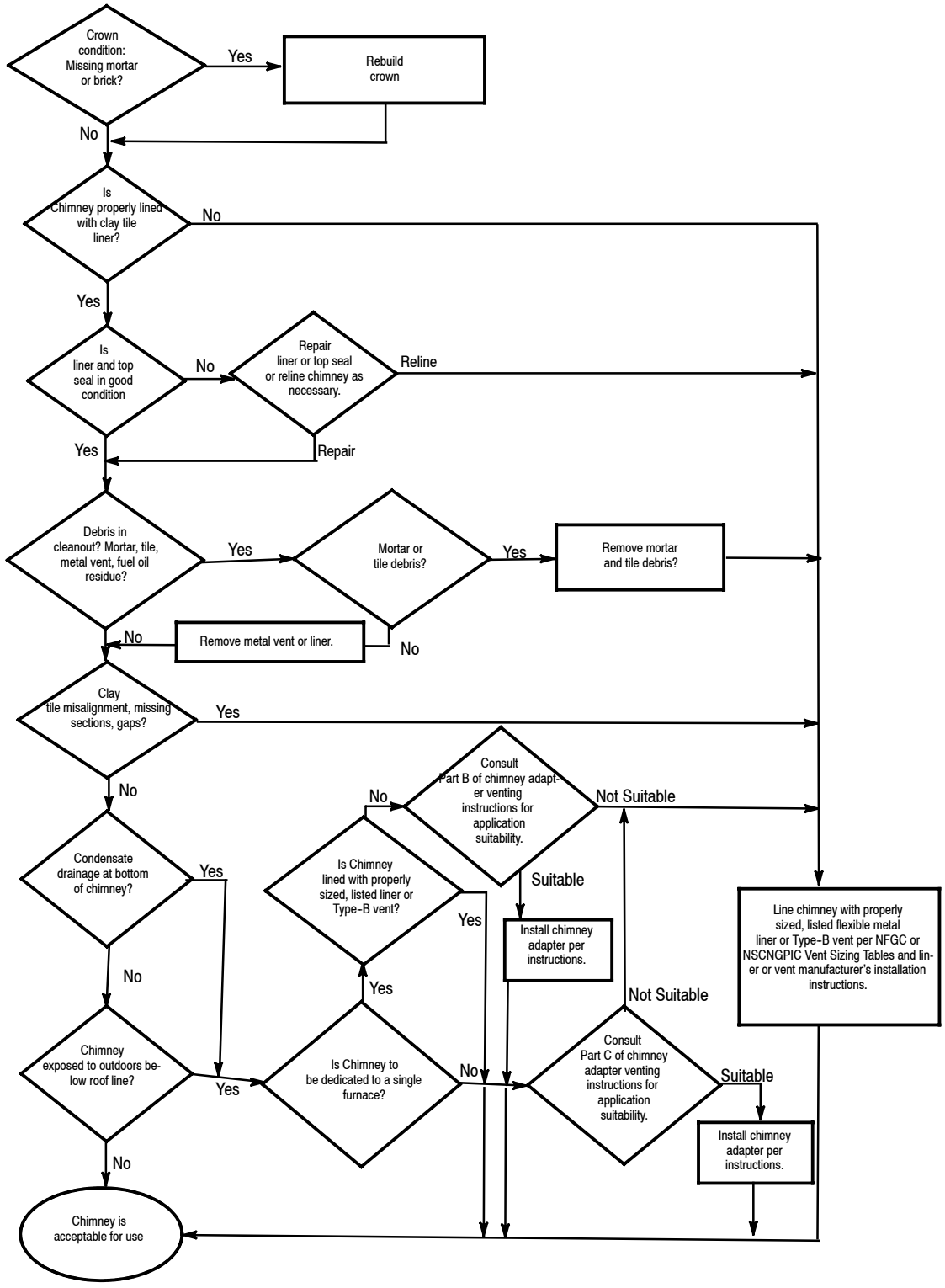
Air for combustion must not be contaminated by halogen compounds which include chlorides, fluorides, bromides, and iodides. These compounds are found in many common home products such as detergent, paint, glue, aerosol spray, bleach, cleaning solvent, salt, and air freshener, and can cause corrosion of furnaces and vents. Avoid using such products in the combustion-air supply. Furnace use during construction of the building could cause the furnace to be exposed to halogen compounds, causing premature failure of the furnace or venting system due to corrosion.

Vent dampers on any appliance connected to the common vent can cause condensation and corrosion in the venting system. Do not use vent dampers on appliances common vented with this furnace.

Figure 11

CHIMNEY INSPECTION CHART

For additional requirements refer to the National Fuel Gas Code NFPA 54/ANSI Z223.1-2006 and NFPA 211-2006 Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances in the U.S.A. or to the Canadian Installation Code CSA-B149.1 in Canada.



8. Gas Supply and Piping

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Models designated for Natural Gas are to be used with Natural Gas ONLY, unless properly converted to use with Propane gas.

Gas Supply Requirements

Gas supply pressure should be within minimum and maximum values listed on rating plate. Pressures are usually set by gas suppliers.

(See Propane Gas Conversion Kit instruction manual for furnaces converted to Propane gas)

- Use only the Type of gas approved for this furnace. See rating plate for approved gas type.
- A $^1/_8$″ NPT plugged tapping, accessible for a test gauge connection,must be installed immediately upstream of the gas supply connection to furnace.
- Gas supply pressure should be within minimum and maximum values listed on rating plate. Pressures are usually set by gas suppliers.
- Gas input must not exceed the rated input shown on the rating plate. Overfiring will result in failure of heat exchanger and cause dangerous operation.
- Do not allow minimum supply pressure to vary downward. Doing so will decrease input to furnace. Refer to **Table 3** for Gas supply. Refer to **Table 5** or **Table 4** for manifold pressures.

Table 3 Gas Pressures

Gas Type	Supply Pressure		
	Recommended	Max.	Min.
Natural	7 in wc (1744 Pa)	14 in wc (3487 Pa)	4.5 in wc 1121 Pa)
Propane	11 in wc (2740 Pa)	14 in wc (3487 Pa)	11 in wc (2740 Pa)

Gas Piping Requirements

NOTE: The gas supply line must be installed by a qualified service technician in accordance with all building codes.

NOTE: In the state of Massachusetts.

a. Gas supply connections MUST be performed by a licensed plumber or gas fitter).

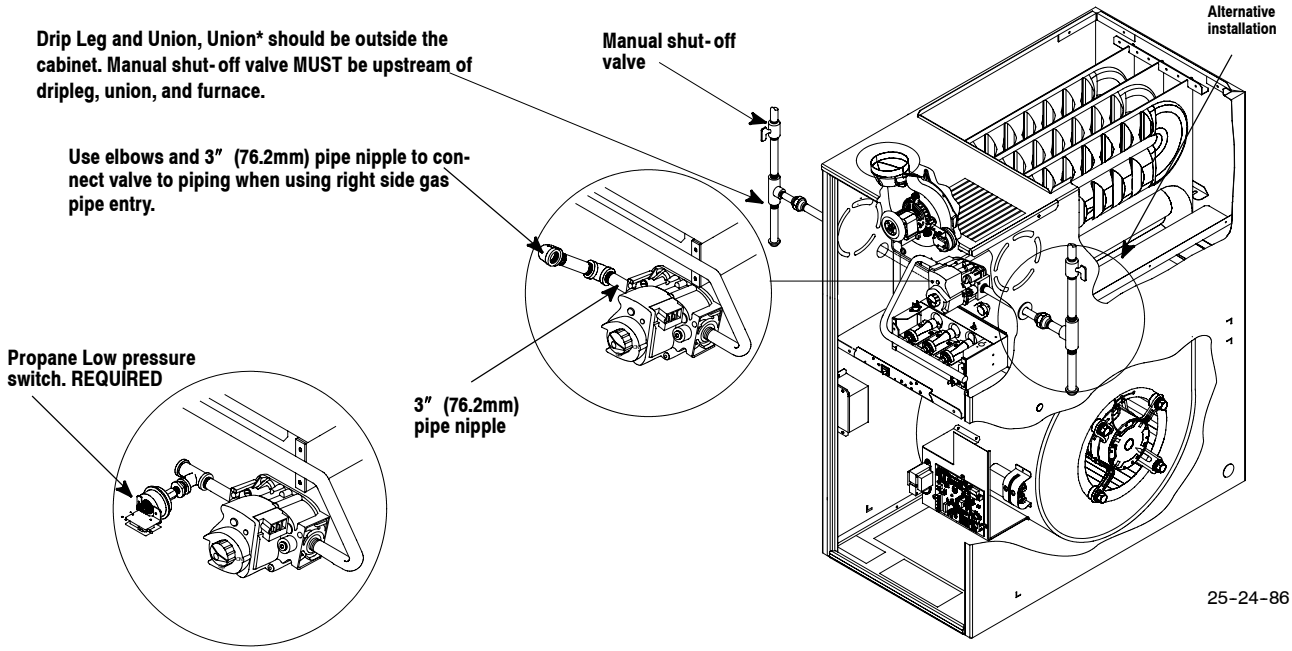
b. When flexible connectors are used, the maximum length shall not exceed 36″ (915 mm).

c. When lever handle type manual equipment shutoff valves are used, they shall be T–handle valves.

d. The use of copper tubing for gas piping is NOT approved by the state of Massachusetts.

1. Install gas piping in accordance with local codes, or in the absence of local codes, the applicable national codes.
2. It is recommended that a manual equipment shutoff valve be installed in the gas supply line outside the furnace. Locate valve as close to the furnace as possible where it is readily accessible. Refer to **Figure 12.**
3. Use black iron or steel pipe and fittings or other pipe approved by local code.
4. Use pipe thread compound which is resistant to natural and Propane gases.
5. Use ground joint unions and install a drip leg no less than 3″ long to trap dirt and moisture before it can enter gas control valve inside furnace.

Figure 12 Typical Gas Piping and Adding Propane Low Pressure Switch



*** Union may be installed inside the cabinet when necessary because of clearances.**

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Use wrench to hold furnace gas control valve when turning elbows and gas line to prevent damage to the gas control valve and furnace.

6. Use two pipe wrenches when making connections to prevent gas valve from turning.

NOTE: If local codes allow the use of a flexible gas appliance connector, always use a new listed connector. Do not use a connector which has previously served another gas appliance.

7. Flexible corrugated metal gas connector may **NOT** be used inside the furnace or be secured or supported by the furnace or ductwork.
8. Properly size gas pipe to handle combined appliance load or run gas pipe directly from gas meter or Propane gas regulator.
9. Install correct pipe size for run length and furnace rating.
10. Measure pipe length from gas meter or Propane second stage regulator to determine gas pipe size.

Left Side Gas Supply Piping

Gas line can be installed directly to the gas valve through the hole provided in the left side of the cabinet. See **Figure 12**

Right Side Gas Supply Piping

Two(2) 90° street elbows or two(2) 90° standard elbows and two(2) close nipples are required for right side gas supply. See **Figure 12.**

Piping with Street Elbows

1. Assemble the elbows so that the outlet of one(1) elbow is 90° from the inlet of the other. The elbows should be tight enough to be leak proof. An additional $^1/_4$ turn will be required at the end of step 2, see **Figure 13**.
2. Screw elbow assembly into gas valve far enough to be leak proof. Position elbow assembly so that the inlet of the elbow is at the bottom of the gas valve. An additional $^1/_2$ turn will be required in step 3. Turn open end of inlet elbow to face the right side of the furnace ($^1/_4$ turn), see **Figure 14**.
3. Turn assembly an additional $^1/_2$ turn to position inlet near the top of the gas valve. In line with gas opening on right side of furnace, see **Figure 12** and **Figure 15**.

Figure 13 Elbows (*8MP)

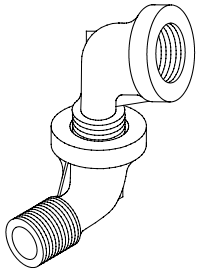


Figure 14 Gas Valve with Elbows (*8MPT/*8MPV)

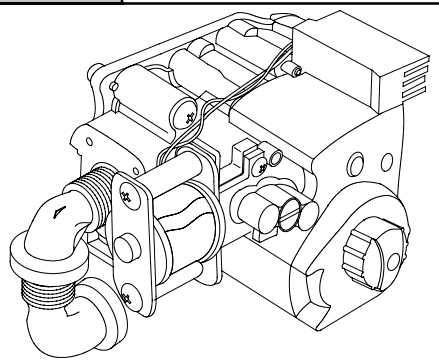
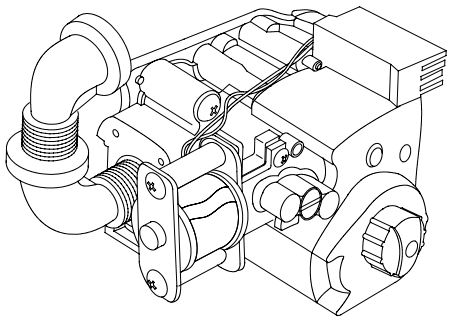


Figure 15 Gas Valve with Elbows (*8MPT/*8MPV)



4. Gas supply line then can be run directly into opening of elbow.

Piping with Close Nipples and Standard Elbows

1. Assemble elbows and nipples similar to street elbows shown in **Figure 13**.
2. Follow steps 2 through 4 ***Piping with Street Elbows.***

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to properly install metal gas connector could result in personal injury, death and/or property damage.

A flexible corrugated metal gas connector must be properly installed, shall not extend through the side of the furnace, and shall not be used inside the furnace.

Black iron pipe shall be installed at the furnace gas control valve and extend a minimum of 2″ outside furnace.

Additional Propane Piping Requirements

- Have a licensed Propane gas dealer make all connections at storage tank and check all connections from tank to furnace.
- If copper tubing is used, it **MUST** comply with limitation set in local codes, or in the absence of local codes, the gas codes of the country having jurisdiction.
- Two-stage regulation of Propane gas is recommended.

Propane Conversion

An accessory kit shall be used to convert to propane gas use, see the furnace rating plate for the Propane conversion accessory kit part number.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

NOx inserts for use with Natural Gas units ONLY. If Propane Gas is required, NOx inserts must be removed.

⚠ WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

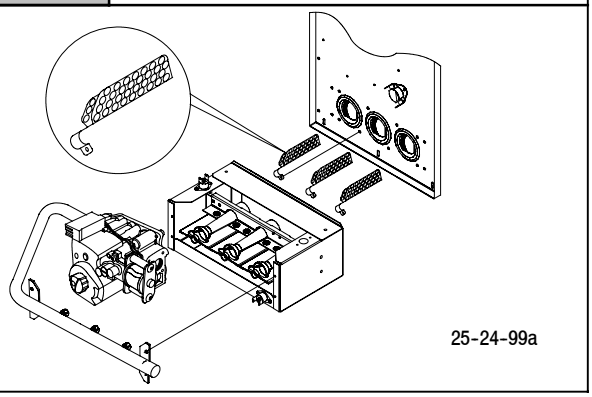
A Propane conversion accessory kit is required when operating the furnace with Propane gas.

For Propane conversion remove screws that secure the NOx insert and discard insert.

Reinstall screws. See **Figure 16**

NOTE: It is very important to reinstall the NOx insert mounting screws.

Figure 16 **Removing NOx inserts**



⚠ WARNING

FIRE OR EXPLOSION HAZARD

An open flame or spark could result in personal injury, death and/or property damage.

Propane gas is heavier than air and will settle and remain in low areas and open depressions.

Thoroughly ventilate area and dissipate gas. Do NOT use a match or open flame to test for leaks, or attempt to start up furnace before thoroughly ventilating area.

Orifice Sizing

NOTE: Factory sized orifices for natural and Propane gas are listed in the furnace Technical Support Manual.

Ensure furnace is equipped with the correct main burner orifices. Refer to **Table 5** or **Table 4** for correct orifice size and manifold pressure for a given heating value and specific gravity for natural and propane gas.

Operation Above 2000ft (609.6m) Altitude

⚠ WARNING

FIRE, EXPLOSION, CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

This high-altitude gas-conversion shall be done by a qualified service agency in accordance with the Manufacturer's instructions and all applicable codes and requirements, or in the absence of local codes, the applicable national codes.

These furnaces may be used at full input rating when installed at altitudes up to 2000ft (609.6m). When installed above 2000ft (609.6m), the High Heat input must be decreased 2% (natural) or 4% (Propane) for each 1000ft (304.8m) above sea level in the USA. In Canada, the input rating must be derated 10% (natural) or 5% (Propane) for altitudes of 2000 to 4500ft (609.6 to 1371.6m) above sea level. This may be accomplished by a simple adjustment of manifold pressure or an orifice change, or a combination of a pressure adjustment and an orifice change. The changes required depend on the installation altitude and the heating value of the fuel. **Table 4 and Table 5** show the proper furnace manifold pressure and gas orifice size to achieve proper performance based on elevation above sea level for both natural gas and propane gas.

To use the natural gas table, first consult your local gas utility for the heating value of the gas supply. Select the heating value in the vertical column and follow across the table until the appropriate elevation for the installation is reached. The value in the box at the intersection of the altitude and heating value provides not only the manifold pressure but also the orifice size. In the natural gas tables the factory-shipped orifice size is in bold (**42**). Other sizes must be obtained from service parts.

High Altitude Input Rate = Nameplate Sea Level Input Rate x (Multiplier) [USA]		
Elevation ft (m)	**High Altitude Multiplier**	
	Natural Gas	**Propane Gas**
2001′ - 3000′ (609.9 - 914.4)	0.95	0.90
3001′ - 4000′ (914.7 - 1219.2)	0.93	0.86
4001′ - 5000′ (1219.5 - 1524)	0.91	0.82
5001′ - 6000′ (1524.3 - 1828.8)	0.89	0.78
6001′ - 7000′ (1829.1 - 2133.6)	0.87	0.74
7001′ - 8000′ (2133.9 - 2438.4)	0.85	0.70

***** Based on mid-range of elevation.

MANIFOLD PRESSURE AND ORIFICE SIZE FOR HIGH ALTITUDE APPLICATIONS

Table 4 — **NATURAL GAS MANIFOLD PRESSURE (in wc)**

HEATING VALUE at ALTITUDE BTU/CU. FT.	MEAN ELEVATION FEET ABOVE SEA LEVEL ft(m)																				
	0 to 2000 (0 to 609.6)			2001 to 3000 (609.9 to 914.4)			3001 to 4000 (914.7 to 1219.2)			4001 to 5000 (1219.5 to 1524)			5001 to 6000 (1524.3 to 1828.8)			6001 to 7000 (1829.1 to 2133.6)			7001 to 8000 (2133.9 to 2438.4)		
	Orifice No.	Mnfld Pressure		Orifice No.	Mnfld Pressure		Orifice No.	Mnfld Pressure		Orifice No.	Mnfld Pressure		Orifice No.	Mnfld Pressure		Orifice No.	Mnfld Pressure		Orifice No.	Mnfld Pressure	
		HI	LO		HI	LO		HI	LO		HI	LO		HI	LO		HI	LO		HI	LO
700	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	41	3.7	1.8
725	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	41	3.7	1.8	41	3.4	1.7
750	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	41	3.5	1.7	**42**	**3.6**	**1.7**
775	--	--	--	--	--	--	--	--	--	--	--	--	41	3.6	1.7	**42**	**3.6**	**1.8**	**42**	**3.3**	**1.6**
800	--	--	--	--	--	--	--	--	--	41	3.6	1.8	**42**	**3.7**	**1.8**	**42**	**3.4**	**1.7**	**42**	**3.1**	**1.5**
825	--	--	--	--	--	--	41	3.7	1.8	41	3.4	1.7	**42**	**3.5**	**1.7**	**42**	**3.2**	**1.6**	43	3.6	1.8
850	--	--	--	--	--	--	41	3.5	1.7	**42**	**3.6**	**1.7**	**42**	**3.3**	**1.6**	43	3.7	1.8	43	3.4	1.7
875	--	--	--	41	3.6	1.7	**42**	**3.6**	**1.8**	**42**	**3.4**	**1.6**	**42**	**3.1**	**1.5**	43	3.5	1.7	43	3.2	1.6
900	--	--	--	**42**	**3.7**	**1.8**	**42**	**3.4**	**1.7**	**42**	**3.2**	**1.6**	43	3.6	1.7	43	3.3	1.6	44	3.5	1.7
925	41	3.7	1.8	**42**	**3.5**	**1.7**	**42**	**3.3**	**1.6**	43	3.7	1.8	43	3.4	1.7	43	3.1	1.5	44	3.3	1.6
950	41	3.5	1.7	**42**	**3.3**	**1.6**	**42**	**3.1**	**1.5**	43	3.5	1.7	43	3.2	1.6	44	3.4	1.7	44	3.1	1.5
975	**42**	**3.7**	**1.8**	**42**	**3.2**	**1.6**	43	3.6	1.8	43	3.3	1.6	44	3.5	1.7	44	3.2	1.6	45	3.6	1.7
1000	**42**	**3.5**	**1.7**	43	3.7	1.8	43	3.4	1.7	43	3.1	1.5	44	3.3	1.6	45	3.7	1.8	45	3.4	1.7
1050	**42**	**3.2**	**1.6**	43	3.3	1.6	43	3.1	1.5	44	3.3	1.6	45	3.6	1.8	--	--	--	--	--	--
1100	43	3.6	1.7	44	3.5	1.7	44	**3.2**	1.6	45	3.6	1.8	--	--	--	--	--	--	--	--	--

Conversion: 1 in wc = 249 Pa

NOTE: Natural gas data is based on 0.60 specific gravity. For fuels with different specific gravity consult the National Fuel Gas Code ANSI Z223.1-2006/NFPA 54-2006 or National Standard of Canada, Natural Gas And Propane Installation Code CSA B149.1-05.

* **In the USA,** derating of these furnaces at 2% (Natural Gas) and 4% (Propane Gas) has been tested and design-certified by CSA. **In Canada**, the input rating must be derated 5% (Natural Gas) and 10% (Propane Gas) for altitudes of 2,000 to 4,500 (609.6 to 1371.6m) above sea level. Use the 2001 to 3000 (609.9 to 914.4m) column in **Table 4 and Table 5**.

The burner orifice part nos. are as follows:

Orifice #41	1096942	Orifice #42	1011351
Orifice #43	1011377	Orifice #44	1011352
Orifice #45	1011353	Orifice #54	1011376
Orifice #55	1011354	Orifice #56	1011355

High Altitude Air Pressure Switch

The factory-installed pressure switches need NOT be changed for any furnace installations from sea level up to and including 8,000′ (24.8.4 m) altitude.

Table 5 — **PROPANE GAS MANIFOLD PRESSURE (in wc)**

HEATING VALUE at ALTITUDE BTU/CU. FT.	MEAN ELEVATION FEET ABOVE SEA LEVEL ft(m)													
	0 to 2000 (0 to 609.6)		2001 to 3000 (609.9 to 914.4)		3001 to 4000 (914.7 to 1219.2)		4001 to 5000 (1219.5 to 1524)		5001 to 6000 (1524.3 to 1828.8)		6001 to 7000 (1829.1 to 2133.6)		7001 to 8000 (2133.9 to 2438.4)	
	HI	LO	HI	LO	HI	LO	HI	LO	HI	LO	HI	LO	HI	LO
2500	10.0	4.9	10.0	4.9	9.0	4.4	10.0	4.9	9.4	4.6	8.5	4.2	10	4.9
Orifice Size	#54		#54		#54		#55		#55		#55		#56	

Conversion: 1 in wc = 249 Pa

NOTE: Propane data is based on 1.53 specific gravity. For fuels with different specific gravity consult the National Fuel Gas Code ANSI Z223.1-2006/NFPA 54-2006 or National Standard Of Canada, Natural Gas And Propane Installation Code CSA B149.1-05.

* **In the USA,** derating of these furnaces at 2% (Natural Gas) and 4% (Propane Gas) has been tested and design-certified by CSA. **In Canada**, the input rating must be derated 5% (Natural Gas) and 10% (Propane Gas) for altitudes of 2,000 to 4,500 (609.6 to 1371.6m) above sea level. Use the 2001 to 3000 (609.9 to 914.4m) column in **Table 4 and Table 5**.

⚠ WARNING

FIRE, EXPLOSION, CARBON MONOXIDE POISONING HAZARD

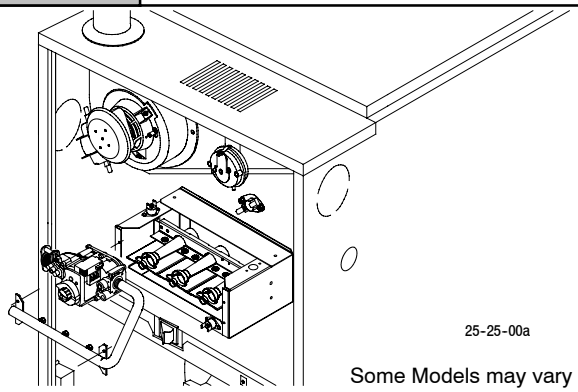
Failure to follow this warning could result in personal injury, death and/or property damage.

This high-altitude gas-conversion shall be done by a qualified service agency in accordance with the Manufacturer's instructions and all applicable codes and requirements, or in the absence of local codes, the applicable national codes.

Changing Orifices

1. After disconnecting power and gas supply to the furnace, remove the burner compartment door, exposing the burner compartment.
2. Disconnect gas line from gas valve so manifold can be removed.
3. Disconnect wiring at gas valve. Be sure to note the proper location of all electrical wiring before being disconnected.
4. Remove the four (4) screws holding the manifold and gas valve to the manifold supports. Do not discard any screws. See **Figure 17**.

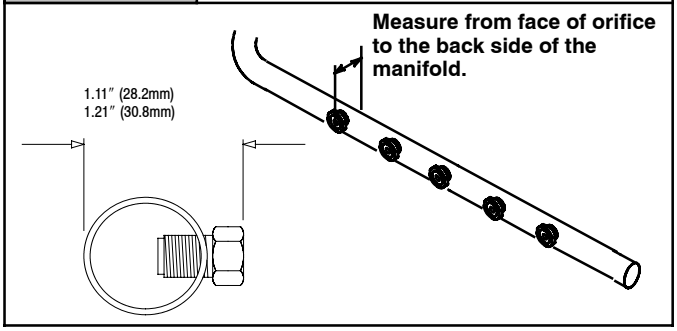
Figure 17 **Manifold**



Some Models may vary

5. Carefully remove the manifold assembly.
6. Remove the orifices from the manifold and replace them with proper sized orifices. See **Figure 18.**
7. Tighten orifices so they are seated and gas tight. See **Figure 18.**
8. Reassemble all parts in reverse order as removed. Be sure to engage the main burner orifices in the proper openings in the burners.
9. After reassembling, turn gas on and check all joints for gas leaks using a soapy solution. All leaks must be repaired immediately.

Figure 18 **Changing Orifices**



Final Gas Piping Check

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury and/or death.

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.

⚠ AVERTISSEMENT

RISQUE D'EXPLOSION ET D'INCENDIE

Le fait de ne pas suivre cet avertissement pourrait entraîner des dommages corporels et / ou la mort.

Ne jamais examiner pour les fuites de gaz avec une flamme vive. Utilisez plutôt un savon fait specifiquement pour la détection des fuites de gaz pour verifier tous les connections.

1. The furnace and the equipment shut off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of $^1/_2$″ PSIG (3.5 Pa). Close the manual shut-off valve before testing at such pressures.
2. The furnace must be isolated from the gas supply system by closing the equipment shut off valve during any pressure testing of the gas supply system at test pressure equal to or less than $^1/_2$″ PSI (3.5 Pa).
3. When installation is complete, test all pipe connections for leaks with the gas pressure less than $^1/_2$″ PSIG (3.5 Pa) to the gas valve.
4. Apply a commercial soap solution to all joints to test for leaks. Correct any leaks indicated by bubbles.
5. Correct even the smallest leak at once.
6. Check for leaks at gas valve and orifice connections to the burner manifold along with the pilot tube connections to the valve and pilot assembly while the furnace is operating.

9. Electrical Wiring

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to turn off power could result in personal injury or death.

Turn OFF electrical power at fuse box or service panel before making any electrical connections and ensure a proper ground connection is made before connecting line voltage.

Power Supply Wiring

The furnace **MUST** be electrically wired and grounded in accordance with local codes, or in the absence of local codes, with the National Electrical Code (NEC), NFPA 70-2008 in the U.S., or the Canadian Electrical Code (CEC), CSA C22.1 in Canada.

The power supply to the furnace connections must be between 104 VAC and 127 VAC during furnace operation for acceptable performance.

Field wiring connections must be made inside the furnace connection box. A suitable strain relief should be used at the point the wires exit the furnace casing.

Copper conductors shall be used. Line voltage wires should conform to temperature limitation of 35° C rise. Wire and circuit breaker sizing shall be based on the ampacity of the furnace electrical components plus the amps for all installed accessories (1.0 amps total for EAC and HUM). Ampacity can be determined by using the NEC or CEC.

NOTE: Furnace will not have normal operation is line polarity is reversed. Check ALL field and control connections prior to operation.

Furnace must be installed so the electrical components are protected from water and **connected to its own separate circuit**.

Junction Box (J-Box) Relocation

The J-Box is installed in the burner compartment on left side of casing. An alternate J-Box location on right side can be used.

1. Remove and save two screws holding J-Box to casing.

2. Move large hole plug from right to left J-Box location.
3. Clip wire tie holding J-Box wires if needed.
4. Move J-Box to alternate location and attach using two screws removed from left side location.
5. Position all wires away from hot surfaces, sharp edges, and moving parts. Do not pinch J-Box wires or other wires when reinstalling burner compartment door.

Thermostat

Heating

The **two-stage** furnace control board will operate with either a single stage or a two-stage heating thermostat and will provide two-stage heating operation.

For **single-stage** thermostat installations, the R and W wires from the thermostat connect to the **R** and **W1** connections on the furnace control board.

Note: The TT (Thermostat Type) SW1 DIP switch # 3 should be in the off position for the furnace to operate properly with a single-stage thermostat. Failure to change DIP switch with single-stage thermostat will result in Low Heat operation ONLY. (See **Figure 21** and wiring diagram)

During operation, the furnace will operate on low Heat for up to12 minutes. If the heat request exists for more than 12 minutes, the furnace will automatically shift to the high Heat mode for the remaining duration of the heating cycle.

For **two-stage** thermostat installations, the **R**, **W1** and **W2** wires from the thermostat connect to the **R**, **W1** and **W2** connections on the furnace control board. Set TT SW1 DIP switch #3 to ON position. During operation, the furnace will shift from Low Heat to High Heat as requested by the thermostat. (See **Figure 19, Figure 20** and wiring diagram)

Heat anticipator setting will need to be measured if 24VAC humidifier is installed. Measure current in series from **R** to **W1** at the thermostat. Be sure 24VAC humidifier is wired up to control. Allow furnace to operate for two minutes before recording the AC amperage reading. Set anticipator on thermostat to recorded value.

Thermostat location has an important effect on the operation of the furnace. Follow instructions included with thermostat for correct mounting and wiring.

Low voltage connections to furnace must be made on terminal board to furnace control board. (See **Figure 19** and **Figure 20**)

Cooling

*8MPT

If cooling is used, the **Y and G** from the thermostat must be connected to the control board **Y/Y2 and G** to energize cooling blower speed.

NOTE: MPT models are not two-stage cooling compatible.

*8MPV

If single-stage cooling is used, the **Y and G** from the thermostat must be connected to the control board **Y/Y2 and G** to energize cooling blower speed.

If two-stage cooling is used, the **Y1, Y2, G** off the thermostat must be connected to **Y1** of the tap select interface board for Low Cooling, **Y/Y2** of the furnace control board for High Cooling and **G** of the furnace control board for continuous fan speed.

Optional Equipment

All wiring from furnace to optional equipment **MUST** conform to local codes or, in the absence of local codes with the latest edition of The National Electric Code, NFPA 70 and/or The Canadian Electric Code CSA C22.1. Install wiring in accordance with manufacturer's instructions. The wiring **MUST** have a minimum temperature rating of 105° C.

Humidifier/Electronic Air Cleaner

The furnace is wired for humidifier and/or electronic air cleaner connection.

HUMIDIFIER - The HUM (24V) terminal is energized when the low pressure switch closes on a call for heat. The HUM (115V) is energized when the inducer is energized.

ELECTRONIC AIR CLEANER - EAC is energized when there is a blower speed call, except it is NOT energized when blower operates in the hard-wired continuous fan mode.

⚠ CAUTION

REDUCED FURNACE LIFE HAZARD

Failure to follow caution instructions may result in reduced furnace life.

Do NOT exceed 115V/1.0 amp. maximum current load for both the EAC terminal and the HUM terminal combined.

Furnace Control Board

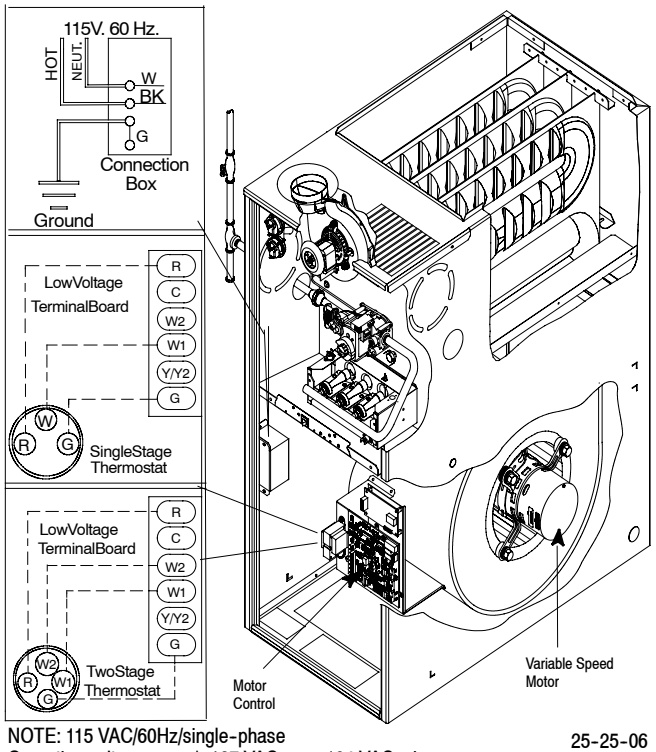
The furnace control board has a fixed blower **ON** delay of 30 seconds for High Heat calls and 45 seconds for Low Heat calls. The blower **OFF** timing is factory preset at 140 seconds. If desired, the fan **OFF** delay can be reset to obtain the longest delay times while still maintaining comfort levels. See "Furnace Wiring Diagram".

Dehumidification - Variable Speed ONLY (*8MPV)

The furnace control board has a dehumidification feature which reduces cooling airflow by 20% when the **DEHUM** terminal [$^1/_4$" (6.4mm) male quick connect] is energized by 24VAC and there is a cooling call. **DEHUM** may be operated by a thermostat dehumidify (24VAC for dehumidify) command or a dehumidistat (switch closes on call for dehumidification) with one terminal connected to (**Y1** for two-stage cooling or **Y/Y2** for single-speed cooling applications) and the other terminal connected to **DEHUM**.

Figure 19 **Electrical Connections *8MPV**

NOTE: Junction Box can be mounted to either the left or right side.



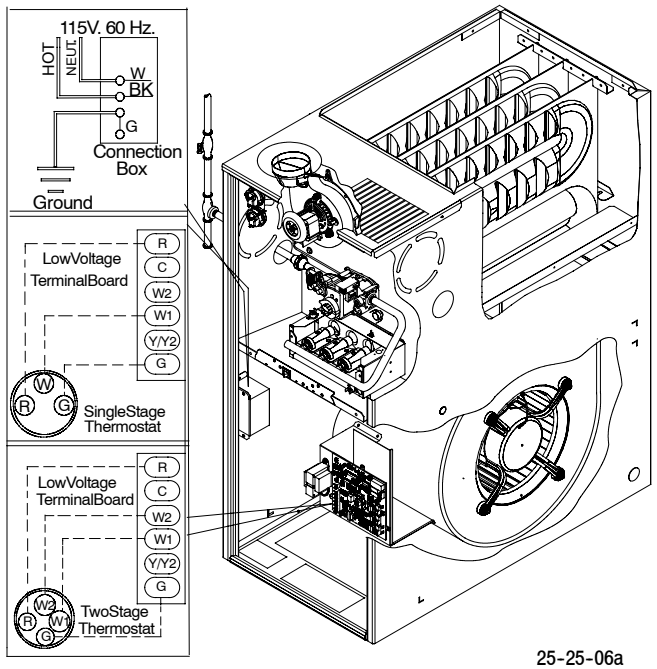
25-25-06

NOTE: 115 VAC/60Hz/single-phase
Operating voltage range*: 127 VAC max, 104 VAC min.

* Permissible limits of voltage at which unit will operate satisfactorily

Figure 20 **Electrical Connections *8MPT**

NOTE: Junction Box can be mounted to either the left or right side.

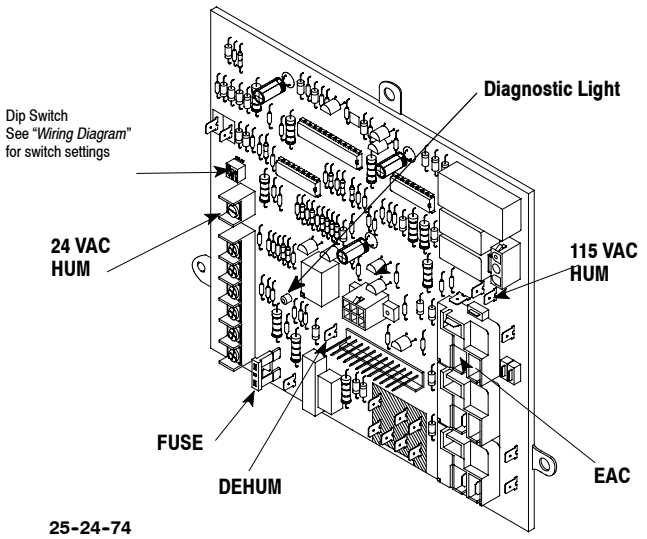


25-25-06a

NOTE: 115 VAC/60Hz/single-phase
Operating voltage range*: 127 VAC max, 104 VAC min.

* Permissible limits of voltage at which unit will operate satisfactorily

Figure 21 **Control Connections**



Furnace Control Fuse

The 24V circuit contains a 5-amp, automotive-type fuse located on furnace control board. (See **Figure 21**) Any electrical shorts to 24V wiring during installation, service, or maintenance may cause fuse to blow. If fuse replacement is required, use only a fuse of identical size (5 amp.).

Tap Select Interface Board (*8MPV)

The Tap Select Interface Board is used with the Variable Speed motor. There are DIP switches **(SW2)** for continuous blower adjust, heating blower adjust, cooling blower adjust and cooling on/off delay profiles. There is a jumper **(J1)** for slight blower adjustment, increase **(+)**/no change (NOM)/decrease **(-)**. There is a jumper **(J2)** for airflow selection of Heat Pump **EFFICIENCY** or **COMFORT**. (**EFFICIENCY** provides no airflow reduction in airflow whether **O** is energized or not. **COMFORT** provides a 10% reduction in airflow when **O** is not energized with a cooling call).

The **O** terminal is available for use for Heat Pump applications, if desired.

The **Y1** terminal (if a two-stage Air Conditioner or two-stage Heat Pump is used) will provide low cooling blower speed when energized. (Only **Y**/**Y2** on the furnace control board is used if a single-stage Air Conditioner or Heat Pump is installed)

10. Ductwork and Filter (Upflow/Horizontal)

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to properly seal duct could result in personal injury or death.

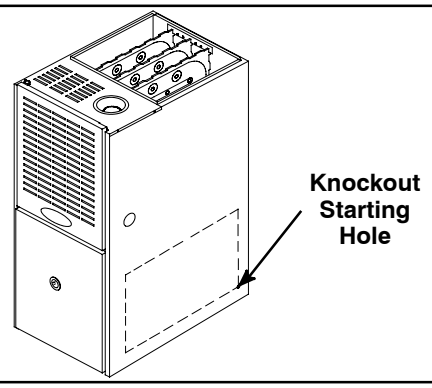
Do NOT draw return air from inside a closet or utility room where furnace is located. Return air duct MUST be sealed to furnace casing.

Duct Connections

This furnace may be installed in only a bottom or side return application. Return air through the back of the furnace is **NOT** allowed.

Side connections can be made by cutting out the embossed area shown in **Figure 22.** A plugged hole is provided at each furnace side duct location to help start cutting the opening.

Figure 22 **Cutting Side Return Air Opening**



Bottom returns can be made by removing the knockout panel in the furnace base. Do **NOT** remove knock-out except for a bottom return.

Duct Design

Design and install air distribution system to comply with Air Conditioning Contractors of America manuals or other approved methods that conform to local codes and good trade practices.

When the furnace is located in an area near or adjacent to the living area, the system should be carefully designed with returns to minimize noise transmission through the return air grille. Any blower moving a high volume of air will produce audible noise which could be objectionable when the furnace is located very close to a living area. It is often advisable to route the return air ducts under the floor or through the attic.

- Refer to furnace **Technical Support Manual** (Blower Data) for air flow information.
- Size ductwork to handle air flow for heating and air conditioning.

Duct Installation Requirements

- When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside of 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.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury or death.

Cool air passing over heat exchanger could cause condensate to form resulting in heat exchanger failure.

- When the furnace is used with a cooling unit, the furnace shall be installed parallel with or on the upstream side of the cooling unit to avoid condensation in the heating element.
- With a parallel flow arrangement, the dampers or other means used to control flow of air shall be adequate to prevent chilled air from entering the furnace. Chilled air going through the furnace could cause condensation and shorten furnace life. Dampers (purchased locally) can be either automatic or manual. Manually or automatically operated dampers **MUST** be equipped with a means to prevent furnace and air conditioning operation, unless damper is in the full heat or cool position.
- Installation of locking–type dampers is recommended in all branches, or in individual ducts to balance system's air flows.
- Non–combustible, flexible duct connectors are recommended for return and supply connections to furnace.
- If air return grille is located close to the fan inlet, install at least one 90° air turn between fan and inlet grille to reduce noise.
- Ductwork installed in attic or exposed to outside temperatures requires a minimum of 2″ (50.8mm) of insulation with outdoor type vapor barrier.
- Ductwork installed in an indoor unconditioned space requires a minimum of 1″ (25.4mm) of insulation with indoor type vapor barrier.

Inspection Panel on some models

For a furnace not equipped with a cooling coil, the outlet duct shall be provided with a removable access panel. This opening shall be accessible when the furnace is installed and shall be of such a size that the heat exchanger can be viewed for possible openings using light assistance or a probe can be inserted for sampling the air stream. This access cover shall be attached in such a manner as to prevent air leaks.

Filters

A filter MUST be used.

Filters are supplied with these furnaces, and additional filters may be purchased from your distributor.

See **Table 6** for required high-velocity filter sizes.

Table 6	High Velocity Air Filter Sizes (max. 600 FPM)		
Cabinet Width in (mm)	Internal Filter in(mm)	External Filter Rack	
	Bottom	Bottom	Side+
15 1/2 (393.7)	14 X 25 (355.6 x 635)	14 X 25 (355.6 x 635)	14 X 25 (355.6 x 635) or 16 X 25 (508 x 635)*
19 1/8 (485.8)	16 X 25 * (406.4 x 635) *	16 X 25 (406.4 x 635)*	16 X 25 (406.4 x 635)*
22 3/4 (577.9)	20 X 25 (508 x 635)*	20 X 25 (508 x 635)*	16 X 25 (508 x 635)*

***** Greater than 1600 CFM with a maximum of 2000 CFM requires both (left and right) side return filter racks or for single return in an upflow application, must use filter rack NAHA001TK. See **Figure 23.**

+ Side return air duct(s) is not permitted with horizontal or downflow furnace installation.

Use either filter type:

- Washable, high-velocity filters are based on a maximum air flow rating of 600 FPM.
- Disposable, low velocity filters are based on a maximum air flow of 300 FPM when used with with external filter grille.

⚠ CAUTION

REDUCED FURNACE LIFE HAZARD

Failure to follow caution instructions may result in reduced furnace life.

Use of excessively dirty and/or restrictive air filters may increase furnace operating temperatures and shorten the life of the furnace.

Filters supplied with the furnace are rated at a maximum of 600 fpm air velocity and sized for the furnace's airflow rate. Replacement filters must be of equivalent type, size, and rating except as described below.

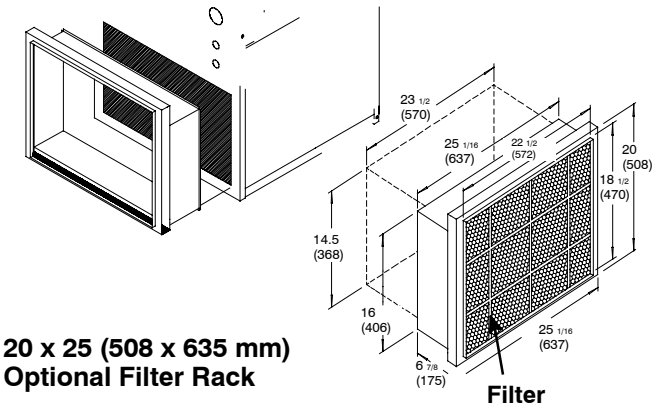
Disposable, low-velocity filters may be used to replace washable, high-velocity filters, providing they are sized for 300 FPM or less.

- The furnaces with 1600 or less CFM rating are supplied with a 16″ x 25″ (406 x 635mm) high-velocity filter and rack. On these models the supplied filter may be installed internally for bottom return or the supplied filter and rack may be mounted externally for bottom return.
- The furnaces with greater than 1600 CFM to 2000 CFM may require that bottom return or both (left and right) side returns are used or for single side return in upflow application, must use filter rack NAHA001TK. Two side return filters and racks are required. Filter racks must be mounted externally. (See **Figure 23** and **Figure 24**.) If return air must be on one side only, an optional 20″ x 25″ (508 x 635mm) filter standoff rack kit can be used. (See **Figure 23**.) For bottom return, an internal filter can be used or a filter rack kit can be mounted externally.
- See Technical Manual, *Circulation Air Blower Data* for additional information.

NOTE: The 20″ x 25″ (508 x 635mm) standoff side filter rack gives more filter area but does not provide more air. (See **Figure 23**.) To achieve 2000 CFM 2 side returns may be required. (See **Figure 25**.)

NOTE: Disposable, low-velocity filters may be replaced with washable, high-velocity filters providing they meet the minimum size areas for 300 FPM or less. Washable, high-velocity filters can be replaced ONLY with same type and size filter.

Figure 23 **Optional Duct Standoff - NAHA001TK in(mm)**



20 x 25 (508 x 635 mm) Optional Filter Rack

Filters Rack Installation

Side Return

Center the filter rack on the side panel, flush with the bottom edge of the furnace. Mark the fastening holes. Drill the fastening holes in the side panel and fasten the filter rack in place with sheet metal screws. See **Figure 24** & **Figure 25.**

Figure 24 **Side Return Filter Rack**

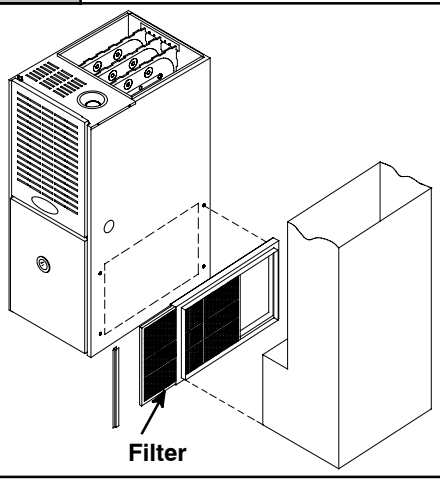
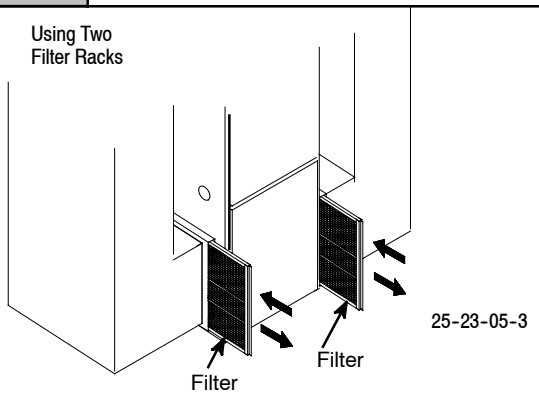


Figure 25 **Filters Installed on Two Sides**



Internal Filter in Bottom Return Installation

When installing a bottom–mounted filter inside the furnace, install the filter clips on the edge of the bottom duct opening with the wider end of the clips toward the blower, as shown in **Figure 26.** Clips may be obtained from your distributor or fabricated from sheet metal (**Figure 27**). Insert filter into side clips first and push filter back until it is fully engaged into back clip.

Figure 26 **Bottom Mounted Filter**

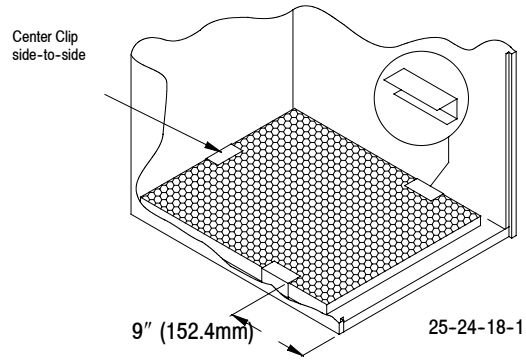
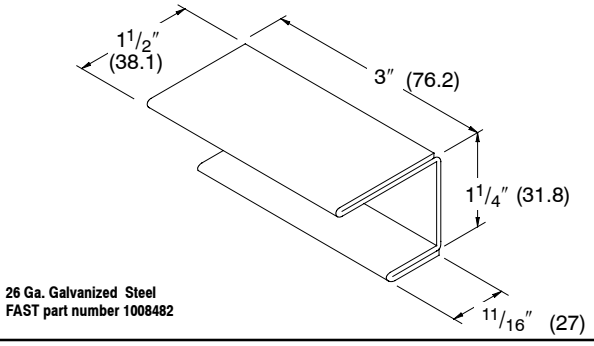


Figure 27 **Filter Clip Construction in(mm)**



Note: If filters are only suitable for heating application, advise homeowner that filter size may need to be increased if air conditioning is added.

Addition Of Air Conditioning

When a refrigeration coil is used in conjunction with this furnace, it must be installed on the discharge side of the furnace to avoid condensation on the heat exchanger. All furnaces are designed with a break–away duct flange on the supply air side of the furnace. This allows for installation in the horizontal right or downflow applications. The coil installation instructions must be consulted for proper coil location and installation procedures. With a parallel flow arrangement, dampers must be installed to prevent chilled air from entering the furnace. If manually operated dampers are used, they must be equipped with a means to prevent operation of either unit unless the damper is in full heat or full cool position.

Copper or plastic tubing may be used for the condensate drain line.

11. Ductwork and Filter (Downflow)

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to properly seal duct could result in personal injury or death.

Do NOT draw return air from inside a closet or utility room where furnace is located. Return air duct MUST be sealed to furnace casing.

⚠ WARNING

FIRE HAZARD

Side return air duct(s) could cause excessive furnace and/or air temperatures, which could result in personal injury, death and/or property damage.

Return air duct is to be connected to only the top of downflow furnace.

⚠ WARNING

BURN HAZARD

Failure to properly install vent shield could result in personal injury or death.

The vent may be hot.

Vent Shield

A vent shield is required for all downflow installations. The vent **Must** exit out the side of the furnace for all downflow installations. This places the hot vent pipe (over 300° F) within reach of children. The vent shield attaches to side of furnace to cover vent pipe. See **Figure 4** in *"Installation" section.*

Outlet Duct Flange

Downflow installations with cased coils require the furnace outlet duct flange to be bent outward and flat to mate the outlet of the furnace to the cased coil.

⚠ WARNING

FIRE HAZARD

Failure to install furnace on noncombustible subbase could result in personal injury, death and/or property damage.

Place furnace on noncombustible subbase on downflow applications, unless installing on non-combustible flooring.

Sub-Bases for Combustible Floors - Furnace Only

Note: When using the subbase for combustible floors, the discharge air duct flanges on the furnace **MUST** be broken down to provide proper fit up to the subbase. Use duct pliers to bend the duct flanges flat onto the furnace casing. DO NOT bend the duct flanges inward (toward the heat exchangers) as air flow restrictions may occur.

The Sub-base for Combustible Floors **MUST** be used when a downflow furnace is set on a combustible floor, even when the furnace is installed on a coil box.

1. Cut the opening in the floor according to the dimensions in **Table 7** because the base is equipped with locating tabs that center the base over the opening.

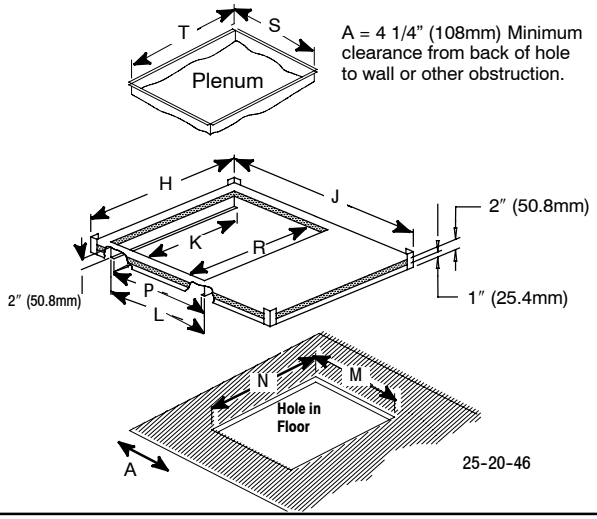
   The opening in the base is $1^1/_4$″ (31.8mm) shorter and $1^1/_8$″ (28.6mm) narrower than the minimum required size of the opening in the floor. This is done to maintain a 1″ clearance between the floor and the plenum.
2. Fabricate the plenum to the dimensions given in **Table 7**. Note that the dimensions given are outside dimensions.
3. Set the base over the opening in the floor, centering the opening in the base over the opening in the floor. Fasten the base to the floor with screws or nails. See **Figure 28** and **Figure 29.**
4. Drop the plenum through the opening in the base. The flange of the plenum should rest on top of the combustible floor base.

Table 7 — Sub-bases for Combustible Floors Dimensions in(mm)

Sub-base for Combustible Floors Part Number	Sub-base for Combustible Floor Dimensions				Opening In Floor		Opening In Base For Plenum		Typical Plenum Dimensions	
	H*	J*	K**	L	M	N	P	R	S	T
Subbase for Furnace Only										
NAHH001SB	$15^{11}/_{16}$ (398.5)	$28^3/_4$ (730.3)	$14^9/_{16}$ (369.9)	16(406.4)	$16^1/_4$ (412.8)	$14^5/_8$ (371.5)	15 (381)	$13^1/_2$ (342.9)	15 (381)	$13^1/_2$ (342.9)
NAHH002SB	$19^5/_{16}$ (490.5)	$28^3/_4$ (730.3)	$18^3/_{16}$ (462)	16(406.4)	$16^1/_4$ (412.8)	$18^1/_4$ (463.6)	15 (381)	$17^1/_8$ (435.6)	15 (381)	$17^1/_8$ (435.6)
NAHH003SB	$22^{15}/_{16}$ (582.6)	$28^3/_4$ (730.3)	$21^{13}/_{16}$ (554)	16(406.4)	$16^1/_4$ (412.8)	$21^7/_8$ (555.6)	15 (381)	$19^3/_4$ (501.7)	15 (381)	$19^3/_4$ (501.7)
Subbase for Coil Box										
NAHH004SB	$15^3/_4$ (25.4)	$20^9/_{16}$ (522.3)	$14^9/_{16}$ (369.9)	$16^1/_{16}$ (408)	$16^1/_4$ (412.8)	$14^5/_8$ (371.5)	15 (381)	$13^1/_2$ (342.9)	15 (381)	$13^1/_2$ (342.9)
NAHH005SB	$19^3/_8$ (181.1)	$20^9/_{16}$ (522.3)	$18^3/_{16}$ (462)	$16^1/_{16}$ (408)	$16^1/_4$ (412.8)	$18^1/_4$ (463.6)	15 (381)	$17^1/_8$ (435.6)	15 (381)	$17^1/_8$ (435.6)
NAHH006SB	23 (284.2)	$20^9/_{16}$ (522.3)	$21^{13}/_{16}$ (554)	$16^1/_{16}$ (408)	$16^1/_4$ (412.8)	$21^7/_8$ (555.6)	15 (381)	$19^3/_4$ (501.7)	15 (381)	$19^3/_4$ (501.7)

* Outside Dimension
** Base Spacer Side To Side

Figure 28 — Exploded View of Sub-Base for Furnace ONLY



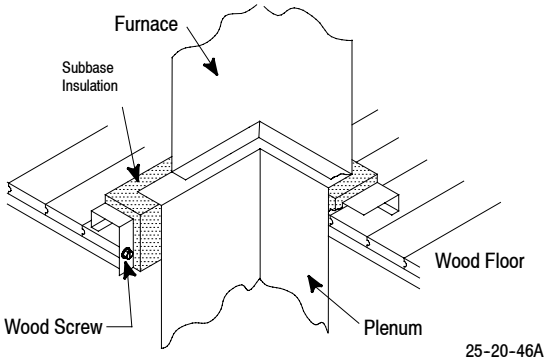
Sub-base for Combustible Floors- Downflow Coil Adapter Box

The sub-base for combustible floors is not required when a downflow furnace, ***used with a downflow coil box***, is set on combustible flooring.

1. Cut the opening in the floor according to the dimensions in **Table 7** because the base is equipped with locating tabs that center the base over the opening.

   The opening in the base is $1^1/_4$″ (31.8mm) shorter and $1^1/_8$″ (28.6mm) narrower than the minimum required size of the opening in the floor. This is done to maintain a 1″ (25.4mm) clearance between the floor and the plenum.

Figure 29 **Setting the Base**



2. Fabricate the plenum to the dimensions given in **Table 7**. Note that the dimensions given are outside dimensions.
3. Set the base over the opening in the floor, centering the opening in the base over the opening in the floor. Fasten the base to the floor with screws or nails. See **Figure 30** and **Figure 31**.

Figure 30 **Exploded View of Base for Downflow Cased Coil**

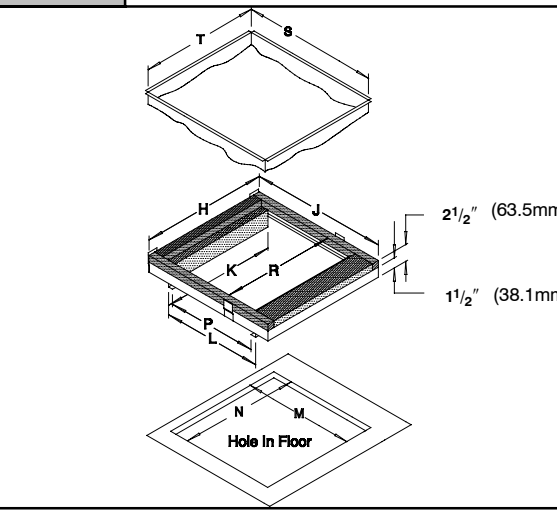
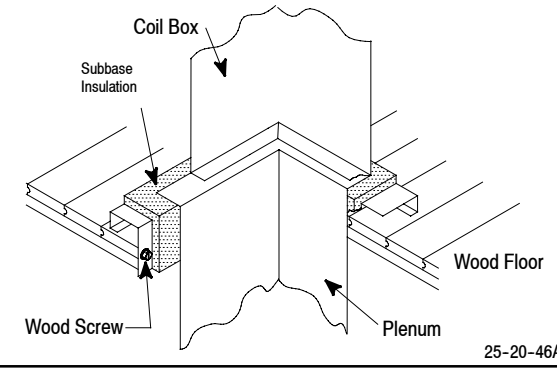
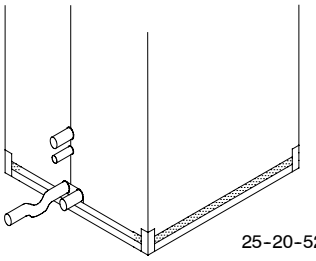


Figure 31 **Setting the Base**



Consideration must be given to the height of the base to allow for easy installation of the condensate drain. See **Figure 32**. This subbase for combustible floors has been designed so that the height of the subbase raises the downflow coil off the floor to allow easy installation of the condensate drain

Figure 32 **Condensate Line Raised by Base**



Non-Combustible Floor

Set the furnace over the opening in the floor. If necessary, grout around the base to seal air leaks between the base and the floor.

Duct Connections

In the downflow position, the return-air duct must be connected to only the top of the furnace. Top return connections can be made by removing the knockout panel in the furnace base. Return air connection through the side(s) or back of the furnace is **NOT** allowed.

Duct Design

Design and install the air distribution system to comply with Air Conditioning Contractors of America manuals or other approved methods that conform to local codes and good trade practices.

When the furnace is located in an area near or adjacent to the living area, the system should be carefully designed with returns to minimize noise transmission through the return air grille. Any blower moving a high volume of air will produce audible noise which, could be objectionable when the furnace is located very close to a living area. It is often advisable to route the return air ducts under the floor or through the attic.

- Refer to furnace **Technical Support Manual** (Blower Data) for air flow information.
- Size ductwork to handle air flow for heating and air conditioning, if used.

Duct Installation Requirements

- When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside of 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.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury or death.

Install cooling coil on furnace discharge. Cool air passing over heat exchanger could cause condensate to form resulting in heat exchanger failure.

- When a furnace is used with a cooling unit, the furnace shall be installed parallel with or on the upstream side of the cooling unit to avoid condensation in the heating element.

- With a parallel flow arrangement, the dampers or other means used to control flow of air shall be adequate to prevent chilled air from entering the furnace. Chilled air going through the furnace could cause condensation and shorten furnace life. Dampers (purchased locally) can be either automatic or manual. Manually or automatically operated dampers **MUST** be equipped with a means to prevent furnace and air conditioning operation, unless damper is in the full heat or cool position.
- Installation of locking–type dampers is recommended in all branches, or in individual ducts to balance system's air flows.
- Non–combustible, flexible duct connectors are recommended for return and supply connections to furnace.
- If air return grille is located close to the fan inlet, install at least one 90° air turn between fan and inlet grille to reduce noise.
- Ductwork installed in attic or exposed to outside temperatures requires a minimum of 2″ (50.8mm) of insulation with outdoor type vapor barrier.
- Ductwork installed in an indoor unconditioned space requires a minimum of 1″ (25.4mm) of insulation with indoor type vapor barrier.

12. Checks and Adjustments

Startup

NOTE: Refer to startup procedures in the ***Users Information Manual*.**

⚠ WARNING

ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZARD

Failure to follow this warning could result in injury, death, and/or property damage.

If any sparks, odors or unusual noises occur, immediately shut OFF gas and power to furnace. Check for wiring errors or obstruction to blower.

Gas Supply Pressure

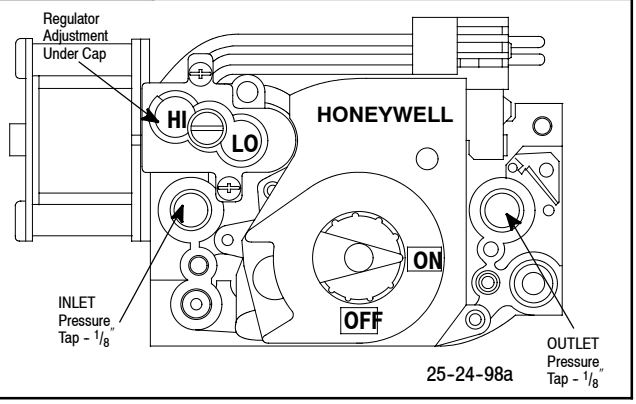
Gas supply pressure should be within minimum and maximum values listed on rating plate. Pressures are usually set by gas suppliers.

Manifold Gas Pressure Adjustments

(High and Low Heat)

NOTE: Make adjustment to manifold pressure with burners operating.

Figure 33 **Typical Gas Control Valve Honeywell**



⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to turn OFF gas at shut off before connecting manometer could result in personal injury, death and/or property damage.

Turn OFF gas at shut off before connecting manometer.

1. With gas **OFF**, connect manometer to manifold pressure tap on the outlet of gas control valve. See **Figure 33**. Use a manometer with a 0 to 12 in wc (0 to 2989 Pa) range.
2. Turn gas **ON**. Operate the furnace on High Heat by using a jumper wire on the **R** to **W1** & **W2** thermostat connections on the furnace control board.
3. Remove manifold pressure adjustment screw cover on furnace gas control valve. Turn adjusting screw counterclockwise to decrease the manifold pressure and clockwise to increase pressure. See **Figure 33**.

NOTE: Adjustment screw cover **MUST** be replaced on gas control valve before reading manifold pressure and operating furnace.

4. Set manifold pressure to value shown in **Table 5** or **Table 4.**
5. Operate the furnace on Low Heat by using a jumper wire on the **R** to **W1** thermostat connections on the furnace control board.

   Note: The SW1 DIP switch #3 should be in the on position to set the Low Heat manifold pressure. (See wiring diagram.)
6. Repeat steps 3 and 4 for Low Heat operation.
7. When the manifold pressures are properly set, replace the adjustment screw covers on the gas control valve.
8. Remove the jumper wires from the thermostat connections on the furnace control board. Remove manometer connection from manifold pressure tap, and replace plug in gas valve.
9. Return SW1 DIP switch #3 to previous setting.
10. Check for leaks at plug.

Natural Gas Input Rating Check

The gas meter can be used to measure input to furnace. Check with gas supplier for actual BTU content.

1. Turn **OFF** gas supply to all appliances other than furnace and start furnace. Use jumper wire on **R** to **W1** and **W2** for High Heat.
2. Time how many seconds it takes the smallest dial on the gas meter to make one complete revolution. Refer to **Example**.

3. Repeat step 2 with jumper wire on **R** to **W1** for Low Heat.
   NOTE: If meter uses a 2 cubic foot dial, divide results (seconds) by two.
   NOTE: SW1 DIP switch #3 must be in ON position. (See furnace wiring diagram). Return SW1 DIP switch #3 to previous setting after check.

Refer to **Example**. The Example is based on a natural gas BTU content of 1,000 BTU's per cubic foot.

Example			
Natural Gas BTU Content per cu. foot	**No. of Seconds Per Hour**	**Time Per Cubic Foot in Seconds**	**BTU Per Hour**
1,000	3,600	48	75,000
1,000 x 3,600 ÷ 48 = 75,000 BTUH			

To Determine the appliance kW input rate from a .05m^3 test dial that has been clocked at 80 seconds for one complete revolution.

Example (kW)			
Number of seconds per hour	**Number of seconds per complete rotation**	**Size of test dial (.05m^3)**	**kW m^3/h**
3,600	80	.05	2.25
3,600 ÷ 80 x .05 = 7.2 m^3/h			
2.25m^3/h x 10.35 kWh/m^3 = 23.28 kW			
23.28 x 3.412 = 79,431 BTU			

4. Remove jumper wire from **R** to **W1** and **W2**.
5. Relight all appliances and ensure all pilots are operating.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury or death.

NOx inserts for use with Natural Gas units ONLY. If Propane Gas is required, NOx inserts must be removed.

Main Burner Flame Check

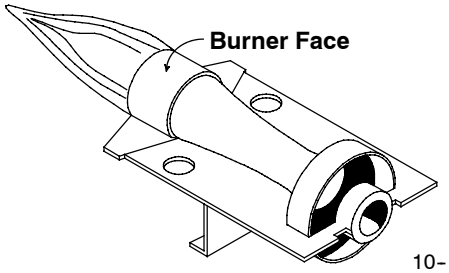
Allow the furnace to run approximately 10 minutes. Then inspect the main burner flames. See **Figure 34**.

Check for the following (**Figure 34**):

- Stable and blue flames. Dust may cause orange tips or wisps of yellow, but flames **MUST NOT** have solid, yellow tips.
- Flames extending directly from burner into heat exchanger.
- Flames do **NOT** touch sides of heat exchanger

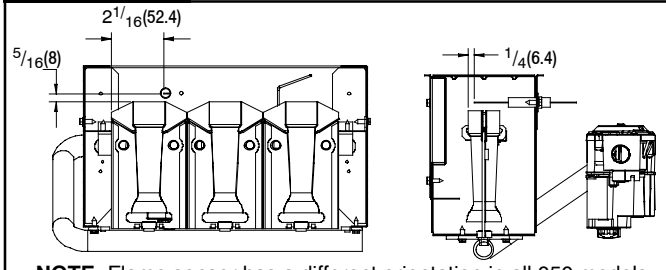
If any problems with main burner flames are noted, it may be necessary to adjust gas pressures or check for drafts.

Figure 34 Main Burner



For ignitor location see **Figure 35**.

Figure 35 Ignitor Location in(mm)



NOTE: Flame sensor has a different orientation in all 050 models.

Temperature Rise Check

⚠ CAUTION

REDUCED FURNACE LIFE HAZARD

Failure to properly set the air temperature rise may result in reduced furnace life.

Use **ONLY** the blower motor speed taps marked "Y" for YES for setting air temperature rise.

Blower Motor Speed Taps for *8MPT Model Sizes

Model Sizes	Heat Stage	LO RED	M LO BLUE	M HI ORN	HI BLK
050B12	LO HI	N N	Y Y	Y Y	Y N
075F14	LO HI	N N	Y Y	Y Y	Y Y
100F14	LO HI	N N	Y N	Y Y	Y Y
100J20	LO HI	Y N	Y N	N Y	N Y
125J20	LO HI	N N	N N	Y Y	Y Y

The blower speed **MUST** be set to give the correct air temperature rise through the furnace as marked on the rating plate. Temperature rise is the difference between supply and return air temperatures.

To check temperature rise,use the following procedure:

1. Place thermometers in supply and return air registers as close to furnace as possible, avoiding direct radiant heat from heat exchangers.
2. Operate furnace on High Heat for ten minutes with all the registers and duct dampers open by using a jumper wire on **R** to **W1** and **W2** thermostat connections on the furnace control board.

   Note: The SW1 DIP switch #3 should be in the on position. (See furnace wiring diagram)
3. Take readings and compare with range specified on rating plate.
4. If the air temperature rise is not in the correct range, the blower speed must be changed. A higher blower speed will lower the temperature rise. A lower blower speed will increase the temperature rise.
5. Repeat steps 2 thru 4 with the furnace operating on Low Heat for 10 minutes by using a jumper wire on the **R** to **W1** thermostat connections on the furnace control board.
6. Remove the jumper wire after the adjustments are complete. Return SW1 DIP switch #3 to previous setting.

Blower Adjustments (*8MPT)

Changing Blower Speed

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Turn OFF power to furnace before changing speed taps.

NOTE: The speed taps that the manufacturer sets at the factory for this furnace are based on a nominal 400 CFM per ton for cooling and the basic mid range on the temperature rise for heating.

Since the manufacturer cannot predict the static pressure that will be applied to the furnace, it is the responsibility of the installer dealer/contractor to select the proper blower motor speed leads for the application when the furnace is installed.

If it is necessary to change speeds, refer to steps below.

1. Refer to *Furnace Wiring Diagram* for location of the heating and cooling speed taps located on the furnace control board as well as location of unused blower motor speed leads. Use the chart (**Table 8**) to determine the blower motor speed settings.

Table 8	**Blower Speed Chart (*8MPT)**
Wire Color	**Motor Speed**
Black	High
Orange*	Med-High
Blue	Med-Low
Red	Low
* Med-High speed may not be provided on all models.	

2. Change the heat or cool blower motor speed by removing the motor lead from the "**HI HEAT or LO HEAT**" or "**COOL**" terminal and replace it with the desired motor speed lead from the **"M1" or "M2**" location. Connect the wire previously removed from the "**HI HEAT or LO HEAT**" or "**COOL**" terminal to the vacated **"M1" or "M2**" terminal.
3. If the same speed must be used for both heating and cooling, remove the undesired motor speed lead from the "**HI HEAT or LO HEAT**" or **"COOL**" terminal and connect that lead to the open terminal at **"M1" or "M2**" location or tape off. Attach a jumper between the "**HI HEAT or LO HEAT**" and "**COOL**" terminals and the remaining motor speed lead.

   NOTE: When using the same speed on motors with (4) speed leads, it will be necessary to tape off the terminal of the motor speed lead removed from the "**HI HEAT or LO HEAT**" or "**COOL**" terminal with electrical tape since an open terminal will not be available at the **"M1" or "M2**" location.

Continuous-Fan using "G"

Energizing the "**G**" terminal on the furnace control board provides continuous fan operation. This is done by connecting the **G** terminal of the thermostat to the **G** terminal on the furnace control board. When the FAN switch is turned from auto to ON the fan will operate continuously at "**LO HEAT**" speed. EAC will be energized in this mode.

NOTE: In heating, the fan will turn off during furnace ignition and warm up then restart at heating speed.

Hard-Wired Continuous Fan

A terminal is provided on the furnace control board located in the circulating air blower compartment for operation of the continuous fan option. This connection is intended for the low speed motor tap, and has a lower contact rating (8 amps) than the heat and cool taps. When the low speed blower lead is connected to this terminal, it will provide low speed blower operation whenever the other three speeds ("**HI HEAT or LO HEAT**" or **COOL**) are not energized.

Thoroughly check the system after modification to ensure the proper operation of the circulating air blower in all modes of operation.

Separate Speed Selections for Low Heat, High Heat, Cool, and Continuous-Fan

Connect low speed lead from circulating air motor to the **"CONT"** terminal at the furnace control board. The appropriate motor leads should already be connected to the "**HI HEAT and LO HEAT**" and **"COOL"** terminals.

Heating and Continuous-Fan Speed the Same

If it is necessary to operate the Low Heat speed and continuous-fan speed using the same blower speed, connect a jumper between the **"LO HEAT"** and **"CONT FAN"** terminals on the furnace control board.

Note: There should be only ONE motor lead going to the **"LO HEAT"** and **"CONT FAN"** terminals.

Blower Adjustments (*8MPV)

Changing Blower Speed

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to disconnect power could result in personal injury or death.

Turn OFF power to furnace before changing blower speed.

NOTE: The blower speeds that the manufacturer sets from the factory for this product are based on a nominal 400 CFM per ton cooling and the mid range on the temperature rise for heating.

Since the manufacturer cannot predict the static pressure that will be applied to the furnace, it is the responsibility of the installing dealer/contractor to select the proper speeds for the application when the furnace is installed.

If it is necessary to change speeds, refer to steps below.

1. The 115 VAC power supply to the furnace must be turned OFF before making adjustments to the motor.

   NOTE: Allow at least 1 minute before restoring power to the furnace after making Blower Control changes.
2. The heating, cooling and continuous blower speeds can be adjusted by changing the SW2 DIP switch settings that are located on the Tap Select Interface Board (see **Figure 36**).

   * Switches #1 and #2 adjust the continuous blower speeds.
   Switches #3 and #4 adjust the heating speed.
   Switches #5 and #6 adjust the cooling speed.
   Switches #7 and #8 adjust the cooling speed on/off delay profiles. See the "*Technical Support Manual"* for the switch settings for the desired airflow rates for the installation.
   The jumper J1 is used to slightly increase **(+)** or decrease **(-)** or not change **(NOM)** the blower speed selected from SW2. J1 effects **BOTH** cooling and heating airflow.
   * Continuous blower selection DIP 10 and 11 will cause the blower to run in high cooling speed for all low cooling **(Y1)** calls. Continuous blower DIP settings of 00 and 01 will allow low cooling **(Y1)** calls to operate normally.

Continuous- Fan using "G"

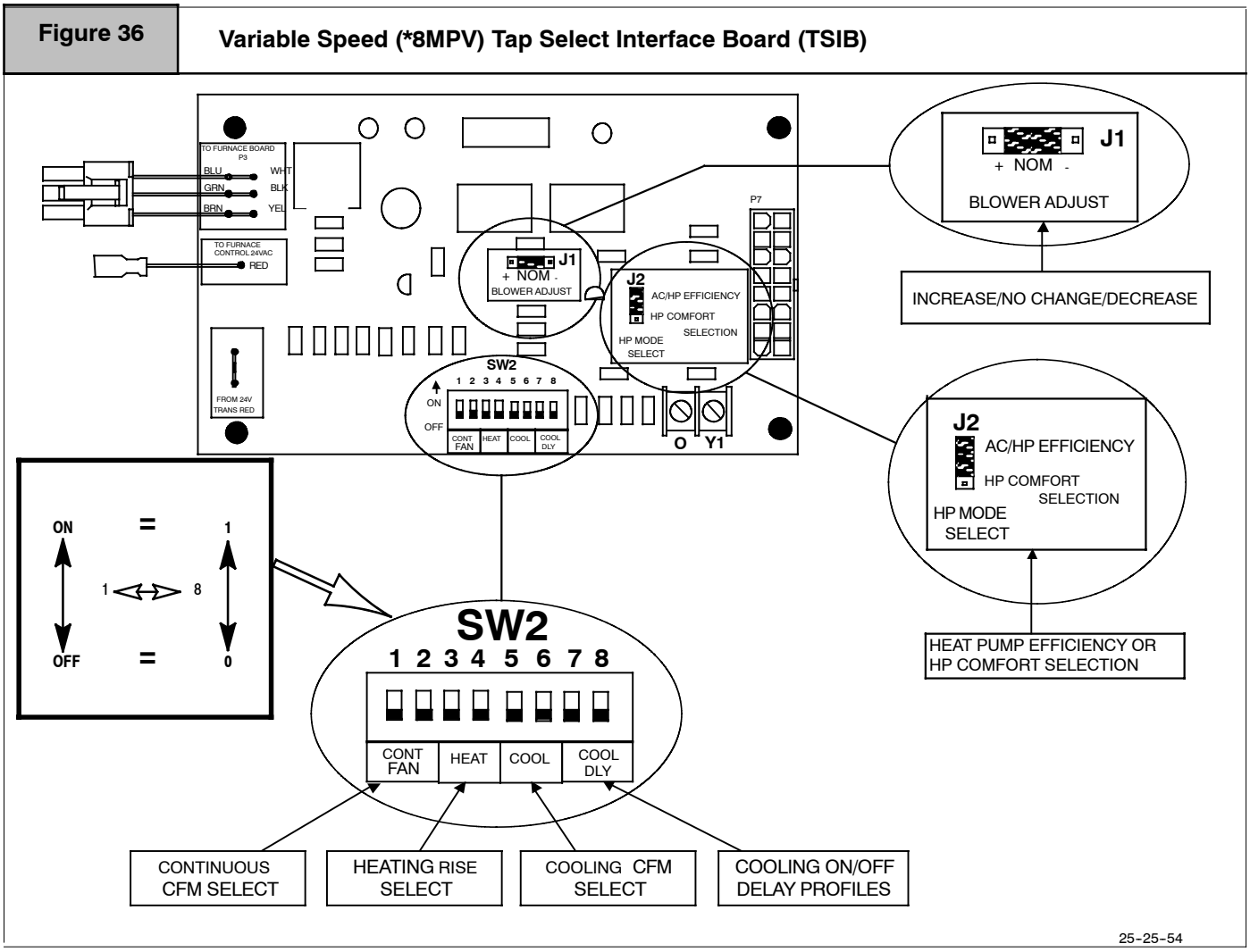
Energizing the "**G**" terminal on the furnace control board provides continuous fan operation. This is done by connecting the **G** terminal of the thermostat to the **G** terminal on the furnace control board. When the FAN switch is turned from auto to ON the fan will operate continuously at airflow selected by DIP SW2 switch #1 and DIP SW2 switch #2. EAC will be energized in this mode.

NOTE: In heating, the fan will not turn off during furnace ignition and warm up.

Hard Wired Continuous Fan Operation

Not available for variable speed models.

Figure 36 **Variable Speed (*8MPV) Tap Select Interface Board (TSIB)**



13. Furnace Maintenance

⚠ WARNING

FIRE, EXPLOSION, OR CARBON MONOXIDE POISONING HAZARD

Failure to have the furnace inspected and maintained could result in personal injury, death, and/or property damage.

It is recommended that the furnace be inspected and serviced on an annual basis (before the heating season) by a qualified service agency.

See "User's Information Manual".

⚠ WARNING

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

- **Before servicing, disconnect all electrical power to furnace.**
- **When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.**
- **Verify proper operation after servicing.**

14. Sequence of Operation & Diagnostics for *8MPT

The following is the normal operating sequence at factory default settings (SW1 OFF/ON/OFF)

Cooling (Y) Request:

24VAC signals applied to Y/Y2 & G terminals of FCB (furnace control board).

- Cool motor speed is energized after 5 second Cool Fan On Delay time.

Y/Y2 & G signals removed from FCB

- Cool motor speed is de-energized after 90 second Cool Fan Off Delay time.

NOTE: DEHUM not available on the *8MPT models.

Continuous Circulating Fan (G) Request:

24VAC signal applied to G terminal of FCB.

- Low-Heat motor speed is energized without delay.

G signal removed from FCB.

- Low-Heat motor speed is de-energized after 5 second delay.

NOTE 1) Furnace de-energizes the fan during the heat exchanger warm-up period on a call for Heating that occurs during a G request unless a blower motor lead is connected to the **CONT FAN** terminal on the FCB, in which case see NOTE 2)

NOTE 2) Heating or Cooling requests received during a Fan request cause the fan speed to change to the appropriate heat or cool speed after the Fan On Delay time expires. The fan returns to continuous circulating speed after the selected Fan Off Delay time expires following loss of the Heating or Cooling request.

Continuous Circulating Fan Hard-Wired (Cont) Request:

Field selected low speed motor tap installed on "CONT FAN" terminal.

- Low speed is energized when power applied to furnace. Operates at this speed continuously while there are no other blower demands from furnace control board. Fan demands from furnace control board for heat, cool or "G" will override hard-wired speed tap.

NOTE 3) EAC is NOT active for hard-wired mode but IS active for fan demands from furnace control board for heat, cool and "G".

Heating (W1) Request (single stage thermostat operation, SW1 DIP switch #3 must be in OFF position) (see furnace wiring diagram):

24VAC signal applied to W1 terminal of FCB.

- Inducer motor turns on at high speed.
- Following a 15 second prepurge delay after the low pressure switch closes, the ignitor begins a 17 second warm up.
- The gas valve is energized, the main burners light at Low Heat rate and flame is sensed.
- The ignitor is de-energized, and the inducer drops to low speed after the main burners ignite.
- The FCB will delay Low Heat blower operation for the 45-second Low Heat Fan On Delay time, timed from the opening of the gas valve.
- If the W1 request is still present after 12 minutes, timed from the opening of the gas valve, the inducer switches to high speed, closing the high pressure switch, then the High Heat solenoid energizes, and the fan switches to High Heat speed.

W1 signal removed from FCB.

- The gas valve de-energizes and the main burners go out.
- The inducer runs at its present speed for a 15 second postpurge period.
- The fan runs at its present speed.
- The fan de-energizes after the selected Heat Fan Off Delay time expires, timed from the gas valve de-energizing.

NOTE 4) If a new Heating request arrives while the control is waiting in the Heat Fan Off Delay time, the FCB will wait for the selected Heat Fan Off Delay then start a new heating cycle as long as the heat call remains.

Heating Request (W1 & W2) (two-stage thermostat operation, SW1 DIP switch #3 must be in ON position) (see furnace wiring diagram):

24VAC signal applied to W1 terminal of FCB.

- Same response as single stage thermostat operation (fan uses Low Stage Heat On Delay) described above except the control will not go to High Heat rate, and High Heat Fan speed unless a W2 signal is applied.

24VAC signal applied to W1 and W2 terminals of FCB.

- Same light-off routine as described for the signal stage thermostat operation except main burners light at High Heat rate, the inducer remains on high speed after ignition, and the FCB will delay blower operation at the High Heat Fan speed for 30 second On Delay time.

NOTE 5) The FCB responds without delay to the presence or loss of W2 (with W1 constant). W1 & W2 result in high inducer, High Heat rate, and High Heat Fan speed. W1 only results in low inducer, Low Heat rate, and Low Heat Fan speed.

Heating Request with Gas Shut Off:

24 VAC signal applied to W1 terminal of FCB.

The FCB will attempt 4 cycles for ignition then go to soft lockout for 3 hours, and then try for ignition again as long as the heat call remains. Power reset will clear lockout.

- Inducer motor turns on at high speed.
- Following a 15 second prepurge delay, the ignitor begins warm up.
- The ignitor glows red-hot for 22 seconds, then turns off. The FCB flashes error code 6.
- The ignitor stays off for 17 seconds, then begins to warm up again.
- The ignitor glows red hot for 22 seconds then turns off. The FCB continues flashing error code 6.
- The ignitor stays off for 17 seconds, then begins to warm up again.
- The ignitor glows red hot for 22 seconds then turns off. The FCB continues flashing error code 6.
- The ignitor stays off for 17 seconds, then begins to warm up again.
- The ignitor glows red hot for 22 seconds then turns off. The FCB proceeds to soft lockout. Stops flashing error code 6, and begins flashing error code 6 + 1.
- The inducer motor de-energizes after a 15 second post purge.

Furnace Control Board Diagnostic Codes (See Figure 37):

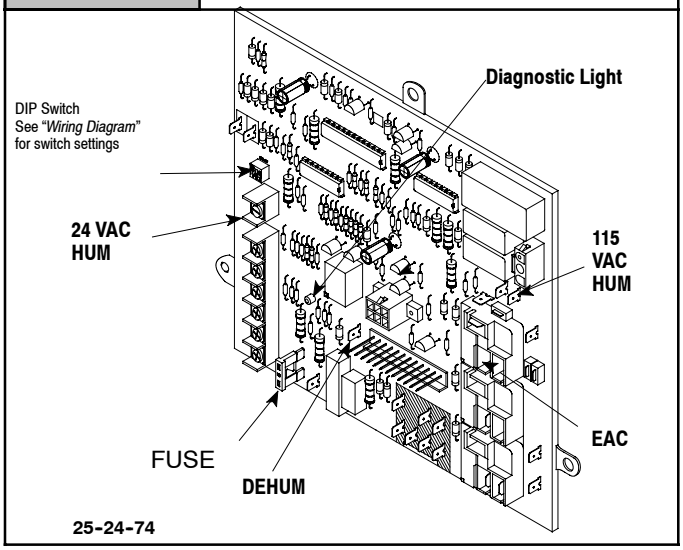
OFF	=	24VAC or 115VAC is off, fuse is open
Heartbeat	=	Normal operation or no previous Diagnostic Code
ON SOLID	=	Soft Lockout - Furnace Control Error (1 hr delay) If code repeats immediately following power reset then replace control
1 Flash	=	Not used
2 Flashes	=	Pressure switch(es) closed when should be open
3 Flashes	=	Low pressure switch open when should be closed
4 Flashes	=	Limit or flame roll-out switch open (less than 2 minutes)
5 Flashes	=	Flame sensed out of sequence
6 Flashes	=	Failure to ignite or flame sense lost while running
6 + 1 Flashes	=	Soft Lockout - Max of four trials for ignition reached (3hr delay)
7 Flashes	=	Soft Lockout - Limit or flame roll-out switch open longer than 2 minutes (1 hr delay) (roll-out switch requires manual reset)
8 Flashes	=	Permanent Lockout - Gas valve relay contact stuck closed or miswired gas valve (power reset only)
9 Flashes	=	High pressure switch open when should be closed
10 Flashes	=	Line voltage polarity or improper transformer phasing on twinned applications

NOTE: The 6 + 1 designation indicates a combination of flash codes.

***** If status code recall is needed, briefly (2-3 seconds) remove then reconnect one limit switch wire (main or rollout) to display last stored status code. Do not remove power or blower door before initiating status code recall or code will be lost. Code is automatically cleared after 72 hours or upon power reset.

***** Proper flame sense microamps: 0.7 microamps D.C. minimum, 2.0 - 4.0 microamps nominal

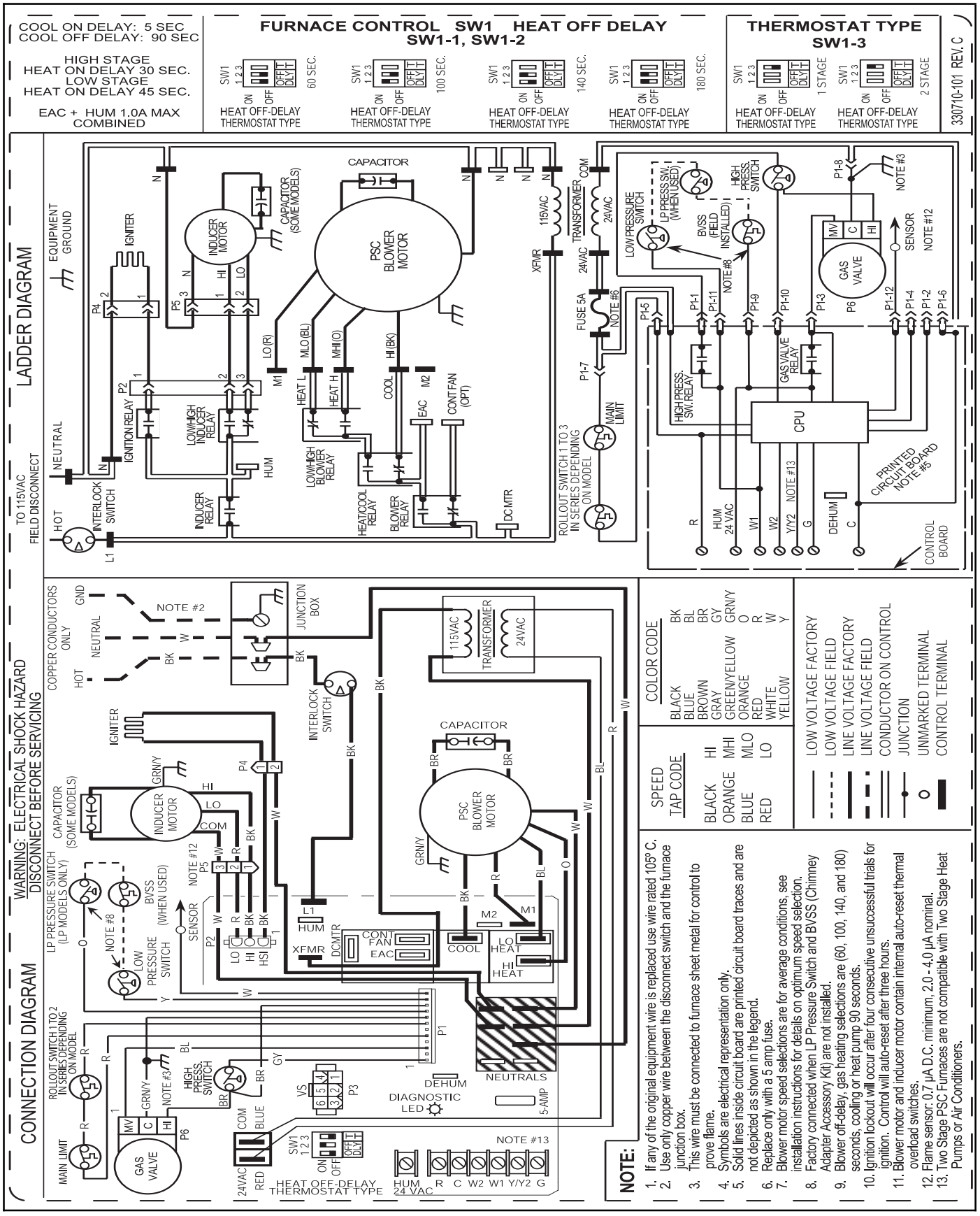
Figure 37 **Control Board**



HUMIDIFIER - The 24VAC HUM is energized when the low pressure switch closes on a call for heat. The 115V HUM (called HUM on Control) is energized when the inducer is energized.

ELECTRONIC AIR CLEANER - EAC is energized when there is a blower speed call. It is NOT energized when blower operates in the hard-wired continuous fan mode.

15. Wiring Diagram *8MPT (Two Stage Heating with PSC Motor)



16. Sequence of Operation & Diagnostics for *8MPV

The following is the normal operating sequence at factory default settings (SW1 OFF/ON/OFF, SW2 all OFF)

NOTE: SW1 DIP switches (G, Y/Y2, W1, W2 thermostat terminals) and DEHUM (1/4" male quick connect terminal) are located on the FCB.

SW2 DIP switches and Y1 and O thermostat terminals are located on the TSIB.

Low Cooling (Y1) Request:

24VAC signals applied to Y1 & G terminals of TSIB (Tap Select Interface Board) and FCB (Furnace Control Board), respectively.

- Low Cooling motor speed is energized after 5 second Cool Fan On Delay time.

Y1 & G signals removed from TSIB and FCB

- Low Cooling motor speed is de-energized after 90 second Cool Fan Off Delay time.

Cooling (Y1) and dehumidification (DEHUM) requests:

- 24 VAC signals applied to Y1, DEHUM & G terminals of TSIB and FCB.
- Same operation as the cooling (Y1) request, except the cooling airflow is reduced 20% to compensate for high humidity conditions during cooling operation. The low cooling airflow returns to the normal setting after the DEHUM signal is removed.

High Cooling (Y1 & Y/Y2) or (Y/Y2) Request:

24VAC signals applied to Y1 & Y/Y2 & G or Y/Y2 & G terminals of FCB (Furnace Control Board).

- High Cooling motor speed is energized after 5 second Cool Fan On Delay time.

Y1 & Y/Y2 & G or Y/Y2 & G signals removed from TSIB and FCB

- High Cooling motor speed is de-energized after 90 second Cool Fan Off Delay time.

High Cooling (Y1 & Y/Y2 or Y/Y2) and dehumidification (DEHUM) requests:

- 24 VAC signals applied to Y1 & Y/Y2 or Y/Y2, DEHUM, & G terminals of and FCB.
- Same operation as the high cooling (Y1 & Y/Y2 or Y/Y2) request, except the cooling airflow is reduced 20% to compensate for high humidity conditions during cooling operation. The high cooling airflow returns to the normal setting after the DEHUM signal is removed.

Low or high cooling and O terminal (Heat Pump mode):

- If the J2 jumper is in the AC/HP EFFICIENCY position, there will be no change in blower airflow regardless of the O terminal being energized or de-energized.
- If the J2 jumper is in the HP COMFORT position, then there will be a 10% reduction in airflow when the O terminal is de-energized (HP heating) and no airflow reduction when O is energized (HP cooling).

NOTE 1) The motor has been set up to recognize the O terminal as energized during cooling calls (reversing valve energized for cooling).

Continuous Circulating Fan (G) Request:

24VAC signal applied to G terminal of FCB.

- Continuous fan speed is energized without delay.

G signal removed from FCB.

- Continuous fan speed is de-energized after 5 second delay.

NOTE 2) Heat or Cooling requests received during a Fan request, cause the fan speed to change to the appropriate heat or cool speed after the Fan On Delay time expires. The fan returns to continuous circulating speed after the selected Fan Off Delay time expires following loss of the Heating or Cooling request.

NOTE 3) Hard-wire option not available for variable speed models.
NOTE 4) Continuous blower selection DIP 10 and 11 will cause the blower to run in high cooling speed for all low cooling **(Y1)** calls. Continuous blower DIP settings of 00 and 01 will allow low cooling **(Y1)** calls to operate normally.

Heating (W1) Request (single stage thermostat operation, SW1 DIP switch #3 on the FCB must be in OFF position) (see furnace wiring diagram):

24VAC signal applied to W1 terminal of FCB.

- Inducer motor turns on at high speed.
- Following a 15 second prepurge delay after the low pressure switch closes, the ignitor begins a 17 second warm up.
- The gas valve is energized, the main burners light at Low Heat rate.
- The ignitor is de-energized, and the inducer drops to low speed after the main burners ignite.
- The FCB will delay Low Heat blower operation for the 45-second Low Heat Fan On Delay time timed from the opening of the gas valve.
- If the W1 request is still present after 12 minutes, timed from the opening of the gas valve, the inducer switches to high speed, closing the high pressure switch, then the High Heat solenoid energizes, and the fan switches to High Heat speed.

W1 signal removed from FCB.

- The gas valve de-energizes and the main burners go out.
- The inducer runs at its present speed for a 15 second postpurge period.
- The fan runs at its present speed.
- The blower de-energizes after the selected Heat Fan Off Delay time expires timed from the gas valve de-energizing.

NOTE 5) If a new Heating request arrives while the control is waiting for the Heat Fan Off Delay time to expire, the FCB will wait for the selected Heat Fan Off Delay, and then start a new heating cycle.

Heating (W1 & W2) Request (two-stage thermostat operation, SW1 DIP switch #3 must be in ON position) (see furnace wiring diagram):

24VAC signals applied to W1 terminal of FCB.

- Same response as single stage thermostat operation described above except the burners, inducer, and blower will not go to high heat rate, and High Heat Fan speed unless a W2 signal is applied.

24VAC signal applied to W1 and W2 terminals of FCB.

- Same light-off routine as described for the signal stage thermostat operation except burners light at High Heat rate, the inducer remains on high speed after ignition, and the FCB will delay High Heat blower operation for the 30-second High Heat Fan On Delay.

NOTE 6) The FCB responds without delay to the presence or loss of W2 (with W1 constant). W1 & W2 result in high inducer, High Heat rate, and High Heat Fan speed. W1 only results in low speed inducer, Low Heat rate, and Low Heat Fan speed.

Heating Request with Gas Shut Off:

24 VAC signals applied to W1 terminal of FCB.
The FCB will attempt 4 cycles for ignition then go to soft lockout for 3 hours, and then try for ignition again as long as the heat call remains. Power reset will clear lockout.

- Inducer motor turns on at high speed.
- Following a 15 second prepurge delay after the low pressure switch closes, the ignitor begins warm up.
- The ignitor glows red-hot for 22 seconds, then turns off. The FCB flashes error code 6.
- The ignitor stays off for 17 seconds, then begins to warm up again.
- The ignitor glows red hot for 22 seconds then turns off. The FCB continues flashing error code 6.
- The ignitor stays off for 17 seconds, then begins to warm up again.
- The ignitor glows red hot for 22 seconds then turns off. The FCB continues flashing error code 6.
- The ignitor stays off for 17 seconds, then begins to warm up again.
- The ignitor glows red hot for 22 seconds then turns off. The FCB proceeds to soft lockout. Stops flashing error code 6, and begins flashing error code 6 + 1.
- The inducer motor de-energizes 15 seconds after error code 6 + 1 starts flashing.

Furnace Control Board Diagnostic Codes (See Figure 37):

OFF	=	24VAC or 115VAC is off, fuse is open
Heartbeat	=	Normal operation or no previous Diagnostic Code
ON SOLID	=	Soft Lockout - Furnace Control Error (1 hr delay)
		If code repeats immediately following power reset then replace control
1 Flash	=	Not used
2 Flashes	=	Pressure switch(es) closed when should be open
3 Flashes	=	Low pressure switch open when should be closed
4 Flashes	=	Limit or flame roll-out switch open (less than 2 minutes)
5 Flashes	=	Flame sensed out of sequence
6 Flashes	=	Failure to ignite or flame sense lost while running
6 + 1 Flashes	=	Soft Lockout - Max of four trials for ignition reached (3 hr delay)
7 Flashes	=	Soft Lockout - Limit or flame roll-out switch open longer than 2 minutes (1 hr delay)
		(roll-out switch requires manual reset)
8 Flashes	=	Permanent Lockout - Gas valve relay contact stuck closed or miswired gas valve (power reset only)
9 Flashes	=	High pressure switch open when should be closed
10 Flashes	=	Improper transformer phasing on twinned applications or improper line voltage polarity.

***** If status code recall is needed, briefly (2-3 seconds) remove then reconnect one limit switch wire (main or rollout) to display last stored status code. Do not remove power or blower door before initiating status code recall or code will be lost. Code is automatically cleared after 72 hours or upon power reset.

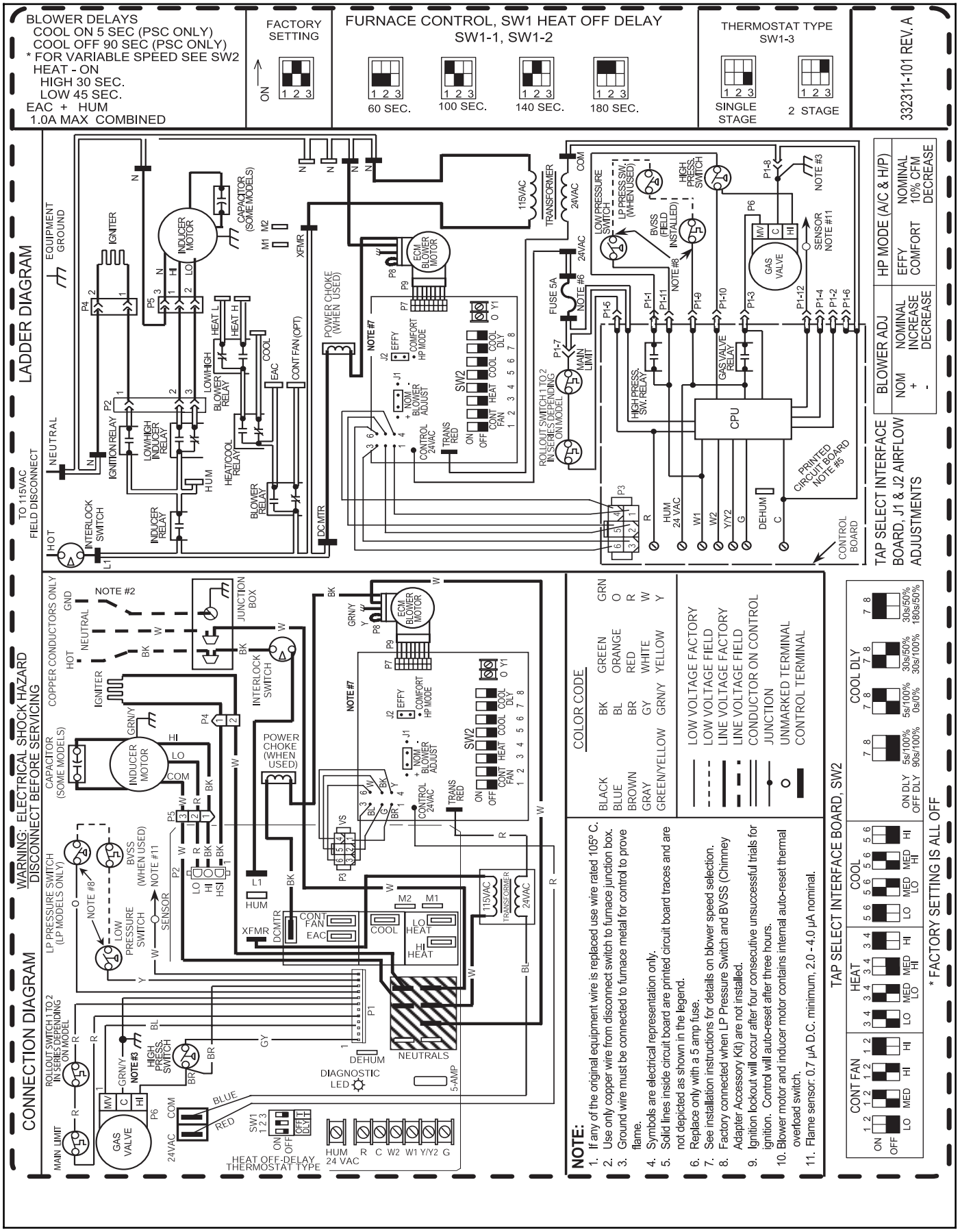
***** Proper flame sense microamps: 0.7 microamps D.C. minimum, 2.0 - 4.0 microamps nominal

NOTE 7) Continuous blower selection DIP 10 and 11 will cause the blower to run in high cooling speed for all low cooling **(Y1)** calls. Continuous blower DIP settings of 00 and 01 will allow low cooling **(Y1)** calls to operate normally.

HUMIDIFIER - The 24VAC HUM is energized when the low pressure switch closes on a call for heat. The 115V HUM (called HUM on Control) is energized when the inducer is energized.

ELECTRONIC AIR CLEANER - EAC is energized when there is a blower speed call. It is NOT energized when blower operates in the hard-wired continuous fan mode.

17. Wiring Diagram *8MPV (Variable Speed Blower Motor)



18. Thermostat Wiring Guide

1. These diagrams are for reference. See thermostat wiring instructions for specific terminal assignments, connections or operation.
2. Humidifier/humidistat is optional and not included with the furnace.
3. Dehumidify feature (MPV models only) requires thermostat with **DEHUM** feature or a separate dehumidistat to get the dehumidification operation. Dehumidistat is optional and not included with the furnace.
4. Underlined terminal indicates intended use for multiple function terminals.
5. TSIB terminals only available on MPV models.
6. Two-stage Air Conditioning or two-stage Heat Pump capability only available with MPV models.
7. **W2** furnace operation is from furnace control algorithm SW1 DIP switch #3 (TT) set to OFF. Furnace runs in Low Heat for 12 minutes then switches to High Heat if heating call still exists.
8. **24V HUM** terminal on furnace control is used to power a humidifier (on call for heat and pressure switch closed) if no **HUM** thermostat option is available.
9. **DEHUM** provides a 20% reduction in airflow (when **Y1** or **Y1** + **Y2** is energized) when the furnace control **DEHUM** terminal is energized with 24V.
10. If no **DEHUM** thermostat option is available, a dehumidistat that has closed contacts on a call for dehumidify may be used
11. **O** provides a 10% reduction in airflow when **Y1** or **Y1** + **Y2** is energized and **O** is NOT energized. (J2 jumper on TSIB must be in HP COMFORT position to get this function. AC/HP EFFICIENCY position results in no reduction of airflow for **Y1** or **Y1** + **Y2** calls regardless of **O** being energized or not.)
12. For Heat Pump/Furnace systems, refer to Fossil Fuel Kit or Dual Fuel Thermostat Installation Instructions for wiring.

Figure 38 **HUM and DEHUM Terminal available from Thermostat. Humidifier Wiring (*MPT/MPV) Models and Dehumidify Wiring (*MPV Models only)**

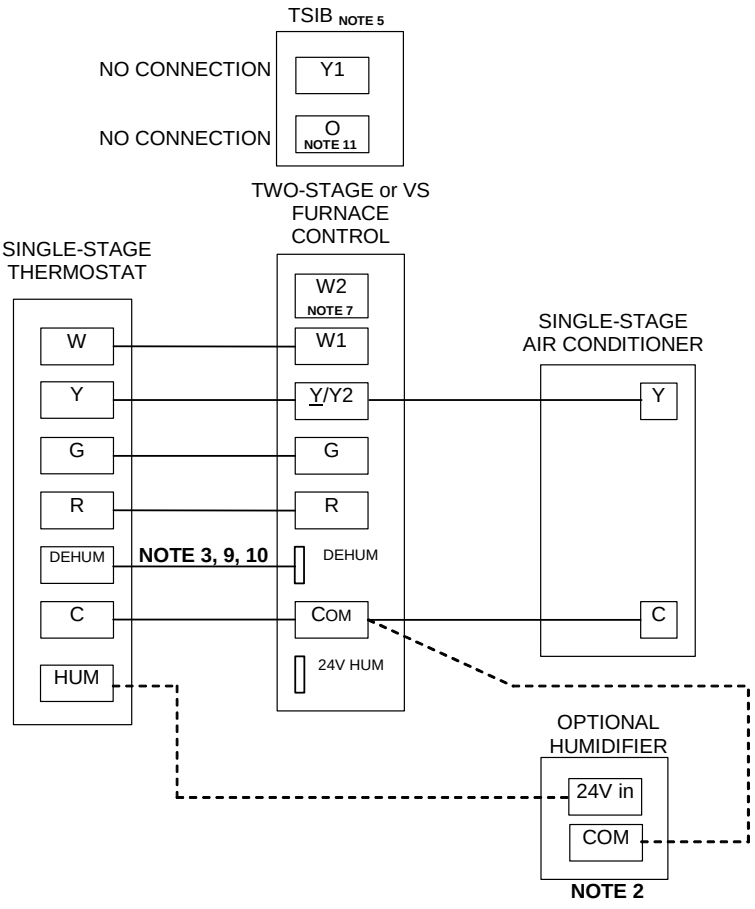


Figure 39 **No HUM and/or DEHUM Terminal available from thermostat. Humidifier Wiring (*MPT/MPV models) Dehumidify wiring (*MPV models only)**

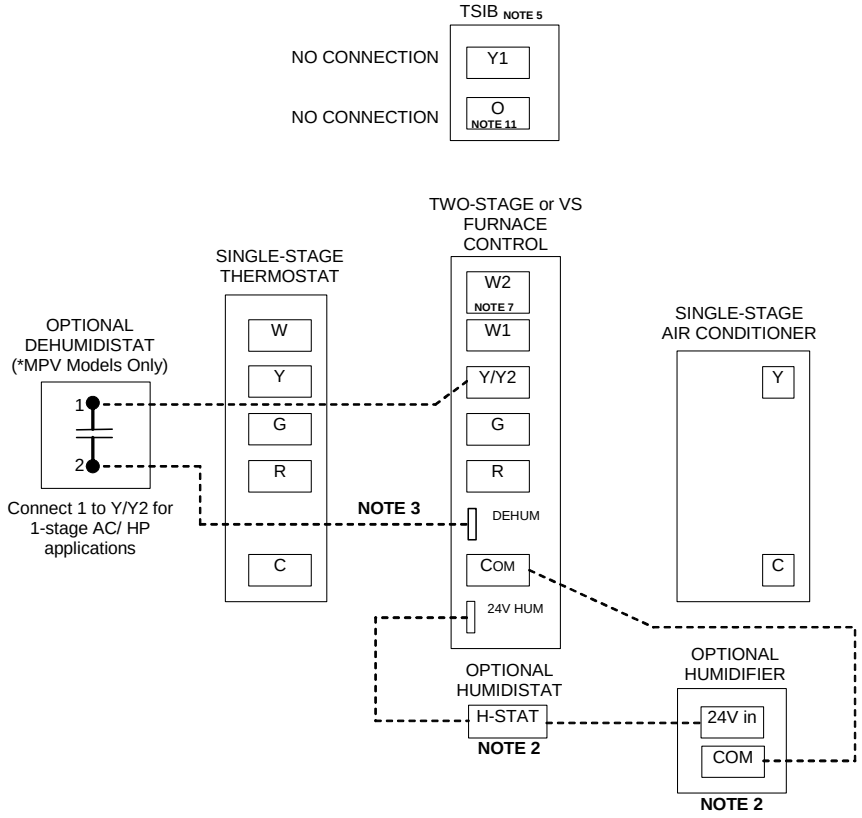


Figure 40 **Single-Stage Thermostat with Two-Stage or Variable Speed Furnace (*MPT/MPV Models) and Single-Stage Air Conditioner**

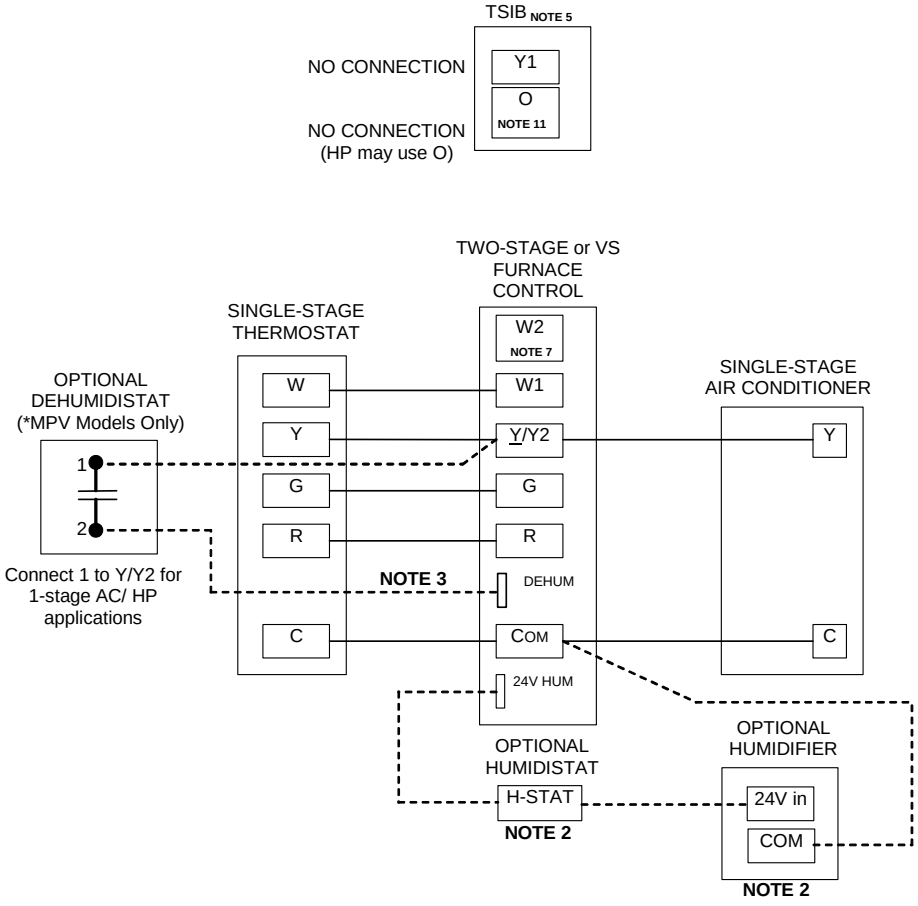


Figure 41 **Two-Stage Thermostat with Two-Stage Furnace or Variable Speed Furnace (*MPT/MPV Models) and Single-Stage Air Conditioner**

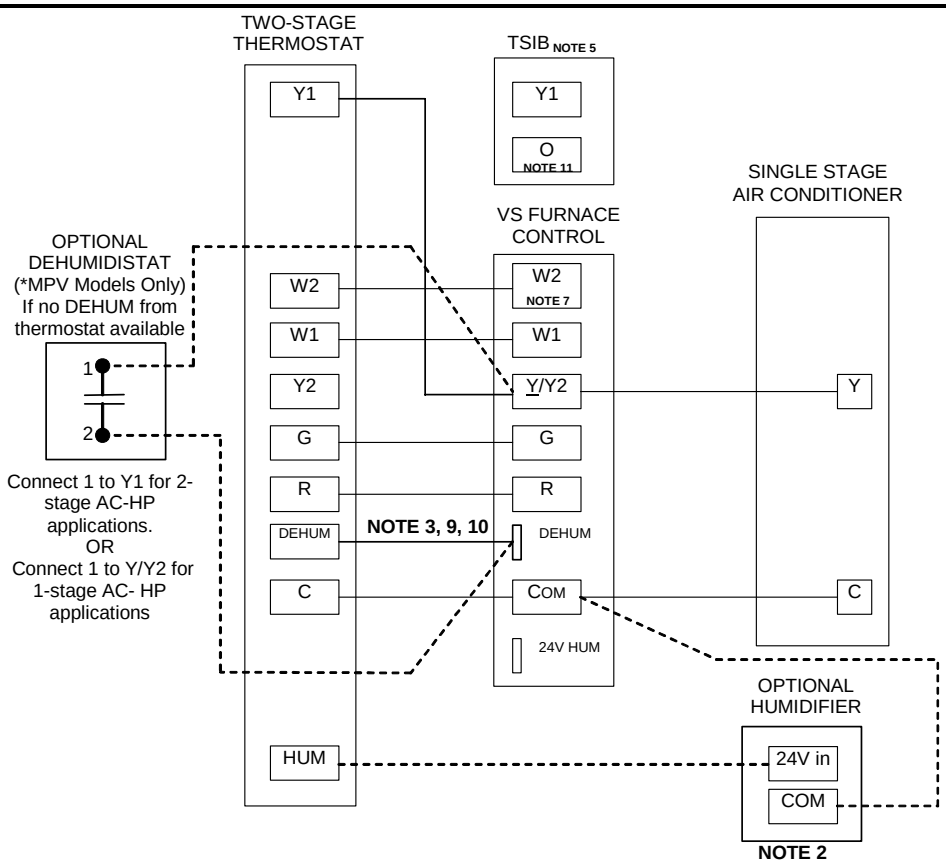


Figure 42 **Two-Stage Thermostat with Variable Speed Furnace (*MPV Models only) and Two-Stage Air Conditioner**