Installation, Start-up, and Operating Instructions

2-SPEED, 2-STAGE INDUCED COMBUSTION DELUXE 4-WAY MULTIPOISE FURNACE

312AAV Series 100

Cancels: New

II 312A-91–1
11–00

NOTE: Read the entire instruction manual before starting the installation.

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SAFETY CONSIDERATIONS

Installing and servicing heating equipment can be hazardous due to gas and electrical components. **Only trained and qualified personnel should install, repair, or service heating equipment.** Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters.

Observe precautions in the literature, on tags, and on labels attached to or shipped with the unit and other safety precautions that may apply.

REGISTERED QUALITY SYSTEM

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

Wear safety glasses and work gloves. Have fire extinguisher available during start-up and adjustment procedures and service calls.

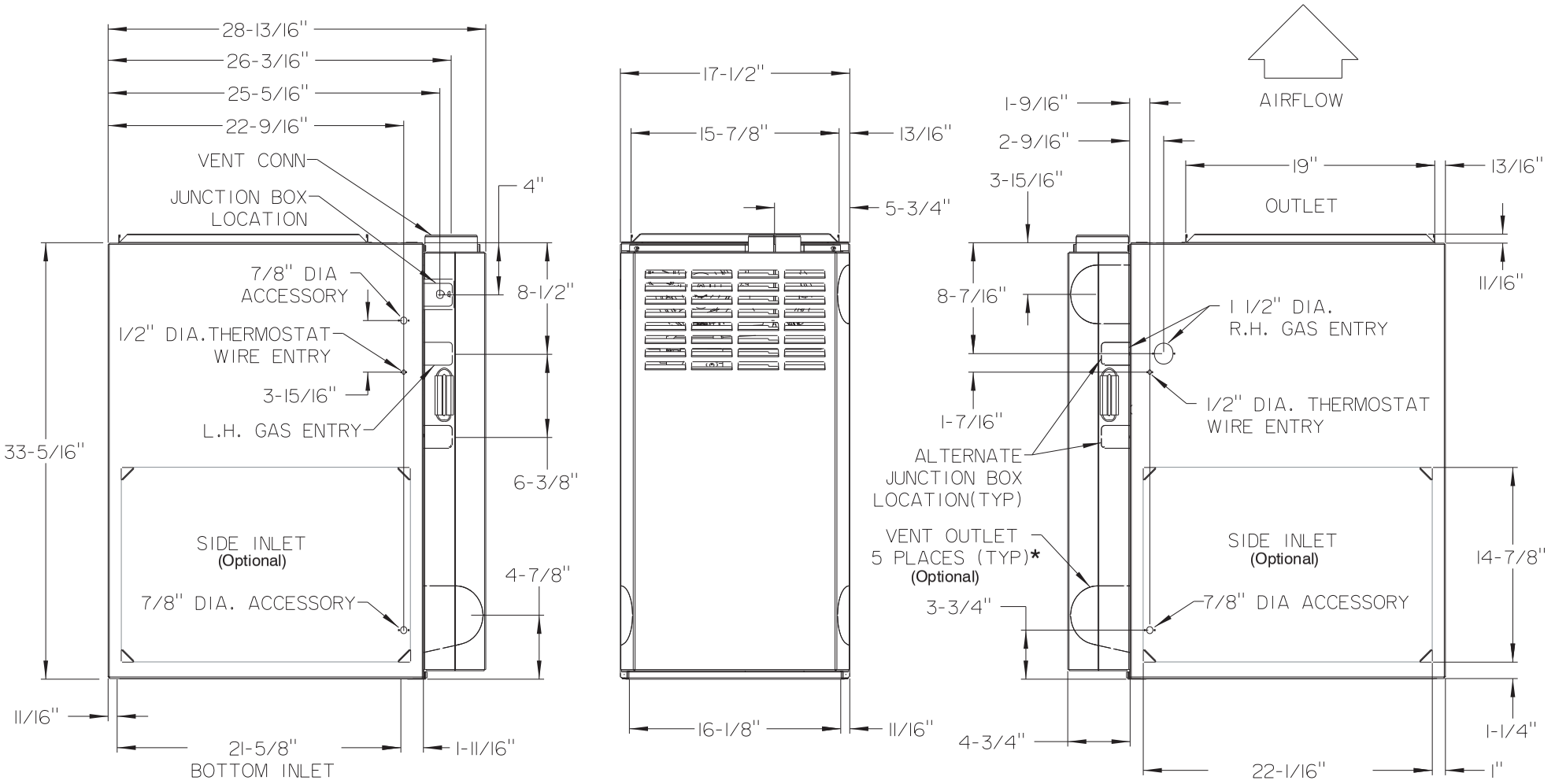
This is the safety alert symbol ⚠ . When you see this symbol on the furnace and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. 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 a hazard which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **would** 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.

INTRODUCTION

The 312AAV, Series 100 (limited) 4–way multipoise Category I furnace is CSA (A.G.A. and C.G.A.) design-certified for natural and propane gas and for installation in alcoves, attics, basements, closets, utility rooms, crawlspaces, and garages. The furnace is factory-shipped for use with natural gas. A CSA (A.G.A. and C.G.A.) listed gas conversion kit is required to convert furnace for use with propane gas. This furnace is **not** approved for installation in mobile homes, recreational vehicles, or outdoors.

These furnaces **shall not** be installed directly on carpeting, tile, or any other combustible material other than wood flooring. For downflow installations, a factory accessory floor base **must** be used when installed on combustible materials and wood flooring. This special base is not required when this furnace is installed on the manufacturer's coil assembly, or when the manufacturer's coil box is used.



NOTES: 1. Two additional 7/8-in. dia holes are located in the top plate.
2. Minimum return-air openings at furnace, based on metal duct. If flex duct is used, see flex duct manufacturer's recommendations for equivalent diameters.
3. Minimum return-air opening at furnace:
   a. For 800 CFM–16-in. round or 14½ x 12-in. rectangle.
   b. For 1200 CFM–20-in. round or 14½ x 19½-in. rectangle.

* In upflow, one optional vent is located on the bottom of the outer door.

Fig. 1–Dimensional Drawing A00264

INSTALLATION

MINIMUM INCHES CLEARANCE TO COMBUSTIBLE CONSTRUCTION
DISTANCE MINIMALE EN POUCES AUX CONSTRUCTIONS COMBUSTIBLES

This forced air furnace is equipped for use with natural gas at altitudes 0-10,000 ft (0-3,050m).

An accessory kit, supplied by the manufacturer,shall be used to convert to propane gas use or may be required for some natural gas applications.

This furnace is for indoor installation in a building constructed on site.

This furnace may be installed on combustible flooring in alcove or closet at minimum clearance as indicated by the diagram from combustible material .

This furnace may be used with a Type B-1 Vent and may be vented in common with other gas-fired appliances.

Cette fournaise à air pulsé est équipée pour utilisation avec gaz naturel et altitudes comprises entre 0-3,050m (0-10,000 pi).

Utiliser une trousse de conversion, fournie par le fabricant, pour passer au gaz propane ou pour certaines installations au gaz naturel.

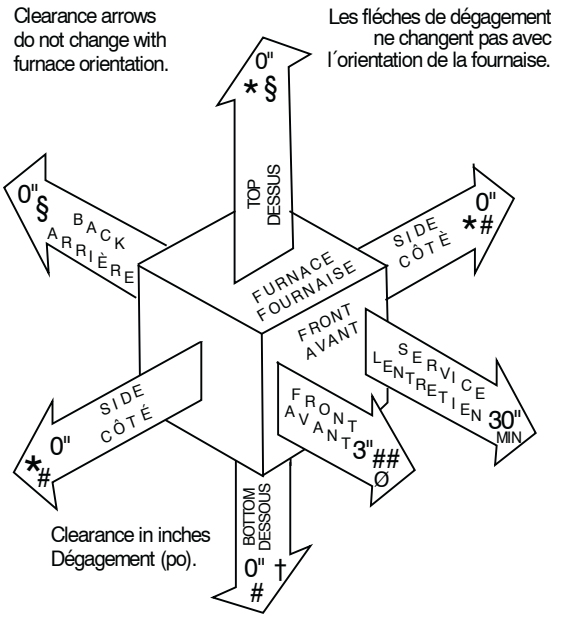
Cette fournaise est prévue pour être installée dans un bâtiment construit sur place.

Cette fournaise peut être installée sur un plancher combustible dans une alcôve ou dans un garde-robe en respectant le minimum d'espace libre des matériaux combustibles, tel qu'indiqué sur le diagramme

Cette fournaise peut être utilisée avec un conduit d´évacuation de Type B-1 ou connectée au conduit commun d´autres appareils à gaz.

This furnace is approved for UPFLOW, DOWNFLOW, and HORIZONTAL installations.

Cette fournaise est approuvée pour l´installation HORIZONTALE et la circulation d´air VERS LE HAUT, VERS LE BAS.



MINIMUM INCHES CLEARANCE TO COMBUSTIBLE CONSTRUCTION

ALL POSITIONS:

\# Vent Clearance to combustibles: For Single Wall vents 6 inches (6 po). For Type B-1 vent type 1 inch (1 po).

\## For single wall vent type 6 inches. For type B-1 vent type 3 inches.

Ø 18 inches front clearance required for alcove.

* 1 inch clearance required from combustibles to supply plenum.

DOWNFLOW POSITIONS:

† For installation on combustible floors only when installed on special base No. KGASB0201ALL, Coil Assembly, Part No. CD5 or CK5, or Coil Casing, Part No. KCAKC.

HORIZONTAL POSITIONS:

§ Line contact is permissible only between lines formed by intersections of top and back of furnace jacket, and building joists, studs, or framing.

DÉGAGEMENT MINIMUM EN POUCES AVEC ÉLÉMENTS DE CONSTRUCTION COMBUSTIBLES

POUR TOUS LES POSITIONS:

\# Dégagement de l' évent avec combustibles: Pour conduit d'évacuation à paroi simple 6 po (6 inches). Pour conduit d'évacuation de Type B-1 1 po (1 inch).

\## Pour conduit d'évacuation à paroi simple 6 po (6 inches). Pour conduit d'évacuation de Type B-1 3 po (3 inches).

Ø Dans une alcôve, on doit maintenir un dégagement à l'avant de 18 po (450mm).

* Un pouce d'espace libre nécessaire entre les matériaux combustibles et le plenum d'alimentation.

POUR LA POSITION COURANT DESCENDANT:

† Pour l'installation sur le plancher combustible seulement quand on utilis la base spéciale, piéce n° KGASB0201ALL, l' ensemble serpentin, piéce n° CD5 ou CK5, ou le carter de serpentin, piéce n° KCAKC.

POUR LA POSITION HORIZONTALE:

§ Le contact avec les conduites de gaz est seulement permis aux intersections des conduites formées par le dessus et l'arriére de l'enveloppe de la fournaise et les solives, les montants ou le cadrage de l'édifice.

326379-101 REV. A (lit-bottom)

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Fig. 2–Clearances to Combustibles

CAUTION: Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rate, air temperature rise, and unit sizing. Improper installation or misapplication may require excessive servicing or cause premature component failure.

WARNING: Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, local gas supplier, or your distributor or branch for information and assistance. The qualified installer or agency must use only factory-authorized and listed kits or accessories when modifying this product.
Failure to follow this warning could result in electrical shock, fire, personal injury or death.

This furnace is designed for minimum continuous return-air temperature of 60°F db or intermittent operation down to 55°F db. Return-air temperature must not exceed 85°Fdb. (See Fig. 3.)

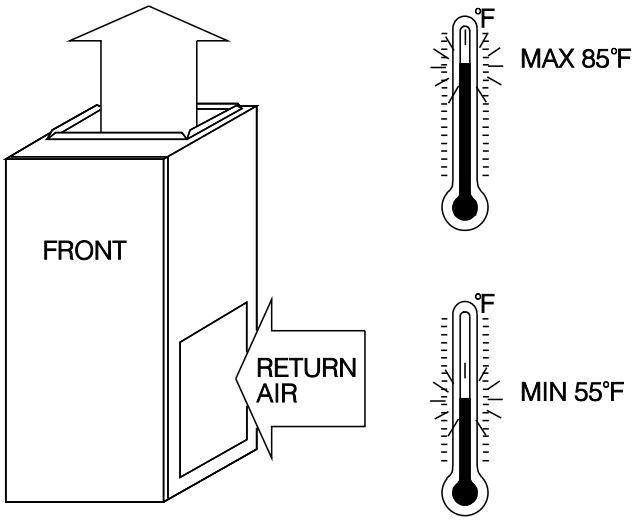

Fig. 3–Return Air Temperature

For accessory installation details, refer to the applicable instruction literature.

NOTE: Remove all shipping brackets and materials before operating the furnace.

CODES AND STANDARDS

Follow all national and local codes and standards in addition to these instructions. The installation must comply with regulations of the serving gas supplier, local building, heating, plumbing, and other codes. In absence of local codes, the installation must comply with the national codes listed below and all authorities having jurisdiction.

In the United States and Canada, follow all codes and standards for the following:

I. SAFETY

- US: National Fuel Gas Code (NFGC) NFPA 54–1999/ANSI Z223.1–1999 and the Installation Standards, Warm Air Heating and Air Conditioning Systems ANSI/NFPA 90B
- CANADA: CAN/CGA-B149.1–and .2–M95 National Standard of Canada. Natural Gas and Propane Installation Codes (NSCNGPIC)

II. GENERAL INSTALLATION

- US: Current edition of the NFGC and the NFPA 90B. For copies, contact the National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269; or for only the NFGC, contact the American Gas Association, 400 N. Capitol, N.W., Washington DC 20001
- CANADA: NSCNGPIC. For a copy, contact Standard Sales, CSA International, 178 Rexdale Boulevard, Etobicoke (Toronto), Ontario, M9W 1R3 Canada

III. COMBUSTION AND VENTILATION AIR

- US: Section 5.3 of the NFGC, Air for Combustion and Ventilation
- CANADA: Part 7 of NSCNGPIC, Venting Systems and Air Supply for Appliances

IV. DUCT SYSTEMS

- US and CANADA: Air Conditioning Contractors Association (ACCA) Manual D, Sheet Metal and Air Conditioning Contractors National Association (SMACNA), or American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 1997 Fundamentals Handbook Chapter 32.

V. ACOUSTICAL LINING AND FIBROUS GLASS DUCT

- US and CANADA: current edition of SMACNA and NFPA 90B as tested by UL Standard 181 for Class I Rigid Air Ducts

VI. GAS PIPING AND GAS PIPE PRESSURE TESTING

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

VII. ELECTRICAL CONNECTIONS

- US: National Electrical Code (NEC) ANSI/NFPA 70–1999
- CANADA: Canadian Electrical Code CSA C22.1

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS PROCEDURE

Use this procedure for all installed and uninstalled furnaces. An ESD service kit (available from commercial sources) may be used to prevent ESD damage.

CAUTION: Electrostatic discharge can affect electronic components. Follow the Electrostatic Discharge Precautions Procedure listed below during furnace installation and servicing to protect the furnace electronic control. Precautions will prevent electrostatic discharges from personnel and hand tools which are held during the procedure. These precautions will help to avoid exposing the control to electrostatic discharge by putting the furnace, the control, and the person at the same electrostatic potential.

1. Disconnect all power to the furnace. Multiple disconnects may be required. DO NOT TOUCH THE CONTROL OR ANY WIRE CONNECTED TO THE CONTROL PRIOR TO DISCHARGING YOUR BODY'S CHARGE TO GROUND.
2. Firmly touch a clean, unpainted metal surface on the furnace chassis close to the control. Tools held in hand during grounding will be discharged.
3. You may proceed to service the control or connecting wires as long as you do nothing to recharge your body (moving or shuffling feet, touching ungrounded objects, etc.)
4. If you touch ungrounded objects, firmly touch a clean, unpainted metal surface again before touching control or wires.

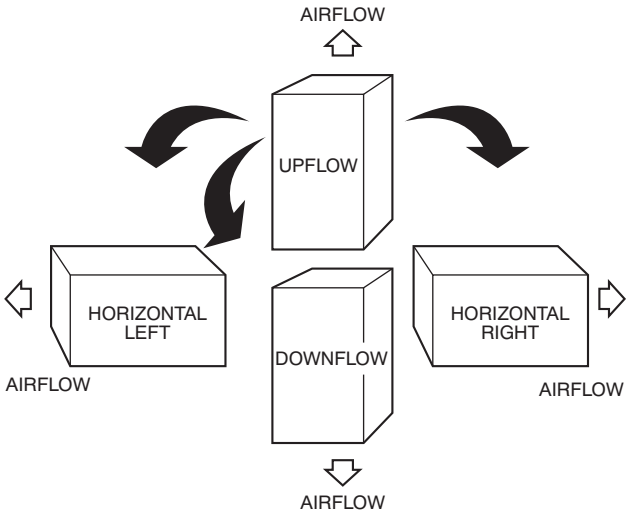

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Fig. 4–Multipoise Orientations

5. Before removing a new control from it's container, discharge your body's charge to the ground. If the control is to be installed in a furnace, follow items 1 through 4 before bringing the control or yourself in contact with the furnace. Put all used and new controls into containers before touching ungrounded objects.

APPLICATIONS

I. GENERAL

This multipoise furnace is shipped in packaged configuration. Some assembly and modifications are required when used in any of the four applications shown in Fig. 4.

II. UPLFLOW APPLICATIONS

In an upflow application, the blower is located below the burner section, and conditioned air is discharged upward.

III. DOWNFLOW APPLICATIONS

In a downflow application, the blower is located above the burner section, and conditioned air is discharged downward.

IV. HORIZONTAL LEFT (SUPPLY-AIR DISCHARGE) APPLICATIONS

In a horizontal left application, the blower is located to the right of the burner section, and conditioned air is discharged to the left.

V. HORIZONTAL RIGHT (SUPPLY-AIR DISCHARGE) APPLICATIONS

In a horizontal right application, the blower is located to the left of the burner section, and conditioned air is discharged to the right.

LOCATION

I. GENERAL

This furnace must:

- be installed so the electrical components are protected from water.
- **not** be installed directly on any combustible material other than wood flooring (refer to INTRODUCTION).
- be located as close to the chimney/vent and attached to an air distribution system. Refer to Air Ducts section.
- be provided ample space for servicing and cleaning. Always comply with minimum fire protection clearances shown on the furnace rating plate.

⚠ **CAUTION:** Do not install furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements are met, in addition to all local codes and ordinances.

⚠ **CAUTION:** Do not operate the furnace during construction. If the furnace is required, use clean outside air free of chlorine and fluorine compounds for combustion and ventilation. These compounds form acids that corrode the heat exchangers and vent system. These compounds are found in paneling and dry wall adhesives, paints, thinners, masonry cleaning materials, and other solvents.

⚠ **WARNING:** DO NOT install the furnace on its back. Safety control operation will not perform properly. A failure to follow this warning can cause a fire, personal injury, or death.

II. LOCATION RELATIVE TO COOLING EQUIPMENT

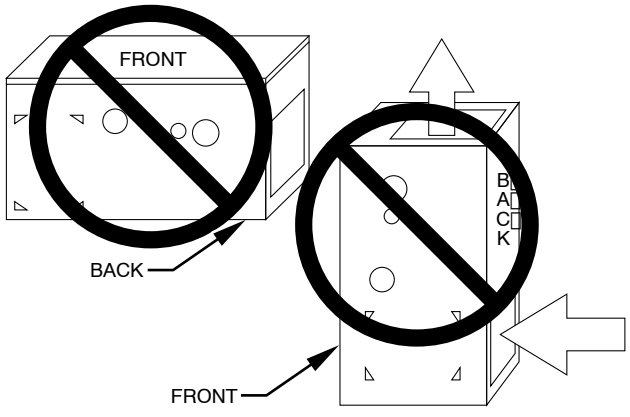

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Fig. 5–Prohibit Installation on Back

The cooling coil must be installed parallel with, or on the downstream side of the unit to avoid condensation in the heat exchangers. When installed parallel with the furnace, dampers or

other flow control must prevent chilled air from entering the furnace. If the dampers are manually operated, they must be equipped with means to prevent operation of either unit unless the damper is in the full-heat or full-cool position.

AIR FOR COMBUSTION AND VENTILATION

Provisions for adequate combustion and ventilation air must be provided in accordance with Section 5.3 of the NFGC, Air for Combustion and Ventilation, or applicable provisions of the local building codes.

Canadian installations must be installed in accordance with NSC-NGPIC Part 7 and all authorities having jurisdiction.

⚠ **WARNING:** When the furnace is installed in a residential garage, the burners and ignition sources must be located at least 18 inches above the floor. The furnace must be located or protected to avoid damage by vehicles. When the furnace is installed in a public garage, airplane hangar, or other building having a hazardous atmosphere, the furnace must be installed in accordance with the National Fire Protection Association, Inc. requirements.

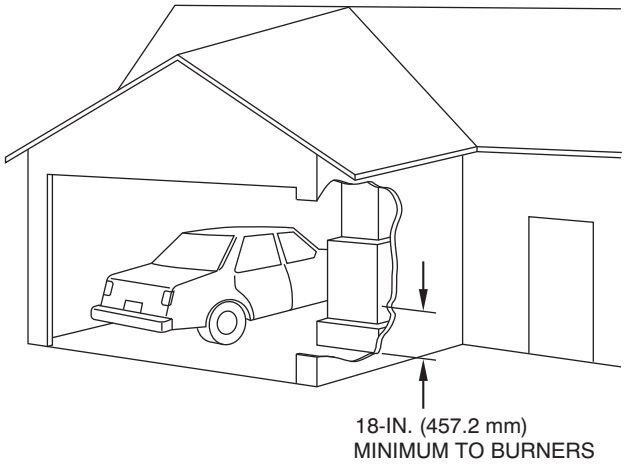


Fig. 6–Location to Burners

⚠ **CAUTION:** Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products.

All fuel-burning equipment must be supplied with air for fuel combustion. Sufficient air **must** be provided to avoid negative pressure in the equipment room or space. A positive seal **must** be made between the furnace cabinet and the return-air duct to prevent pulling air from the burner area and from blocked vent safeguard opening.

⚠ **CAUTION:** The operation of exhaust fans, kitchen ventilation fans, clothes dryers, or fireplaces could create a NEGATIVE PRESSURE CONDITION at the furnace. Make-up air MUST be provided for the ventilation devices, in addition to that required by the furnace.

The requirements for combustion and ventilation air depend upon whether the furnace is located in an unconfined or confined space.

I. UNCONFINED SPACE

An **unconfined space** has a volume of at least 50 cu ft for each 1000 Btuh total input for all appliances (furnaces, clothes dryers, water heaters, etc.) in the space.

For example:

TABLE 1–312AAV FLOOR AREA

312AAV FURNACE INPUT (BTUH)	MINIMUM WITH 7–1/2 FT CEILING (SQ. FT.)
88,000	587

If the unconfined space is constructed unusually tight, air for combustion and ventilation **must** come from either the outdoors or spaces freely communicating with the outdoors. Combustion and ventilation openings must be equivalent to those used for a confined space (defined below). Return air must not be taken from the room unless an equal or greater amount of air is supplied to the room.

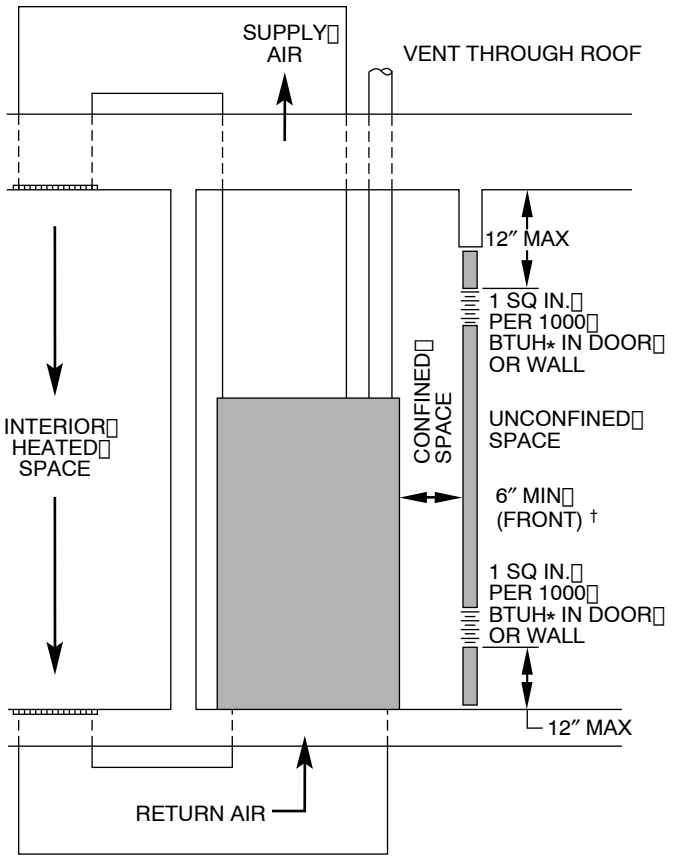
II. CONFINED SPACE

A **confined space** has a volume less than 50 cu ft per 1000 Btuh of total input ratings of all appliances installed in that space. A confined space **must** have provisions for supplying air for combustion, ventilation, and dilution of flue gases using 1 of the following methods in Table 2 and Fig. 7and 8.

NOTE: When determining the free area of an opening, the blocking effect of louvers, grilles, and screens must be considered. If the free area of the louver or grille design is unknown, assume wood louvers have a 20 percent free area and metal louvers or grilles have a 60 percent free area. Screens must not be smaller than 1/4-in. mesh. Louvers and grilles must be constructed so they cannot be closed.

The opening size depends upon whether air comes from outside of the structure or an unconfined space inside the structure.

1. Air from inside the structure requires 2 openings (for structures not of unusually tight construction):
   a. Each opening must have a minimum free area of not less than 1 sq in per 1000 Btuh of total input rating for all gas utilization equipment in the confined space, but not less than 100 sq in. The minimum dimension of air openings should be no smaller than 3 in. (See Table 2 and Fig. 7 and 8).
   b. If building construction is unusually tight, a permanent opening directly communicating with the outdoors shall be provided. (See next section).
   c. If the furnace is installed on a raised platform to provide a return-air plenum, and return air is taken directly from the hallway or space adjacent to furnace, all air for combustion must come from outdoors.
2. Air from outside the structure requires 1 of the following:
   a. If combustion air is taken from outdoors through 2 vertical ducts, the openings and ducts **must** have at least 1 sq in. of free area per 4000 Btuh of total input for all equipment within the confined space. (See Fig. 8 and Table 2.)
   b. If combustion air is taken from outdoors through 2 horizontal ducts, the openings and ducts **must** have at least 1 sq in. of free area per 2000 Btuh of total input for all equipment within the confined space. (See Fig. 8 and Table 2.)
   c. If combustion air is taken from the outdoors through a single opening or duct (horizontal or vertical) commencing within 12 in. of the top of the confined space, the opening and duct **must** have at least 1 sq in. of free area



* Minimum opening size is 100 sq in. with minimum dimensions of 3 in.

† Minimum of 3 in. when type-B1 vent is used.

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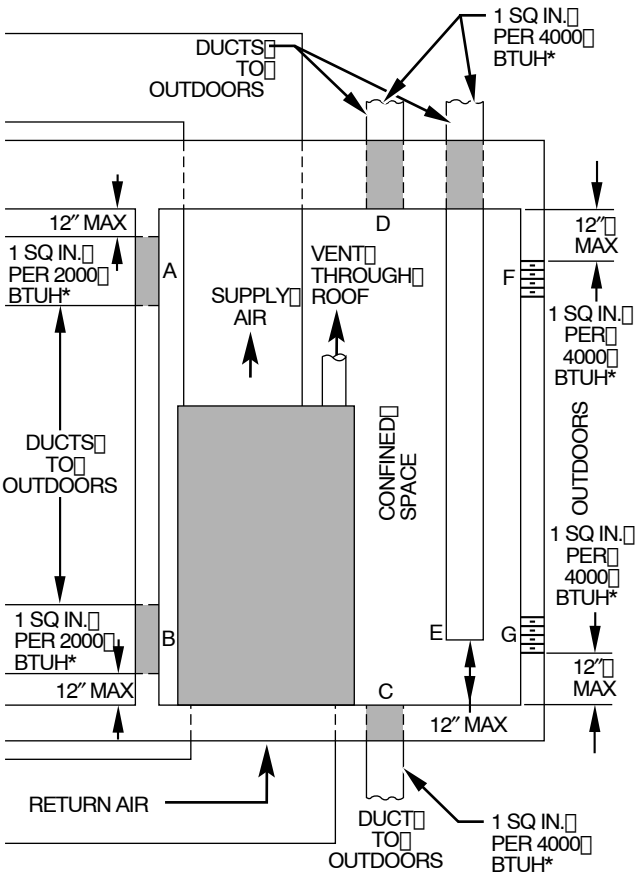
Fig. 7–Confined Space: Air for Combustion and Ventilation from an Unconfined Indoor Space



*Minimum dimensions of 3 in.

NOTE: Use any of the following combinations of openings:
A & B C & D D & E F & G

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Fig. 8–Confined Space: Air for Combustion and Ventilation from Outdoors

per 3000 Btuh of the total input for all equipment within the confined space and not less than the sum of the areas of all vent connectors in the confined space. Equipment clearances to the structure shall be at least 1 in. from the sides and back and 6 in. from the front of the appliances. See Table 2 and Fig. 8.

When ducts are used, they must be of the same cross sectional area as the free area of the openings to which they connect. The minimum dimension of ducts must not be less than 3 in.

III. AIR DUCTS

A. General Requirements

The duct system should be designed and sized according to accepted national standards such as those published by: Air Conditioning Contractors Association (ACCA), Sheet Metal and Air Conditioning Contractors National Association (SMACNA) or American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). Or consult *The Air Systems Design Guidelines* reference tables available from your local distributor. The duct system should be sized to handle the required system design CFM at the design external static pressure.

When a furnace is installed so that the supply ducts carry air to areas outside the space containing the furnace, the return air must also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

Secure ductwork with proper fasteners for type of ductwork used. Seal supply- and return-duct connections to furnace with code approved tape or duct sealer.

Flexible connections should be used between ductwork and furnace to prevent transmission of vibration. Ductwork passing through unconditioned space should be insulated to enhance system performance. When air conditioning is used, a vapor barrier is recommended.

Maintain a 1-in. clearance from combustible materials to supply air ductwork for a distance of 36 in. horizontally from the furnace. See NFPA 90B or local code for further requirements.

B. Ductwork Acoustical Treatment

Metal duct systems that do not have a 90 degree elbow and 10 ft of main duct to the first branch take-off may require internal acoustical lining. As an alternative, fibrous ductwork may be used if constructed and installed in accordance with the latest edition of SMACNA construction standard on fibrous glass ducts. Both acoustical lining and fibrous ductwork shall comply with NFPA 90B as tested by UL Standard 181 for Class 1 Rigid air ducts.

C. Supply Air Connections

UPFLOW FURNACES

Connect supply-air duct to 3/4-in. flange on furnace supply-air outlet. Bend flange upward to 90° with wide duct pliers. The supply-air duct attachment must ONLY be connected to furnace supply-/outlet-air duct flanges or air conditioning coil casing (when used). DO NOT cut main furnace casing to attach supply side air duct, humidifier, or other accessories. All accessories MUST be connected external to furnace main casing. Supply air opening duct flanges must be modified per Fig. 14.

TABLE 2–MINIMUM FREE AREA OF COMBUSTION AIR OPENING*

312AAV FURNACE INPUT (BTUH)	AIR FROM INDOOR UNCONFINED SPACE	OUTDOOR AIR THROUGH VERTICAL DUCTS		OUTDOOR AIR THROUGH HORIZONTAL DUCTS		OUTDOOR AIR THROUGH SINGLE DUCT	
	Free Area of Opening (Sq In.)	Free Area of Opening and Duct (Sq. In.)	Round Pipe (in. Dia)	Free Area of Opening and Duct (sq In.)	Round Pipe (in. Dia)	Free Area of Opening and Duct (Sq In.)	Round Pipe (In. Dia)
88,000	100	22.0	6	44.0	8	29.33	7

* Free area shall be equal to or greater than the sum of the areas of all vent connectors in the confined space. Opening area must be increased if other gas appliances in the space require combustion air.

DOWNFLOW FURNACES

Connect supply-air duct to supply-air opening on furnace. The supply-air duct attachment must ONLY be connected to furnace supply/outlet or air conditioning coil casing (when used). When installed on combustible material, supply-air duct attachment must ONLY be connected to an accessory subbase or factory approved air conditioning coil casing. DO NOT cut main furnace casing to attach supply side air duct, humidifier, or other accessories. All accessories MUST be connected external to furnace casing. Supply air opening duct flanges must be modified per Fig. 14.

HORIZONTAL FURNACES

Connect supply-air duct to supply air opening on furnace. The supply-air duct attachment must ONLY be connected to furnace supply/outlet or air conditioning coil casing (when used). DO NOT cut main furnace casing to attach supply side air duct, humidifier, or other accessories. All accessories MUST be connected external to furnace casing. Supply air opening duct flanges must be modified per Fig. 14.

D. Return Air Connections

DOWNFLOW AND HORIZONTAL FURNACES

> ⚠ **WARNING:** Never connect return-air ducts to the back of the furnace. A failure to follow this warning can cause a fire, personal injury, or death.

The return-air duct must be connected to return-air opening (bottom inlet) as shown in Fig. 1. DO NOT cut into casing sides (left or right). Side opening is permitted for only upflow furnaces. Bypass humidifier connections should be made at ductwork or coil casing sides exterior to furnace.

UPFLOW FURNACES

The return-air duct must be connected to bottom, sides (left or right), or a combination of bottom and side(s) of main furnace casing as shown in Fig. 1. Bypass humidifier may be attached into unused side return air portion of the furnace casing.

INSTALLATION

I. LEVELING LEGS (IF DESIRED)

When furnace is used in upflow position with side inlet(s), leveling legs may be desired. (See Fig. 9.) Install field-supplied, corrosion-resistant 5/16-in. machine bolts and nuts.

NOTE: The maximum length of bolt should not exceed 1-1/2 in.

1. Position furnace on its back. Locate and drill a 5/16-in. diameter hole in each bottom corner of furnace. (See Fig. 9.) Holes in bottom closure panel may be used as guide locations.
2. For each hole, install nut on bolt and then install bolt and nut in hole. (Install flat washer if desired.)
3. Install another nut on other side of furnace base. (Install flat washer if desired.)
4. Adjust outside nut to provide desired height, and tighten inside nut to secure arrangement.

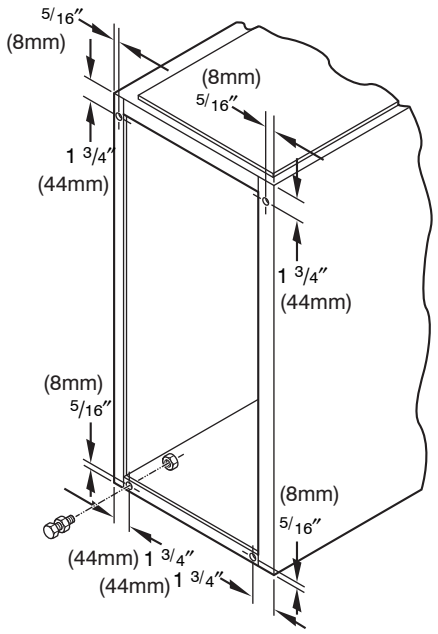

Fig. 9–Leveling Legs

NOTE: Bottom closure must be used when leveling legs are used.

NOTE: Remove and discard bottom closure panel when bottom inlet is used.

II. BOTTOM CLOSURE PANEL

These furnaces are shipped with bottom closure panel installed in bottom return-air opening. This panel MUST be in place when side return air is used.

To remove bottom closure panel, perform the following:

1. Tilt or raise furnace and remove 2 screws holding front filler panel. See Fig. 10)
2. Rotate front filler panel downward to release holding tabs.
3. Remove bottom closure panel.
4. Reinstall front filler panel and screws.

NOTE: Side return-air openings can ONLY be used in UPFLOW configurations.

III. DOWNFLOW INSTALLATION

NOTE: For downflow applications, this furnace is approved for use on combustible flooring when special base (Part No. KGASB0201ALL) is used. Special base is not required when this furnace is installed on manufacturer's Coil Assembly Part No. CD5 or CK5, or Coil Box Part No. KCAKC is used.

1. Determine application being installed from Table 3.
2. Construct hole in floor per dimensions specified in Table 3 and Fig. 11.
3. Construct plenum to dimensions specified in Table 3 and Fig. 11.
4. If downflow subbase (KGASB) is used, install as shown in Fig. 12.

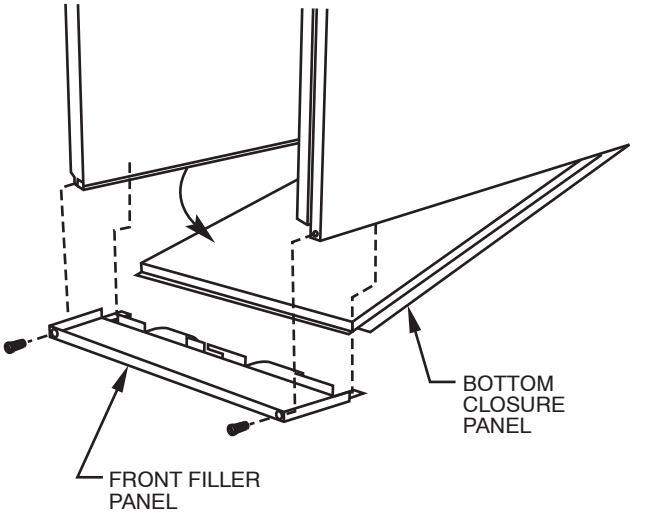

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Fig. 10–Removing Bottom Closure Panel

If Coil Assembly Part No. CD5 or CK5 or Coil Box Part No. KCAKC is used, install as shown in Fig. 13.

NOTE: Remove the furnace perforated supply-air duct flanges when they interfere with mating flanges on the coil on downflow subbase. To remove the supply-air duct flange, use wide duct pliers or duct flange tool to bend flange back and forth until it breaks off. Be careful of sharp edges. (See Fig. 14.)

> ⚠ **WARNING:** Do not bend duct flanges inward. This will affect airflow across heat exchangers and may cause limit cycling or premature heat exchanger failure. Remove duct flange completely or bend it inward a minimum of 210° as shown in Fig. 14.

IV. HORIZONTAL ATTIC INSTALLATION

> ⚠ **WARNING:** Do not install the furnace on its back; safety control operation will be adversely affected. Never connect return-air ducts to the sides or back of the furnace. Failure to follow this warning could result in fire, personal injury, or death.

The furnace can be installed horizontally on either the left-hand (LH) or right-hand (RH) side. A typical attic installation is shown in Fig. 17.

A. Construct a Working Platform

Construct working platform on location where all required furnace clearances are met. (See Fig. 2 and 17.)

B. Install Furnace

1. Position furnace in desired location.
2. Connect gas supply pipe. See Fig. 17 for typical piping entry.
3. Connect supply- and return-air ducts with filter media cabinet per Step 6.
4. Install 24- X 24-in. sheet metal shield on platform in front of louvered control panel as shown in Fig. 17.

V. INSTALLATION IN HORIZONTAL CRAWLSPACE APPLICATIONS

These furnaces can be installed horizontally in either horizontal left or right discharge position. In a crawlspace, furnace can either be hung from floor joist or installed on suitable blocks or pad. (See Fig. 16). Furnace can be suspended from each corner by hanger bolts and angle iron supports. (See Fig. 15.) Cut hanger bolts (4 each 3/8-in. all-thread rod) to desired length. Use 1 X 3/8-in. flat washers, 3/8-in. lockwashers, and 3/8-in. nuts on hanger rods as shown in Fig. 15.

> ⚠ **CAUTION:** The entire length of the furnace MUST be supported when furnace is used in a horizontal position. When suspended, bottom brace supports sides and center blower shelf. When unit is supported from the ground, blocks or pad should support sides and center blower shelf area.

VI. MEDIA CABINET (PN 325887–701) AND FILTER ARRANGEMENT

Center media cabinet on furnace return-air inlet. If flush fit required with media cabinet to back of furnace casing, a field supplied patch plate is required to seal gap at front edge of furnace and media cabinet. Insert filter (supplied with furnace) into media cabinet.

> ⚠ **WARNING:** Never operate a furnace without a filter or with filter access door removed. Failure to follow this warning could result in fire, personal injury, or death.

VII. GAS PIPING

Gas piping must be installed in accordance with national and local codes. Refer to current edition of NFGC in the U.S.

Canadian installations must be made in accordance with NSCNGPIC and all authorities having jurisdiction.

Gas supply line should be a separate line running directly from meter to furnace, if possible.

Refer to Table 5 for recommended gas pipe sizing. Risers must be used to connect to furnace and to meter. Support all gas piping with appropriate straps, hangers, etc. Use a minimum of 1 hanger every 6 ft. Joint compound (pipe dope) should be applied sparingly and only to male threads of joints. Pipe dope must be resistant to the action of propane gas.

> ⚠ **CAUTION:** If a flexible connector is required or allowed by the authority having jurisdiction, black iron pipe shall be installed at the gas valve and extend a minimum of 2 in. outside the furnace casing.

> ⚠ **CAUTION:** Connect gas pipe to furnace using a backup wrench to avoid damaging gas controls.

> ⚠ **WARNING:** Never purge a gas line into a combustion chamber. Never use matches, candles, flame, or other sources of ignition for purpose of checking leakage. Use a soap-and-water solution to check for leakage. A failure to follow this warning could result in fire, explosion, personal injury, or death.

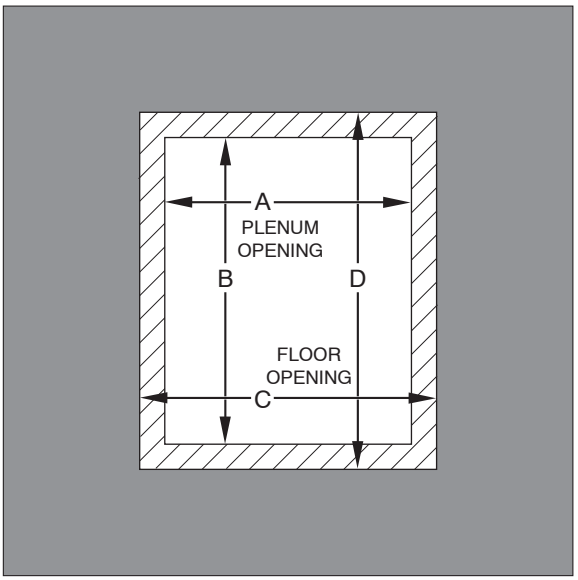

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Fig. 11– Floor and Plenum Opening Dimensions

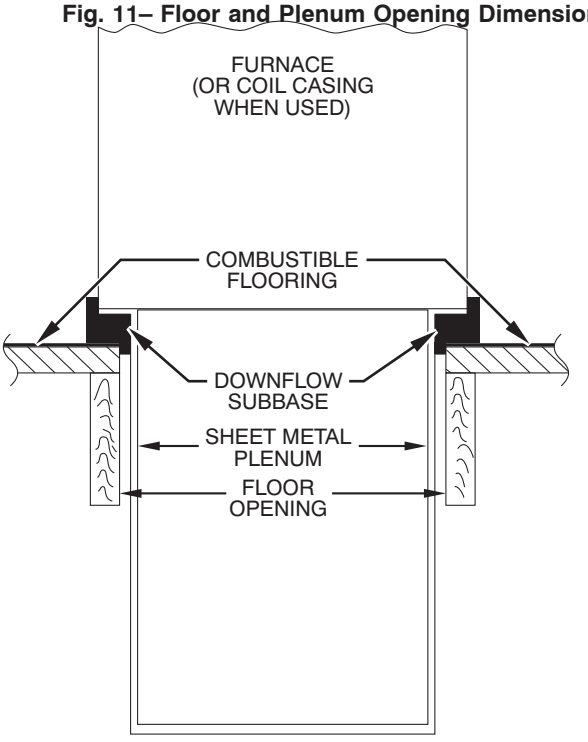

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Fig. 12–Furnace, Plenum, and Subbase Installed on a Combustible Floor

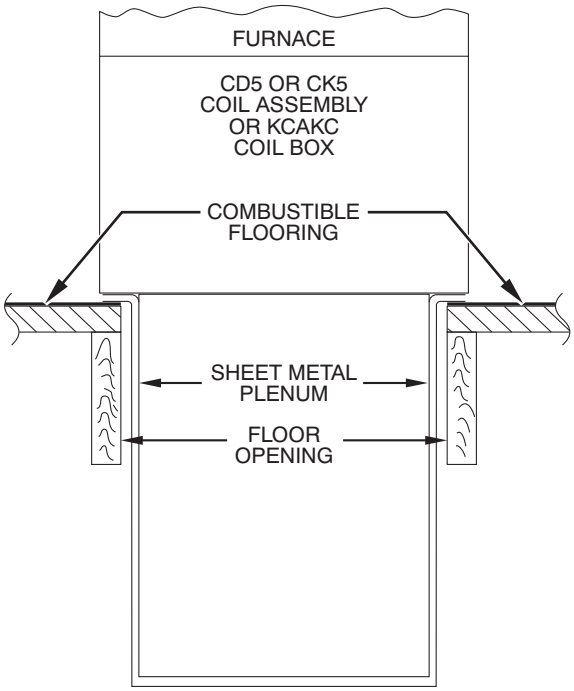

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Fig. 13–Furnace, Plenum, and Coil Assembly or Coil Box Installed on a Combustible Floor

TABLE 3–OPENING DIMENSIONS (IN.)

FURNACE CASING WIDTH	APPLICATION	PLENUM OPENING		FLOOR OPENING	
		A	B	C	D
17–1/2	Upflow Applications	16	24–1/8	16–5/8	24–3/4
	Downflow Applications on Non-Combustible Flooring	15–7/8	19	16–1/2	19–5/8
	Downflow Applications on Combustible Flooring Using KGASB Subbase Furnace with or wothout CD5 or CK5 Coil Assembly or KCAKC Coil Box	15–1/8	19	16–3/4	20–3/8

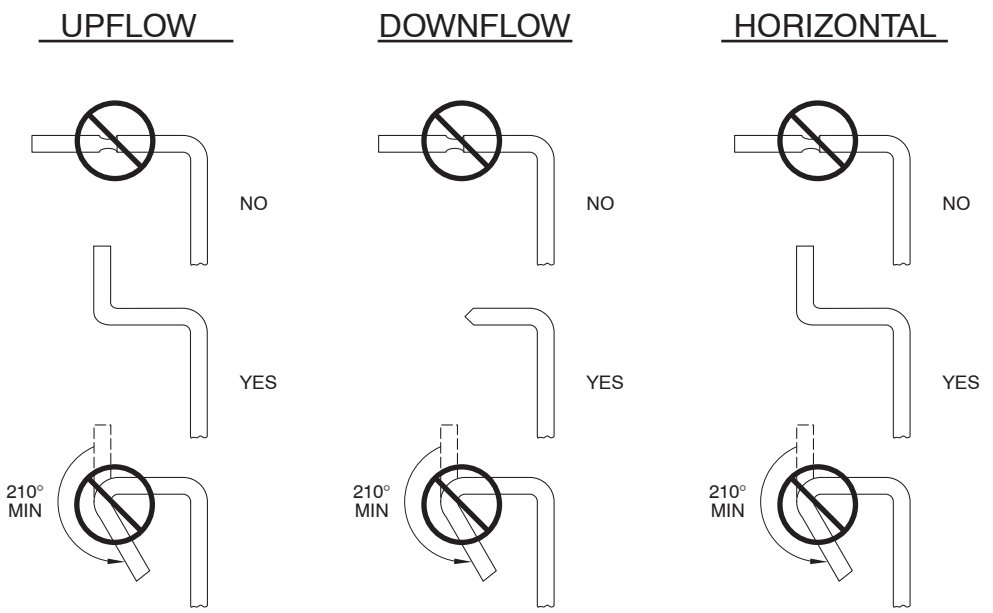

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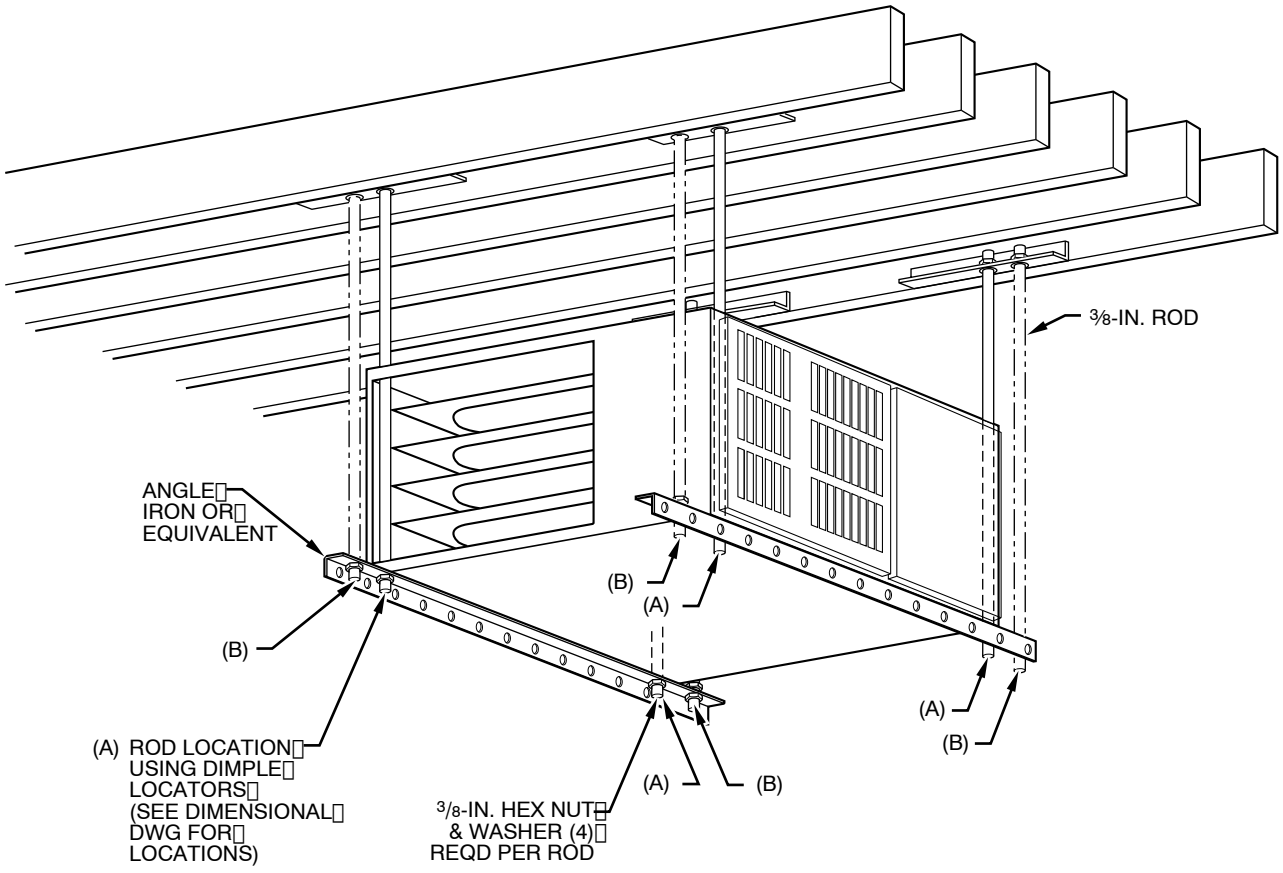
Fig. 14–Duct Flanges



(A) PREFERRED ROD LOCATION

(B) ALTERNATE ROD LOCATION

NOTES: 1. A 1 In. clearance minimum between top of furnace and combustible material.

2. The entire length of furnace must be supported when furnace is used in horizontal position.

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Fig. 15–Horizontal Installation Hung from Joists

WARNING: Use proper length of pipe to avoid stress on gas control manifold. Failure to follow this warning could result in a gas leak resulting in fire, explosion, personal injury, or death.

Install a sediment trap in riser leading to furnace. Trap can be installed by connecting a tee to riser leading to furnace so straight-through section of tee is vertical. Then connect a capped nipple into lower end of tee. Capped nipple should extend below level of gas controls. Place a ground joint union between gas control manifold and manual gas shutoff valve. (See Fig. 18.)

TABLE 4–FILTER INFORMATION (IN.)

FURNACE CASING WIDTH	FILTER SIZE		FILTER TYPE
	Side Return	Bottom Return	
17–1/2	(1) 16 x 25 x 1†	(1) 16 x 25 x 1†	Cleanable

† Factory provided with the furnace.

TABLE 5–MAXIMUM CAPACITY OF PIPE*

NOMINAL IRON PIPE SIZE (IN.)	INTERNAL DIAMETER (IN.)	LENGTH OF PIPE (FT)				
		10	20	30	40	50
1/2	0.622	175	120	97	82	73
3/4	0.824	360	250	200	170	151
1	1.049	680	465	375	320	285
1–1/4	1.380	1400	950	770	660	580
1–1/2	1.610	2100	1460	1180	990	900

* Cubic tf if gas per hr for gas pressure of 0.5 psig (14–in wc) or less, and a pressure drop of 0.5–in wc (based on a 0.60 specific gravity gas).
Ref: Table 10–2 NFGC.

Piping should be pressure tested in accordance with local and national plumbing and gas codes before the furnace has been attached. If the pressure exceeds 0.5 psig (14-in. wc), the gas supply pipe must be disconnected from the furnace and capped before the pressure test. If the test pressure is equal to or less than 0.5 psig (14-in. wc), turn off electric shutoff switch located on the gas valve before the test. It is recommended that the ground joint union be loosened before pressure testing.

After all connections have been made, purge the lines and check for gas leakage with regulated gas supply pressure.

An accessible manual shutoff valve MUST be installed upstream of furnace gas controls and within 6 ft of furnace. A 1/8-in. NPT plugged tapping, accessible for test gage connection, MUST be installed immediately upstream of gas supply connection to furnace and downstream of manual shutoff valve.

NOTE: The gas valve inlet pressure tap connection is suitable to use as test gage connection providing test pressure DOES NOT exceed maximum 0.5 psig (14-in. wc) stated on gas valve. (See Fig. 33.) Piping should be pressure tested in accordance with NFGC, local and national plumbing and gas codes before furnace is attached. In Canada, refer to current edition of NSCNGPIC.

VIII. ELECTRICAL CONNECTIONS

See Fig. 21 for field wiring diagram showing typical field 115-v wiring.Check all factory and field electrical connections for tightness.

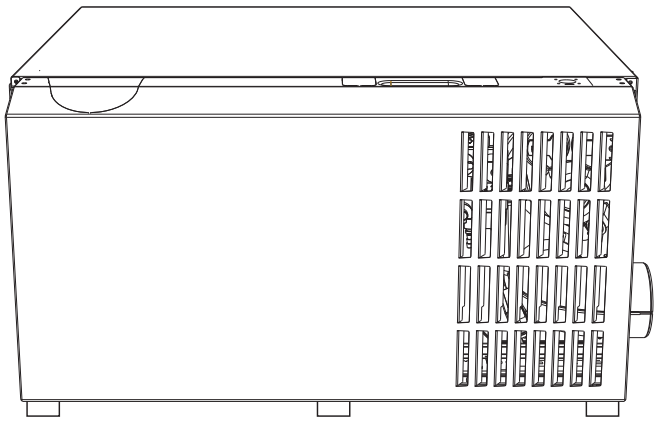

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Fig.16–Horizontal Installation on Blocks

WARNING: Blower access panel door switch opens 115-v power to control. No component operation can occur. Do not bypass or close switch with panel removed. Failure to follow this warning could result in personal injury or death.

CAUTION: Furnace control must be grounded for proper operation or control will lock out. Control is grounded through green wire routed to gas valve and burner box screw.

A. 115–v Wiring

Before proceeding with electrical connections, make certain that voltage, frequency, and phase correspond to that specified on unit rating plate. Also, check to be sure that service provided by utility is sufficient to handle load imposed by this equipment. Refer to rating plate or Table 6 for equipment electrical specifications.

Make all electrical connections in accordance with National Electrical Code (NEC) ANSI/NFPA 70-1999 and any local codes or ordinances that might apply. For Canadian installations, all electrical connections must be made in accordance with Canadian Electrical Code CSA C22.1 or authorities having jurisdiction.

CAUTION: Do not connect aluminum wire between disconnect switch and furnace. Use only copper wire.

CAUTION:

Use a separate, fused branch electrical circuit containing a properly sized fuse or circuit breaker for this furnace. See Table 6 for wire size and fuse specifications. A disconnecting means must be located within sight from and readily accessible to furnace.

NOTE: Proper polarity must be maintained for 115-v wiring. If polarity is incorrect, control LED status indicator light will flash rapidly and furnace will NOT operate.

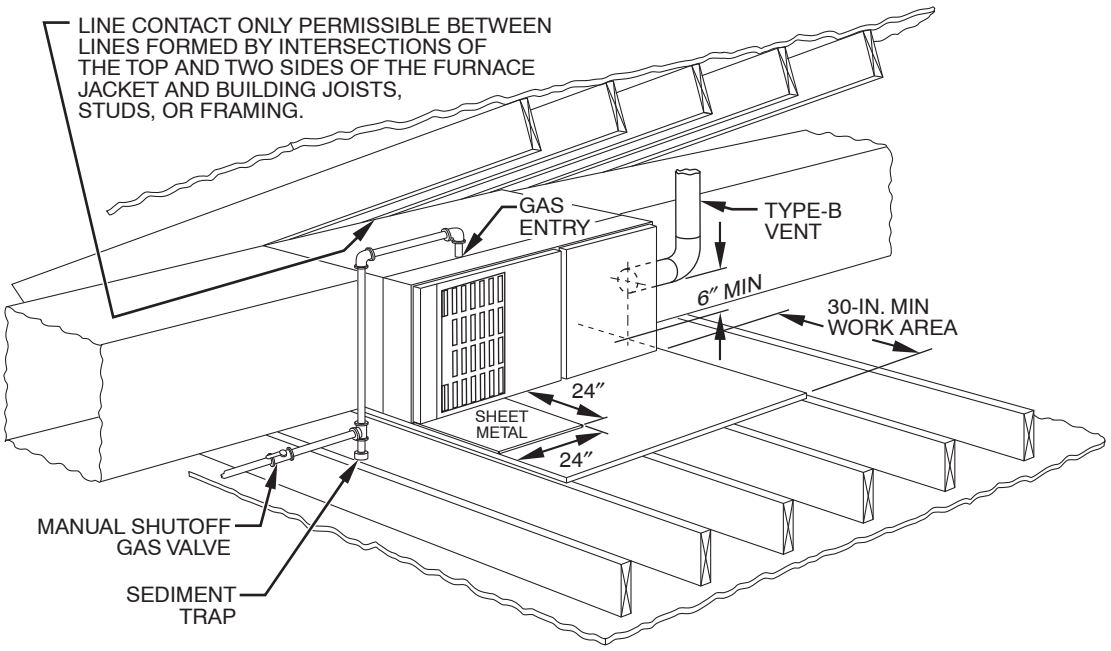

Fig. 17–Typical Attic Installation

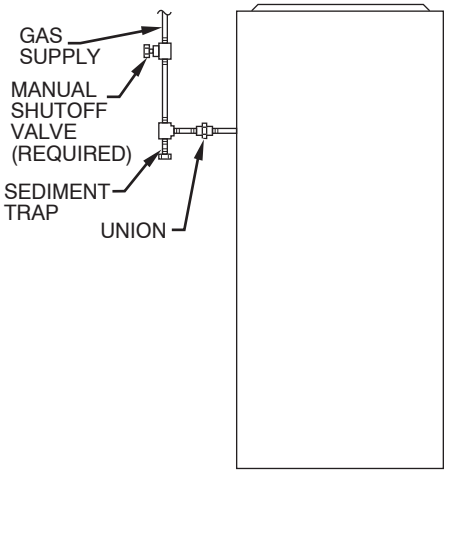

Fig. 18–Typical Gas Pipe Arrangement

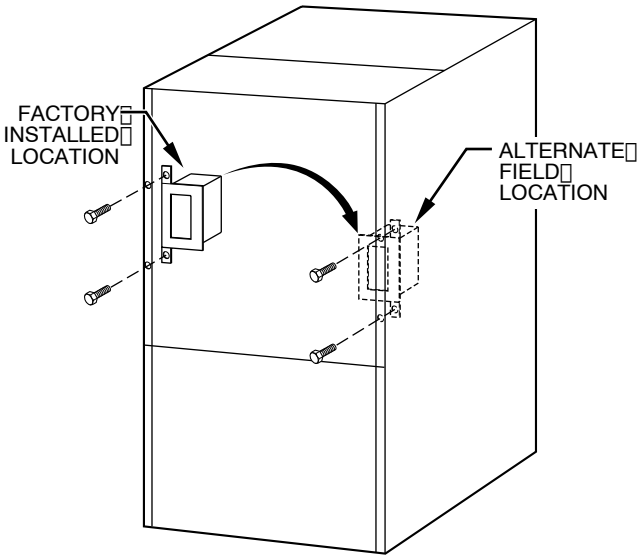

Fig. 19–Relocating J-Box

⚠ **WARNING:** The cabinet MUST have an uninterrupted or unbroken ground according to NEC ANSI/NFPA 70-1999 and Canadian Electrical Code CSA C22.1 or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground. Failure to follow this warning could result in electrical shock, fire, or death.

J-BOX RELOCATION

1. Remove 1 screw holding auxiliary J-box. (See Fig. 19.)
2. Cut wire tie on loop in wires to J-box.
3. Locate box to desired location.
4. Fasten J-Box to casing with screw.
5. Remove U-shaped cut-out from outer door to clear J-Box.
6. Route J-box wires within furnace away from sharp edges and hot surfaces.

⚠ **CAUTION:** If manual disconnect switch is to be mounted on furnace, select a location where a drill or fastener will not contact electrical or gas components.

B. 24–v Wiring

Make field 24-v connections at the 24-v terminal strip. (See Fig. 22.) Connect terminal Y/Y2 as shown in Fig. 21 for proper cooling operation. Use only AWG No. 18, color-coded, copper thermostat wire.

The 24-v circuit contains an automotive-type, 3-amp fuse located on the control. Any direct shorts during installation, service, or maintenance could cause this fuse to blow. If fuse replacement is required, use ONLY a 3-amp fuse of identical size.

C. Accessories

1. Electronic Air Cleaner (EAC)

TABLE 6–ELECTRICAL DATA

UNIT SIZE	VOLTS-HERTZ-PHASE	OPERATING VOLTAGE RANGE		MAXIMUM UNIT AMPS	MINIMUM WIRE GAGE	MAXIMUM WIRE LENGTH (FT)‡	MAXIMUM FUSE OR CKT BKR AMPS†
		Maximum*	Minimum*				
042090	115–60–1	127	104	9.0	14	31	15

* Permissible limits of the voltage range at which the unit operates satisfactorily.
† Time-delay type is recommended.
‡ Length shown is as measured 1 way along wire path between unit and service panel for maximum 2 percent voltage drop.

Two male 1/4–in quick-connect terminals, marked EAC-1 and EAC-2 are provided for EAC connection. (See Fig. 22.) These terminals are energized with 115-v, (1.0-amp maximum) during blower motor operation. To connect EAC power leads to furnace control, install 1/4–in. female quick-connect terminals on EAC power leads.

2. Humidifier (HUM)

   Screw terminals HUM (1/4-in male quick-connect) and COM-24V are provided for 24-v humidifier connection. The terminals are energized with 24-v 0.5-amp maximum when gas valve is energized.

⚠ **WARNING:** DO NOT connect furnace control HUM terminal to HUM (humidifier) terminal on Thermidistat, Zone Controller or similiar device. See Thermidistat™, Zone Controller, thermostat, or controller manufacturer's instructions for proper connection. A failure to follow this warning could result in fire.

NOTE: A field-supplied, 115-v controlled relay connected to EAC terminals may be added if humidifier operation is desired during blower operation.

D. Venting

See Fig. 20, Venting Orientation for approved vent configurations.

Refer to the national or local installtion code such as NFGC in the U.S. or the NSCNGPIC in Canada for proper vent sizing and installation requirements. Use the enclosed Installation Instructions (Vent Tables for 1-and 2-stage Category I Fan-Assisted Furnaces) for a quick, easy reference.

NOTE: Vent sizing length starts at furnace vent elbow.

Rotate furnace vent elbow to position desired. Remove U-shaped cut-out (knockout) on door to clear the vent pipe. Support the vent pipe at the furnace with metal pipe strap.

After fully assembling the vent connector to the furnace vent elbow, securely fasten the vent connector to the vent elbow with two field-supplied, corrosion-resistant, sheet metal screws located 180° apart.

The horizontal portion of the venting system shall maintain a minimum of 1/4-in. upward slope per linear ft and it shall be rigidly supported every 5 ft or less with hangers or straps to ensure that there will be no movement after installation.

START-UP, ADJUSTMENT, AND SAFETY CHECK

I. GENERAL

NOTE: Proper polarity must be maintained for 115-v wiring. If polarity is incorrect, control status indicator light will flash rapidly and furnace will not operate.

The furnace must have a 115-v power supply properly connected and grounded. Proper polarity must be maintained for correct operation. Thermostat wire connections at R, W, C, and Y must be made at the 24-v terminal block on the furnace control. The gas service pressure must not exceed 0.5 psig (14-in. wc), but must be no less than 0.16 psig (4.5-in. wc).

⚠ **CAUTION:** This furnace is equipped with manual reset limit switches in the gas control area. The switches open and shut off power to the gas valve, if a flame rollout or overheating condition occurs in the gas control area. DO NOT bypass the switches. Correct inadequate combustion air supply problem and reset the switches.

Before operating furnace, check each manual-reset switch for continuity.

The blower compartment door must be in place to complete the 115–v circuit to the furnace.

II. SEQUENCE OF OPERATION

⚠ **CAUTION:** Furnace control must be grounded for proper operation or control will lockout. Control is grounded through green wire rotated to gas valve and burner bracket screw.

Using the schematic diagram in Fig. 23, follow the sequence of operation through the different modes. Read and follow the wiring diagram very carefully.

NOTE: If a power interruption occurs during a call for heat (W/W1 or W/W1-and-W2), the control will start a 90-second blower-only ON period two seconds after power is restored, if the thermostat is still calling for gas heating. The green LED light will flash code 12 during the 90-second period, after which the LED will be ON continuous, as long as no faults are detected. After the 90-second period, the furnace will respond to the thermostat normally.

The blower door must be installed for power to be conducted through the blower door interlock switch ILK to the furnace control CPU, transformer TRAN, inducer motor IDM, blower motor BLWM, hot-surface igniter HSI, and gas valve GV.

1. **Two-Stage Heating (Adaptive mode) with Single-Stage Thermostat**
   (See Fig. 21 for thermostat connections)

   This furnace can operate as a two-stage furnace with a single-stage thermostat because the furnace control CPU includes a programmed adaptive sequence of controlled operation, which selects low-heat or high-heat operation. This selection is based upon the stored history of the length of previous gas-heating periods of the single-stage thermostat.

   The furnace will start up in either low- or high-heat. If the furnace starts up in low-heat, the control CPU determines the low-heat on-time (from 0 to 16 minutes) which is permitted before switching to high-heat.

   If the power is interrupted, the stored history is erased and the control CPU will initially select low-heat for up to 16 minutes and then switch to high-heat, as long as the thermostat continues to call for heat. Subsequent selection is based on stored history of the thermostat cycle times.

   The wall thermostat ″calls for heat″, closing the R to W circuit. The furnace control performs a self-check, verifies

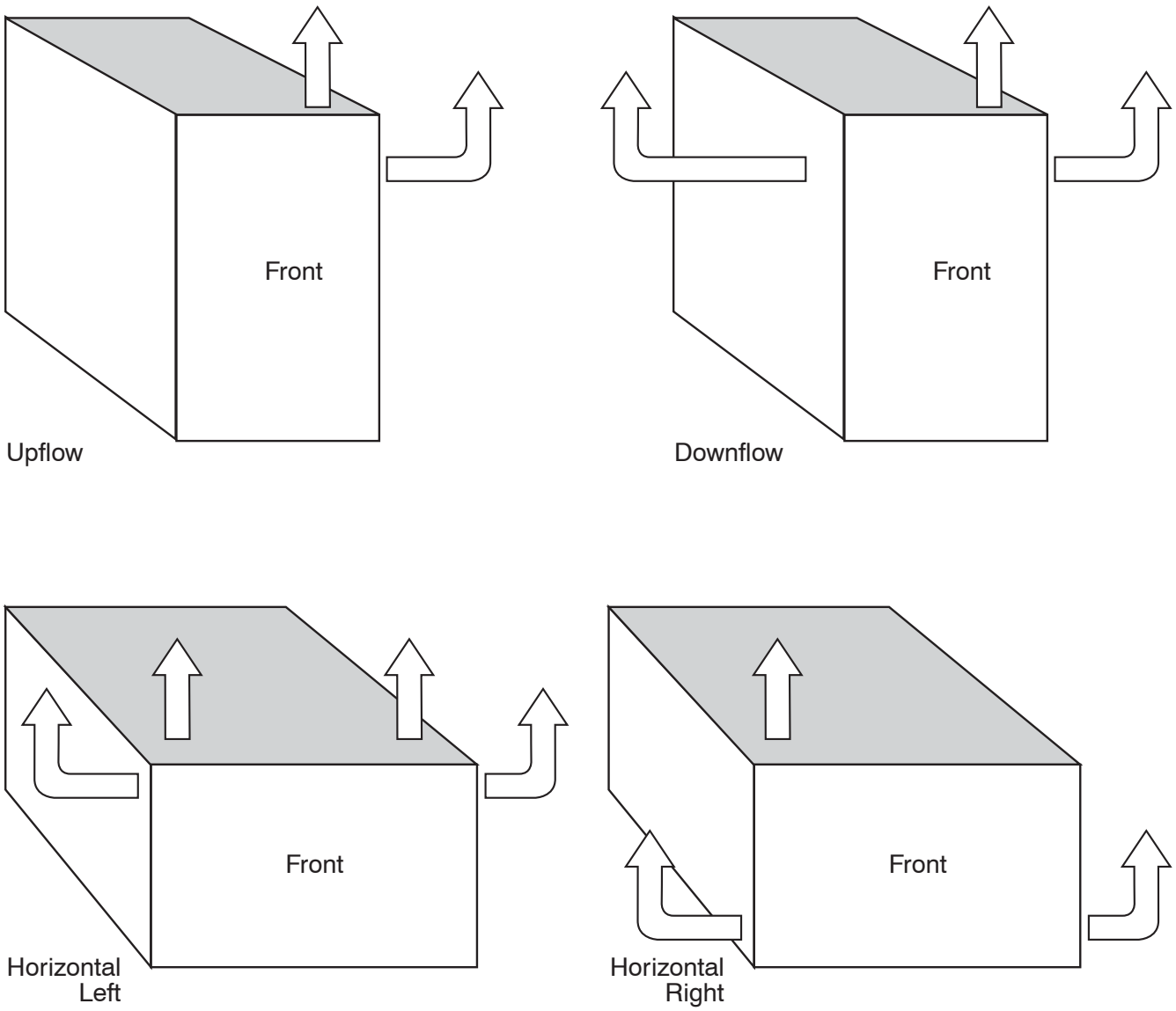

Fig. 20–Vent Orientation

the low-heat and high-heat pressure switch contacts LPS and HPS are open, and starts the inducer motor IDM in high-speed.

NOTE: The low-heat only switch LHT selects either the low-heat only operation mode when ON, (see item 2. below) or the adaptive heating mode when OFF in response to a call for heat. (See Fig. 22.) Table 7 and 8show the dipswitch setup information. When the W2 thermostat terminal is energized it will always cause high-heat operation when the R-to-W circuit is closed, regardless of the setting of the low-heat only switch.

TABLE 7-BLOWER OFF DELAY SETUP SWITCH (SW) POSITION

DESIRED HEATING MODE BLOWER-OFF DELAY (SEC)	SETUP SWITCH	
	SW-2	SW-3
90	OFF	OFF
120	OFF	ON
150	ON	OFF
180	ON	ON

a. **Inducer Prepurge Period**- If the furnace control CPU selects low-heat operation the inducer motor IDM comes up to speed, the low-heat pressure switch LPS closes, the inducer motor IDM switches to low-speed, and the furnace control CPU begins a 15-second prepurge period. If the low-heat pressure switch LPS fails to remain closed the inducer motor IDM will switch back to high-speed. After the low-heat pressure switch re-closes the furnace control CPU will begin a 15-second prepurge period, and continue to run the inducer motor IDM at high-speed for the low-heat cycle while flashing status code 32.

If the furnace control CPU selects high-heat operation, the inducer motor IDM remains running at high-speed, and the high-heat pressure switch relay HPSR is de-energized to close the NC contact. When sufficient pressure is available the high-heat pressure switch HPS closes, and the high-heat gas valve solenoid GV-HI is energized. The furnace control CPU begins a 15-second prepurge period after the low-heat pressure switch LPS closes. If the high-heat pressure switch HPS fails to close and the low-heat pressure switch LPS closes, the furnace will operate at low-heat gas flow rate until the high-heat pressure switch closes for a maximum of 2 minutes after ignition, after which a normal shutdown occurs and the furnace reinstates the heating startup sequence.

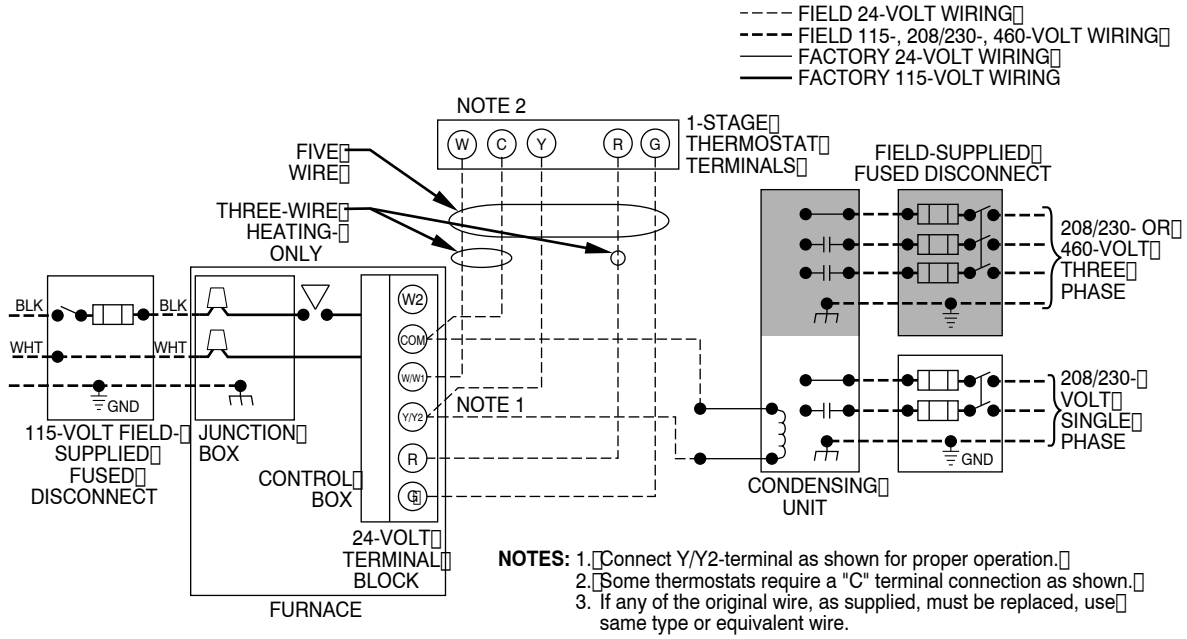

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Fig. 21–Heating and Cooling Application Wiring Diagram with 1–Stage Thermostat

b. **Igniter Warm-Up**- At the end of the prepurge period, the Hot-Surface Igniter HSI is energized for a 17-second igniter warm-up period.

c. **Trial-for-Ignition Sequence**- When the igniter warm-up period is completed the main gas valve relay contacts GVR-1 and -2 close to energize the gas valve solenoid GV-M, the gas valve opens, and 24 vac power is supplied for a field-installed humidifier at the HUM terminal. The gas valve solenoid GV-M permits gas flow to the burners where it is ignited. After 5 seconds, the igniter HSI is de-energized and a 2-second Flame-Proving period begins.

If the furnace control CPU selects high-heat operation, the high-heat gas valve solenoid GV-HI is also energized.

d. **Flame-Proving**- When the burner flame is proved at the flame-proving sensor electrode FSE, the furnace control CPU begins the blower-ON delay period and continues to hold the gas valve GV-M open. If the burner flame is not proved within two seconds, the control CPU will close the gas valve GV-M, and the control CPU will repeat the ignition sequence for up to three more Trials-For-Ignition before going to Ignition-Lockout. **Lockout will be reset** automatically after three hours, by momentarily interrupting 115 vac power to the furnace, or by interrupting 24 vac power at SEC1 or SEC2 to the furnace control CPU (not at W/W1, G, R, etc.).

If flame is proved when flame should not be present, the furnace control CPU will lock out of Gas-Heating mode and operate the inducer motor IDM on high speed until flame is no longer proved.

If flame is proved when flame should not be present, the furnace control CPU will lock out of Gas-Heating mode and operate the inducer motor IDM until flame is no longer proved.

e. **Blower-ON Delay**-If the burner flame is proven the blower-ON delay for low-heat and high-heat are as follows:

Low-Heat - 45 seconds after the gas valve GV-M is energized the blower motor BLWM is energized at LO HEAT speed.

High-Heat - 25 seconds after the gas valve GV-M is energized the BLWM is energized at HI HEAT speed. Simultaneously, the electronic air cleaner terminal EAC-1 is energized and remains energized as long as the blower motor BLWM is energized.

f. **Switching from Low-to High-Heat**-If the furnace control CPU switches from low-heat to high-heat, the furnace control CPU will switch the inducer motor IDM speed from low to high. The high-heat pressure switch relay HPSR is de-energized to close the NC contact. When sufficient pressure is available the high-heat pressure switch HPS closes, and the high-heat gas valve solenoid GV-HI is energized. The blower motor BLWM will switch to HI HEAT speed five seconds after the furnace control CPU switches from low-heat to high-heat.

g. **Switching from High- to Low-Heat**-The furnace control CPU will not switch from high-heat to low-heat while the thermostat R-to-W circuit is closed when using a single-stage thermostat.

h. **Blower-OFF Delay**- When the thermostat is satisfied, the R-to-W circuit is opened, de-energizing the gas valve GV-M, stopping gas flow to the burners, and de-energizing the humidifier terminal HUM. The inducer motor IDM will remain energized for a 5-second post-purge period. The blower motor BLWM and air cleaner terminal EAC-1 will remain energized for 90, 120, 150, or 180 seconds (depending on selection at blower-OFF delay switches). The furnace control CPU is factory-set for a 120-second blower-OFF delay.

2. **Two-Stage Thermostat and Two-Stage Heating**

(See Fig. 30 for thermostat connections)

The wall thermostat ″calls for heat″, closing the R-to-W1 circuit for low-heat or closing the R-to-W1-and-W2 circuits for high-heat. The furnace control performs a self-check, verifies the low-heat and high-heat pressure switch contacts

TABLE 8-SETUP SWITCH DESCRIPTION

SETUP SWITCH NO.	NORMAL POSITION	DESCRIPTION OF USE
SW-1 Low-Gas Heat (Adaptive Mode)	OFF (Single-Stage Thermostat)	Turn switch off for installations with single-stage thermostats; control selects low-gas-heat or high-gas-heat operation based on previous cycles. Turn switch on for installations with 2–stage thermostats to permit only low-gas-heat operation in response to closing R-W/W1. High-gas heat is supplied only when R-to-W/W1-and-W2 are closed.
SW-2 and SW3	ON, OFF	Switches control gas heating mode blower off delay. (See Table B).

LPS and HPS are open, and starts the inducer motor IDM in high-speed.

The start up and shut down functions and delays described in item 1. above apply to the 2-stage heating mode as well, except for switching from low- to high-Heat and vice versa.

NOTE: In this mode the low-heat-only switch LHT must be ON to select the low-heat only operation mode in response to closing the thermostat R-to-W1 circuit. Closing the thermostat R-to-W1-and-W2 circuits always causes high-heat operation, regardless of the setting of the low-heat-only switch.

a. **Switching from Low- to High-Heat**-If the thermostat R-to-W1 circuit is closed and the R-to-W2 circuit closes, the furnace control CPU will switch the inducer motor IDM speed from low to high. The high-heat pressure switch relay HPSR is de-energized to close the NC contact. When sufficient pressure is available the high-heat pressure switch HPS closes, and the high-heat gas valve solenoid GV-HI is energized. The blower motor BLWM will switch to HI-HEAT speed five seconds after the R-to-W2 circuit closes.

b. **Switching from High- to Low-Heat** - If the thermostat R-to-W2 circuit opens, and the R-to-W1 circuit remains closed, the furnace control CPU will switch the inducer motor IDM speed from high to low. The high-heat pressure switch relay HPSR is energized to open the NC contact and de-energize the high-heat gas valve solenoid GV-HI. When the inducer motor IDM reduces pressure sufficiently, the high-heat pressure switch HPS will open. The gas valve solenoid GV-M will remain energized as long as the low-heat pressure switch LPS remains closed. The blower motor BLWM will switch to LO-HEAT speed five seconds after the R-to-W2 circuit opens.

3. **Cooling Mode**

The thermostat “calls for cooling.”

a. **Single-Speed Cooling**- (See Fig. 21 for thermostat connections)

The thermostat closes the R-to-G-and-Y circuits. The R-to-Y circuit starts the outdoor unit, and the R-to-G-and-Y/Y2 circuits start the furnace blower motor BLWM on COOL speed.

The electronic air cleaner terminal EAC-1 is energized with 115 vac when the blower motor BLWM is operating.

When the thermostat is satisfied, the R-to-G-and-Y circuits are opened. The outdoor unit will stop, and the furnace blower motor BLWM will continue operating on the COOL speed for an additional 90 seconds. Jumper Y/Y2 to DHUM to reduce the cooling off-delay to 5 seconds. (See Fig. 22.)

NOTE: The air conditioning relay disable jumper ACRDJ must be connected to enable the adaptive cooling mode in response to a call for cooling. (See Fig. 22.) When in place the furnace control CPU can turn on the air conditioning relay ACR to energize the Y/Y2 terminal and switch the outdoor unit to high-cooling.

b. **Single-Stage Thermostat and Two-Speed Cooling (Adaptive Mode)**-(See Fig. 31 for thermostat connections)

This furnace can operate a two-speed cooling unit with a single-stage thermostat because the furnace control CPU includes a programmed adaptive sequence of controlled operation, which selects low-cooling or high-cooling operation. This selection is based upon the stored history of the length of previous cooling periods of the single-stage thermostat.

The furnace control CPU can start up the cooling unit in either low- or high-cooling. If starting up in low-cooling, the furnace control CPU determines the low-cooling on-time (from 0 to 20 minutes) which is permitted before switching to high-cooling.

If the power is interrupted, the stored history is erased and the furnace control CPU will initially select low-cooling for up to 20 minutes and then energize the air conditioning relay ACR to energize the Y/Y2 terminal and switch the outdoor unit to high-cooling, as long as the thermostat continues to call for cooling. Subsequent selection is based on stored history of the thermostat cycle times.

The wall thermostat ″calls for cooling″, closing the R-to-G-and-Y circuits. The R-to-Y1 circuit starts the outdoor unit on low-cooling speed, and the R-to-G-and-Y1 circuits starts the furnace blower motor BLWM at low-cool speed (same speed as LO-HEAT).

If the furnace control CPU switches from low-cooling to high-cooling, the furnace control CPU will energize the air conditioning relay ACR. When the air conditioning relay ACR is energized the R-to-Y1-and-Y2 circuits switch the outdoor unit to high-cooling speed, and the R-to-G-and-Y1-and-Y/Y2 circuits switch the furnace blower motor BLWM to COOL speed.

The electronic air cleaner terminal EAC-1 is energized with 115 vac whenever the blower motor BLWM is operating.

When the thermostat is satisfied, the R-to-G-and-Y circuit are opened. The outdoor unit stops, and the furnace blower BLWM and electronic air cleaner terminal EAC-1 will remain energized for an additional 90 seconds. Jumper Y1 to DHUM to reduce the cooling off-delay to 5 seconds. (See Fig. 22.)

NOTE: When transitioning from low-cooling to high-cooling the outdoor unit compressor will shut down for 1 minute while the furnace blower motor BLWM continues to run at low-cool speed (same speed as LO-HEAT) until the outdoor unit compressor comes back on at high speed.

c. **Two-Stage Thermostat and Two-Speed Cooling-**(See Fig. 30 for thermostat connections)

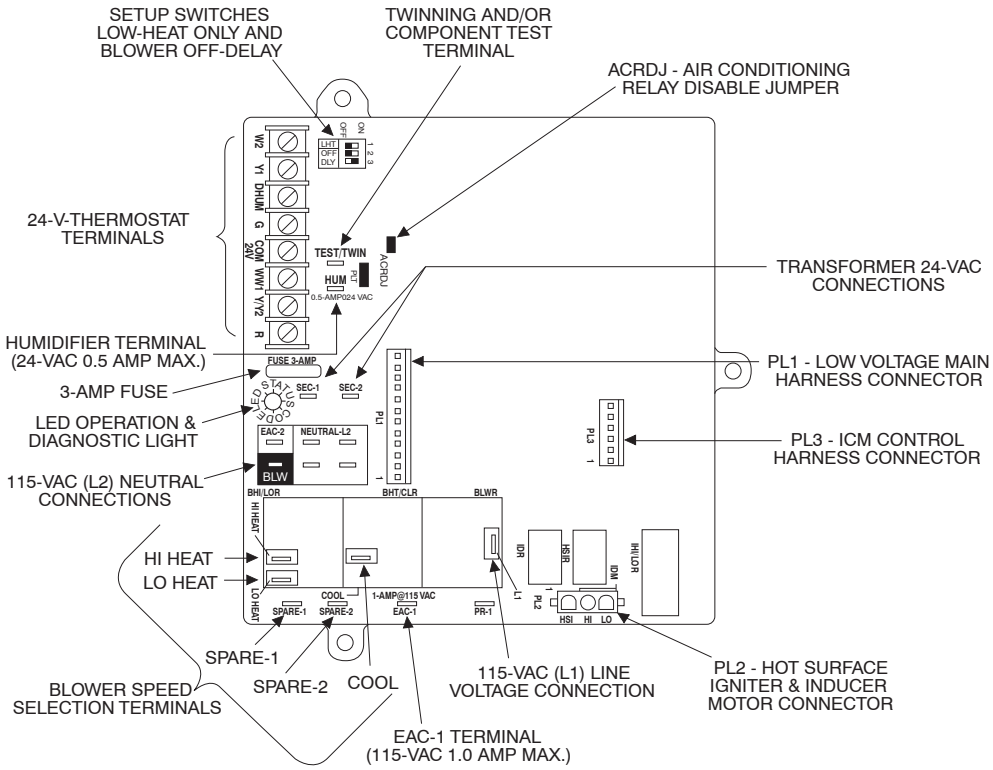

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Fig. 22–Furnace Control

The thermostat closes the R-to-G-and-Y1 circuits for low-cooling or closes the R-to-G-and-Y1-and-Y2 circuits for high-cooling. The R to Y1 circuit starts the outdoor unit on low-cooling speed, and the R-to-G-and-Y1 circuit starts the furnace blower motor BLWM on low-cool speed (same speed as LO-HEAT). The R-to-Y1-and-Y2 circuits start the outdoor unit on high-cooling speed, and the R-to-G-and-Y/Y2 circuits start the furnace blower motor BLWM on COOL speed.

The electronic air cleaner terminal EAC-1 is energized with 115 vac whenever the blower motor BLWM is operating.

When the thermostat is satisfied, the R-to-G-and-Y1 or R-to-G-and-Y1-and-Y2 circuits are opened. The outdoor unit stops, and the furnace blower BLWM and electronic air cleaner terminal EAC-1 will remain energized for an additional 90 seconds. Jumper Y1 to DHUM to reduce the cooling off-delay to 5 seconds. (See Fig. 22.)

NOTE: The air conditioning relay disable jumper ACRDJ must be disconnected to allow thermostat control of the outdoor unit staging. (See Fig. 22.)

4. **Thermidistat Mode**

(See Fig. 24, 25, 26, and 27 for Thermidistat connections) The dehumidification output, DHUM on the Thermidistat should be connected to the furnace control thermostat terminal DHUM. When there is a dehumidify demand, the DHUM input is activated, which means 24 vac signal is removed from the DHUM input terminal. In other words, the DHUM input logic is reversed. The DHUM input is turned ON when no dehumidify demand exists. Once 24 vac is detected by the furnace control on the DHUM input, the furnace control operates in Thermidistat mode. If the DHUM input is off for more than 48 hours, the furnace control reverts back to non-Thermidistat mode.

The cooling operation described in item 3 above also applies to operation with a Thermidistat. The exceptions are listed below:

a. When the R-to-G-and-Y1 circuit is closed and there is a demand for dehumidification, the furnace blower motor BLWM will continue running at low-cool speed (same speed as LO-HEAT).

b. When the R-to-G-and Y/Y2 circuit is closed and there is a demand for dehumidification, the furnace blower motor BLWM will drop the blower speed from COOL to HI-HEAT for a maximum of 10 minutes before reverting back to COOL speed. If there is still a demand for dehumidification after 20 minutes, the furnace control CPU will drop the blower speed back to HI-HEAT speed. This alternating 10-minute cycle will continue as long as there is a call for cooling.

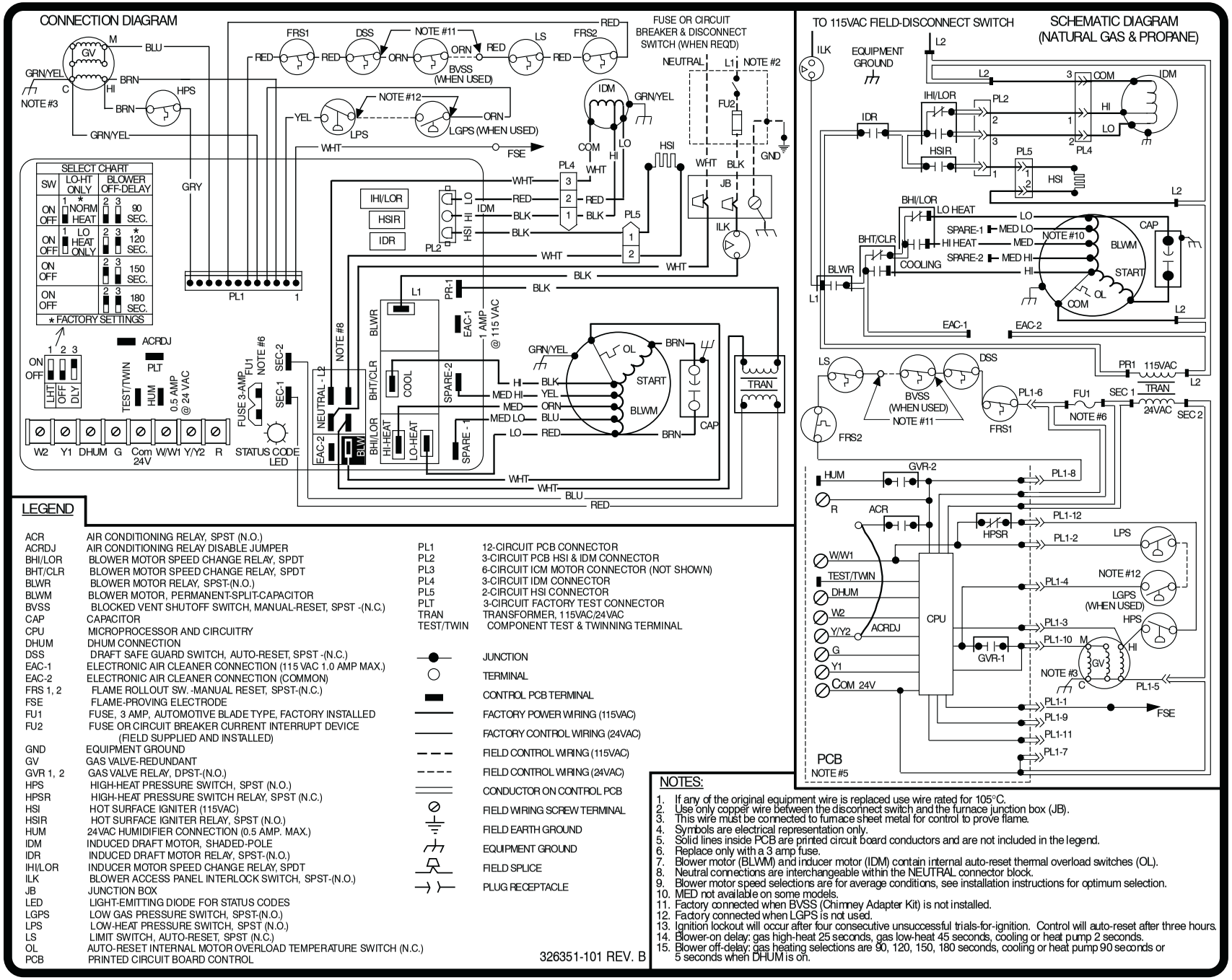
c. When the ″call for cooling″ is satisfied and there is a demand for dehumidification, the cooling blower-off delay is decreased from 90 seconds to 5 seconds.

5. **Continuous Blower Mode**

When the R-to-G circuit is closed by the thermostat, the blower motor BLWM will operate on continuous-blower speed (can be set to LO-HEAT, HI-HEAT, or COOL speed). Factory default is LO-HEAT speed. Terminal EAC-1 is energized as long as the blower motor BLWM is energized.

During a call for heat, the blower BLWM will stop during igniter warm-up (17 seconds), ignition, and blower-ON delay (45 seconds in low-heat, and 25 seconds in high-heat), allowing the furnace heat exchangers to heat up more quickly, then restarts at the end of the blower-ON delay period at LO HEAT or HI HEAT speed.

The blower motor BLWM will revert to continuous-blower speed after the heating cycle is completed. In high-heat, the



LEGEND

ACR	AIR CONDITIONING RELAY, SPST (N.O.)	PL1	12-CIRCUIT PCB CONNECTOR
ACRDJ	AIR CONDITIONING RELAY DISABLE JUMPER	PL2	3-CIRCUIT PCB HSI & IDM CONNECTOR
BHI/LOR	BLOWER MOTOR SPEED CHANGE RELAY, SPDT	PL3	6-CIRCUIT ICM MOTOR CONNECTOR (NOT SHOWN)
BHT/CLR	BLOWER MOTOR SPEED CHANGE RELAY, SPDT	PL4	3-CIRCUIT IDM CONNECTOR
BLWR	BLOWER MOTOR RELAY, SPST-(N.O.)	PL5	2-CIRCUIT HSI CONNECTOR
BLWM	BLOWER MOTOR, PERMANENT-SPLIT-CAPACITOR	PLT	3-CIRCUIT FACTORY TEST CONNECTOR
BVSS	BLOCKED VENT SHUTOFF SWITCH, MANUAL-RESET, SPST -(N.C.)	TRAN	TRANSFORMER, 115VAC/24VAC
CAP	CAPACITOR	TEST/TWIN	COMPONENT TEST & TWINNING TERMINAL
CPU	MICROPROCESSOR AND CIRCUITRY		
DHUM	DHUM CONNECTION		
DSS	DRAFT SAFE GUARD SWITCH, AUTO-RESET, SPST -(N.C.)		JUNCTION
EAC-1	ELECTRONIC AIR CLEANER CONNECTION (115 VAC 1.0 AMP MAX.)		TERMINAL
EAC-2	ELECTRONIC AIR CLEANER CONNECTION (COMMON)		CONTROL PCB TERMINAL
FRS 1, 2	FLAME ROLLOUT SW. -MANUAL RESET, SPST-(N.C.)		FACTORY POWER WIRING (115VAC)
FSE	FLAME-PROVING ELECTRODE		FACTORY CONTROL WIRING (24VAC)
FU1	FUSE, 3 AMP, AUTOMOTIVE BLADE TYPE, FACTORY INSTALLED		FIELD CONTROL WIRING (115VAC)
FU2	FUSE OR CIRCUIT BREAKER CURRENT INTERRUPT DEVICE (FIELD SUPPLIED AND INSTALLED)		FIELD CONTROL WIRING (24VAC)
GND	EQUIPMENT GROUND		CONDUCTOR ON CONTROL PCB
GV	GAS VALVE-REDUNDANT		FIELD WIRING SCREW TERMINAL
GVR 1, 2	GAS VALVE RELAY, DPST-(N.O.)		FIELD EARTH GROUND
HPS	HIGH-HEAT PRESSURE SWITCH, SPST (N.O.)		EQUIPMENT GROUND
HPSR	HIGH-HEAT PRESSURE SWITCH RELAY, SPST (N.C.)		FIELD SPLICE
HSI	HOT SURFACE IGNITER (115VAC)		PLUG RECEPTACLE
HSIR	HOT SURFACE IGNITER RELAY, SPST (N.O.)		
HUM	24VAC HUMIDIFIER CONNECTION (0.5 AMP. MAX.)		
IDM	INDUCED DRAFT MOTOR, SHADED-POLE		
IDR	INDUCED DRAFT MOTOR RELAY, SPST-(N.O.)		
IHI/LOR	INDUCER MOTOR SPEED CHANGE RELAY, SPDT		
ILK	BLOWER ACCESS PANEL INTERLOCK SWITCH, SPST-(N.O.)		
JB	JUNCTION BOX		
LED	LIGHT-EMITTING DIODE FOR STATUS CODES		
LGPS	LOW GAS PRESSURE SWITCH, SPST-(N.O.)		
LPS	LOW-HEAT PRESSURE SWITCH, SPST (N.O.)		
LS	LIMIT SWITCH, AUTO-RESET, SPST (N.C.)		
OL	AUTO-RESET INTERNAL MOTOR OVERLOAD TEMPERATURE SWITCH (N.C.)		
PCB	PRINTED CIRCUIT BOARD CONTROL		

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NOTES:

1. If any of the original equipment wire is replaced use wire rated for 105°C.
2. Use only copper wire between the disconnect switch and the furnace junction box (JB).
3. This wire must be connected to furnace sheet metal for control to prove flame.
4. Symbols are electrical representation only.
5. Solid lines inside PCB are printed circuit board conductors and are not included in the legend.
6. Replace only with a 3 amp fuse.
7. Blower motor (BLWM) and inducer motor (IDM) contain internal auto-reset thermal overload switches (OL).
8. Neutral connections are interchangeable within the NEUTRAL connector block.
9. Blower motor speed selections are for average conditions, see installation instructions for optimum selection.
10. MED not available on some models.
11. Factory connected when BVSS (Chimney Adapter Kit) is not installed.
12. Factory connected when LGPS is not used.
13. Ignition lockout will occur after four consecutive unsuccessful trials-for-ignition. Control will auto-reset after three hours.
14. Blower-on delay: gas high-heat 25 seconds, gas low-heat 45 seconds, cooling or heat pump 2 seconds.
15. Blower off-delay: gas heating selections are 90, 120, 150, 180 seconds, cooling or heat pump 90 seconds or 5 seconds when DHUM is on.

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Fig. 23–Furnace Wiring Diagram

furnace control CPU will hold the blower motor BLWM at HI HEAT speed during the selected blower-OFF delay period before reverting to continuous-blower speed.

When the thermostat ″calls for low-cooling″, the blower motor BLWM will switch to operate at low-cool speed (same speed as LO-HEAT). When the thermostat is satisfied, the blower motor BLWM will operate an additional 90 seconds on low-cool speed before reverting back to continuous-blower speed.

When the thermostat ″calls for high-cooling″, the blower motor BLWM will operate at COOL speed. When the thermostat is satisfied, the blower motor BLWM will operate an additional 90 seconds on COOL speed before reverting back to continuous-blower speed.

When the R-to-G circuit is opened, the blower motor BLWM will continue operating for an additional 5 seconds, if no other function requires blower motor BLWM operation.

Continuous-Blower Speed Selection from Thermostat- To select different continuous-blower speeds from the room thermostat, momentarily turn the FAN switch or push-button on the room thermostat to OFF (AUTO) for 1-3 seconds after the blower motor BLWM is operating. The furnace control CPU will shift the continuous-blower speed from the factory setting of LO-HEAT to HI-HEAT speed. Momentarily turning the FAN switch to OFF (AUTO) again at the thermostat will shift the continuous-blower speed from HI-HEAT to COOL. Repeating the procedure will shift the continuous-blower speed from COOL to LO-HEAT speed. The selection can be changed as many times as desired and is stored in the memory to be automatically used following a power interruption.

6. **Heat Pump**

(See Fig. 26, 27, 28, and 29 for thermostat connections)

When installed with a heat pump, the furnace control automatically changes the timing sequence to avoid long blower off times during demand defrost cycles. When the R-to-W/W1-and-Y1 or R-to-W/W1-and-Y1-and-G circuits are energized the furnace control CPU will switch to or turn on the blower motor BLWM at low-cool speed (same speed as LO-HEAT), and begin a low-heat cycle. The blower motor BLWM will remain on until the end of the prepurge period, then shut off for 24 seconds, then come back on at LO-HEAT speed. When the W/W1 input signal disappears, the furnace control begins a normal inducer post-purge period and the blower remains running at LO-HEAT speed. If the R-to-W/W1-and-Y1-and-G signals disappear at the same time, the blower motor BLWM will remain on for the selected blower-OFF delay period. If the R-to-W/W1-and-Y1 signals disappear, leaving the G signal, the blower motor BLWM will remain on for the selected blower-OFF delay period then switch to continuous-blower speed.

When the R-to-W/W1-and-Y/Y2, R-to-W/W1-and-Y/Y2-and-G, R-to-W/W1-and-Y1-and-Y/Y2, or R-to-W/W1-and-Y1-and-Y/Y2-and-G circuits are energized the furnace control CPU will switch to or turn on the blower motor BLWM at COOL speed, and begin a high-heat cycle. The blower motor BLWM will remain on until the end of the prepurge period, then shut off for 24 seconds then come back on at HI-HEAT speed. When the W/W1 input signal disappears, the furnace control begins a normal inducer post-purge period and the blower switches to COOL speed after a 3-second delay. If the R-to-W/W1-and-Y/Y2-and-G or R-to-W/W1-and-Y1-and-Y/Y2-and-G signals disappear at the same time, the blower motor BLWM will remain on for the selected blower-OFF delay period. If the R-to-W/W1-and-Y/Y2 or R-to-W/W1-and-Y1-and-Y/Y2 signals disappear, leaving the G signal, the blower motor BLWM will remain on for the selected blower-OFF delay period, then switch to continuous-blower speed.

1. Heat pump **MUST** have a high pressure switch for dual fuel applications.
2. Refer to outdoor equipment Installation Instructions for additional information and setup procedure.
3. Select the “ZONE” position on the two-speed heat pump control.
4. Outdoor Air Temperature Sensor must be attached in all dual fuel applications.
5. Dip switch No. 1 on Thermidistat should be set in **OFF** position for air conditioner installations. This is factory default.
6. Dip switch No. 1 on Thermidistat should be set in**ON** position for heat pump installations.
7. Dip switch No. 2 on Thermidistat should be set in **OFF** position for single-speed compressor operation. This is factory default.
8. Dip switch No. 2 on Thermidistat should be set in **ON** position for two-speed compressor operation.
9. Configuration Option No. 10 “Dual Fuel Selection” must be turned**ON** in all dual fuel applications.
10. NO connection should be made to the furnace HUM terminal when using a Thermidistat.
11. Optional connection. If wire is connected, dip switch No. 1 on furnace control should be set in ON position to allow Thermidistat/Thermostat to control furnace staging.
12. Optional connection. If wire is connected, ACRDJ jumper on furnace control shouild be removed to allow Thermidistat/Thermostat to control outdoor unit staging.
13. Furnace must control its own high-stage heating operation via furnace control algorithm. This is factory default.
14. The RVS Sensing terminal “L” should not be connected. This is internally used to sense defrost operation.
15. **DO NOT SELECT** the “FURNACE INTERFACE” or “BALANCE POINT” option on the two-speed heat pump control board. This is controlled internally by the Thermidistat/Dual Fuel Thermostat.
16. Dip switch D on Dual Fuel Thermostat should be set in **OFF** position for single-speed compressor operation. This is factory default.
17. Dip switch D on Dual Fuel Thermostat should be set in **ON** position for two-speed compressor operation.

III. START-UP PROCEDURES

1. **Purge Gas Lines:**After all connections have been made, purge the lines and check for leaks.

> ⚠ **WARNING:** Never purge a line into a combustion chamber. Never use matches, candles, flame, or other sources of ignition for the purpose of checking leakage. Use a soap-and-water solution to check for leakage. Failure to follow this warning can cause fire, explosion, personal injury, or death.

2. **Component Self-Test:**The furnace control allows all components, except the gas valve, to be run for short period of time. This feature helps diagnose a system problem in case of a component failure. To begin component test procedure, short (jumper) the Com-24v terminal on control and the TEST/TWIN 3/16-inch quick-connect terminal on control (behind the Com-24v terminal) for approximately 2 sec. (See Fig. 22.)

TABLE 9–MODEL 312AAV GAS ORIFICE SIZE* AND MANIFOLD PRESSURES FOR GAS INPUT (TABULATED DATA BASED ON 22,000 BTUH HIGH-HEAT/14,500 BTUH FOR LOW-HEAT PER BURNER, DERATED 4 PERCENT FOR EACH 1000 FT ABOVE SEA LEVEL)

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure
U.S.A. and Canada	0 to 2000	850	42	3.6/1.6	42	3.8/1.6	41	3.5/1.5	41	3.6/1.6	41	3.7/1.6
		875	42	3.4/1.5	42	3.6/1.5	42	3.7/1.6	42	3.8/1.6	41	3.5/1.5
		900	42	3.2/1.4	42	3.4/1.5	42	3.5/1.5	42	3.6/1.6	42	3.7/1.6
		925	43	3.7/1.6	42	3.2/1.4	42	3.3/1.4	42	3.4/1.5	42	3.5/1.5
		950	43	3.6/1.5	43	3.7/1.6	43	3.8/1.6	42	3.2/1.4	42	3.3/1.4
		975	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6	43	3.7/1.6	43	3.8/1.7
		1000	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6
		1025	44	3.5/1.5	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5
		1050	44	3.3/1.4	44	3.4/1.5	44	3.6/1.5	43	3.2/1.4	43	3.3/1.4
		1075	45	3.8/1.7	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5	43	3.2/1.4
		1100	45	3.7/1.6	45	3.8/1.7	44	3.2/1.4	44	3.4/1.5	44	3.5/1.5
ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure
U.S.A. and Canada	U.S.A. Altitudes 2001 to 3000 or Canada Altitudes 2000 to 4500	775	42	3.4/1.5	42	3.5/1.5	42	3.6/1.6	42	3.7/1.6	42	3.8/1.7
		800	43	3.8/1.7	42	3.3/1.4	42	3.4/1.5	42	3.5/1.5	42	3.6/1.6
		825	43	3.6/1.6	43	3.7/1.6	42	3.2/1.4	42	3.3/1.4	42	3.4/1.5
		850	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6	43	3.8/1.6	42	3.2/1.4
		875	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6
		900	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4	43	3.3/1.5	43	3.4/1.5
		925	44	3.3/1.5	44	3.4/1.5	44	3.5/1.5	43	3.2/1.4	43	3.3/1.4
		950	45	3.8/1.6	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5	44	3.6/1.5
		975	46	3.8/1.6	45	3.7/1.6	45	3.8/1.7	44	3.3/1.4	44	3.4/1.5
		1000	46	3.8/1.6	46	3.7/1.6	46	3.8/1.7	45	3.8/1.6	44	3.2/1.4
		1025	46	3.4/1.5	46	3.5/1.5	46	3.6/1.6	46	3.8/1.6	45	3.7/1.6
ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure
U.S.A. Only	3001 to 4000	750	43	3.8/1.7	42	3.3/1.4	42	3.4/1.5	42	3.5/1.5	42	3.6/1.6
		775	43	3.6/1.6	43	3.7/1.6	43	3.8/1.7	42	3.3/1.4	42	3.4/1.5
		800	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6	43	3.7/1.6	43	3.8/1.7
		825	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6
		850	44	3.4/1.5	44	3.5/1.5	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5
		875	44	3.2/1.4	44	3.3/1.5	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4
		900	45	3.7/1.6	45	3.8/1.7	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5
		925	46	3.7/1.6	46	3.8/1.7	45	3.7/1.6	44	3.2/1.4	44	3.5/1.4
		950	46	3.5/1.5	46	3.6/1.6	46	3.7/1.6	45	3.7/1.6	45	3.8/1.6
		975	47	3.8/1.6	46	3.4/1.5	46	3.5/1.5	46	3.7/1.6	46	3.8/1.6
		1000	47	3.6/1.6	47	3.7/1.6	47	3.8/1.7	46	3.5/1.5	46	3.6/1.6
ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure	Orifice no.	Manifold Pressure
U.S.A. Only	4001 to 5000	725	43	3.6/1.6	43	3.7/1.6	42	3.2/1.4	42	3.3/1.4	42	3.4/1.5
		750	43	3.4/1.5	43	3.5/1.5	43	3.6/1.5	43	3.7/1.6	43	3.8/1.7
		775	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6
		800	44	3.4/1.5	44	3.5/1.5	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5
		825	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5	43	3.2/1.4
		850	46	3.8/1.7	45	3.8/1.6	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5
		875	46	3.6/1.6	46	3.7/1.6	45	3.7/1.6	45	3.8/1.6	44	3.2/1.4
		900	46	3.4/1.5	46	3.5/1.5	46	3.6/1.6	46	3.8/1.6	45	3.7/1.6
		925	47	3.7/1.6	47	3.8/1.6	46	3.4/1.5	46	3.6/1.5	46	3.7/1.6
		950	47	3.5/1.5	47	3.6/1.6	47	3.7/1.6	47	3.8/1.7	46	3.5/1.5

* Orifice numbers (43) shown in shading are factory installed.

TABLE 9–MODEL 312AAV GAS ORIFICE SIZE* AND MANIFOLD PRESSURES FOR GAS INPUT RATE (CONTINUED)
(TABULATED DATA BASED ON 22,000 BTUH HIGH-HEAT/14,500 FOR LOW-HEAT PER BURNER, DERATED 4 PERCENT FOR EACH 1000 FT ABOVE SEA LEVEL)

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only	5001 to 6000	700	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6	43	3.7/1.6	43	3.8/1.7
		725	44	3.6/1.6	43	3.2/1.4	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6
		750	44	3.4/1.5	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4	43	3.3/1.5
		775	45	3.8/1.7	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5	44	3.6/1.6
		800	46	3.8/1.6	45	3.7/1.6	45	3.8/1.7	44	3.3/1.4	44	3.4/1.5
		825	46	3.5/1.5	46	3.7/1.6	46	3.8/1.6	45	3.7/1.6	45	3.8/1.7
		850	47	3.8/1.6	46	3.4/1.5	46	3.6/1.5	46	3.7/1.6	46	3.8/1.6
		875	47	3.6/1.5	47	3.7/1.6	47	3.8/1.7	46	3.5/1.5	46	3.6/1.6
		900	48	3.8/1.7	47	3.5/1.5	47	3.6/1.6	47	3.7/1.6	47	3.8/1.7
		925	48	3.6/1.6	48	3.8/1.6	47	3.4/1.5	47	3.5/1.5	47	3.6/1.6
		950	48	3.4/1.5	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6	47	3.4/1.5
		975	49	3.8/1.7	48	3.4/1.5	48	3.5/1.5	48	3.6/1.6	48	3.7/1.6
		1000	49	3.6/1.6	49	3.8/1.6	48	3.3/1.4	48	3.4/1.5	48	3.5/1.5
ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only	6001 to 7000	650	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6	43	3.7/1.6	43	3.8/1.7
		675	44	3.6/1.6	43	3.2/1.4	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6
		700	44	3.3/1.5	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4	43	3.3/1.4
		725	45	3.8/1.6	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5
		750	46	3.7/1.6	46	3.8/1.7	45	3.8/1.6	44	3.2/1.4	44	3.3/1.4
		775	46	3.5/1.5	46	3.6/1.6	46	3.7/1.6	46	3.8/1.7	45	3.8/1.6
		800	47	3.7/1.6	47	3.8/1.7	46	3.5/1.5	46	3.6/1.6	46	3.7/1.6
		825	47	3.5/1.5	47	3.6/1.6	47	3.7/1.6	47	3.8/1.7	46	3.5/1.5
		850	48	3.7/1.6	48	3.8/1.7	47	3.5/1.5	47	3.6/1.6	47	3.7/1.6
		875	48	3.5/1.5	48	3.6/1.6	48	3.8/1.6	47	3.4/1.5	47	3.5/1.5
ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only	7001 to 8000	625	44	3.6/1.6	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6
		650	44	3.3/1.5	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4	43	3.3/1.4
		675	45	3.7/1.6	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5
		700	46	3.7/1.6	46	3.8/1.6	45	3.7/1.6	45	3.8/1.7	44	3.5/1.4
		725	46	3.4/1.5	46	3.5/1.5	46	3.6/1.6	46	3.8/1.6	45	3.7/1.6
		750	47	3.6/1.6	47	3.7/1.6	46	3.4/1.5	46	3.5/1.5	46	3.6/1.6
		775	47	3.4/1.5	47	3.5/1.5	47	3.6/1.6	47	3.7/1.6	46	3.4/1.5
		800	48	3.6/1.6	48	3.7/1.6	47	3.4/1.5	47	3.5/1.5	47	3.6/1.6
		825	48	3.4/1.5	48	3.5/1.5	48	3.6/1.6	48	3.8/1.6	47	3.4/1.5
		850	49	3.8/1.6	48	3.3/1.4	48	3.4/1.5	48	3.5/1.5	48	3.6/1.6
ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only	8001 to 9000	600	44	3.4/1.5	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4	43	3.3/1.4
		625	45	3.7/1.6	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5
		650	46	3.6/1.6	46	3.8/1.6	45	3.7/1.6	45	3.8/1.7	44	3.3/1.4
		675	47	3.8/1.7	46	3.5/1.5	46	3.6/1.6	46	3.7/1.6	46	3.8/1.7
		700	47	3.6/1.5	47	3.7/1.6	47	3.8/1.7	46	3.5/1.5	46	3.6/1.6
		725	48	3.8/1.6	47	3.4/1.5	47	3.5/1.5	47	3.7/1.6	47	3.8/1.6
		750	48	3.5/1.5	48	3.6/1.6	48	3.8/1.6	47	3.4/1.5	47	3.5/1.5
		775	48	3.3/1.4	48	3.4/1.5	48	3.5/1.5	48	3.6/1.6	48	3.8/1.6
		800	49	3.6/1.6	49	3.8/1.6	48	3.3/1.4	48	3.4/1.5	48	3.5/1.5

* Orifice numbers (43) shown in shading are factory installed.

TABLE 9–MODEL 312AAV GAS ORIFICE SIZE* AND MANIFOLD PRESSURES FOR GAS INPUT RATE (CONTINUED) (TABULATED DATA BASED ON 22,000 BTUH HIGH-HEAT/14,500 BTUH FOR LOW-HEAT PER BURNER, DERATED 4 PERCENT FOR EACH 1000 FT ABOVE SEA LEVEL)

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only	9001 to 10,000	575	45	3.8/1.6	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5
		600	46	3.6/1.6	46	3.7/1.6	45	3.7/1.6	45	3.8/1.7	44	3.2/1.4
		625	47	3.8/1.6	46	3.5/1.5	46	3.6/1.6	46	3.7/1.6	46	3.8/1.7
		650	47	3.5/1.5	47	3.6/1.6	47	3.7/1.6	46	3.4/1.5	46	3.5/1.5
		675	48	3.7/1.6	48	3.8/1.7	47	3.5/1.5	47	3.6/1.6	47	3.7/1.6
		700	48	3.4/1.5	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6	47	3.4/1.5
		725	49	3.8/1.6	48	3.3/1.4	48	3.4/1.5	48	3.5/1.4	48	3.6/1.6
		750	49	3.5/1.5	49	3.6/1.6	49	3.8/1.6	48	3.3/1.4	48	3.4/1.5
		775	49	3.3/1.4	49	3.4/1.5	49	3.5/1.5	49	3.6/1.6	49	3.7/1.6

* Orifice numbers (43) shown in shading are factory installed.

NOTE: Component test feature will not operate if any thermostat signal is present at the control.

Component test sequence is as follows:

a. Momentarily short (jumper) TEST/TWIN and Com-24v terminals until LED goes off.

b. LED will display previous status code 4 times.

c. Inducer motor starts on high-speed and continues to run until Step H of component test sequence.

d. Hot surface igniter is energized for 15 sec., then de-energized.

e. Blower motor operates on LO-HEAT speed for 10 sec.

f. Blower motor operates on HI-HEAT speed for 10 sec.

g. Blower motor operates on COOL speed for 10 sec.

h. Inducer motor goes to low-speed for 10 sec., then stops.

3. **Operate Furnace:** Follow procedures on operating instructions label attached to furnace.

4. **Furnace Restart:** With the furnace operating, set the thermostat below room temperature and observe that the furnace goes off. Set the thermostat above room temperature and observe that the furnace restarts.

IV. ADJUSTMENTS

1. Set gas input rate

Furnace gas input rate on rating plate is for installations at altitudes up to 2000 ft. Furnace input rate must be within ±2 percent of furnace rating plate input.
In the U.S.A., the input rating for altitudes above 2,000 ft. must be reduced by 4

for each 1,000 ft. above sea level.
In Canada, input rating must be reduced by 10

for altitudes of 2,000 ft. to 4,500 ft. above sea level.

4. Determine natural gas orifice size and manifold pressure for correct input.

a. Obtain average yearly gas heat value (at installed altitude) from local gas supplier.

b. Obtain average yearly gas specific gravity from local gas supplier.

c. Verify furnace model. Table 9 may only be used for model 312AAV furnaces.

d. Find installation altitude in Table 9.

NOTE: For Canada altitudes of 2000 to 4500 ft, use U.S.A. altitudes of 2001 to 3000 ft in Table 9.

e. Find closest natural gas heat value and specific gravity in Table 9.

f. Follow heat value and specific gravity lines to point of intersection to find orifice size and low-and high-heat manifold pressure settings for proper operation.

g. Check and verify burner orifice size in furnace. NEVER ASSUME ORIFICE SIZE. ALWAYS CHECK AND VERIFY.

EXAMPLE: (0–2000 ft altitude)
Heating value = 975 Btu/cu ft
Specific gravity = 0.62
Therefore: Orifice No. 43*
Manifold pressure: 3.6-in. wc for high-heat
1.6-in. wc for low-heat
* Furnace is shipped with No. 43 orifices. In this example all main burner orifices are the correct size and do not need to be changed to obtain proper input rate.

5. Adjust manifold pressure to obtain input rate.

a. Remove regulator seal caps that conceal adjustment screws for low-and high-heat gas valve pressure regulators. (See Fig.32)

b. Move setup switch LHT on control to ON position. (See Fig. 22). This keeps furnace locked in low-heat operation.

c. Jumper R and W/W1 thermostat connections on control to start furnace.

d. Turn low-heat adjusting screw (5/64 hex Allen wrench) counterclockwise (out) to decrease input rate or clockwise (in) to increase input rate.

NOTE: DO NOT set low-heat manifold pressure less than 1.3–in wc or more than 1.7–in. wc for natural gas. If manifold pressure is outside this range, change main burner orifices.

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

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

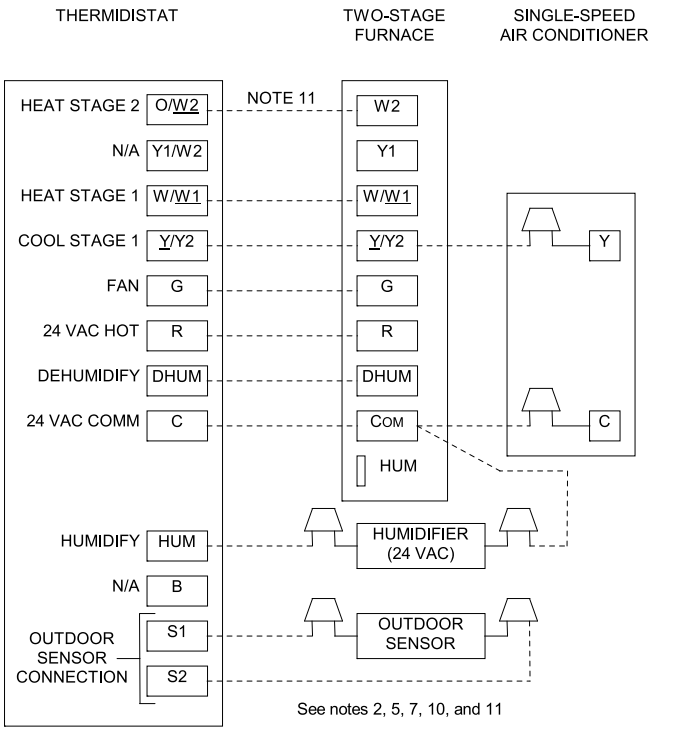

Fig. 24–Two-Stage Furnace with Single-Speed Air Conditioner

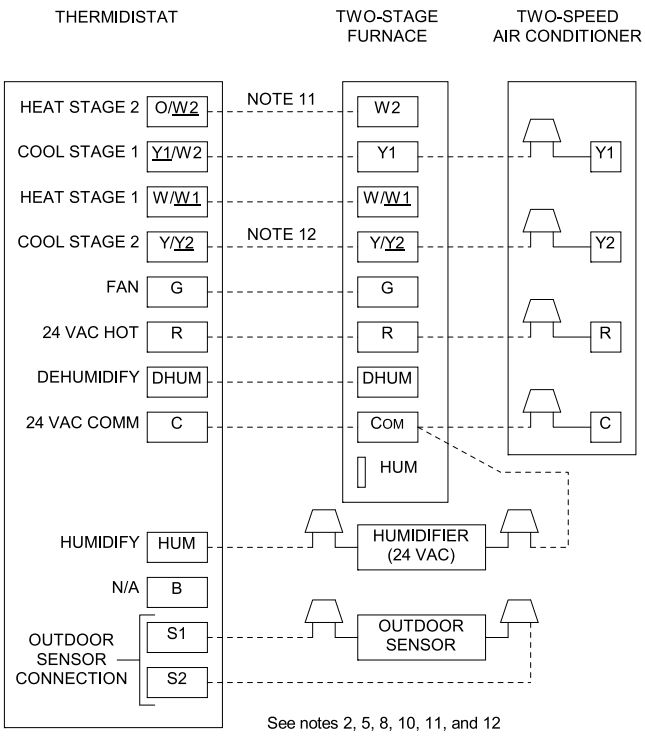

Fig. 25–Two-Stage Furnace with Two-Speed Air Conditioner

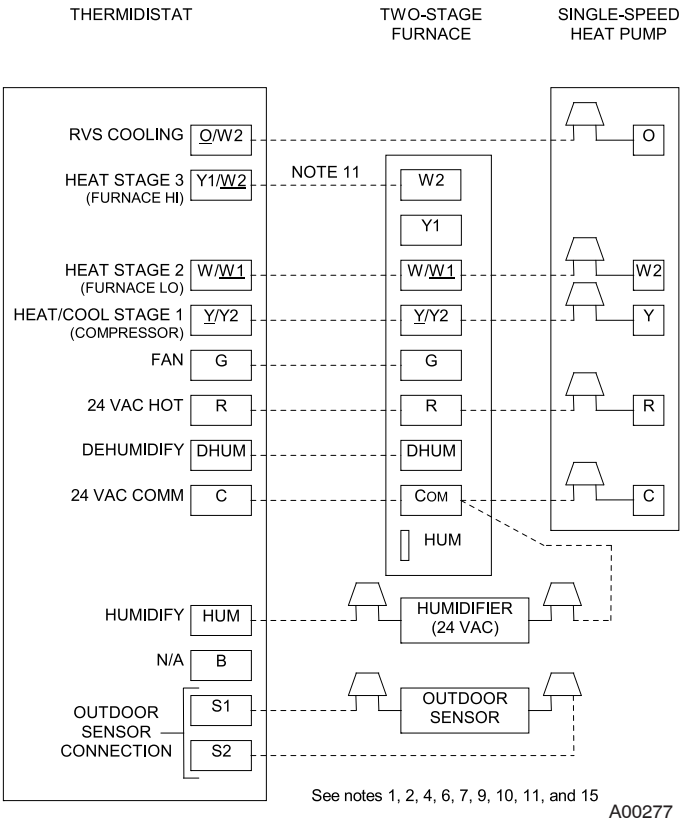

Fig. 26–Two-Stage Furnace with Single-Speed Heat Pump (Dual Fuel)

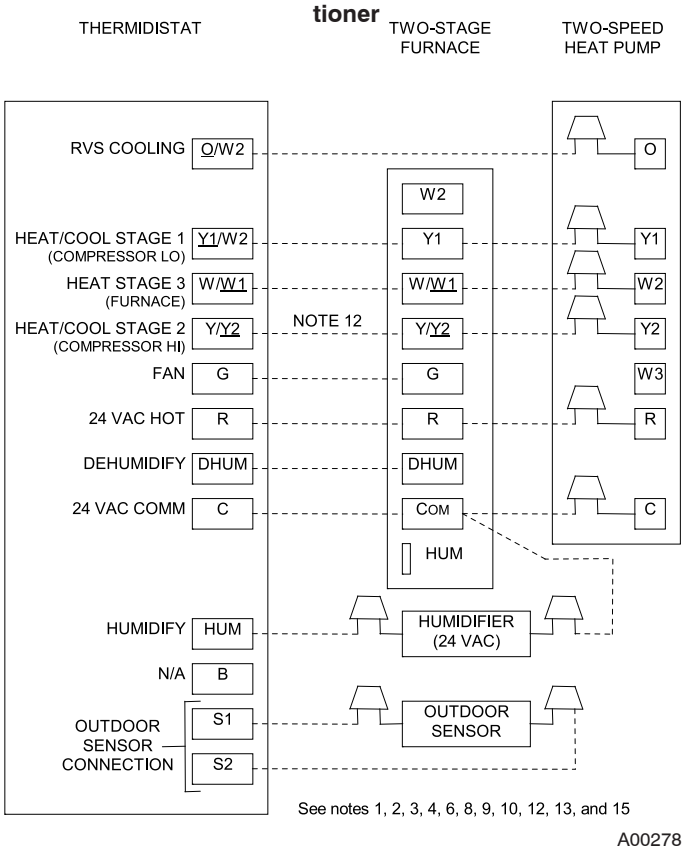

Fig. 27–Two-Stage Furnace with Two-Speed Heat Pump (Dual Fuel)

e. Move setup switch LHT to OFF position after completing low-heat adjustment.

f. Jumper R and W2 thermostat connections on control. (See Fig. 22.) This keeps furnace locked in high-heat operation.

g. Turn high-heat adjusting screw (5/64 hex Allen wrench) counterclockwise (out) to decrease input rate or clockwise (in) to increase rate.

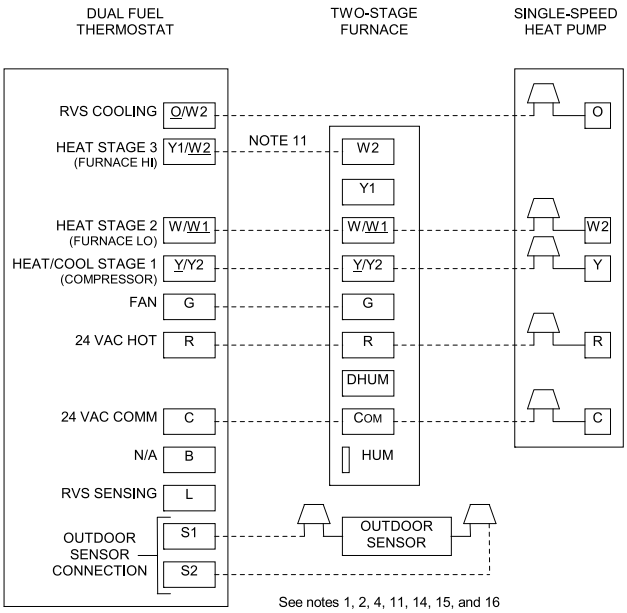

Fig. 28–Dual Fuel Thermostat with Two-Stage Furnace and Single-Speed Heat Pump

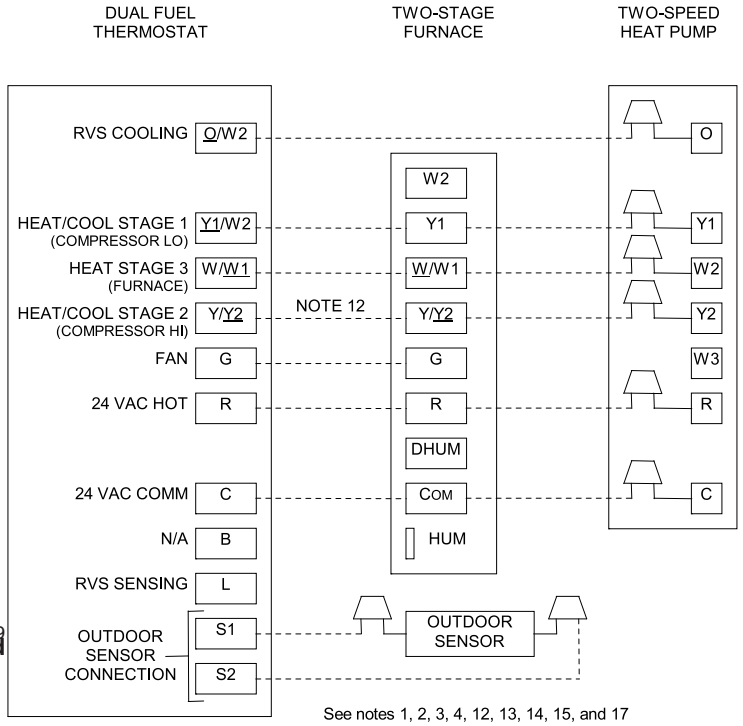

Fig. 29– Dual Fuel Thermostat with Two-Stage Furnace and Two-Speed Heat Pump

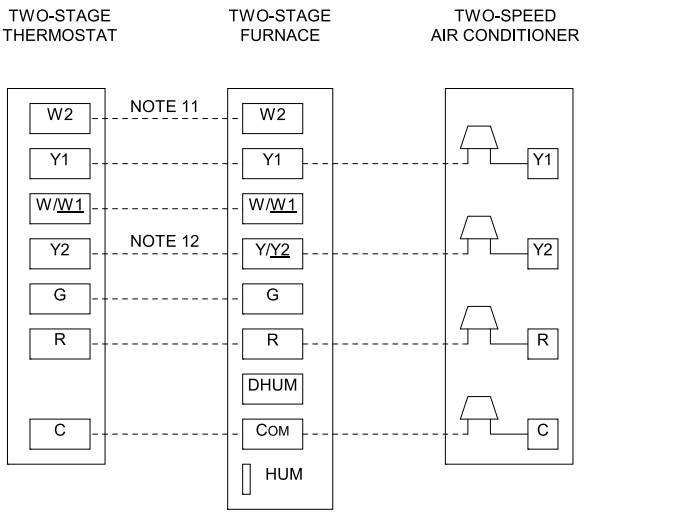

Fig. 30–Two-Stage Thermostat with Two-Stage Furnace and Two-Speed Air Conditioner

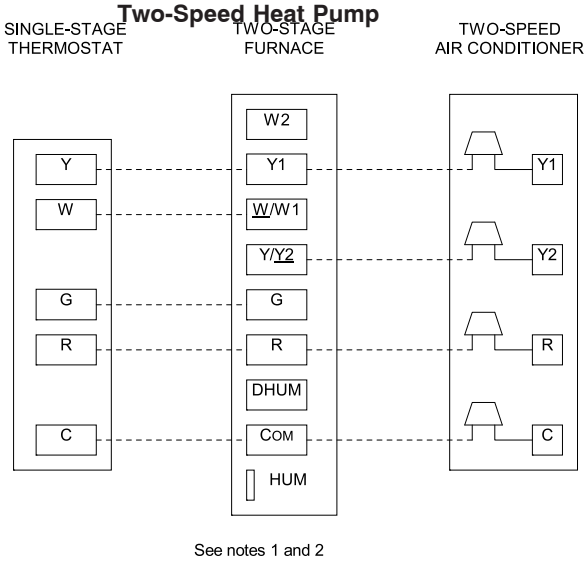

Fig. 31–Single-Stage Thermostat with Two-Stage Furnace and Two-Speed Air Conditioner

NOTE: DO NOT set high-heat manifold pressure less than 3.2–in. wc or more than 3.8–in. wc for natural gas. If manifold pressure is outside this range, change main burner orifices.

h. When correct input is obtained, replace caps that conceal gas valve regulator adjustment screws. Main burner flame should be clear blue, almost transparent. (See Fig. 34.)

i. Remove jumper R-to-W2.

6. Verify natural gas input rate by clocking gas meter.

a. Calculate high-altitude adjustment (if required).
UNITED STATES
At altitudes above 2000 ft, this furnace has been approved for a 4 percent derate for each 1000 ft above sea level. See example and Table 10 for derate multiplier factor.
CANADA
At installation altitudes from 2000 to 4500 ft, this furnace must be derated 10 percent by an authorized Gas Conversion Station or Dealer. To determine correct input rate for altitude, see example above and use 0.90 as derate multiplier factor.

b. Check that gas valve adjustment caps are in place for proper input to be clocked.

c. Obtain yearly heat value average for local gas supply.

NOTE: Be sure heating value of gas used for calculation is correct for your altitude. Consult local gas utility for altitude adjustment of gas heating value.

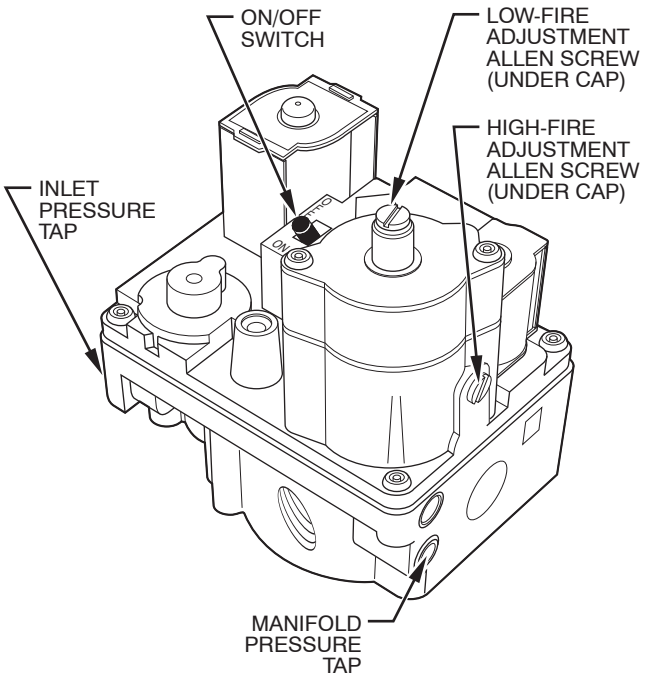

Fig. 32–Redundant Automatic Gas Control Valve

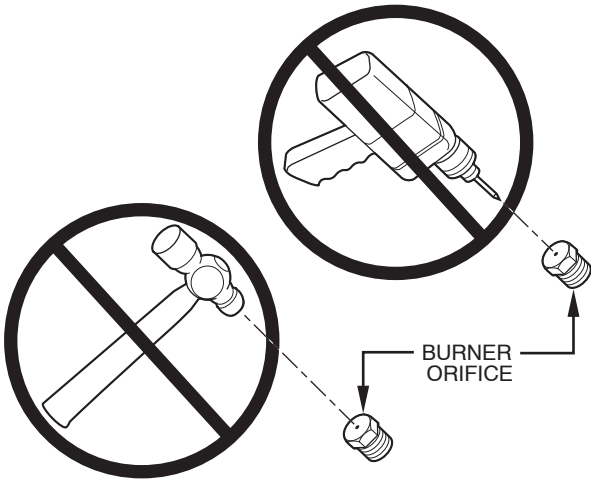

Fig. 33–Orifice Hole

⚠ **CAUTION:** DO NOT redrill orifices. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flames. This can result in flame impingement of heat exchangers, causing failures.

d. Check and verify orifice size in furnace. NEVER ASSUME THE ORIFICE SIZE. ALWAYS CHECK AND VERIFY.

e. Turn off all other gas appliances and pilots.

f. Move setup switch LHT to ON position. (See Fig. 22.) This keeps furnace locked in low-heat operation.

g. Jumper R to W/W1.

h. Let furnace run for 3 minutes in low-heat operation.

i. Measure time (in sec) for gas meter to complete 1 revolution. Note reading.

j. Refer to Table 11 for cubic ft of gas per hr.

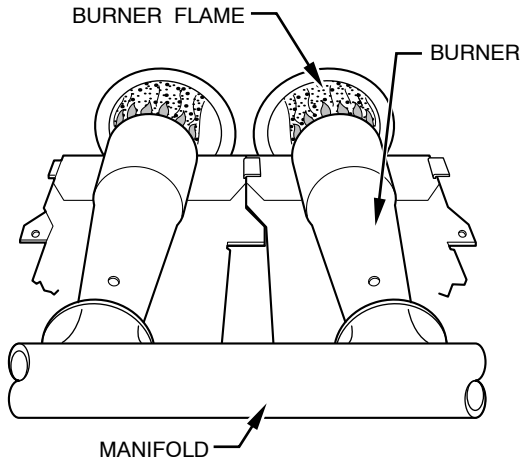

Fig. 34-Burner Flame

TABLE 10–ALTITUDE DERATE MULTIPLIER FOR U.S.A.

ALTITUDE (FT)	PERCENT OF DERATE	DERATE MULTIPLIER FACTOR FOR U.S.A.*
0–2000	0	1.00
2001–3000	8–12	0.90
3001–4000	12–16	0.86
4001–5000	16–20	0.82
5001–6000	20–24	0.78
6001–7000	24–28	0.74
7001–8000	28–32	0.70
8001–9000	32–36	0.66
9001–10,000	36–40	0.62

* Derate multiplier factor is based on midpoint altitude for altitude range.

EXAMPLE:
88,000 BTUH INPUT FURNACE INSTALLED AT 4300 FT.

		Derate		Furnace Input Rate
Furnace Input Rate	X	Multiplier	=	at Installation
at Sea Level		Factor		Altitude
88,000	X	0.82	=	72,160

k. Multiply gas rtate cu ft/hr by heating value (Btu/cu ft).

l. Move setup switch LHT to OFF position and jumper R and W2 thermostat connections. (See Fig. 22.) This keeps furnace locked in high-heat operation. Repeat items h through k for high-heat operation.

EXAMPLE: (High–heat operation at 0-2000 ft altitude)
Furnace input from rating plate is 88,000 Btuh.
Btu heating input = Btu/cu ft X cu ft/hr
Heating value of gas = 1050 Btu/cu ft
Time for 1 revolution of 2-cu ft dial = 87 sec
Gas rate = 83 cu ft/hr (from Table 11)
Btu heating input = 83 X 1050 = 87,150 Btuh. In this example, the orifice size and manifold pressure adjustment is within ±2 percent of the furnace input rate.

NOTE: Measured gas inputs (high-heat and low-heat) must be within ± 2 percent of that stated on furnace rating plate when installed at sea level or derated per that stated above when installed at higher altitudes.

m. Remove jumper across R, W/W1, and W2 thermostat connections to terminate call for heat.

7. Set temperature rise.

Place LHT in ON position. Jumper R to W/W1 and W2 to check high-gas-heat temperature rise. To check low-gas-heat temperature rise, remove jumper to W2. Determine air temperature rise for both high and low fire. Do not exceed temperature rise ranges specified on unit rating plate for high-and low-fire.

The furnace must operate within the temperature rise ranges specified on the furnace rating plate. Determine the air temperature as follows:

a. Place thermometers in return and supply ducts as close to furnace as possible. Be sure thermometers do not see heat exchangers so that radiant heat does not affect readings. This practice is particularly important with straight-run ducts.

b. When thermometer readings stabilize, subtract return-air temperature from supply-air temperature to determine air temperature rise.

NOTE: If the temperature rise is outside this range, first check:

(1.) Gas input for low-and high-fire opeation.

(2.) Derate for altitude if applicable.

(3.) Return and supply ducts for excessive restrictions causing static pressures greater than 0.50–in. wc.

c. Adjust air temperature rise by adjusting blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise. Fro high fire, speed selection can be med-high, med (5–speed blowers only), or med-low (factory setting). For low fire, speed selection can be low (factory setting), med-low, or med (5–speed blowers only).

⚠ **WARNING:** Disconnect 115-v electrical power before changing speed tap. Failure to follow this warning could result in personal injury.

d. To change motor speed selection for high heat, remove blower motor lead from control HI-HEAT terminal. (See Fig. 22 and 23.) Select desired blower motor speed lead from 1 of the other terminals and relocate it to the HI-HEAT terminal. (See Table 11 for lead color identification). Reconnect original lead to SPARE terminal. Follow this procedure for proper selection of COOL and LO-HEAT speed selection.

TABLE 11–SPEED SELECTION

COLOR	SPEED	AS SHIPPED
White	Common	BLW
Black	High	COOL
Yellow	Med-High	SPARE
Orange†	Med	SPARE
Blue	Med-Low	HI-HEAT
Red	Low*	LO HEAT

* Continuous-blower speed-as shipped default

† Available on 5–speed blowers only.

⚠ **CAUTION:** Recheck temperature rise. It must be within limits specified on the rating plate. Recommended operation is at the midpoint of rise range or above.

8. Set thermostat heat anticipator.

a. When using a nonelectric thermostat, the thermostat heat-anticipation must be set to match the amp draw of the electrical components in the R-W/W1 circuit. Accurate amp draw readings can be obtained at the wires normally connected to thermostat subbase terminals, R and W/W1.

Fig. 16 illustrates an easy method of obtaining actual amp draw. The amp reading should be taken after blower motot has started and furnace is operating in low-heat. To operate furnace in low-heat, first move LHT to ON position, then connect ammeter wires as shown in Fig. 37. The thermostat anticipator should NOT be in th circuit while measuring current. If thermostat has no subbase, the thermostat must be disconnected from R and W/W1 wires during current measurement. Return LHT to OFF after completing the reading. See thermostat manufacturer's instructions for adjusting heat-anticipator.

b. When using an elctronic thermostat, set cycle rate for 3 cycles per hr.

TABLE 12–GAS RATE (CU FT/HR)

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

V. CHECK SAFETY CONTROLS

The flame sensor, gas valve, and pressure switch were all checked in the Start-up procedure section as part of normal operation.

1. Check Main Limit Switches

This control shuts off combustion control system and energizes air-circulating blower motor, if furnace overheats.

Recommended method of checking this limit control is to gradually block off return air after furnace has been operating for a period of at least 5 minutes. As soon as limit control has shut off burners, return-air opening should be unblocked to permit normal air circulation. By using this method to check limit control, it can be established that limit is functioning properly and will operate if there is a restricted return-air supply or motor failure. If limit control does not function during this test, cause must be determined and corrected.

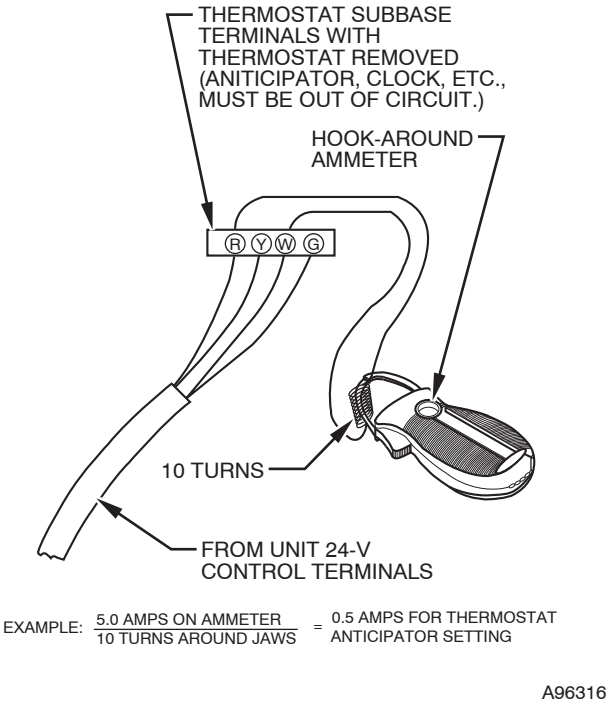

Fig. 35–Amp Draw Check With Ammeter

2. Check draft safeguard switch.

The purpose of this control is to permit the safe shutdown of the furnace during certain blocked vent conditions.

a. Disconnect power to furnace and remove vent connector from furnace vent elbow. Be sure to allow time for vent pipe to cool down before removing.

b. Restore power to furnace and set room thermostat above room temperature.

c. After normal start-up, allow furnace to operate for 2 minutes, then block vent elbow in furnace 100 percent. Furnace should cycle off within 2 minutes.

d. Remove blockage and reconnect vent pipe to furnace vent elbow.

e. Switch will auto-reset when it cools.

3. Check Pressure Switch

This control proves operation of the draft inducer blower.

a. Turn off 115-v power to furnace.

b. Remove outer door and disconnect inducer motor lead wires from wire harness.

c. Turn on 115-v power to furnace.

d. Set thermostat to ″call for heat″ and wait 1 minute. When pressure switch is functioning properly, hot surface igniter should NOT glow and control diagnostic light flashes a status code 32. If hot surface igniter glows when inducer motor is disconnected, shut down furnace immediately. Determine reason pressure switch did not function properly and correct condition.

e. Turn off 115-v power to furnace.

f. Reconnect inducer motor wires, replace outer door, and turn on 115-v power.

VI. CHECKLIST

1. Put away tools and instruments. Clean up debris.
2. Check that switches for LHT and OFF-DLY are selected as desired.
3. Verify that blower and burner access doors are properly installed.
4. Cycle test furnace with room thermostat.
5. Check operation of accessories per manufacturer's instructions.
6. Review User's Guide with owner.
7. Leave literature packet near furnace.

CHECKLIST—INSTALLATION

LOAD CALCULATION

_____ Heating Load (Btuh)

_____ Cooling Load (Btuh)

_____ Furnace Model Selection

AIR FOR COMBUSTION AND VENTILATION

_____ Unconfined Space

_____ Confined Space

VENTING

_____ NFGC (United States)

_____ NSCNGPIC (Canada)

_____ Local Codes

_____ 1/4-in. Upward Slope

_____ Joints Secure

_____ See Attached Vent Table Instructions

CHECKLIST—START-UP

_____ Gas Input Rate
(Set Within 2 percent of Rating Plate)

_____ Temperature Rise Adjusted

_____ Thermostat Anticipator Setting Adjusted or

_____ Thermostat Cycle Rate (3 cycles per Hr)

CHECK SAFETY CONTROLS OPERATION

_____ Primary Limit

_____ Pressure Switches

_____ Draft Safeguard Switch