installation, start-up, and operating instructions

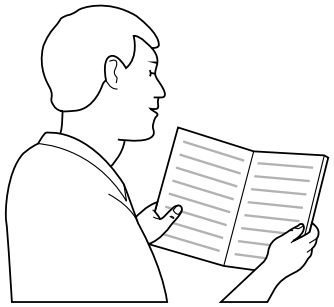
4-WAY MULTIPOISE FIXED-CAPACITY CONDENSING GAS FURNACE

345MAV

Series B

Cancels: II 345M-40-2 II 345M-40-3

5-99



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

As an ENERGY STAR® Partner, BRYANT Heating & Cooling Systems Company has determined that this product meets the ENERGY STAR® guidelines for energy efficiency.

REGISTERED QUALITY SYSTEM

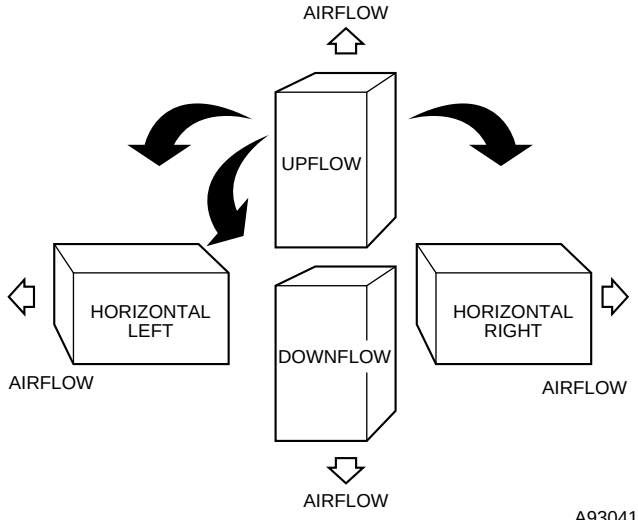

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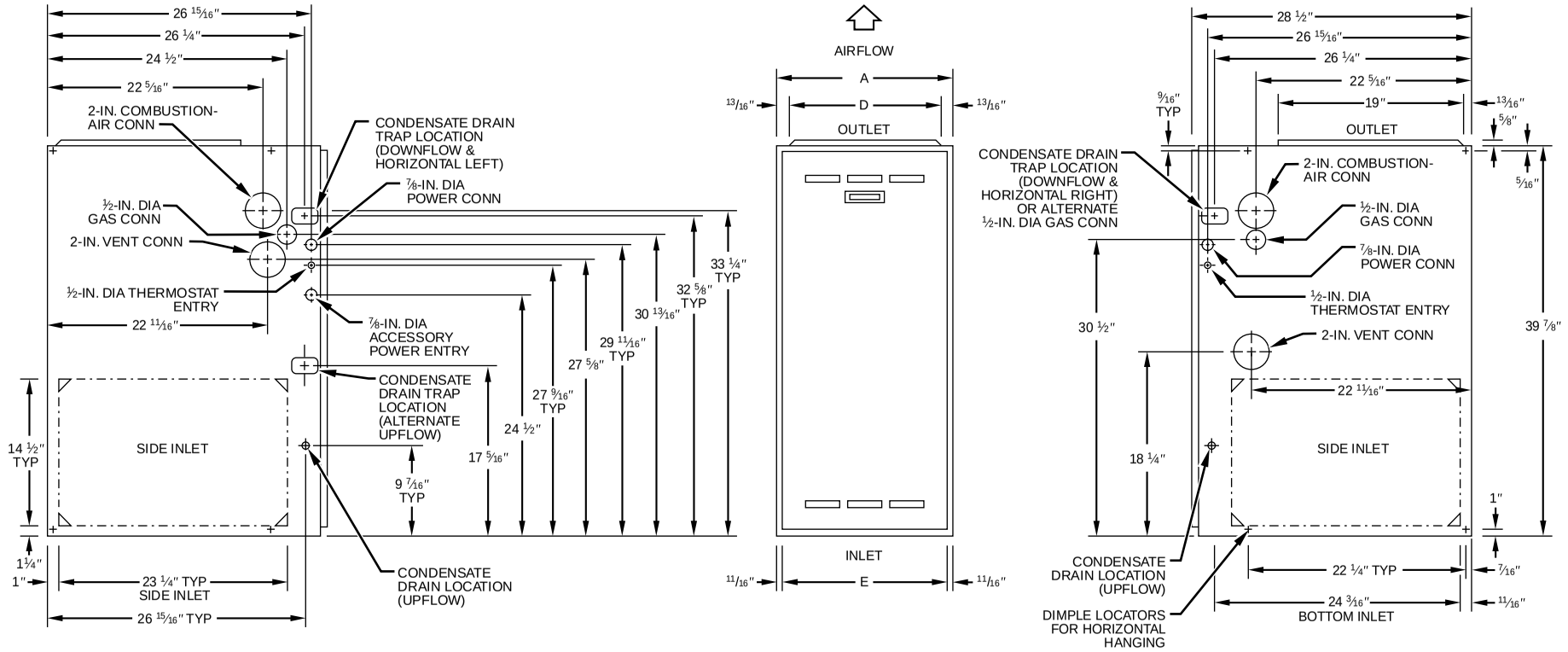
Fig. 1—Multipoise Orientations



NOTES:
1. Minimum return-air openings at furnace, based on metal duct. If flex duct is used, see flex duct manufacturer's recommendations for equivalent diameters.
2. 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.
   c. For 1600 CFM–22-in. round or 14½ x 23¼-in. rectangle.
   d. For airflow requirements above 1800 CFM, see Air Delivery table in Product Data literature for specific use of single side inlets. The use of both side inlets, a combination of 1 side and the bottom, or the bottom only will ensure adequate return air openings for airflow requirements above 1800 CFM.

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DIMENSIONS (IN.)

UNIT SIZE	A	D	E
024040	17-1/2	15-7/8	16
036040	17-1/2	15-7/8	16
024060	17-1/2	15-7/8	16
036060	17-1/2	15-7/8	16
048060	17-1/2	15-7/8	16
036080	17-1/2	15-7/8	16
048080	17-1/2	15-7/8	16
060080	21	19-3/8	19-1/2
048100	21	19-3/8	19-1/2
060100	21	19-3/8	19-1/2
060120	24-1/2	22-7/8	23

→ **Fig. 2—Dimensional Drawing**

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. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in literature, on tags, and on labels attached to or shipped with unit and other safety precautions that may apply.

Follow all safety codes, including the National Fuel Gas Code (NFGC) NFPA 54/ANSI Z223.1-1996, and the Installation Standards, Warm Air Heating and Air Conditioning Systems (NFPA 90B) ANSI/NFPA 90B. In Canada, refer to the current edition of the CAN/CGA-B149.1 and .2-M95 National Standard of Canada, Natural Gas and Propane Installation Codes (NSCNGPIC). Wear safety glasses and work gloves. Have a fire extinguisher available during start-up and adjustment procedures and service calls.

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

Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **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.

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

⚠ **CAUTION:** Electrostatic discharge can affect electronic components. Take precautions 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. DO NOT TOUCH THE CONTROL OR **ANY** WIRE CONNECTED TO THE CONTROL PRIOR TO DISCHARGING YOUR BODY'S ELECTROSTATIC CHARGE TO GROUND.
2. Firmly touch a clean, unpainted, metal surface of the furnace chassis which is close to the control. Tools held in a person's hand during grounding will be satisfactorily discharged.
3. After touching the chassis you may proceed to service the control or connecting wires as long as you do nothing that

INSTALLATION

This forced air furnace is equipped for use with natural gas at altitudes 0 - 10,000 ft (0 - 3,050m), except 140 size Furnaces are only approved for altitudes 0 - 7,000 ft. (0 - 2,135m).

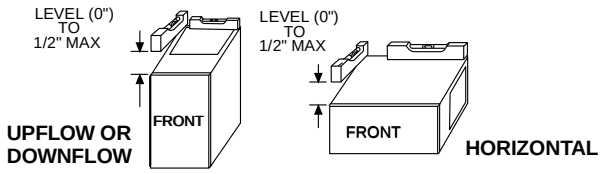
An accessory kit, supplied by the manufacturer, shall be used to convert to propane gas use or may be required for some natural gas applications.

This furnace is for indoor installation in a building constructed on site. This furnace may be installed in a manufactured (mobile) home when stated on rating plate and using factory authorized kit.

This furnace may be installed on combustible flooring in alcove or closet at minimum clearance from combustible material.

This appliance requires a special venting system. Refer to the installation instructions for parts list and method of installation. This furnace is for use with schedule-40 PVC, PVC-DWV, or ABS-DWV pipe, and must not be vented in common with other gas-fired appliances. Construction through which vent/air intake pipes may be installed is maximum 24 inches (600 mm), minimum 3/4 inches (19 mm) thickness (including roofing materials).

Furnace must be installed level, or pitched forward within 1/2 inch of level for proper drainage. Failure will result in equipment or property damage. See Installation Manual for IMPORTANT unit support details on horizontal applications.



MINIMUM INCHES CLEARANCE TO COMBUSTIBLE CONSTRUCTION

ALL POSITIONS:

* Minimum front clearance for service 30 inches (762mm).

†† 140 size furnaces require 1 inch back clearance to combustible materials.

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.

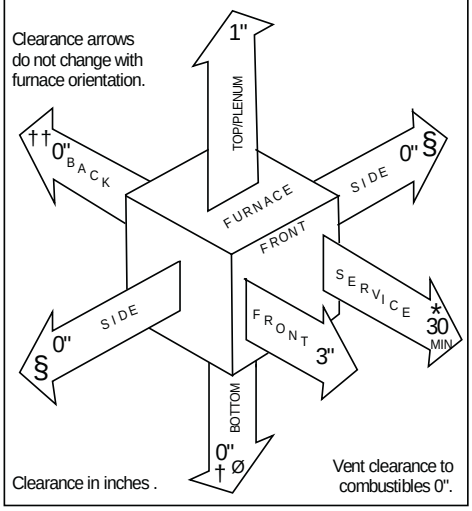
HORIZONTAL POSITIONS:

§ Clearance shown is for air inlet and air outlet end. Line contact is permissible only between lines formed by intersections of top and two sides of furnace jacket, and building joists, studs, or framing.

Ø 120 and 140 size Furnaces require 1 inch bottom clearance to combustible materials.

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

Clearance arrows do not change with furnace orientation.



Clearance in inches .

Vent clearance to combustibles 0".

324999-201 REV. A
(LIT. TOP)

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→ **Fig. 3—Clearances to Combustibles**

recharges your body with static electricity (for example; DO NOT move or shuffle your feet, DO NOT touch ungrounded objects, etc.).

4. If you touch ungrounded objects (recharge your body with static electricity), firmly touch furnace again before touching control or wires.
5. Use this procedure for installed and uninstalled (ungrounded) furnaces.
6. Before removing a new control from its container, discharge your body's electrostatic charge to ground to protect the control from damage. If the control is to be installed in a furnace, follow items 1 through 5 before bringing the control or yourself into contact with the furnace. Put all used AND new controls into containers before touching ungrounded objects.
7. An ESD service kit (available from commercial sources) may also be used to prevent ESD damage.

INTRODUCTION

The 345MAV Multipoise Condensing Gas-Fired Furnaces are A.G.A./C.G.A. certified for natural and propane gases and for installation in alcoves, attics, basements, closets, utility rooms, crawlspaces, and garages. The furnace is factory-shipped for use with natural gas. An A.G.A/C.G.A certified gas conversion kit is required to convert furnace for use with propane gas. These furnaces are suitable for installation in a residence built on site or a manufactured residence completed at final site. The design of this furnace line is NOT A.G.A./C.G.A. certified for installation in recreation vehicles, in manufactured (mobile) homes, or outdoors. These furnaces SHALL NOT be installed directly on carpeting, tile, or any other combustible material other than wood flooring. In downflow installations, factory accessory floor base MUST be used when installed on combustible materials and wood flooring. These furnaces are shipped with the drain and pressure tubes connected for UPFLOW applications. Minor modifications are required when used in DOWNFLOW, HORIZONTAL RIGHT, or HORIZONTAL LEFT (supply-air discharge direction) applications as shown in Fig. 1. See details in Applications section.

These furnaces are shipped with the following materials to assist in proper furnace installation. These materials are shipped in the main blower compartment.

Installer Packet includes:
- Installation, Start-Up, and Operating Instructions
- Service and Maintenance Instructions
- User's Information Manual
- Warranty Certificate

Loose Parts Bag includes:	Quantity
Pressure tube extension	1
Collector box or condensate trap extension tube	1
Inducer housing drain tube	1
1/2-in. CPVC street elbow	2
Drain tube coupling	1
Drain tube coupling grommet	1
Vent and combustion-air pipe support	2
Combustion-air pipe perforated disk assembly	1
Vent Pipe Extension	1*

* (ONLY supplied with some furnaces)

This furnace must be installed with a direct-vent (combustion air and flue) system and a factory accessory termination kit. In a direct-vent system, all air for combustion is taken directly from the outside atmosphere and all flue products are discharged to the outside atmosphere. See furnace and factory accessory termination kit instructions for proper installation.

Before installing the furnace in the United States, refer to the NFGC and the NFPA 90B.

For copies of the NFGC and NFPA 90B contact the National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269; or American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209.

Before installing the furnace in Canada, refer to the NSCNGPIC. Contact Standard Sales, CSA International, 178 Rexdale Boulevard, Etobicoke, (Toronto) Ontario, Canada M9W 1R3.

Installation must comply with regulations of serving gas supplier and local building, heating, plumbing or other codes in effect in the area in which installation is made. In absence of local codes, installation must comply with the NFGC in the United States and the NSCNGPIC in Canada.

These instructions cover minimum requirements for a safe installation 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 pace with changing residential construction practices. We require these instructions as a minimum for a safe installation.

⚠ **CAUTION:** Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rate, air temperature rise, unit leveling, and unit sizing. Improper installation or misapplication of furnace can 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 or 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.

For accessory installation details, refer to applicable installation literature.

APPLICATIONS

I. GENERAL

Some assembly and modifications are required for furnaces installed in any of the 4 applications shown in Fig. 1. All drain and pressure tubes are connected as shown in Fig. 5. See appropriate application instructions for these procedures.

II. UPFLOW APPLICATIONS

An upflow furnace application is where furnace blower is located below combustion and controls section of furnace, and conditioned air is discharged upwards.

A. Condensate Trap Location (Factory-Shipped Orientation)

The condensate trap is factory installed in the blower shelf and factory connected for UPFLOW applications. A factory-supplied tube is used to extend the condensate trap drain connection to the desired furnace side for field drain attachment. See Condensate Trap Tubing (Factory-Shipped Orientation) section for drain tube extension details.

B. Condensate Trap Tubing (Factory-Shipped Orientation)

NOTE: See Fig. 5 or tube routing label on main furnace door to confirm location of these tubes.

1. Collector Box Drain, Inducer Housing Drain, Relief Port, and Pressure Switch Tubes

   These tubes should be factory attached to condensate trap and pressure switch ready for use in UPFLOW applications. These tubes can be identified by their connection location

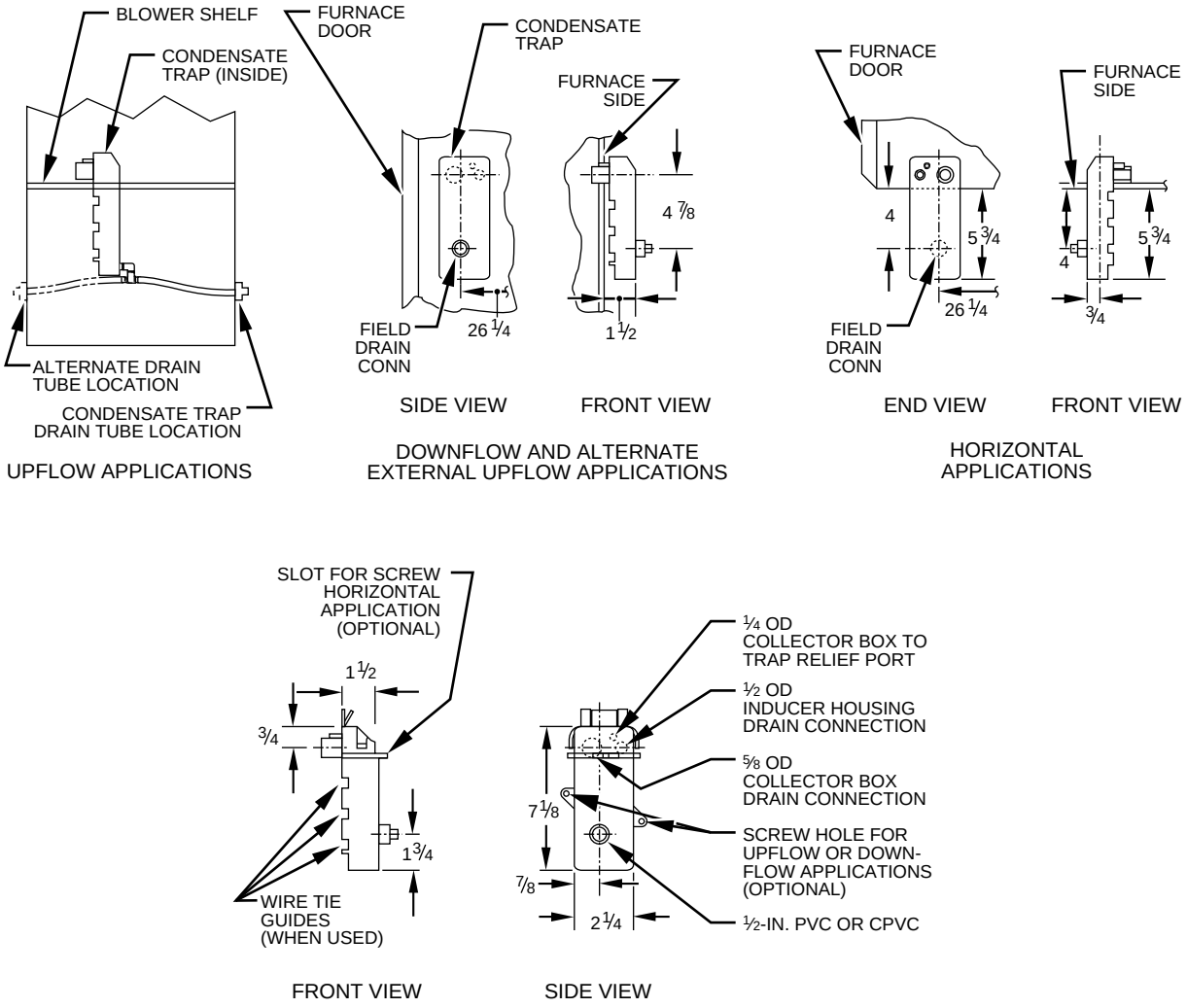

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Fig. 4—Condensate Trap

and also by a color label on each tube. These tubes are identified as follows: collector box drain tube (blue label), inducer housing drain tube (violet label or molded), relief port tube (green label), and pressure switch tube (pink label).

2. Condensate Trap Drain Tube

   The condensate trap drain connection must be extended for field attachment by doing the following:

   a. Determine location of field drain connection. (See Fig. 2 or 5.)

NOTE: If internal filter is used, drain tube should be located to opposite side of casing of return duct attachment to assist in filter removal.

   b. Remove and discard casing drain hole plug button from desired side.

   c. Install drain tube coupling grommet (factory-supplied in loose parts bag) in selected casing hole.

   d. Slide drain tube coupling (factory-supplied in loose parts bag) through grommet ensuring long end of coupling faces blower.

   e. Cement 2 factory-supplied 1/2-in. street CPVC elbows to the rigid drain tube connection on the condensate trap. (See Fig. 5.) These elbows must be cemented together and cemented to condensate trap drain connection.

NOTE: Failure to use CPVC elbows may allow drain to kink and prevent draining.

   f. Connect larger diameter drain tube and clamp (factory-supplied in loose parts bag) to condensate trap and clamp securely.

   g. Route tube to coupling and cut to appropriate length.

   h. Attach tube to coupling and clamp securely.

C. Condensate Trap Location (Alternate Upflow Orientation)

An alternate location for the condensate trap is the left-hand side of casing. (See Fig. 2 and 6.)

NOTE: If the alternate left-hand side of casing location is used, the factory-connected drain and relief port tubes must be disconnected and modified for attachment. See Condensate Trap Tubing (Alternate Upflow Orientation) section for tubing attachment.

To relocate condensate trap to the left-hand side, perform the following:

1. Remove 3 tubes connected to condensate trap.
2. Remove trap from blower shelf by gently pushing tabs inward and rotating trap.
3. Remove casing hole filler cap from casing hole. (See Fig. 2 or 6.)
4. Install casing hole filler cap into blower shelf hole where trap was removed.
5. Install condensate trap into left-hand side casing hole by inserting tube connection stubs through casing hole and rotating until tabs snap into locking position.

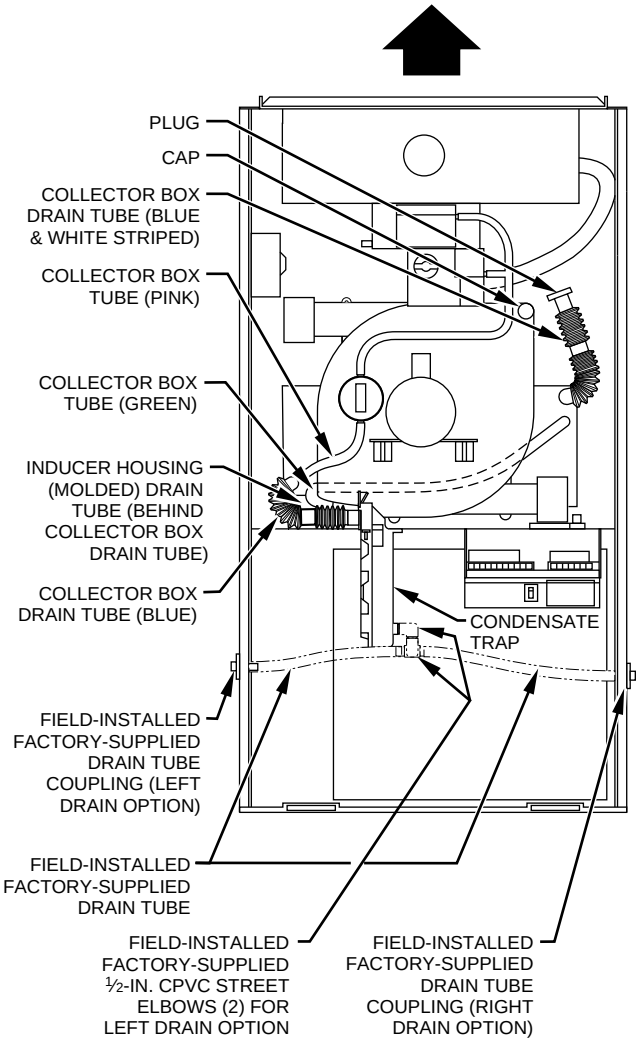

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Fig. 5—Factory-Shipped Upflow Tube Configuration (Shown With Blower Access Panel Removed)

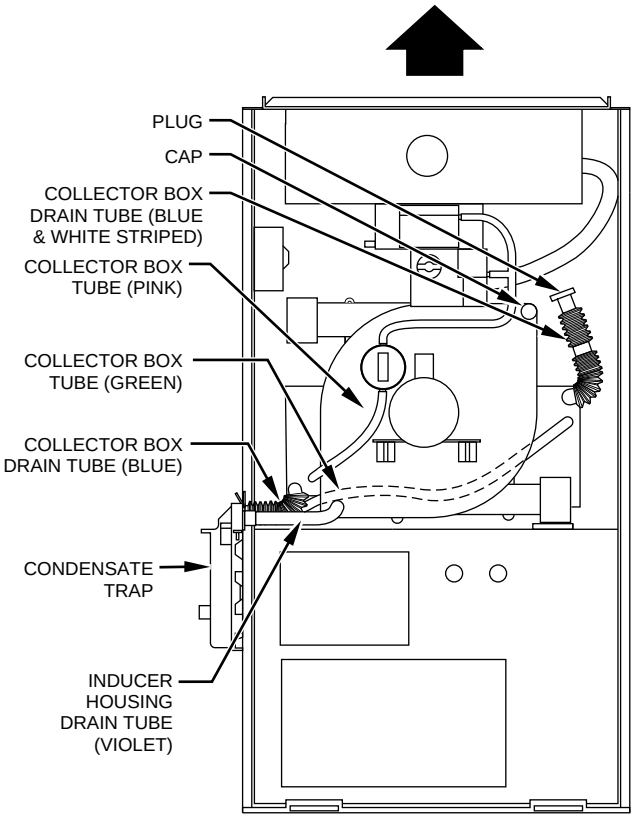

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Fig. 6—Alternate Upflow Tube Configuration and Trap Location

D. Condensate Trap Tubing (Alternate Upflow Orientation)

NOTE: See Fig. 6 or tube routing label on main furnace door to confirm location of these tubes.

1. Collector Box Drain Tube

   Connect collector box drain tube (blue label) to condensate trap.

NOTE: On 17-1/2-in. wide furnaces ONLY, cut tube between corrugated sections to prevent kinks from occurring.

2. Inducer Housing Drain Tube
   a. Remove and discard LOWER (molded) inducer housing drain tube which was previously connected to condensate trap.
   b. Use inducer housing drain extension tube (violet label and factory-supplied in loose parts bag) to connect LOWER inducer housing drain connection to the condensate trap.
   c. Determine appropriate length, cut, and connect tube.
   d. Clamp tube to prevent any condensate leakage.
3. Relief Port Tube
   a. Connect relief port tube (green label) to condensate trap.
   b. Use smaller diameter tube (factory-supplied in loose parts bag) to extend this tube if required.
   c. Determine appropriate length, cut, and connect tube.

E. Condensate Trap Field Drain Attachment

Refer to Condensate Drain section for recommendations and procedures.

F. Pressure Switch Tubing

The LOWER collector box pressure tube (pink label) is factory connected to the pressure switch and should not require any modification.

NOTE: See Fig. 5 or 6 or tube routing label on main furnace door to check for proper connections.

G. Upper Collector Box and Inducer Housing (Unused) Drain Connections

UPPER COLLECTOR BOX DRAIN CONNECTION

Attached to the UPPER collector box drain connection is a factory-installed corrugated, plugged tube (blue and white striped label). This tube is plugged to prevent condensate leakage in this application. Ensure this tube is plugged.

NOTE: See Fig. 5 or 6 or tube routing label on main furnace door to check for proper connections.

UPPER INDUCER HOUSING DRAIN CONNECTION

Attached to the UPPER (unused) inducer housing drain connection is a cap and clamp. This cap is used to prevent condensate leakage in this application. Ensure this connection is capped.

NOTE: See Fig. 5 or 6 or tube routing label on main furnace door to check for proper connections.

H. Condensate Trap Freeze Protection

Refer to Condensate Drain Protection section for recommendations and procedures.

III. DOWNFLOW APPLICATIONS

A downflow furnace application is where furnace blower is located above combustion and controls section of furnace, and conditioned air is discharged downwards.

A. Condensate Trap Location

The condensate trap must be removed from the factory-installed blower shelf location and relocated in selected application location as shown in Fig. 2, 7, or 8.

To relocate condensate trap from the blower shelf to desired location, perform the following:

1. Remove 3 tubes connected to condensate trap.
2. Remove trap from blower shelf by gently pushing tabs inward and rotating trap.
3. Remove casing hole filler cap from casing hole. (See Fig. 2, 7, or 8.)
4. Install casing hole filler cap into blower shelf hole where trap was removed.
5. Install condensate trap into desired casing hole by inserting tube connection stubs through casing hole and rotating until tabs snap into locking position.

B. Condensate Trap Tubing

NOTE: See Fig. 7 or 8 or tube routing label on main furnace door to check for proper connections.

1. Collector Box Drain Tube
   a. Remove factory-installed plug from LOWER collector box drain tube (blue and white striped label).
   b. Install removed clamp and plug into UPPER collector box drain tube (blue label) which was connected to condensate trap.
   c. Connect LOWER collector box drain connection to condensate trap.
      (1.) Condensate Trap Located on Left Side of Casing
         (a.) Connect LOWER collector box drain tube (blue and white striped label) to condensate trap. Tube does not need to be cut.
         (b.) Clamp tube to prevent any condensate leakage.
      (2.) Condensate Trap Located on Right Side of Casing
         (a.) Install drain tube coupling (factory-supplied in loose parts bag) into collector box drain tube (blue and white striped label) which was previously plugged.
         (b.) Connect larger diameter drain tube (factory-supplied in loose parts bag) to drain tube coupling, extending collector box drain tube for connection to condensate trap.
         (c.) Route extended collector box drain tube between gas valve and inlet housing as shown in Fig. 8.
         (d.) Determine appropriate length and cut.
         (e.) Connect to condensate trap.
         (f.) Clamp tube to prevent any condensate leakage.
2. Inducer Housing Drain Tube
   a. Remove factory-installed cap and clamp from LOWER inducer housing drain connection.

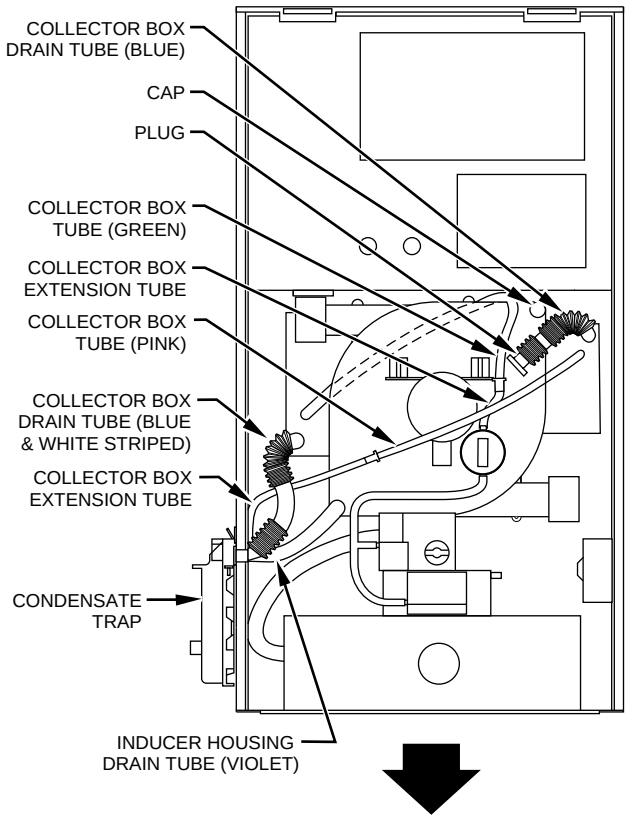


Fig. 7—Downflow Tube Configuration (Left-Hand Trap Installation)

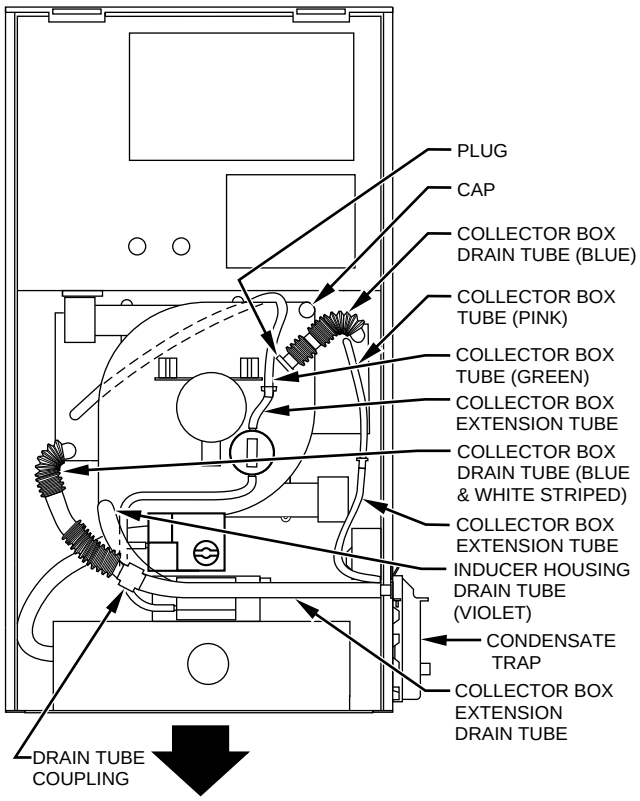


Fig. 8—Downflow Tube Configuration (Right-Hand Trap Installation)

b. Remove and discard UPPER (molded) inducer housing drain tube which was previously connected to condensate trap.

c. Install cap and clamp on UPPER inducer housing drain connection where molded drain tube was removed.

d. Use inducer housing drain tube (violet label and factory-supplied in loose parts bag) to connect LOWER inducer housing drain connection to the condensate trap.

e. Connect inducer housing drain connection to condensate trap.

(1.) Condensate Trap Located on Left Side of Casing

(a.) Determine appropriate length and cut.

(b.) Connect tube to condensate trap.

(c.) Clamp tube to prevent any condensate leakage.

(2.) Condensate Trap Located on Right Side of Casing

(a.) Route inducer housing drain tube (violet label) between gas valve and inlet housing behind collector box drain tube.

(b.) Determine appropriate length and cut.

(c.) Connect tube to condensate trap.

(d.) Clamp tube to prevent any condensate leakage.

3. Relief Port Tube
   Refer to Pressure Switch Tubing section for connection procedure.

C. Condensate Trap Field Drain Attachment

Refer to Condensate Drain section for recommendations and procedures.

D. Pressure Switch Tubing

One collector box pressure tube (pink label) is factory connected to the pressure switch for use when furnace is installed in UPFLOW applications. This tube MUST be disconnected and used for the condensate trap relief port tube. The other collector box pressure tube (green label) which was factory connected to the condensate trap relief port connection MUST be connected to the pressure switch in DOWNFLOW or HORIZONTAL RIGHT applications.

NOTE: See Fig. 7 or 8 or tube routing label on main furnace door to check for proper connections.

Relocate tubes as described below.

1. Disconnect collector box pressure tube (pink label) attached to pressure switch.
2. Use smaller diameter tube (factory-supplied in loose parts bag) to extend collector box pressure tube (green label) which was previously connected to condensate trap relief port connection.
3. Connect collector box pressure tube (green label) to pressure switch connection labeled "collector box."
4. Use remaining smaller diameter tube (factory-supplied in loose parts bag) to extend collector box pressure tube (pink label) which was previously connected to pressure switch.
5. Route this extended tube (pink label) to condensate trap relief port connection.
6. Determine appropriate length, cut, and connect tube.
7. Clamp tube to relief port connection.

E. Condensate Trap Freeze Protection

Refer to Condensate Drain Protection section for recommendations and procedures.

IV. HORIZONTAL LEFT (SUPPLY-AIR DISCHARGE) APPLICATIONS

A horizontal left furnace application is where furnace blower is located to the right of combustion and controls section of furnace, and conditioned air is discharged to the left.

CAUTION: Local codes may require a drain pan under entire furnace and condensate trap when a condensing furnace is used in an attic application or over a finished ceiling.

NOTE: In Canada, installations shall be in accordance with current NSCNGPIC and/or local codes.

NOTE: The auxiliary junction box (J-Box) MUST be relocated to opposite side of furnace casing. (See Fig. 9.) See Electrical Connection section for J-Box relocation.

A. Condensate Trap Location

The condensate trap must be removed from the factory-installed blower shelf location and relocated in selected application location as shown in Fig. 2 or 9.

To relocate condensate trap from the blower shelf to desired location, perform the following:

1. Remove 3 tubes connected to condensate trap.
2. Remove trap from blower shelf by gently pushing tabs inward and rotating trap.
3. Remove casing hole filler cap from casing hole. (See Fig. 2 or 9.)
4. Install casing hole filler cap into blower shelf hole where trap was removed.
5. Install condensate trap into casing hole by inserting tube connection stubs through casing hole and rotating until tabs snap into locking position.

B. Condensate Trap Tubing

NOTE: See Fig. 9 or tube routing label on main furnace door to check for proper connections.

1. Collector Box Drain Tube
   a. Install drain tube coupling (factory-supplied in loose parts bag) into collector box drain tube (blue label) which was previously connected to condensate trap.
   b. Connect large diameter drain tube and clamp (factory-supplied in loose parts bag) to drain tube coupling, extending collector box drain tube.
   c. Route extended tube (blue label) to condensate trap and cut to appropriate length.
   d. Clamp tube to prevent any condensate leakage.
2. Inducer Housing Drain Tube
   a. Remove and discard LOWER (molded) inducer housing drain tube which was previously connected to condensate trap.
   b. Use inducer housing drain extension tube (violet label and factory-supplied in loose parts bag) to connect LOWER inducer housing drain connection to the condensate trap.
   c. Determine appropriate length, cut, and connect tube.
   d. Clamp tube to prevent any condensate leakage.
3. Relief Port Tube
   a. Use smaller diameter tube (factory-supplied in loose parts bag) to extend collector box tube (green label) which was previously connected to the condensate trap.
   b. Route extended collector box pressure tube to relief port connection on the condensate trap.
   c. Determine appropriate length, cut, and connect tube.
   d. Clamp tube to prevent any condensate leakage.

C. Condensate Trap Field Drain Attachment

Refer to Condensate Drain section for recommendations and procedures.

D. Pressure Switch Tubing

The LOWER collector box pressure tube (pink label) is factory connected to the pressure switch for use when furnace is installed in UPFLOW applications. This tube MUST be disconnected, extended, rerouted, and then reconnected to the pressure switch in HORIZONTAL LEFT applications.

NOTE: See Fig. 9 or tube routing label on main furnace door to check for proper connections.

Modify tube as described below.

1. Disconnect collector box pressure tube (pink label) attached to pressure switch.
2. Use smaller diameter tube (factory-supplied in loose parts bag) to extend tube disconnected in item 1.
3. Route extended tube:
   a. Behind inducer housing.
   b. Between blower shelf and inducer housing.
   c. Behind inducer motor bracket.
   d. Between inducer motor and pressure switch.
4. Determine appropriate length, cut, and reconnect tube to pressure switch connection labeled COLLECTOR BOX.

E. Condensate Trap Freeze Protection

Refer to Condensate Drain Protection section for recommendations and procedures.

F. Construct a Working Platform

Construct working platform where all required furnace clearances are met. (See Fig. 3 and 10.)

CAUTION: The condensate trap MUST be installed below furnace. See Fig. 4 for dimensions. The drain connection to condensate trap must also be properly sloped to an open drain.

NOTE: Vent pipe length is restricted to a minimum of 5 ft. (See Table 4.)

NOTE: A 12-in. minimum horizontal pipe section is recommended with short (5 to 8 ft) vent systems. This recommendation is to reduce excessive condensate droplets from exiting the vent pipe. (See Fig. 10 or 32.)

V. HORIZONTAL RIGHT (SUPPLY-AIR DISCHARGE) APPLICATIONS

A horizontal right furnace application is where furnace blower is located to the left of combustion and controls section of furnace, and conditioned air is discharged to the right.

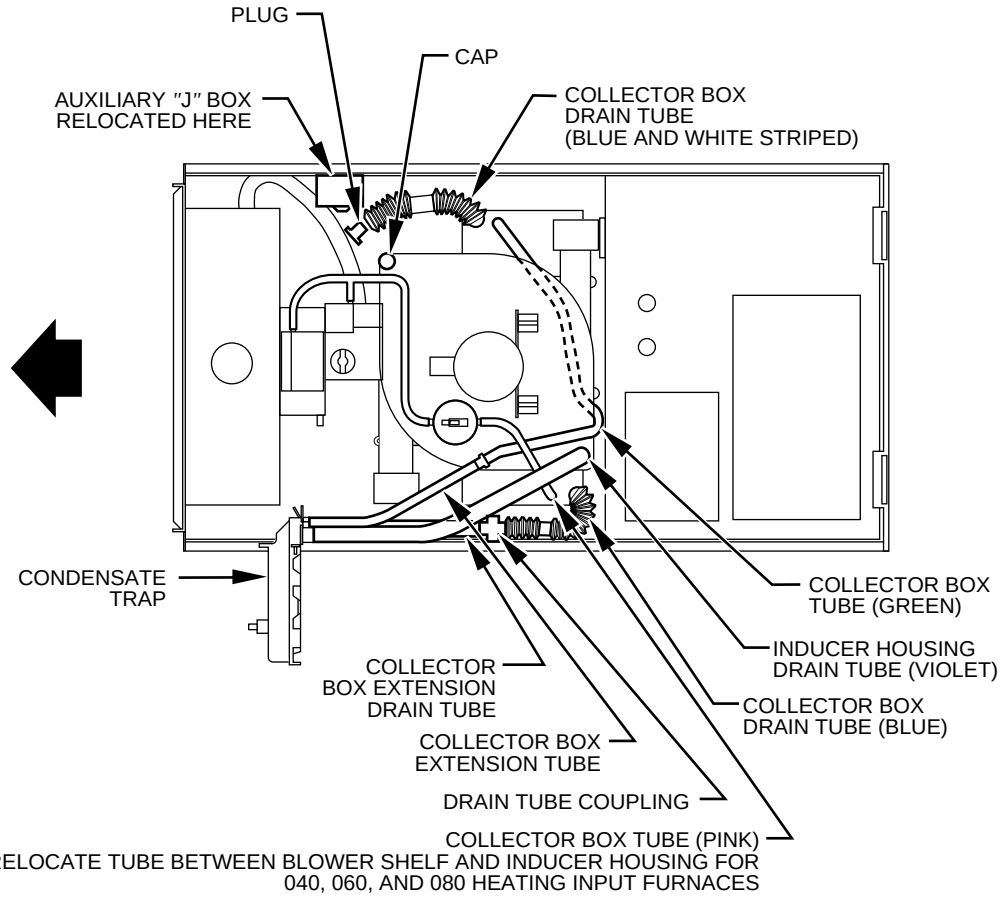
CAUTION: Local codes may require a drain pan under entire furnace and condensate trap when a condensing furnace is used in attic application or over a finished ceiling.

NOTE: In Canada, installations shall be in accordance with current NSCNGPIC Installation Codes and/or local codes.

A. Condensate Trap Location

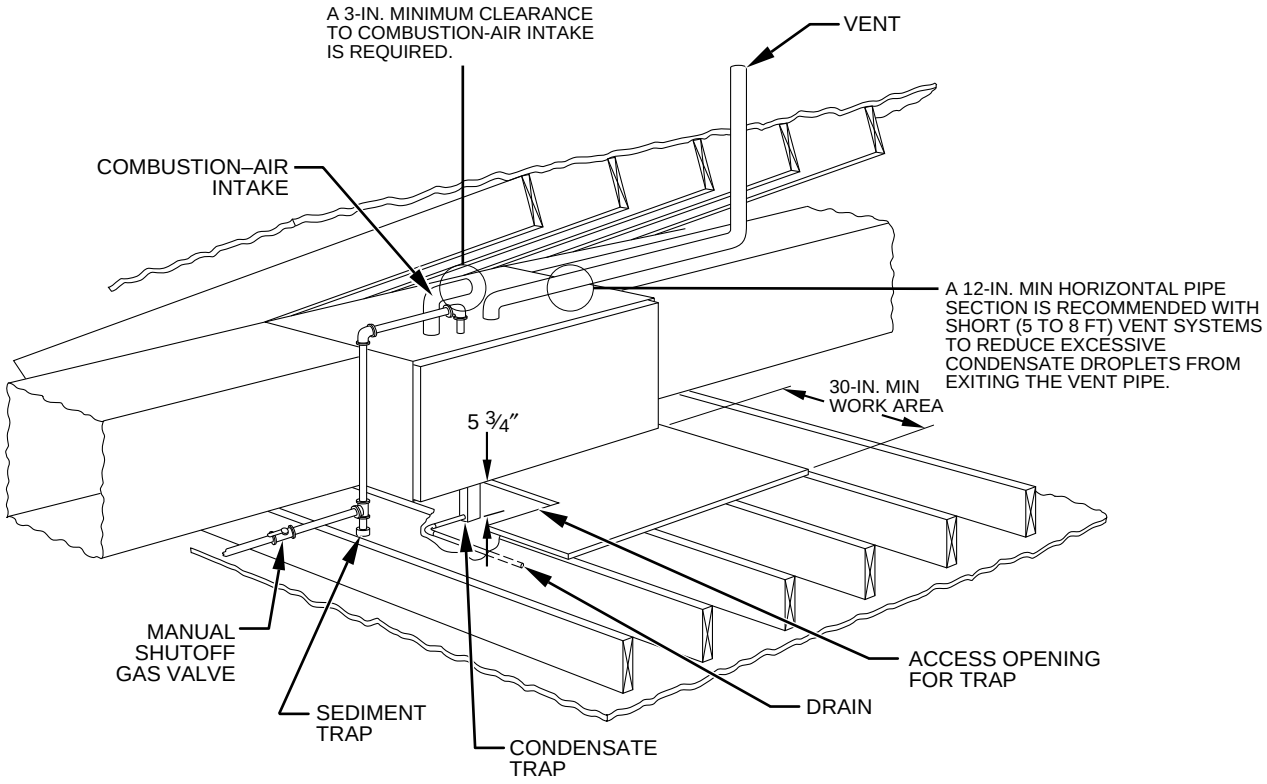
The condensate trap must be removed from the factory-installed blower shelf location and relocated in selected application location as shown in Fig. 2 or 11.

To relocate condensate trap from the blower shelf to desired location, perform the following:



A93302

Fig. 9—Horizontal Left Tube Configuration



NOTE: LOCAL CODES MAY REQUIRE A DRAIN PAN UNDER THE FURNACE AND CONDENSATE TRAP WHEN A CONDENSING FURNACE IS INSTALLED ABOVE FINISHED CEILINGS.

A96184

Fig. 10—Attic Location and Working Platform

1. Remove 3 tubes connected to condensate trap.
2. Remove trap from blower shelf by gently pushing tabs inward and rotating trap.
3. Remove casing hole filler cap from casing hole. (See Fig. 2 or 11.)
4. Install casing hole filler cap into blower shelf hole where trap was removed.
5. Install condensate trap into casing hole by inserting tube connection stubs through casing hole and rotating until tabs snap into locking position.

B. Condensate Trap Tubing

NOTE: See Fig. 11 or tube routing label on main furnace door to check for proper connections.

1. Collector Box Drain Tube
   a. Remove factory-installed plug from LOWER collector box drain tube (blue and white striped label).
   b. Install removed clamp and plug into UPPER collector box drain tube (blue label) which was previously connected to condensate trap.
   c. Connect LOWER collector box drain tube (blue and white striped label) to condensate trap. Tube does not need to be cut.
   d. Clamp tube to prevent any condensate leakage.
2. Inducer Housing Drain Tube
   a. Remove factory-installed cap and clamp from LOWER inducer housing drain connection.
   b. Remove and discard UPPER (molded) inducer housing drain tube which was previously connected to condensate trap.
   c. Install cap and clamp on UPPER inducer housing drain connection where molded drain tube was removed.
   d. Use inducer housing drain extension tube (violet label and factory-supplied in loose parts bag) to connect LOWER inducer housing drain connection to condensate trap.
   e. Determine appropriate length, cut, and connect tube to condensate trap.
   f. Clamp tube to prevent any condensate leakage.
3. Relief Port Tube
   Refer to Pressure Switch Tubing section for connection procedure.

C. Condensate Trap Field Drain Attachment

Refer to Condensate Drain section for recommendations and procedures.

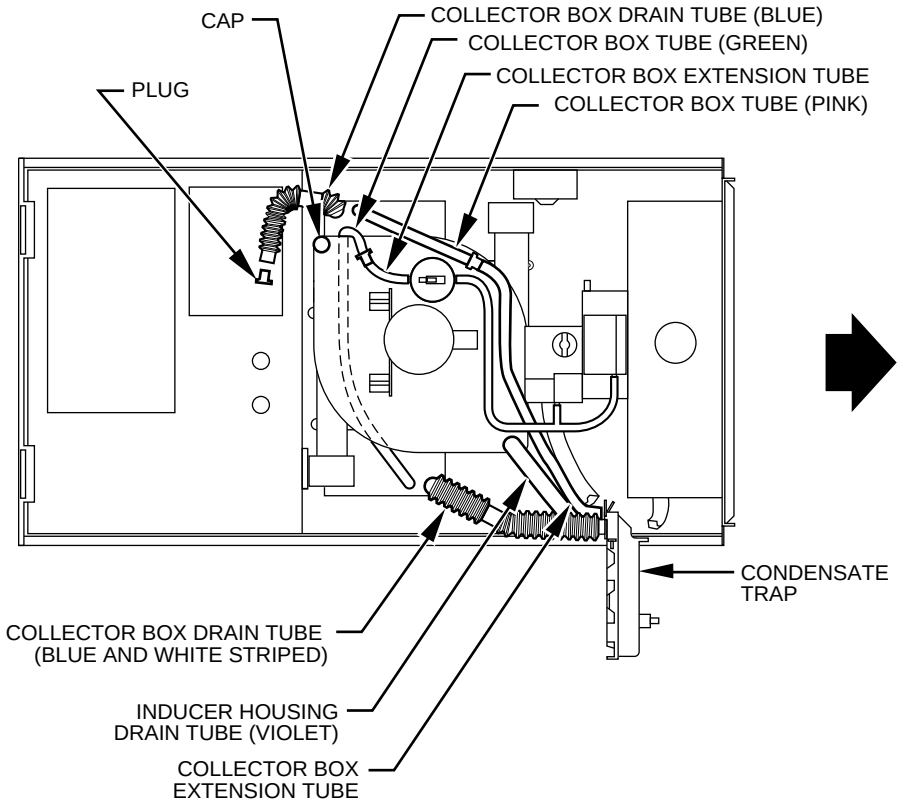
D. Pressure Switch Tubing

One collector box pressure tube (pink label) is factory connected to the pressure switch for use when furnace is installed in UPFLOW applications. This tube MUST be disconnected and used for the condensate trap relief port tube. The other collector box pressure tube (green label) which was factory connected to the condensate trap relief port connection MUST be connected to the pressure switch in DOWNFLOW or HORIZONTAL RIGHT applications.

NOTE: See Fig. 11 or tube routing label on main furnace door to check for proper connections.

Relocate tubes as described below.

1. Disconnect collector box pressure tube (pink label) attached to pressure switch.
2. Use smaller diameter tube (factory-supplied in loose parts bag) to extend collector box pressure tube (green label) which was previously connected to condensate trap relief port connection.



A93303

Fig. 11—Horizontal Right Tube Configuration

3. Route extended collector box pressure tube behind inducer motor bracket then between inducer motor and pressure switch.
4. Connect collector box pressure tube (green label) to pressure switch connection labeled COLLECTOR BOX.
5. Use remaining smaller diameter tube (factory-supplied in loose parts bag) to extend collector box pressure tube (pink label) which was previously connected to pressure switch.
6. Route this extended tube (pink label) to condensate trap relief port connection.
7. Determine appropriate length, cut, and connect tube.
8. Clamp tube to relief port connection.

E. Condensate Trap Freeze Protection

Refer to Condensate Drain Protection section for recommendations and procedures.

F. Construct a Working Platform

Construct working platform where all required furnace clearances are met. (See Fig. 3 and 10.)

> ⚠ **CAUTION:** The condensate trap MUST be installed below furnace. See Fig. 4 for dimensions. The drain connection to condensate trap must also be properly sloped to an open drain.

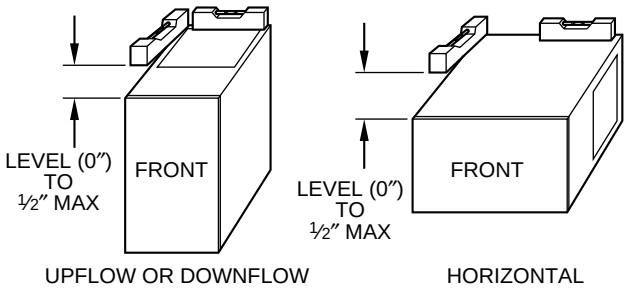
NOTE: Vent pipe length is restricted to a minimum of 5 ft. (See Table 4.)

NOTE: A 12-in. minimum horizontal pipe section is recommended with short (5 to 8 ft) vent systems. This recommendation is to reduce excessive condensate droplets from exiting the vent pipe. (See Fig. 10 or 33.)

LOCATION

I. GENERAL

When a furnace is installed so that supply ducts carry air to areas outside the space containing the furnace, return air must also be handled by ducts sealed to furnace casing. The ducts terminate outside the space containing the furnace to ensure there will not be a negative pressure condition within equipment room or space. This furnace must be installed so electrical components are protected from water.



A93025

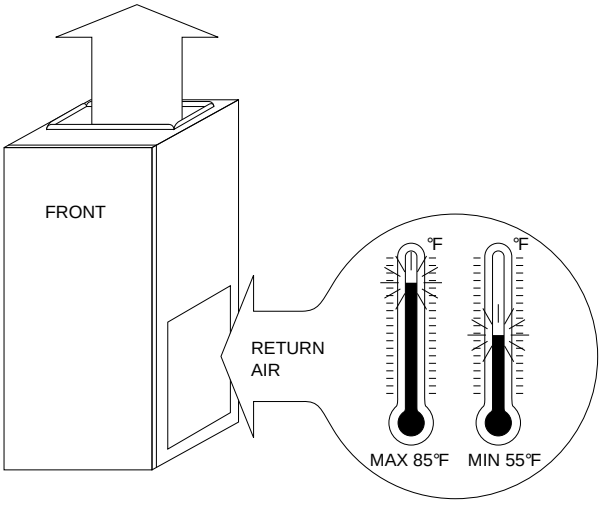
NOTE: For proper furnace operation, install furnace so that it is level or pitched forward within 1/2 in. to ensure proper condensate drainage from secondary heat exchangers.

Locate furnace as close to center of air distribution system as possible.

Locate furnace so vent pipe maximum length is not exceeded. Refer to Table 4—Maximum Allowable Pipe Length.

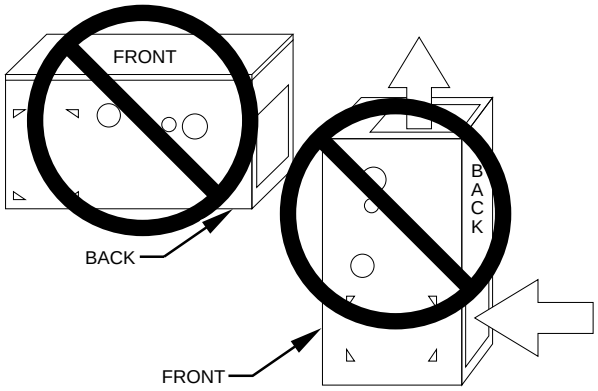
Provide ample space for servicing and cleaning. Always comply with minimum fire protection clearances shown on unit's clearance to combustibles label. (See Fig. 3.) Locate furnace where available electric power and gas supplies meet specifications on furnace rating plate.

> ⚠ **CAUTION:** Do not install furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements are met.



A93042

NOTE: These furnaces are designed for a minimum continuous return-air temperature of 60°F or intermittent operation down to 55°F such as when used with a night setback thermostat. Return-air temperature must not exceed a maximum of 85°F. Failure to follow these return-air temperature limits may affect reliability of heat exchangers, motors, and controls.



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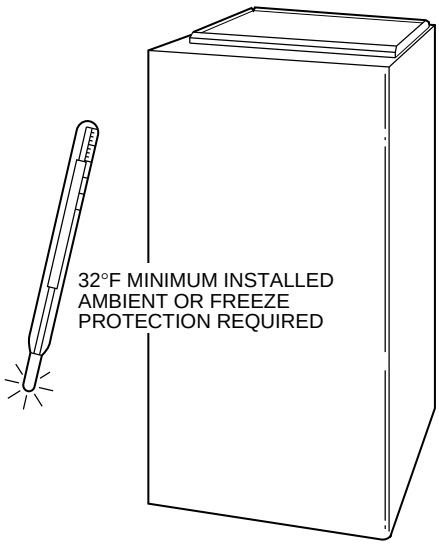
⚠ **WARNING:** Do not install furnace on its back. Safety control operation will be adversely affected. Never connect return-air ducts to back of furnace. Failure to follow this warning could result in fire, personal injury, or death.

⚠ **CAUTION:** Do not use this furnace during construction when adhesives, sealers, and/or new carpets are being installed and curing. If the furnace is required during construction, use clean outside air for combustion and ventilation. Compounds of chlorine and fluorine, when burned with combustion air, form acids which will cause corrosion of heat exchangers. Some of these compounds are released from paneling and dry wall adhesives, paints, thinners, masonry cleaning materials, and many other solvents commonly used in the construction process. Excessive exposure to contaminated combustion air will result in safety and performance related problems.



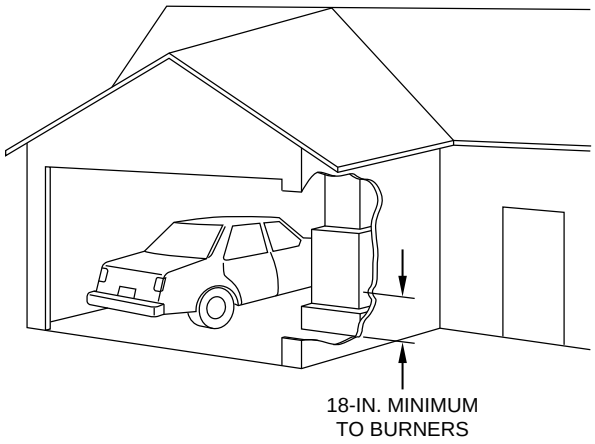
A93058

⚠ **CAUTION:** If these furnaces are installed in an unconditioned space where ambient temperatures may be 32°F or lower, freeze protection measures must be taken.

II. FURNACE LOCATION RELATIVE TO COOLING EQUIPMENT

The cooling coil must be installed parallel with or on downstream side of furnace to avoid condensation in heat exchanger. When installed parallel with a furnace, dampers or other means used to control flow of air must prevent chilled air from entering furnace. If dampers are manually operated, they must be equipped with a means to prevent operation of either unit unless damper is in full-heat or full-cool position.

III. HAZARDOUS LOCATIONS



A93044

> ⚠ **WARNING:** When furnace is installed in a residential garage, it must be installed so that burners and ignition sources are located a minimum of 18 in. above floor. The furnace must be located or protected to avoid physical damage by vehicles. When furnace is installed in a public garage, airplane hangar, or other building having a hazardous atmosphere, unit must be installed in accordance with requirements of National Fire Protection Association, Inc.

AIR FOR COMBUSTION AND VENTILATION

I. GENERAL

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

Canadian installations must be in accordance with Section 7 of the NSCNGPIC and all authorities having jurisdiction.

> ⚠ **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 combustion of the fuel. Sufficient air MUST be provided to ensure there will not be a negative pressure in the equipment room or space. In addition, a positive seal MUST be made between the furnace cabinet and the return-air duct to prevent pulling air from the burner area and draft safeguard opening into the circulating air.

> ⚠ **CAUTION:** The operation of exhaust fans, kitchen ventilation fans, clothes dryers, fireplaces, or other appliances including attic and crawlspace exhaust fans could create a negative air pressure condition at the furnace. Make-up air must be provided for these devices, in addition to that required by the furnace.

The requirements for combustion and ventilation air depend upon whether the furnace is located in a CONFINED or UNCONFINED space.

II. UNCONFINED SPACE

An unconfined space must have at least 50 cu ft for each 1000 Btuh of total input for all the appliances (such as furnaces, clothes dryers, water heaters, etc.) in the space.

For Example:

MINIMUM FLOOR AREA FOR UNCONFINED SPACE	
345MAV Furnace Input Btuh	Minimum Sq Ft With 7-1/2 Ft Ceiling
40,000	267
60,000	400
80,000	533
100,000	667
120,000	800

If the unconfined space is of unusually tight construction, air for combustion and ventilation MUST come from either the outdoors or spaces freely communicating with the outdoors. Combustion and ventilation openings must be sized the same as for a confined space as defined below. Return air must not be taken from the room unless an equal or greater amount of air is supplied to the room.

III. CONFINED SPACE

A confined space has a volume of less than 50 cu ft per 1000 Btuh of the total input rating for all appliances installed in that space. A confined space MUST have 2 permanent openings, 1 within 12 in. of the ceiling, and the other within 12 in. of the floor which freely communicate with an unconfined space or the outdoors. (See Fig. 12 or 13.)

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

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

A. All Air from Inside the Structure

1. Each opening MUST have at least 1 sq in. of free area per 1000 Btuh of the total input for all equipment within the confined space, but not less than 100 sq in. per opening. (See Fig. 12.) The minimum dimension of air openings shall not be less than 3 in.

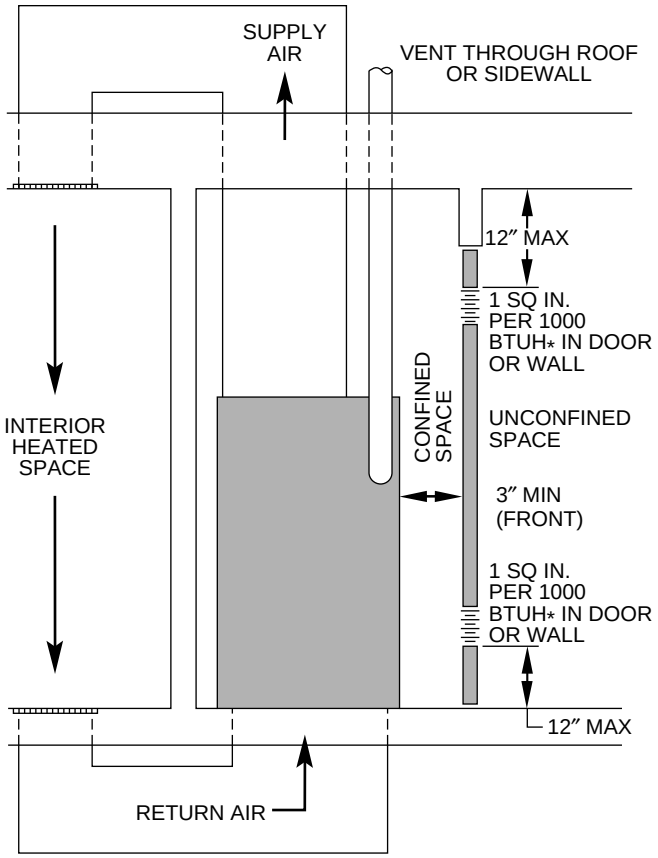
For Example:

COMBUSTION AIR FROM UNCONFINED SPACE	
345MAV Furnace Input Btuh	Free Area per Opening (Sq In.)
40,000	100
60,000	100
80,000	100
100,000	100
120,000	120

2. If the building is constructed unusually tight, in addition to the 2 permanent openings that freely communicate with an unconfined space, a permanent opening directly communicating with the outdoors should be provided. This opening shall have a minimum free area of 1 sq in. per 4000 Btuh of total input rating for all equipment in the enclosure.
3. 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 the furnace, all air for combustion must come from outdoors. (See Fig. 13.)

B. All Air from Outside the Structure

1. If combustion air is taken from outdoors through vertical ducts, the openings and ducts MUST have at least 1 sq in. of free area per 4000 Btuh of the total input for all equipment within the confined space. (See Fig. 13.)

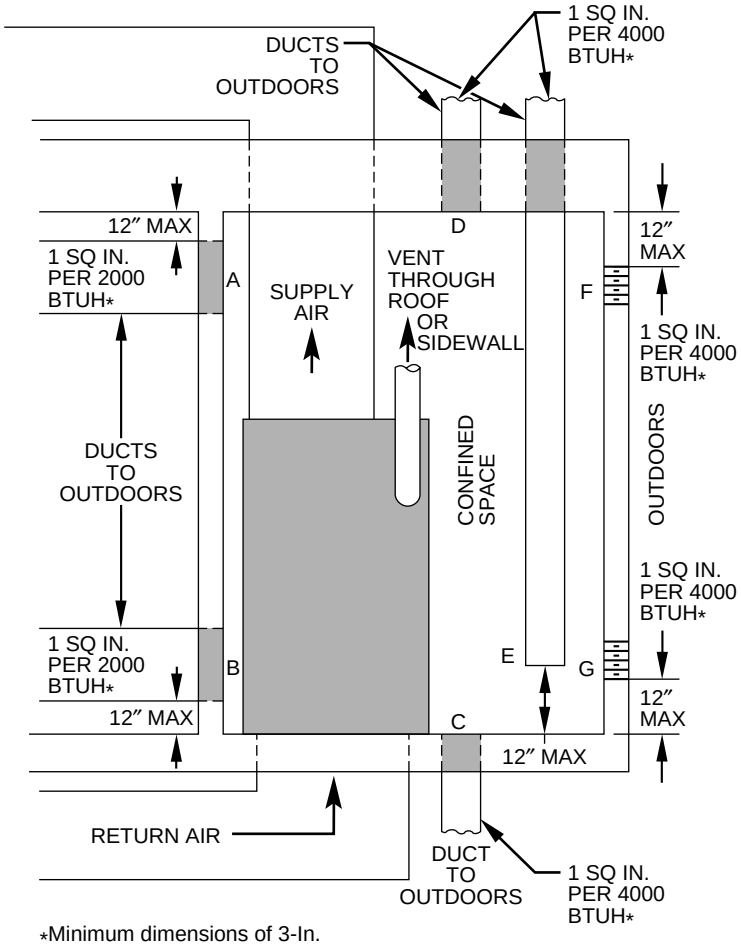


* Minimum opening size is 100 sq. in. with minimum dimensions of 3-In.

NOTE: Side clearance required as needed for combustion-air pipe and termination, vent pipe, and gas and electrical connections.

A96185

Fig. 12—Confined Space: Air for Combustion and Ventilation from an Unconfined Space



*Minimum dimensions of 3-In.

NOTES: 1. Use any of the following combinations of openings:
A & B C & D D & E F & G

2. Side clearance required as needed for combustion-air pipe and termination, vent pipe, and gas and electrical connections.

A96186

Fig. 13—Confined Space: Air for Combustion and Ventilation from Outdoors

For Example:

COMBUSTION AIR FROM OUTDOORS THROUGH VERTICAL DUCTS		
345MAV Furnace Input Btuh	Free Area per Opening (Sq In.)	Round Pipe (In. Dia)
40,000	10.0	4
60,000	15.0	5
80,000	20.0	6
100,000	25.0	6
120,000	30.0	7

2. If combustion air is taken from outdoors through horizontal ducts, the openings and ducts MUST have at least 1 sq in. of free area per 2000 Btuh of the total input for all equipment within the confined space. (See Fig. 13.)
3. 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. (See Fig. 13.)

For Example:

COMBUSTION AIR FROM OUTDOORS THROUGH HORIZONTAL DUCTS		
345MAV Furnace Input Btuh	Free Area per Opening (Sq In.)	Round Pipe (In. Dia)
40,000	20.0	6
60,000	30.0	7
80,000	40.0	8
100,000	50.0	8
120,000	60.0	9

INSTALLATION

I. LEVELING LEGS (IF DESIRED)

When furnace is used in upflow position with side inlet(s), leveling legs may be desired. (See Fig. 14.) 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. 14.) 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.)

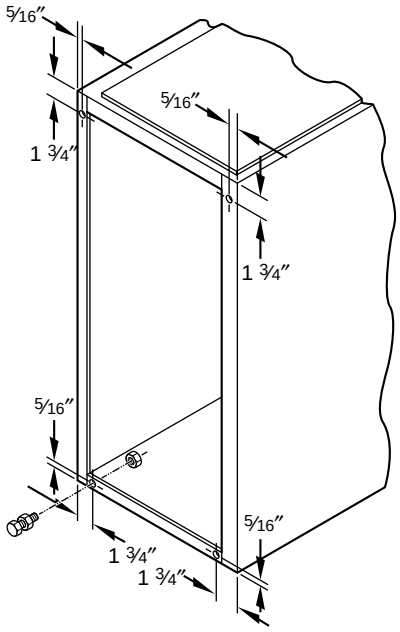


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Fig. 14—Leveling Legs

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.

NOTE: Bottom closure must be used when leveling legs are used. See Bottom Closure Panel section.

II. INSTALLATION ON A CONCRETE SLAB

1. Construct hole in floor per dimensions in Fig. 15.
2. Place plenum and furnace as shown in Fig. 16.

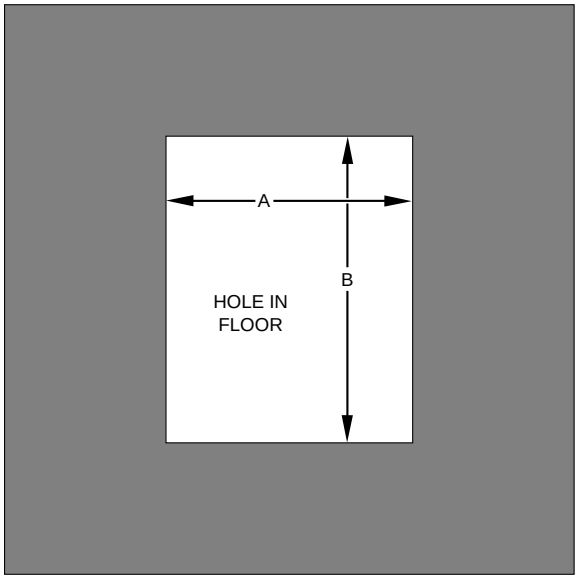
III. INSTALLATION ON A COMBUSTIBLE FLOOR (DOWNFLOW APPLICATIONS)

1. Cut and frame hole in floor per dimensions in Installation Instructions packaged with downflow subbase kit.

NOTE: Remove furnace perforated, discharge duct flanges when they interfere with mating flanges on coil on downflow subbase. To remove furnace perforated, discharge 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. 17.)

> ⚠ **WARNING:** Do not bend duct flanges inward as shown in Fig. 17. This will affect airflow across heat exchangers and may cause limited cycling or premature heat exchanger failure. Remove duct flange completely or bend it inward a minimum of 210° as shown in Fig. 17.

2. When complete, downflow subbase, plenum, and furnace (or coil casing when used) should be installed as shown in Fig. 18.



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OPENING DIMENSIONS (IN.)

FURNACE CASING WIDTH	A	B	
		Heat Only	Heat/Cool*
17-1/2	16-7/16	19-5/8	19-7/16
21	19-7/8	19-5/8	19-7/16
24-1/2	23-7/16	19-5/8	19-7/16

* These dimensions apply when a model CD or CK Evaporator Coil casing is to be installed.

Fig. 15—Floor Opening in Concrete Slab

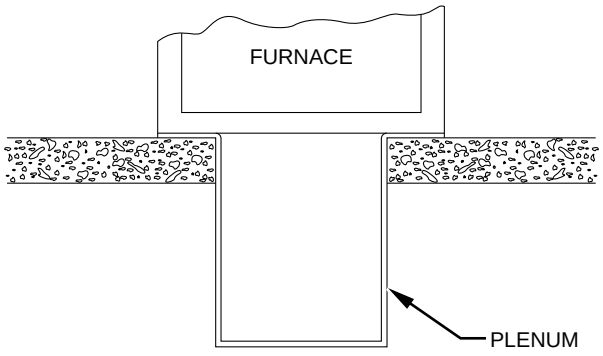

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Fig. 16—Furnace on a Concrete Slab (Non-Garage Installation)

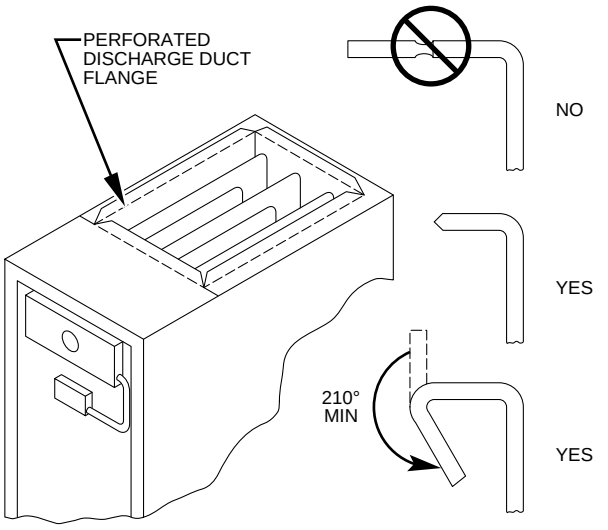


Fig. 17—Duct Flanges

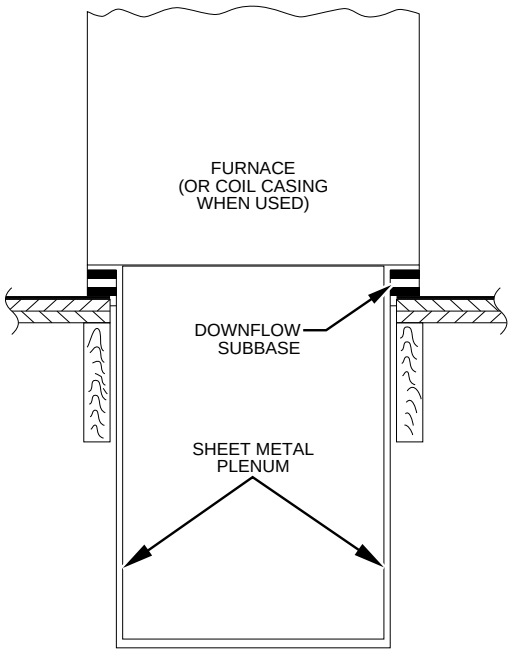


Fig. 18—Furnace, Plenum, and Subbase Installed on a Combustible Floor

IV. INSTALLATION IN HORIZONTAL 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. Furnace can be suspended from each corner by hanger bolts and angle iron supports. (See Fig. 19.) 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. 19. Dimples are provided for hole locations. (See Fig. 2.)

⚠ **CAUTION:** The entire length of furnace MUST be supported when furnace is used in a horizontal position to ensure proper draining.

V. 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 factory *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 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. 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.

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 non-combustible material. 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 main casing.

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 main casing.

D. Return Air Connections

1. 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. DO NOT connect any portion of return-air duct to back of furnace casing.

2. Downflow and Horizontal Furnaces

The return-air duct must be connected to return-air opening provided as shown in Fig. 1. DO NOT cut into casing sides or back to attach any portion of return-air duct. Bypass humidifier connections should be made at ductwork or coil casing sides exterior to furnace.

VI. FILTER ARRANGEMENT

⚠ **CAUTION:** Never operate unit without a filter or with blower access panel removed.

Factory-supplied washable framed filters are shipped in blower compartment. Determine location for filter and relocate filter retaining wire if necessary. See Table 1 to determine correct filter size for desired filter location. Table 1 indicates filter size, location, and quantity shipped with this furnace. See Fig. 2 for location and size of bottom and side return-air openings.

TABLE 1—FILTER INFORMATION

FURNACE CASING WIDTH (IN.)	FILTER SIZE (IN.)*		FILTER TYPE FRAMED
	Side Return	Bottom Return	
17-1/2	(1) 16 X 25 X 1†	(1) 16 X 25 X 1	Cleanable
21	(1) 16 X 25 X 1	(1) 20 X 25 X 1†	Cleanable
24-1/2	(2) 16 X 25 X 1†	(1) 24 X 25 X 1	Cleanable

* Filters can be field modified by cutting frame as marked and folding to desired size. Alternate sizes can be ordered from your distributor or dealer.
† Factory-provided with furnace.

⚠ **CAUTION:** Air delivery above 1800 CFM requires that both sides, a combination of 1 side and bottom, or bottom only of furnace be used for return air.

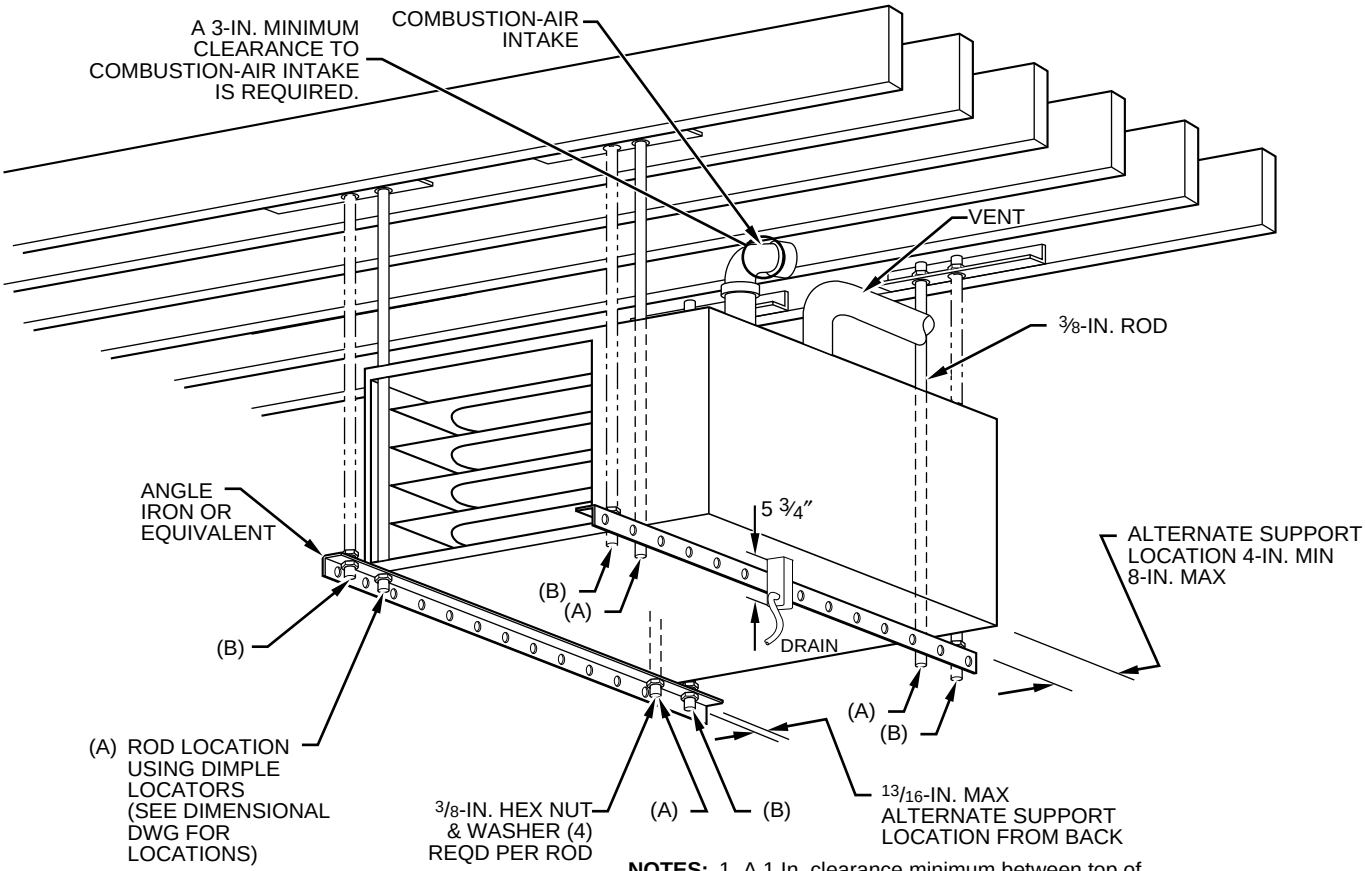
NOTE: Side return-air openings can ONLY be used in UPFLOW configurations. Install filter(s) as shown in Fig. 20.

Bottom return-air opening may be used with all 4 orientations. Filter may need to be cut to fit some furnace widths. Install filter as shown in Fig. 21.

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

VII. BOTTOM CLOSURE PANEL

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



(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 to ensure proper drainage.

3. Bottom side combustion-air entry cannot be used when furnace is installed with hangers as shown.

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Fig. 19—Crawlspace Horizontal Application

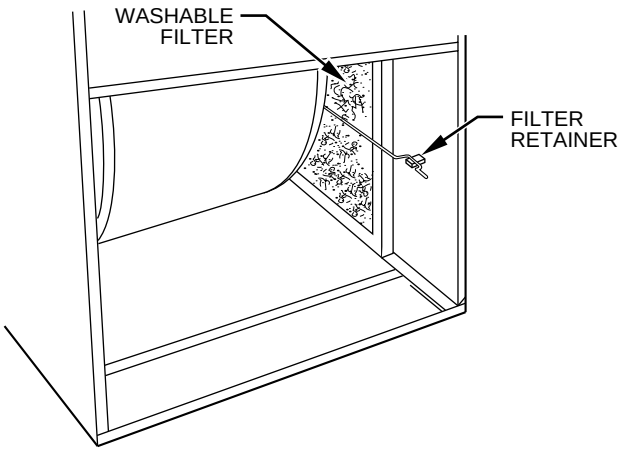

Fig. 20—Filter Installed for Side Inlet

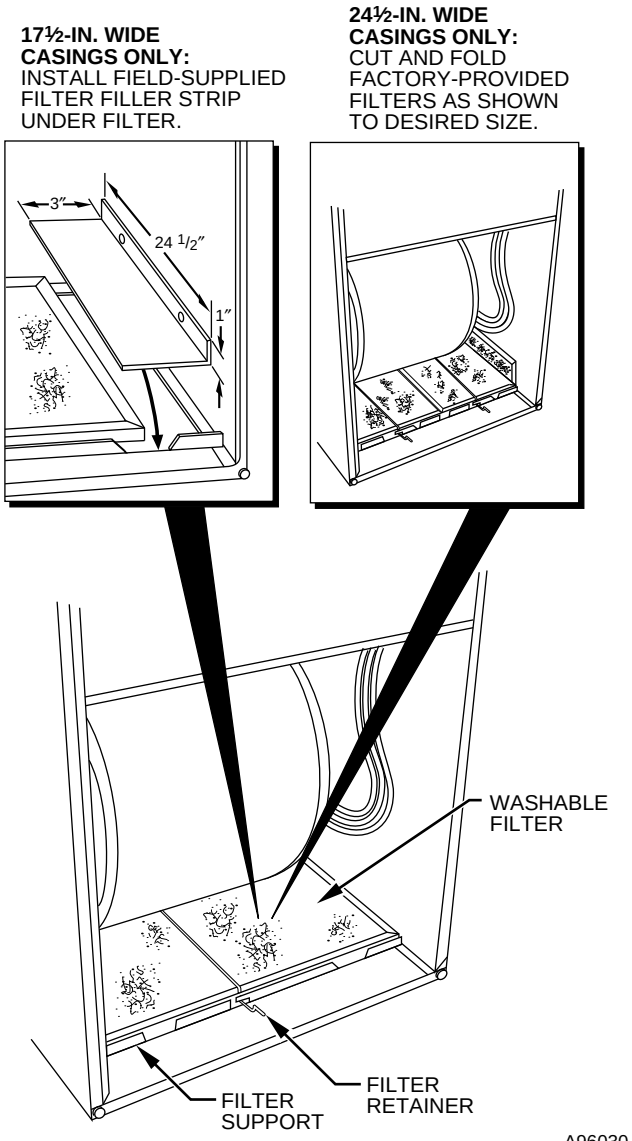

Fig. 21—Bottom Filter Arrangement

To remove bottom closure panel, perform following:

1. Tilt or raise furnace and remove 2 screws holding front filler panel. (See Fig. 22.)
2. Rotate front filler panel downward to release holding tabs.
3. Remove bottom closure panel.
4. Reinstall front filler panel and screws.

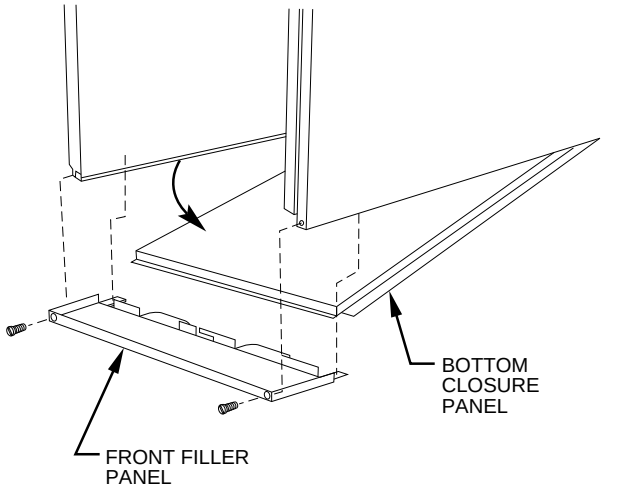

Fig. 22—Removing Bottom Closure Panel

VIII. GAS PIPING

Gas piping must be installed in accordance with national and local codes. Refer to current edition of NFGC. 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 2 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 propane gas.

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

⚠ **WARNING:** Gas valve ON and OFF switch MUST be facing forward or tilted upward. (See Fig. 40.) Failure to follow this warning could result in property damage or death.

⚠ **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.

⚠ **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. 23.)

TABLE 2—MAXIMUM CAPACITY OF PIPE (CU FT PER HR)*

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

* For gas pressures 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 .

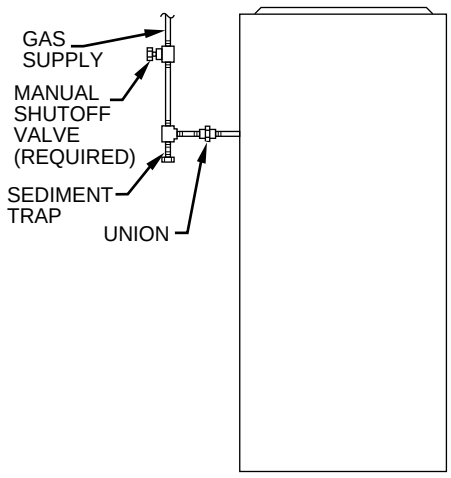

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Fig. 23—Typical Gas Pipe Arrangement

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

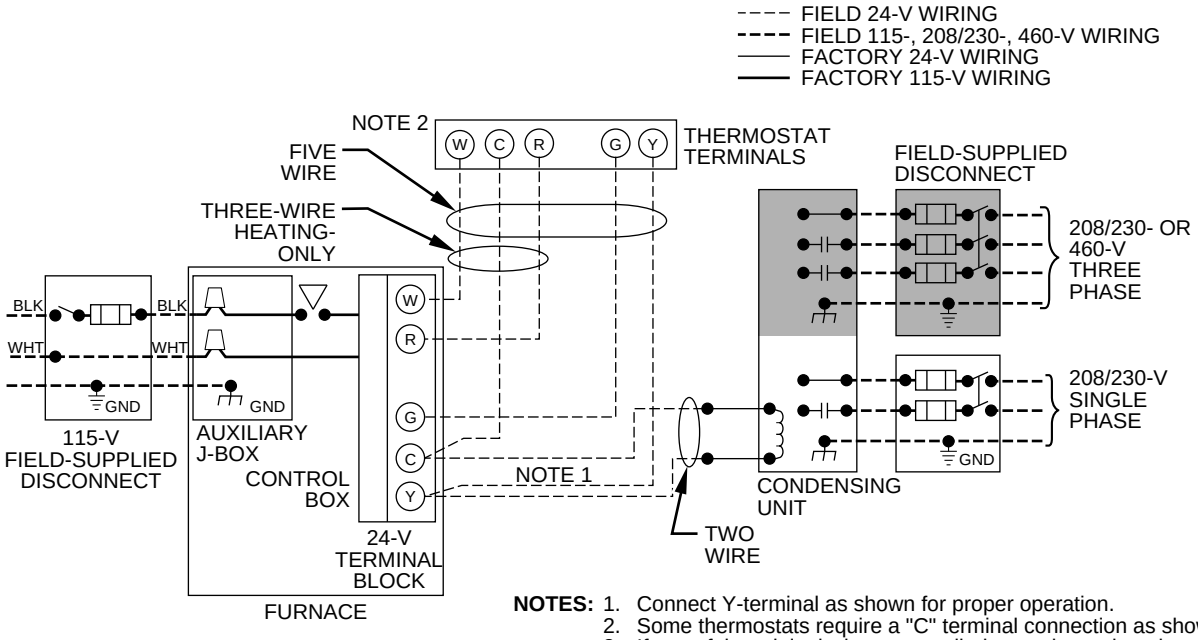
An accessible manual shutoff valve MUST be installed upstream of furnace gas controls and within 6 ft of furnace. A 1/8-in. NPT plugged tapping, accessible for test gage connection, MUST be installed immediately upstream of gas supply connection to furnace and downstream of manual shutoff valve.

NOTE: The gas valve inlet press 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. 40.) Piping should be pressure tested in accordance with local and national plumbing and gas codes before furnace is attached. In Canada, refer to current edition of NSCNGPIC. If pressure exceeds 0.5 psig (14-in. wc), gas supply pipe must be disconnected from furnace and capped before pressure test. If test pressure is equal to or less than 0.5 psig (14-in. wc), turn off electric shutoff switch located on gas valve before test. It is recommended that ground joint union be loosened before pressure testing. After all connections have been made, purge lines and check for leakage.

ELECTRICAL CONNECTIONS

See Fig. 24 for field wiring diagram showing typical field 115-v and 24-v wiring. Check all factory and field electrical connections for tightness.

WARNING: Blower access panel door switch opens 115-v power to control center. 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.



NOTES: 1. Connect Y-terminal as shown for proper operation.
2. Some thermostats require a "C" terminal connection as shown.
3. If any of the original wire, as supplied, must be replaced, use same type or equivalent wire.

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Fig. 24—Heating and Cooling Application Wiring Diagram

TABLE 3—ELECTRICAL DATA

UNIT SIZE	VOLTS—HERTZ—PHASE	OPERATING VOLTAGE RANGE		MAX UNIT AMPS	UNIT AMPACITY†	MIN WIRE SIZE	MAX WIRE LENGTH (FT)‡	MAX FUSE OR CKT BKR AMPS**
		Max*	Min*					
024040	115—60—1	127	104	6.1	8.4	14	44	15
036040	115—60—1	127	104	7.3	10.0	14	37	15
024060	115—60—1	127	104	6.1	8.4	14	44	15
036060	115—60—1	127	104	7.1	9.8	14	38	15
048060	115—60—1	127	104	9.5	12.8	14	29	15
036080	115—60—1	127	104	7.6	10.4	14	36	15
048080	115—60—1	127	104	10.0	13.4	14	28	15
060080	115—60—1	127	104	14.1	18.4	12	31	20
048100	115—60—1	127	104	10.2	13.5	14	27	15
060100	115—60—1	127	104	14.8	19.3	12	30	20
060120	115—60—1	127	104	14.6	19.1	12	30	20

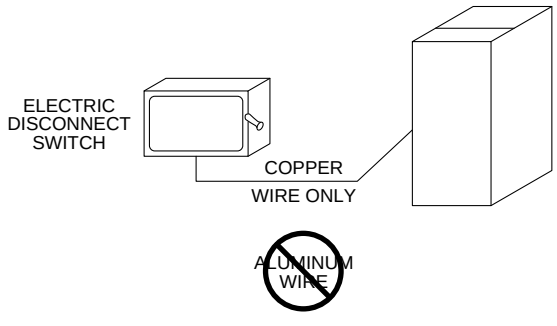
* Permissible limits of voltage range at which unit will operate satisfactorily.
† Unit ampacity = 125 percent of largest operating component's full load amps plus 100 percent of all other potential operating components' (EAC, humidifier, etc.) full load amps.
‡ Length shown is as measured 1 way along wire path between unit and service panel for maximum 2 percent voltage drop.
** Time-delay type is recommended.

⚠ **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.

I. 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 3 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 subauthorities having jurisdiction.



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

Use a separate, fused branch electrical circuit containing a properly sized fuse or circuit breaker for this furnace. See Table 3 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 center status code indicator light will flash rapidly and furnace will NOT operate.

⚠ **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 2 screws holding auxiliary J-box. (See Fig. 25.)
2. Rotate J-box 180° and attach box to right side, using holes provided.

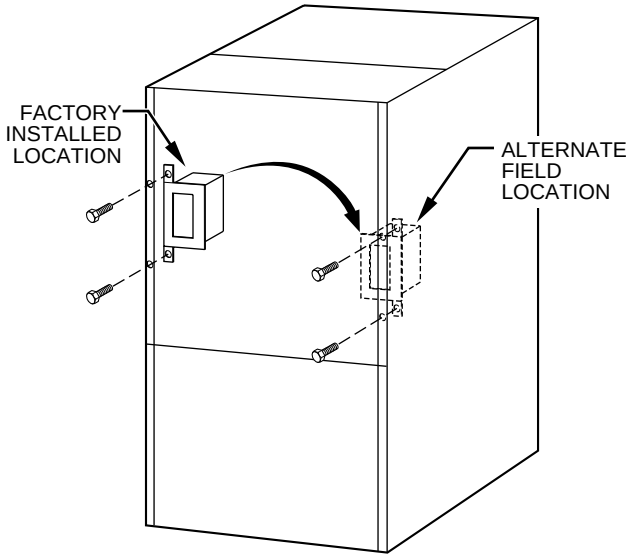

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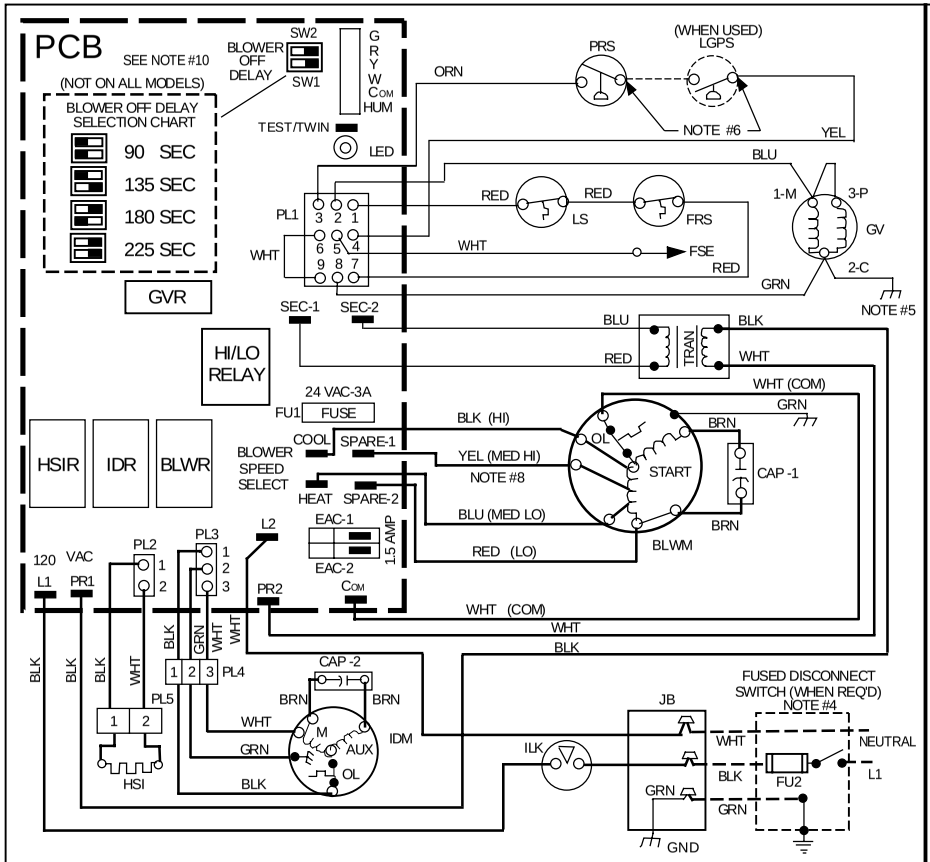
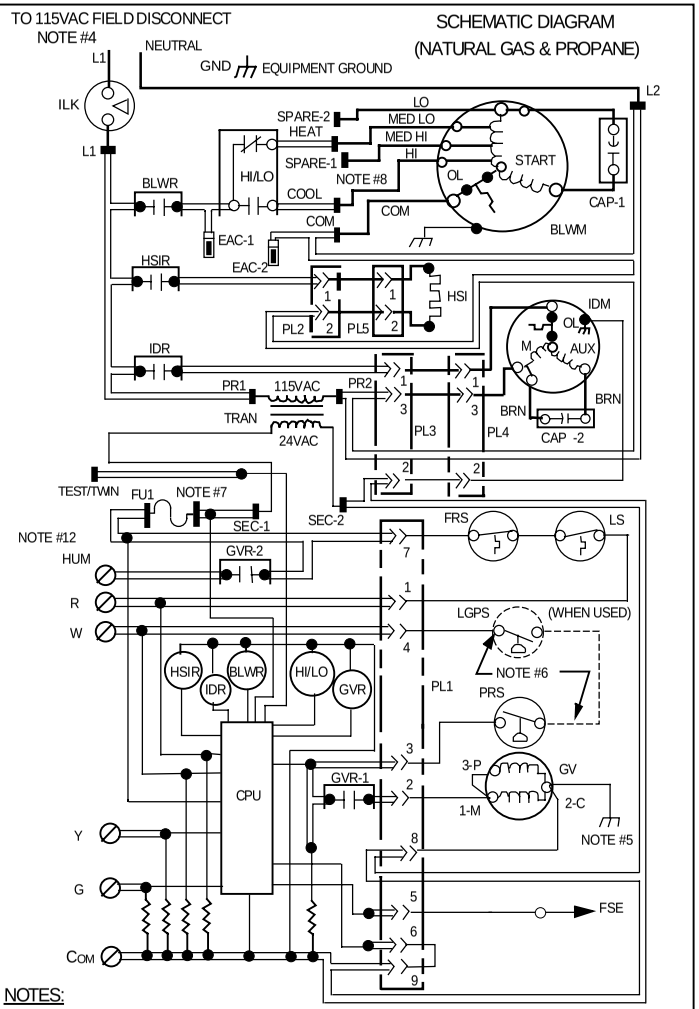
Fig. 25—Relocating J-Box

⚠ **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.





LEGEND

BLWR	BLOWER MOTOR RELAY, SPST-(N.O.)
BLWM	BLOWER MOTOR
CAP	CAPACITOR
CPU	MICROPROCESSOR AND CIRCUITRY
EAC-1	ELECTRONIC AIR CLEANER CONNECTION (115 VAC 1.5 AMP MAX.)
EAC-2	ELECTRONIC AIR CLEANER CONNECTION (COMMON)
FRS	FLAME ROLLOUT SW. -MANUAL RESET, SPST-(N.C.)
FSE	FLAME PROVING ELECTRODE
FU1	FUSE, 3 AMP, AUTOMOTIVE BLADE TYPE, FACTORY INSTALLED
FU2	FUSE OR CIRCUIT BREAKER CURRENT INTERRUPT DEVICE (FIELD INSTALLED & SUPPLIED)
GND	EQUIPMENT GROUND
GV	GAS VALVE-REDUNDANT OPERATORS
GVR	GAS VALVE RELAY, DPST-(N.O.)
HI/LO	BLOWER MOTOR SPEED CHANGE RELAY, SPDT
HSI	HOT SURFACE IGNITOR (115 VAC)
HSIR	HOT SURFACE IGNITOR RELAY, SPST-(N.O.)
HUM	24VAC HUMIDIFIER CONNECTION (.5 AMP. MAX.)
IDM	INDUCED DRAFT MOTOR
IDR	INDUCED DRAFT RELAY, SPST-(N.O.)
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.)
LS	LIMIT SWITCH, AUTO RESET, SPST(N.C.)
OL	AUTO-RESET INTERNAL MOTOR OVERLOAD TEMP. SW.
PCB	PRINTED CIRCUIT BOARD
PL1	9-CIRCUIT CONNECTOR
PL2	2-CIRCUIT PCB CONNECTOR
PL3	3-CIRCUIT IDM CONNECTOR
PL4	3-CIRCUIT IDM EXTENSION CONNECTOR
PL5	2-CIRCUIT HSI/PCB CONNECTOR
PRS	PRESSURE SWITCH, SPST-(N.O.)
SW1 & 2	BLOWER OFF DELAY
TEST/TWIN	COMPONENT TEST & TWIN TERMINAL
TRAN	TRANSFORMER-115VAC/24VAC
	JUNCTION
	UNMARKED TERMINAL
	PCB TERMINAL
	FACTORY WIRING (115VAC)
	FACTORY WIRING (24VAC)
	FIELD WIRING (115VAC)
	FIELD WIRING (24VAC)
	CONDUCTOR ON PCB
	FIELD WIRING TERMINAL
	FIELD EARTH GROUND
	EQUIPMENT GROUND
	FIELD SPLICE
	PLUG RECEPTACLE

NOTES:

1. IF ANY OF THE ORIGINAL EQUIPMENT WIRE IS REPLACED USE WIRE RATED FOR 105˚C.
2. INDUCER (IDM) AND BLOWER (BLWM) MOTORS CONTAIN INTERNAL AUTO-RESET THERMAL OVERLOAD SWITCHES (OL).
3. BLOWER MOTOR SPEED SELECTIONS ARE FOR AVERAGE CONDITIONS, SEE INSTALLATION INSTRUCTIONS FOR DETAILS ON OPTIMUM SPEED SELECTION.
4. USE ONLY COPPER WIRE BETWEEN THE DISCONNECT SWITCH AND THE FURNACE JUNCTION BOX (JB).
5. THIS WIRE MUST BE CONNECTED TO FURNACE SHEETMETAL FOR CONTROL TO PROVE FLAME.
6. FACTORY CONNECTED WHEN LGPS NOT USED.
7. REPLACE ONLY WITH A 3 AMP FUSE.
8. YELLOW LEAD NOT ON ALL MOTORS.
9. BLOWER-ON DELAY, GAS HEATING 60 SECONDS, COOLING OR HEAT PUMP 2 SECONDS.
10. BLOWER-OFF DELAY, GAS HEATING 90, 135, 180 OR 225 SECONDS, COOLING OR HEAT PUMP 90 SECONDS. (135 SECONDS ONLY ON SOME MODELS)
11. IGNITION-LOCKOUT WILL OCCUR AFTER FOUR CONSECUTIVE UNSUCCESSFUL TRIALS-FOR-IGNITION. CONTROL WILL AUTO-RESET AFTER THREE HOURS.
12. SOME MODELS MAY HAVE SPADE QUICK CONNECT TERMINALS.

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Fig. 26—Wiring Diagram

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II. 24-V WIRING

Make field 24-v thermostat connections at 24-v terminal block on control center. For proper cooling operation, Y wire from thermostat MUST be connected to Y terminal on control center, as shown in Fig. 24. The 24-v terminal board is marked for easy connection of field wiring. (See Fig. 26.) The 24-v circuit contains a 3-amp, automotive-type fuse located on control center. (See Fig. 27.) Any electrical shorts of 24-v wiring during installation, service, or maintenance may cause fuse to blow. If fuse replacement is required, use only a fuse of identical size (3 amp).

NOTE: Use AWG No. 18 color-coded copper thermostat wire for lengths up to 100 ft. For wire lengths over 100 ft, use AWG No. 16 wire.

III. ACCESSORIES

1. Electronic Air Cleaner (EAC)

   Two quick-connect terminals marked EAC-1 and EAC-2 are provided for EAC connection. (See Fig. 27.) These terminals are energized with 115v (1.5-amp maximum) during blower motor operation.

2. Humidifier (HUM)

   A quick-connect terminal (HUM) and screw terminal (COM) are provided for 24-v humidifier connection. (See Fig. 26.) HUM terminal is energized with 24v (0.5-amp maximum) after inducer motor prepurge period.

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

VENTING

The 345MAV Furnaces require a dedicated, (one 345MAV furnace only) sealed vent system. All air for combustion is taken from the area adjacent to furnace, and all flue products are discharged to outside atmosphere.

I. REMOVAL OF EXISTING FURNACES FROM COMMON VENT SYSTEMS

If furnace being replaced was connected to a common vent system with other appliances, the following steps shall be followed with each appliance connected to the venting system placed in operation, while any other appliances connected to the venting system are not in operation:

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

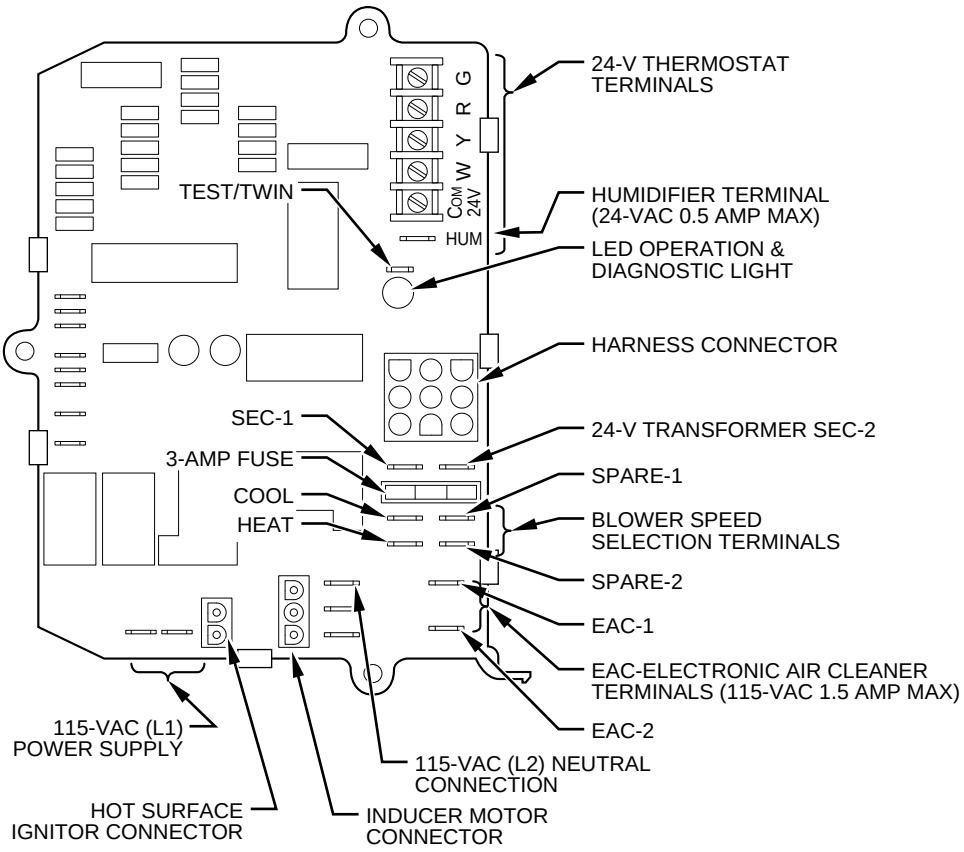

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Fig. 27—Control Center

7. If improper venting is observed during any of above tests, the venting system must be corrected.

Vent system or vent connectors may need to be resized. For any other appliances when resizing vent systems or vent connectors, system or connector must be sized to approach minimum size determined in appropriate table in NFGC or NSCNGPIC.

II. COMBUSTION-AIR AND VENT PIPING

A. General

> **WARNING:** Solvent cements are combustible. Keep away from heat, sparks, and open flame. Use only in well-ventilated areas. Avoid breathing in vapor or allowing contact with skin or eyes. Failure to follow this warning could result in fire, property damage, personal injury, or death.

→ Combustion-air and vent pipe fittings must conform to American National Standards Institute (ANSI) standards and American Society for Testing and Materials (ASTM) standards D1785 (schedule-40 PVC), D2665 (PVC-DWV), D2241 (SDR-21 and SDR-26 PVC), D2661 (ABS-DWV), F628 (schedule-40 ABS), or F891 (PVC-DWV cellular core) or F441 schedule-40 CPVC pipe) and F438 (schedule-40 CPVC fittings). Pipe cement and primer must conform to ASTM standards D2564 or F493 (PVC or CPVC) or D2235 (ABS).

In Canada construct all combustion-air and vent pipes for this unit of CSA or ULC certified schedule-40 PVC, PVC-DWV or ABS-DWV pipe and pipe cement. SDR pipe is NOT approved in Canada.

B. Combustion Air Pipe

> **CAUTION:** Combustion air must not be taken from inside a structure that is frequently contaminated by halogens, which include fluorides, chlorides, bromides, and iodides. These elements are found in aerosols, detergents, bleaches, cleaning solvents, salts, air fresheners, adhesives, paint, and other household products. Locate combustion-air inlet as far as possible from swimming pool and swimming pool pump house.
> Excessive exposure to contaminated combustion air will result in safety and performance related problems.

NOTE: Furnace combustion-air connections are sized for 2-in. pipe. The combustion-air pipe will be 2-in. diameter in all installations.

Furnace combustion-air connection must be attached as shown in Fig. 28. Combustion-air intake housing plug may need to be relocated in some applications.

Combustion-air pipe must terminate outside of furnace casing with 1 elbow. Orient elbow so that opening faces down for upflow or downflow applications. Orient elbow so that it faces sideways (left or right) for horizontal left or horizontal right applications. (See Fig. 28.) Maintain a 3-in. minimum clearance between the opening of the combustion-air inlet pipe and any object.

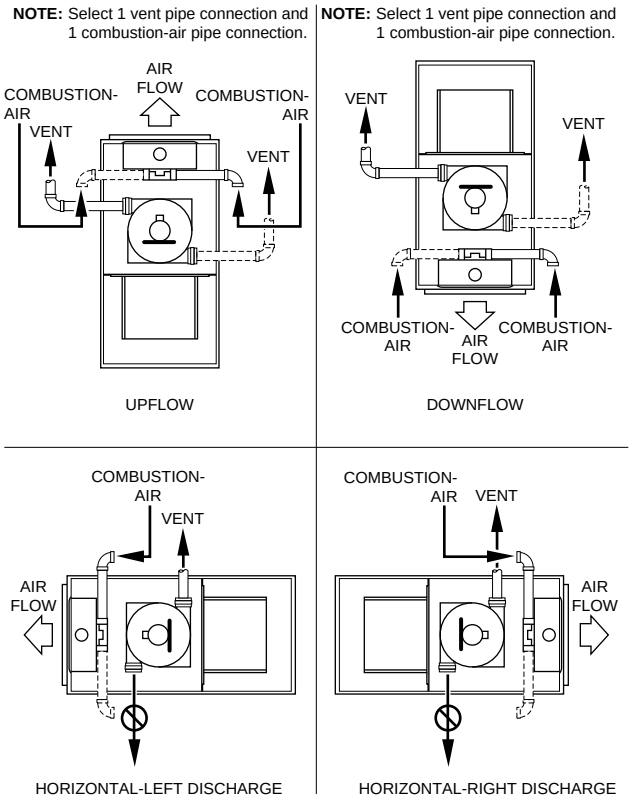
NOTE: All pipe joints must be watertight except attachment of combustion-air inlet pipe to inlet housing connection, since it may be necessary to remove pipe for servicing.

Install combustion air inlet pipe as follows:

1. Assemble combustion-air inlet pipe.
   a. Permanently install perforated disk assembly (factory-supplied in loose parts bag) in combustion-air elbow using RTV or by cementing. (See Fig. 29.)

      For 120,000 Btuh size units only: Separate the 2 halves of perforated disk assembly and use only the shouldered disk half.

   b. Determine length of straight portion of combustion-air inlet pipe from table in Fig. 29.
   c. Cut field-supplied 2-in diameter PVC pipe to determined length.
   d. Permanently attach elbow/perforated disk assembly to straight portion of pipe using RTV or by cementing. (See Fig. 29.)
2. Attach combustion-air inlet pipe.



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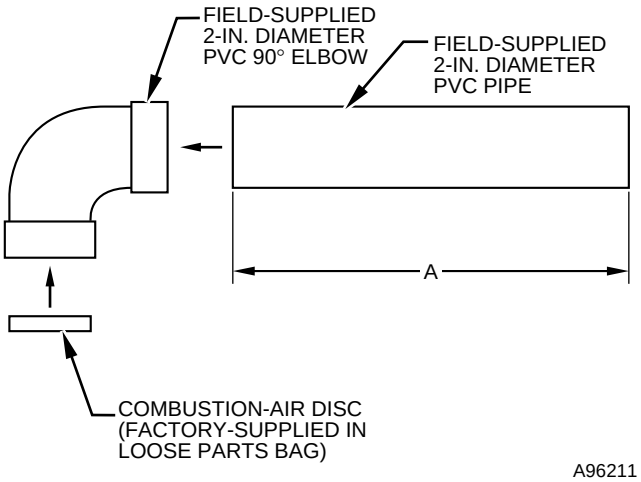
> **CAUTION:** Make sure there is adequate clearance (3-in. minimum) to any fixed or loose objects in order to ensure an adequate combustion-air supply.

Fig. 28—Combustion-Air and Vent Pipe Connections

   a. Determine location of combustion-air intake pipe connection to combustion-air intake housing as shown in Fig. 28 for application.
   b. Reposition combustion-air intake housing plug fitting in appropriate unused intake housing connection.
   c. Install pipe support (factory-supplied in loose parts bag) into selected furnace casing combustion-air pipe hole. Pipe support should be positioned at bottom of casing hole.
   d. Insert assembled combustion-air inlet pipe into intake housing.
   e. Make sure elbow is oriented in an acceptable direction and that the minimum clearance of 3 in. is observed. (See Fig. 28.)
   f. Drill a 1/8-in. hole in 2-in. combustion-air inlet pipe using hole in intake housing as a guide.
   g. Install a field-supplied No. 6 or No. 8 sheet metal screw into combustion-air pipe.



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LENGTH OF STRAIGHT PIPE PORTION OF COMBUSTION-AIR INLET PIPE ASSEMBLY (IN.)

CASING WIDTH	A
17-1/2	8-1/2 ± 1/2
21	10-1/2 ± 1/2
24-1/2	12 ± 1/2

Fig. 29—Combustion-Air Inlet Pipe Assembly

NOTE: Do not attach combustion-air intake pipe permanently to combustion-air intake housing since it may be necessary to remove pipe for service of ignitor or flame sensor.

The combustion-air intake plug fitting must be installed in unused combustion-air intake housing. This fitting must be attached by using RTV sealant, or by drilling a 1/8-in. hole in fitting, using hole in intake housing as a guide. Install a field-supplied No. 6 or No. 8 sheet metal screw.

NOTE: DO NOT OVERTIGHTEN SCREW. Breakage to intake housing or fitting may cause air leakage to occur.

A plugged drain connection has been provided on this fitting for use when moisture is found in combustion-air intake pipe and combustion box. If use of this drain connection is desired, drill out fitting's tap plug with a 3/16-in. drill and connect a field-supplied 3/8-in. tube. This tube should be routed to open condensate drain for furnace and A/C (if used), and should be trapped. (See Fig. 30.)

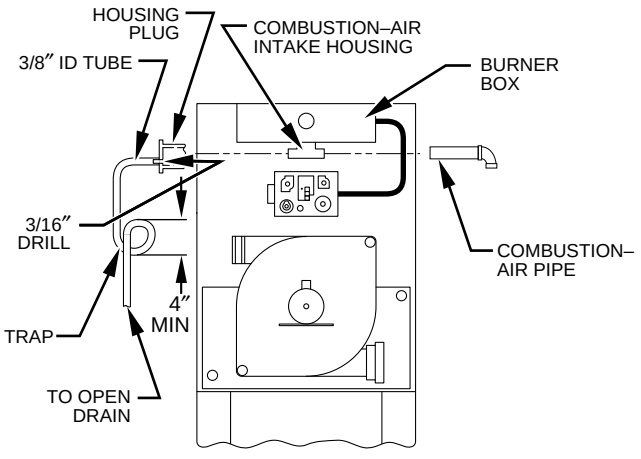

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Fig. 30—Intake Housing Plug Fitting Drain

C. Vent Pipe

NOTE: Furnace vent pipe connections are sized for 2-in. pipe. Any vent pipe size change should be made outside furnace casing in vertical pipe. (See Fig. 31.) This allows proper drainage of vent condensate.

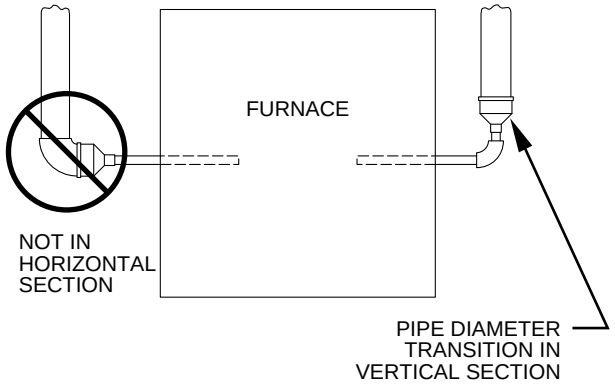

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Fig. 31—Vent Pipe Diameter Transition Location and Elbow Configuration

Determine vent pipe diameter and maximum pipe lengths using Table 4.

Furnace vent pipe connection must be attached as shown in Fig. 28. Inducer housing alternate vent cap may need to be relocated in some applications.

NOTE: Starting at furnace, slope vent pipe a minimum of 1/4 in. per linear ft upward to termination(s) with no sags between hangers.

⚠ **CAUTION:** When vent pipe is exposed to temperatures below freezing, such as when it passes through an unheated space or when a chimney is used as a raceway, pipe must be insulated as described in Table 5 with Armaflex-type insulation.

⚠ **WARNING:** Vent pipes must be airtight and watertight. Failure to follow this warning could result in property damage, personal injury, or death.

NOTE: The minimum vent pipe length for these furnaces is 5 ft. Short pipe lengths (5-8 ft) may discharge water droplets. These droplets may be undesirable, and a 12-in. minimum offset pipe section is recommended to reduce excessive droplets from exiting vent pipe outlet. (See Fig. 32.)

NOTE: Do not count elbows or pipe sections in terminations or within furnace. See shaded areas in Fig. 34.

EXAMPLE:
An 036080 size furnace located in Indianapolis, elevation 650 ft above sea level, could be installed in an application requiring 3 elbows and 32 ft of vent pipe. Table 4 indicates this application would allow a 2-in. diameter vent pipe. At 0-2000 ft elevation, 2-in. pipe is good for up to 35 ft with 3 elbows. If same installation were in Albuquerque, elevation 5250 ft above sea level, installation would require 2-1/2 in. vent pipe. At 5001- to 6000-ft elevation, 2-in. pipe is allowed for up to 23 ft with 3 elbows, but 2-1/2 in. pipe can be used for up to 70 ft with 3 elbows.

Install vent pipe as follows:

1. Determine location of vent pipe connection to inducer housing as shown in Fig. 28 for application.
2. → Reposition elastomeric (rubber) inducer housing outlet cap and clamp to appropriate unused inducer housing connection. Tighten clamp.

TABLE 4—MAXIMUM ALLOWABLE VENT PIPE LENGTH (FT)

ALTITUDE (FT)	UNIT SIZE	VENT PIPE DIAMETER (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
0 to 2000	024040 036040	1	5	NA	NA	NA	NA	NA
		1-1/2	70	70	65	60	60	55
		2	70	70	70	70	70	70
	024060 036060 048060	1-1/2	20	15	10	5	NA	NA
		2	70	70	70	70	70	70
	036080 048080 060080	1-1/2	10	NA	NA	NA	NA	NA
		2	55	50	35	30	30	20
		2-1/2	70	70	70	70	70	70
	048100 060100	2	5	NA	NA	NA	NA	NA
		2-1/2	40	30	20	20	10	NA
		3	70	70	70	70	70	70
	060120	2-1/2	10	NA	NA	NA	NA	NA
		3*	70	70	70	70	70	70

ALTITUDE (FT)	UNIT SIZE	VENT PIPE DIAMETER (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
2001 to 3000	024040 036040	1-1/2	67	62	57	52	52	47
		2	70	70	70	70	70	70
	024060 036060 048060	1-1/2	17	12	7	NA	NA	NA
		2	70	67	66	61	61	61
	036080 048080 060080	2	49	44	30	25	25	15
		2-1/2	70	70	70	70	70	70
	048100 060100	2-1/2	35	26	16	16	6	NA
		3	70	70	70	70	66	61
	060120	3*	63	62	62	61	61	61

ALTITUDE (FT)	UNIT SIZE	VENT PIPE DIAMETER (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
3001 to 4000	024040 036040	1-1/2	64	59	54	49	48	43
		2	70	70	70	70	70	70
	024060 036060 048060	1-1/2	16	11	6	NA	NA	NA
		2	68	63	62	57	57	56
	036080 048080 060080	2	46	41	28	23	22	13
		2-1/2	70	70	70	70	70	70
	048100 060100	2-1/2	33	24	15	14	5	NA
		3	70	70	70	66	61	56
	060120	3*	59	59	58	57	57	56

ALTITUDE (FT)	UNIT SIZE	VENT PIPE DIAMETER (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
4001 to 5000†	024040 036040	1-1/2	60	55	50	45	44	39
		2	70	70	70	70	70	70
	024060 036060 048060	1-1/2	15	10	5	NA	NA	NA
		2	64	59	58	53	52	52
	036080 048080 060080	2	44	39	26	21	20	11
		2-1/2	70	70	70	70	70	70
	048100 060100	2-1/2	31	22	13	12	NA	NA
		3	70	70	67	62	57	52
	060120	3*	56	55	54	53	52	52

* Wide radius elbow.
† Vent sizing for Canadian installations over 4500 ft (1370 m) above sea level are subject to acceptance by the local authorities having jurisdiction.
NA—Not Allowed; pressure switch will not make.

NOTES:
1. Do not use pipe size greater than those specified in table or incomplete combustion, flame disturbance, or flame sense lockout may occur.
2. Assume two 45° elbows equal one 90° elbow. Long radius elbows are desirable and may be required in some cases.
3. Elbows and pipe sections within the furnace casing and at the vent termination should not be included in vent length or elbow count.
4. The minimum pipe length is 5 ft for all applications.

TABLE 4—MAXIMUM ALLOWABLE VENT PIPE LENGTH (FT) Continued

ALTITUDE (FT)	UNIT SIZE	VENT PIPE DIAMETER (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
5001 to 6000†	024040 036040	1-1/2	57	52	47	42	40	35
		2	70	70	70	70	70	70
	024060 036060 048060	1-1/2	14	9	NA	NA	NA	NA
		2	60	55	54	49	48	47
	036080 048080 060080	2	41	36	23	18	17	8
		2-1/2	70	70	70	70	70	70
	048100 060100	2-1/2	29	21	12	11	NA	NA
		3	70	67	62	57	52	47
	060120	3*	53	52	50	49	48	47

ALTITUDE (FT)	UNIT SIZE	VENT PIPE DIAMETER (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
6001 to 7000†	024040 036040	1-1/2	53	48	43	38	37	32
		2	70	70	68	67	66	64
	024060 036060 048060	1-1/2	13	8	NA	NA	NA	NA
		2	57	52	50	45	44	43
	036080 048080 060080	2	38	33	21	16	15	6
		2-1/2	70	70	68	67	66	64
	048100 060100	2-1/2	27	19	10	9	NA	NA
		3	68	63	58	53	48	43
	060120	3*	49	48	47	45	44	43

ALTITUDE (FT)	UNIT SIZE	VENT PIPE DIAMETER (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
7001 to 8000†	024040 036040	1-1/2	49	44	39	34	33	28
		2	66	65	63	62	60	59
	024060 036060 048060	1-1/2	12	7	NA	NA	NA	NA
		2	53	48	46	41	40	38
	036080 048080 060080	2	36	31	19	14	12	NA
		2-1/2	66	65	63	62	60	59
	048100 060100	2-1/2	25	17	8	7	NA	NA
		3	63	58	53	48	43	38
	060120	3*	46	44	43	41	40	38

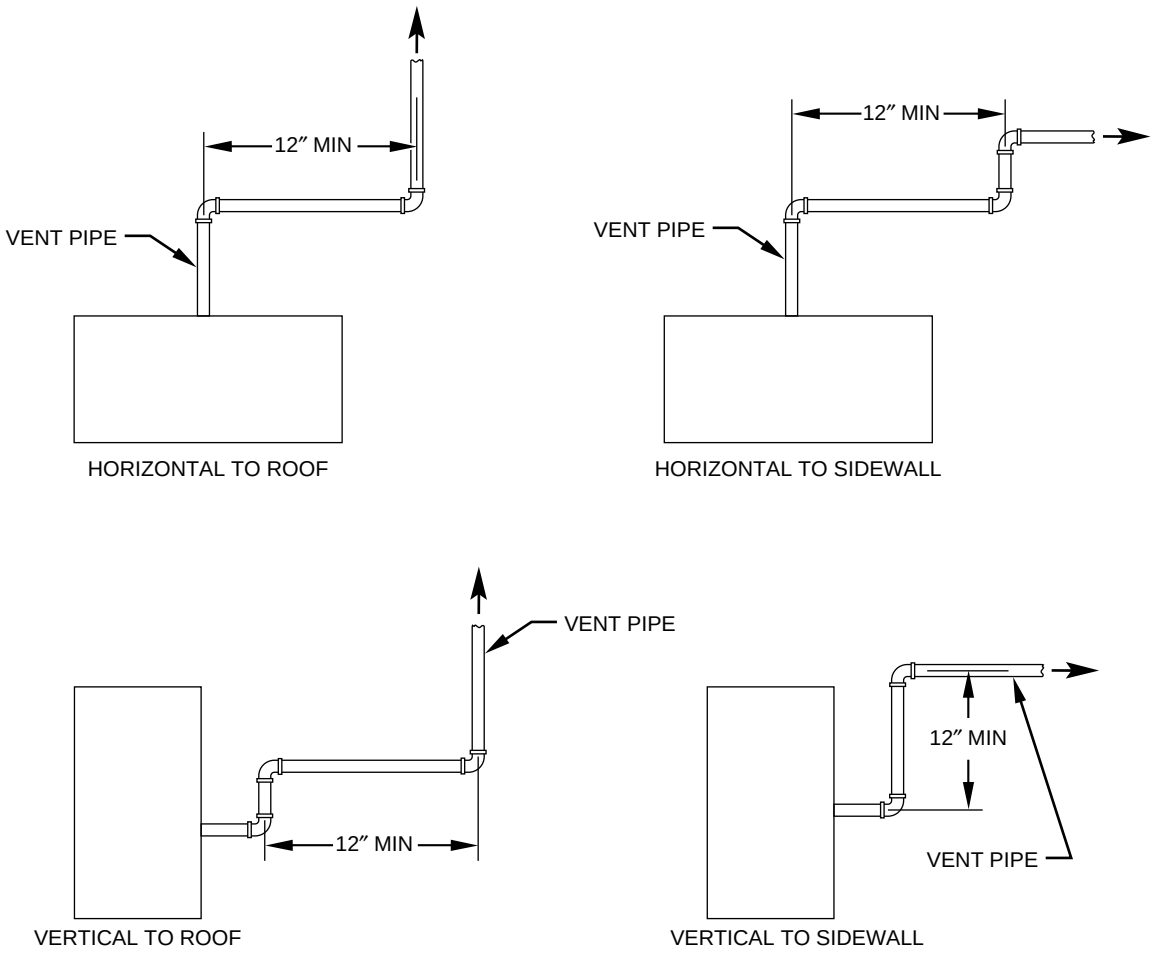
ALTITUDE (FT)	UNIT SIZE	VENT PIPE DIAMETER (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
8001 to 9000†	024040 036040	1-1/2	46	41	36	31	29	24
		2	62	60	58	56	55	53
	024060 036060 048060	1-1/2	11	6	NA	NA	NA	NA
		2	49	44	42	37	35	34
	036080 048080 060080	2	33	28	17	12	10	NA
		2-1/2	62	60	58	56	55	53
	048100 060100	2-1/2	23	15	7	5	NA	NA
		3	59	54	49	44	39	34
	060120	3*	43	41	39	37	35	34

* Wide radius elbow.
† Vent sizing for Canadian installations over 4500 ft (1370 m) above sea level are subject to acceptance by the local authorities having jurisdiction.
NA—Not Allowed; pressure switch will not make.
NOTES:
1. Do not use pipe size greater than those specified in table or incomplete combustion, flame disturbance, or flame sense lockout may occur.
2. Assume two 45° elbows equal one 90° elbow. Long radius elbows are desirable and may be required in some cases.
3. Elbows and pipe sections within the furnace casing and at the vent termination should not be included in vent length or elbow count.
4. The minimum pipe length is 5 ft for all applications.

TABLE 4—MAXIMUM ALLOWABLE VENT PIPE LENGTH (FT) Continued

ALTITUDE (FT)	UNIT SIZE	VENT PIPE DIAMETER (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
9001 to 10,000†	024040 036040	1-1/2	42	37	32	27	25	20
		2	57	55	53	51	49	47
	024060 036060 048060	2	45	40	38	33	31	29
	036080 048080 060080	2	30	25	14	9	7	NA
		2-1/2	57	55	53	51	49	47
	048100 060100	2-1/2	21	13	5	NA	NA	NA
		3	54	49	44	39	34	29
	060120	3*	39	37	35	33	31	29

* Wide radius elbow.
† Vent sizing for Canadian installations over 4500 ft (1370 m) above sea level are subject to acceptance by the local authorities having jurisdiction.
NA—Not Allowed; pressure switch will not make. **NOTES:**
1. Do not use pipe size greater than those specified in table or incomplete combustion, flame disturbance, or flame sense lockout may occur.
2. Assume two 45° elbows equal one 90° elbow. Long radius elbows are desirable and may be required in some cases.
3. Elbows and pipe sections within the furnace casing and at the vent termination should not be included in vent length or elbow count.
4. The minimum pipe length is 5 ft for all applications.



NOTE: A 12-In. minimum offset pipe section is recommended with short (5 to 8 ft) vent systems. This recommendation is to reduce excessive condensate droplets from exiting the vent pipe.

A96189

Fig. 32—Short Vent (5 to 8 Ft) System

TABLE 5—MAXIMUM ALLOWABLE EXPOSED VENT PIPE LENGTH (FT) WITH INSULATION IN WINTER DESIGN TEMPERATURE AMBIENT*

UNIT SIZE	WINTER DESIGN TEMPERATURE (°F)	MAX PIPE DIAMETER (IN.)	WITHOUT INSULATION	WITH 3/8-IN. OR THICKER INSULATION†
040	20	1.5	51	70
	0	1.5	28	70
	-20	1.5	16	70
	20	2	45	70
	0	2	22	70
	-20	2	10	58
060	20	2	65	70
	0	2	35	70
	-20	2	20	70
080	20	2	55	55
	0	2	48	55
	-20	2	30	55
	20	2.5	70	70
	0	2.5	47	70
	-20	2.5	28	70
100	20	2.5	40	40
	0	2.5	40	40
	-20	2.5	38	40
	20	3	70	70
	0	3	50	70
	-20	3	28	70
120	20	3	70	70
	0	3	61	70
	-20	3	37	70

* Pipe length (ft) specified for maximum pipe lengths located in unconditioned spaces. Pipes located in unconditioned space cannot exceed total allowable pipe length as specified in Table 4.
† Insulation thickness based on R value of 3.5 (ft ^{2}•°F•hr.)/(Btu•in.)

WARNING: Inducer housing outlet cap must be installed and fully seated against inducer housing. Clamp must be tightened to prevent any condensate leakage. Failure to follow this warning could result in electrical shock, fire, personal injury, or death.

3. Install pipe support (factory-supplied in loose parts bag) into selected furnace casing vent pipe hole. Pipe support should be positioned at bottom of casing hole.

→ 4. Be certain that mating surfaces of inducer housing connection, elastomeric coupling, and 2-in. diameter vent pipe are clean and dry. Assemble the elastomeric (rubber) vent coupling (with 2 loose clamps) onto inducer housing connection. Insert the 2-in. diameter vent pipe through the elastomeric (rubber) coupling and fully into inducer housing connection until it bottoms on the internal stop. Tighten both clamps to secure the pipe to inducer housing. Tighten the clamp screws to 15 in.-lb. of torque.

→ **WARNING:** Vent pipe must be installed and fully seated against inducer housing internal stop. Clamp must be tightened to prevent any condensate leakage. Failure to follow this warning could result in electrical shock, fire, personal injury, or death.

NOTE: A 2-in. diameter pipe must be used within the furnace casing. Make all pipe diameter transitions outside furnace casing.

VENT EXTENSION PIPE

Some furnaces are supplied with a PVC vent extension pipe (2-in. diameter by 12-in. long). This pipe has a built-in channel to assist vent condensate disposal. When this vent extension pipe is supplied, it must be used to connect the field vent pipe to furnace inducer housing on ALL upflow and downflow applications.

NOTE: See label on vent extension pipe for proper installation. This pipe may be shortened if an elbow is used to connect vent extension tube to field-installed vent pipe.

5. Working from furnace to outside, cut pipe to required length(s).
6. Deburr inside and outside of pipe.
7. Chamfer outside edge of pipe for better distribution of primer and cement.
8. Clean and dry all surfaces to be joined.
9. Check dry fit of pipe and mark insertion depth on pipe.

NOTE: It is recommended that all pipes be cut, prepared, and preassembled before permanently cementing any joint.

10. After pipes have been cut and preassembled, apply generous layer of cement primer to pipe fitting socket and end of pipe to insertion mark. Quickly apply approved cement to end of pipe and fitting socket (over primer). Apply cement in a light, uniform coat on inside of socket to prevent buildup of excess cement. Apply second coat.
11. While cement is still wet, twist pipe into socket with 1/4 turn. Be sure pipe is fully inserted into fitting socket.
12. Wipe excess cement from joint. A continuous bead of cement will be visible around perimeter of a properly made joint.
13. Handle pipe joints carefully until cement sets.
14. Support vent piping a minimum of every 5 ft (3 ft for SDR-21 or -26 PVC) using perforated metal hanging strap.

15. Slope vent pipe toward furnace a minimum of 1/4 in. per linear ft with no sags between hangers.
16. Use appropriate methods to seal openings where vent pipe passes through roof or sidewall.

D. Extended Exposed Sidewall Pipes

Sidewall vent pipe termination may be extended beyond area shown in Fig. 34 in outside ambient by insulating pipe as indicated in Table 5.

1. Determine vent pipe diameter, as stated above, using total pipe length and number of elbows.
2. Find appropriate temperature for your application and furnace model using winter design temperature (used in load calculations).
3. Determine required insulation thickness for exposed pipe lengths.

NOTE: Pipe length (ft) specified for maximum pipe lengths located in unconditioned spaces cannot exceed total allowable pipe length as specified in Table 4.

III. VENT TERMINATION

Vent pipe must terminate either through roof or sidewall. See Table 6 for required clearances. See Fig. 33, 34, and 35 for exterior piping arrangements.

Consideration of the following should be made when determining an appropriate location for termination:

1. Comply with all clearance requirements stated in Table 6.
2. Termination should be positioned where vent vapors will not damage plants/shrubs or air conditioning equipment.
3. Termination should be positioned where it will not be damaged by or subjected to foreign objects such as stones, balls, etc.
4. Termination should be positioned where vent vapors are not objectionable.

IV. MULTIVENTING

When 2 or more 345MAV Furnaces are vented near each other, each furnace must be individually vented. NEVER common vent or breach vent 345MAV furnaces.

CONDENSATE DRAIN

I. GENERAL

Condensate trap is shipped installed in the blower shelf and factory connected for UPFLOW applications. Condensate trap must be RELOCATED for use in DOWNFLOW and HORIZONTAL applications.

Condensate trap MUST be used for all applications.

An external trap is not required when connecting the field drain to this condensate trap.

The field drain connection (condensate trap or drain tube coupling) is sized for 1/2-in. CPVC, 1/2-in. PVC, or 5/8-in. ID tube connection.

Drain pipe and fittings must conform to ANSI standards and ASTM D1785 or D2846. CPVC or PVC cement and primer must conform to ASTM D2564 or F493. In Canada, use CSA or ULC certified schedule 40 CPVC or PVC drain pipe, fittings, and cement.

When a condensate pump is required, select a pump which is approved for condensing furnace applications. To avoid condensate spillage, select a pump with an overflow switch.

Furnace condensate is mildly acidic, typically in the pH range of 3.2 to 4.5. Due to corrosive nature of unneutralized condensate, a condensate pH neutralizing filter may be desired. Check with local authorities to determine if a pH neutralizer is required.

TABLE 6—VENT PIPE TERMINATION CLEARANCES

LOCATION	CLEARANCE (FT)	
	U.S.A.	Canada
Above grade level or above anticipated snow depth	1	1†
Dryer vent	3	3
From plumbing vent stack	3	3
From any mechanical fresh air intake	1	6
For furnaces with an input capacity of 100,000 Btuh or less—from any non-mechanical air supply (windows or doors which can be opened) or combustion-air opening	1	1
For furnaces with an input capacity greater than 100,000 Btuh—from any non-mechanical air supply (windows or doors which can be opened) or combustion-air opening	1	3
From service regulator vent, electric and gas meters, and relief equipment	4*	6‡
Above grade when adjacent to public walkway	Note 3	Note 3

* Horizontal distance.
† 18 in. above roof surface in Canada.
‡ 36 in. to electric meter in Canada only.
NOTES:
1. If installing 2 adjacent 345MAV Furnaces, refer to Multiventing and Vent Terminations section for proper vent configurations.
2. When locating vent terminations, consideration must be given to prevailing winds, location, and other conditions which may cause recirculation of the appliance's own flue products or the flue products of adjacent vents. Recirculation can cause poor combustion, inlet condensate problems, and accelerated corrosion of heat exchangers.
3. Vent termination can not terminate less than 2 ft horizontal and 7 ft above public walkway or where condensate vapor or droplets may be a hazard.

II. APPLICATION

The furnace, A/C, and humidifier drains may be combined and drained together. The A/C drain must have an external, field-supplied trap prior to the furnace drain connection. All drain connections (furnace, A/C, or humidifier) must be terminated into an open or vented drain as close to the respective equipment as possible to prevent siphoning of the equipment's drain.

See Fig. 36 for example of possible field drain attachment using 1/2-in. CPVC or PVC tee for vent and A/C or humidifier drain connection.

Outdoor draining of the furnace is permissible if allowed by local codes. Caution should be taken when freezing ambient may freeze drain pipe and prohibit draining.

> ⚠ **WARNING:** Caution should be taken to prevent draining where slippery conditions may cause personal injuries. Excessive condensate draining may cause saturated soil conditions which may result in damage to plants.

III. CONDENSATE DRAIN PROTECTION

Freezing condensate left in condensate trap and drain line may cause cracks, and possible water damage may occur. If freeze protection is required, use condensate freeze protection accessory or equivalent 3 to 6 watt per ft at 120v and 40°F self-regulating, shielded, and waterproof heat tape. See Installation Instructions supplied with accessory or heat tape manufacturer's recommendations.

1. Fold heat tape in half and wrap on itself 3 times.
2. Locate heat tape between sides of condensate trap back. (See Fig. 37.)
3. Use wire ties to secure heat tape in place. Wire ties can be positioned in notches of condensate trap sides. (See Fig. 37.)

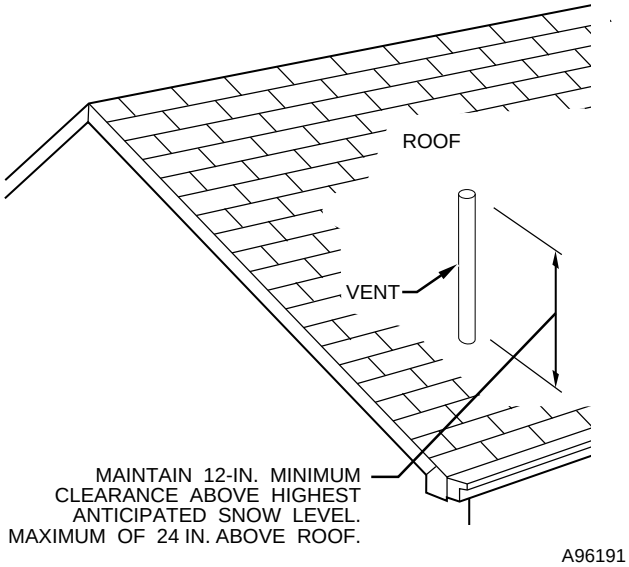


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Fig. 33—Roof Termination (Preferred)

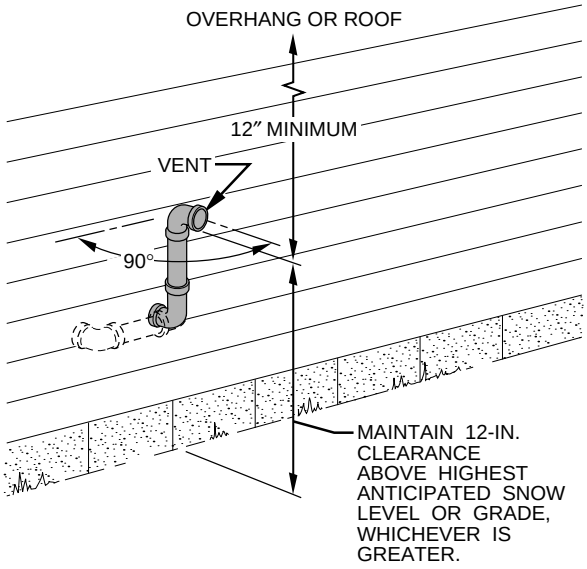

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Fig. 34—Sidewall Termination with 2 Elbows (Preferred)

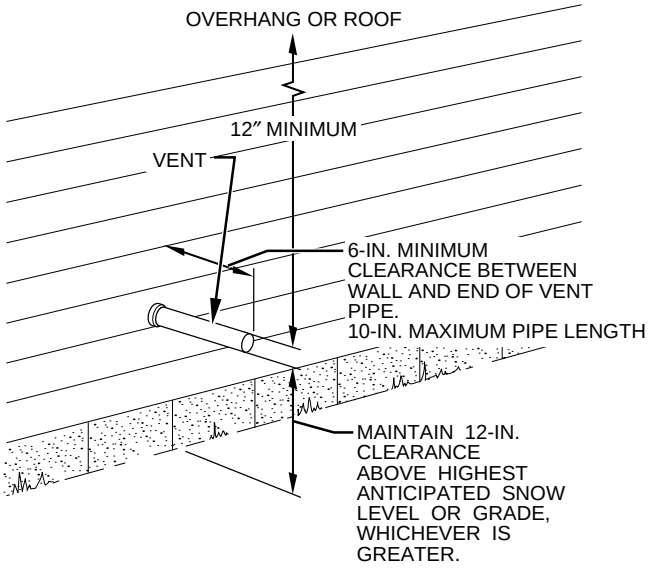

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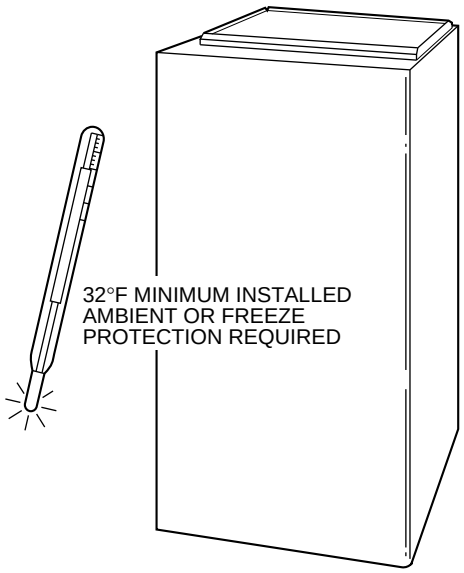
Fig. 35—Sidewall Termination with Straight Pipe



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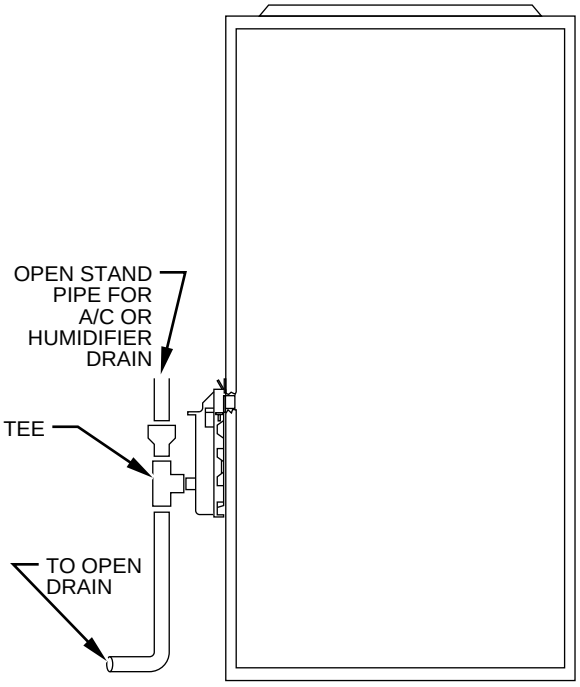
CAUTION: Unit must not be installed, operated, and then turned off and left in an unoccupied structure during cold weather when temperature drops to 32°F and below unless drain trap and drain line have adequate freeze protection. See Service and Maintenance Instructions for winterizing procedure.



A94054

Fig. 36—Example of Field Drain Attachment

4. Wrap field drain pipe with remaining heat tape, approximately 1 wrap per ft.
5. When using field-supplied heat tape, follow heat tape manufacturer's instructions for all other installation guidelines.

SEQUENCE OF OPERATION

> ⚠ **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.

Using schematic diagram, follow sequence of operation through different modes. (See Fig. 26.) This furnace has a new control system. Read and follow wiring diagram carefully.

NOTE: If 115-v power supply to furnace or blower access panel switch is interrupted during a call for heat, blower operates for 90 sec when power is restored before heating cycle is resumed.

I. HEATING MODE

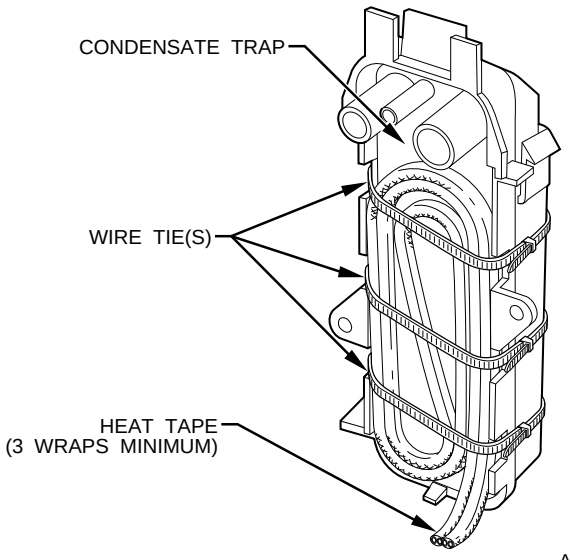
When wall thermostat "calls for heat," R-W circuit closes. Furnace control performs a self-check, verifies pressure switch contacts are open, and starts inducer motor.

1. **Prepurge period**—As inducer motor comes up to speed, pressure switch contacts close to begin a 15-sec prepurge period.
2. **Ignitor warm up**—At end of prepurge period, ignitor is energized for a 17-sec ignitor warm-up period.
3. **Ignition sequence**—When ignitor warm-up period is completed, gas valve opens, permitting gas flow to burners where it is ignited. After 5 sec, ignitor is de-energized and a 2-sec flame-sensing period begins.

   HUM terminal on control center is energized with gas valve. See Accessories — Humidifier section.
4. **Flame sensing**—When burner flame is sensed, control begins blower on delay period and continues holding gas valve open.

   If burner flame is not sensed, control center de-energizes gas valve and ignition sequence is repeated.

NOTE: Ignition sequence repeats 3 additional times before a lockout occurs. Lockout automatically resets after 3 hr or can be manually reset by turning off 115v (not at thermostat) for 3 sec minimum, then turning it on again.



A93036

Fig. 37—Condensate Trap Heat Tape

5. **Blower on delay**—Sixty sec after burner flame is proven, blower motor is energized on heating speed. Simultaneously, electronic air cleaner terminal EAC-1 is energized.
6. **Blower off delay**—When thermostat is satisfied, circuit between R-W is opened, de-energizing gas valve (stopping gas flow to burners) and humidifier. Blower motor and electronic air cleaner remain energized for 135 sec.
7. **Post purge**—Inducer motor remains energized 15 sec after burners are extinguished.

II. COOLING MODE

When thermostat "calls for cooling," R-G and R-Y circuits close. R-Y circuit starts outdoor condensing unit, and combined R-Y and R-G circuit starts furnace blower motor on cooling speed. Electronic air cleaner EAC-1 terminal is energized with 115v whenever blower is operating.

When thermostat is satisfied, R-G and R-Y circuits are opened, furnace blower continues operating on cooling speed for an additional 90 sec.

III. CONTINUOUS BLOWER MODE

When R-G circuit is made, blower motor operates on heating speed.

NOTE: Electronic air cleaner EAC-1 terminal is energized with 115v whenever blower is operating.

If a "call for heat" (R-W) occurs while thermostat is in continuous blower mode, blower stops to allow furnace heat exchangers to heat up more quickly, then restarts at end of blower on delay period of 60 sec.

Blower reverts to continuous operation after heating cycle is completed.

If a "call for cooling" (R-Y) occurs while thermostat is in continuous blower mode, blower changes from continuous blower speed (heating speed) to cooling speed.

When thermostat cooling call is satisfied, R-Y opens and blower operates an additional 90 sec at cooling speed before reverting back to continuous operation (heating speed).

IV. HEAT PUMP MODE

When installed with a heat pump, furnace control automatically changes blower on delay timing sequence to avoid no blower operation time during demand defrost cycles. When R-W and R-Y or R-W, R-Y, and R-G thermostat inputs are received at the same time at furnace control center, control starts blower in heating speed. Then a gas heat mode begins. Blower remains operating at heating speed for 15 sec or until end of prepurge period, then blower shuts off until end of ignitor warm up and trial for ignition periods (a total of 24 sec). Blower restarts at heating speed.

When R-W thermostat call disappears, control completes inducer post-purge period (15 sec) and changes to cooling speed after a 2-sec delay.

If R-W, R-Y, and R-G thermostat signals should disappear simultaneously, blower remains on for heating blower off delay period of 135, and the inducer goes through 15 sec post-purge period. If R-W and R-Y thermostat signals should disappear, leaving R-G thermostat signal, blower remains on in heating speed and inducer remains on for 15 sec to complete post-purge period.

Control initiates a 90-sec blower only on period before starting another heat pump cycle if there is a power interruption. Anytime control senses false flame, control locks out of heating mode. This reaction occurs because control ignores W input due to false flame signal and, as a result, sees only Y input and goes into cooling mode blower off delay. All other control functions remain in standard format.

NOTE: EAC-1 terminal is energized whenever blower operates. HUM terminal is only energized when gas valve is energized.

V. COMPONENT TEST

A. Component Test Sequence

NOTE: All components are functionally operated except the gas valve.

When component test is initiated, the following sequence of events occurs:

1. LED flashes a status code 4 times.
2. Inducer motor starts and continues to run for remainder of component test.
3. Hot surface ignitor is energized for 15 sec, then de-energized.
4. Main blower operates at cooling speed for 10 sec, then turns off.
5. Main blower operates at heating speed for 10 sec, then turns off.
6. Inducer motor stops.

Component test can be initiated by one of the following procedures.

B. Initiating Component Test By Removing Main Limit Switch Wire

NOTE: NO thermostat signal may be present at control center and all blower time delay off periods must be completed.

1. Leave 115-v power to furnace turned on.
2. Remove main furnace door.
3. Look into blower access panel sight glass for current LED status.

NOTE: Leave blower access panel installed to maintain power to control center to view current LED status.

4. BRIEFLY remove either wire from the main limit switch until the LED goes out, then reconnect it.

> ⚠ **CAUTION:** Make sure limit switch wire does not contact any metallic component such as the gas valve. If wire is shorted, 3-amp fuse on control center will blow.

NOTE: If wire to main limit is disconnected longer than 4 sec, the control senses limit circuit is open. Main blower will start and fault retrieval request will be ignored.

5. When above items have been completed, the component test sequence will occur as described in the Component Test Sequence section above.

NOTE: Be sure to record the status code which is flashed 4 times at start of component test for further troubleshooting.

6. After component test is completed and LED is ON continuously indicating the furnace is ready to operate when a signal from the thermostat is received, replace main furnace door.

C. Initiating Component Test By Jumpering Control TEST Terminal

1. Remove main furnace door.
2. Remove blower access panel.
3. Manually close blower access panel door switch. Use a piece of tape to hold switch closed.

> ⚠ **WARNING:** Blower access panel door switch opens 115-v power to control center. No component operation can occur. Caution must be taken when manually closing this switch for service purposes. Failure to follow this warning could result in electrical shock, personal injury, or death.

4. BRIEFLY short (jumper) TEST, 1/4-in. quick-connect terminal on control center (adjacent to the LED diagnostic light) and the COM terminal on thermostat connection block. (See Fig. 26.)

NOTE: If TEST to COM terminals are jumpered longer than 2 sec, LED will flash rapidly, and retrieval request will be ignored.

5. When above items have been completed, the component test sequence will occur as described in the Component Test Sequence section above.

NOTE: Be sure to record the status code which is flashed 4 times at start of component test for further troubleshooting.

6. After component test is completed and furnace is operating properly, release blower access panel door switch, replace blower access panel, and replace main furnace door.

START-UP PROCEDURES

I. GENERAL

1. Furnace must have a 115-v power supply properly connected and grounded. Proper polarity must be maintained for correct operation.

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

2. Thermostat wire connections at terminals R, W, G, and Y must be made at 24-v terminal block on control center.
3. Natural 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).
4. Blower access panel must be in place to complete 24-v electrical circuit to furnace.

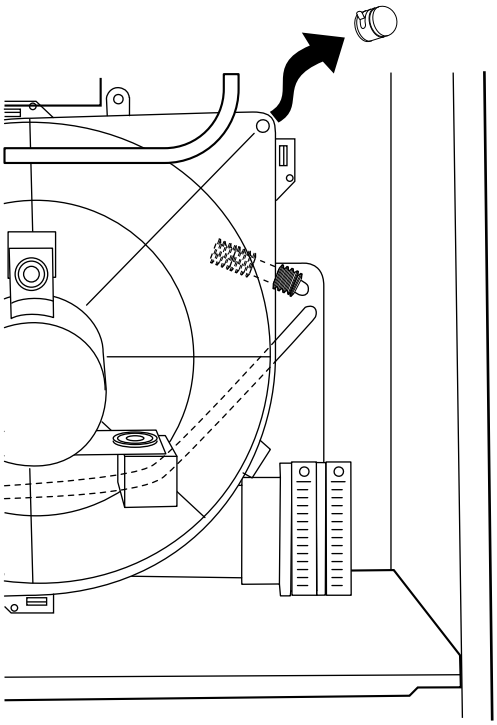
> ⚠ **CAUTION:** These furnaces are equipped with a manual reset limit switch in burner box. This switch will open if an overheat condition (rollout) occurs in burner enclosure. Correct inadequate combustion-air supply or improper venting condition and reset switch. DO NOT jumper this switch.

Before operating furnace, check each manual reset switch for continuity. If necessary, press button to reset switch.

II. PRIME CONDENSATE TRAP WITH WATER

> ⚠ **CAUTION:** Condensate trap must be PRIMED or proper draining may not occur. The condensate trap has 2 internal chambers which can ONLY be primed by pouring water into the inducer drain side of condensate trap.

1. Remove upper inducer housing drain connection cap. (See Fig. 38.)
2. Connect field-supplied 1/2-in. ID tube to upper inducer housing drain connection.
3. Insert field-supplied funnel into tube.
4. Pour 1 quart of water into funnel/tube. Water should run through inducer housing, overfill condensate trap, and flow into open field drain. (See Fig. 39.)



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→ **Fig. 38—Inducer Housing Drain Tube**

5. Remove funnel and tube from inducer housing and replace drain connection cap and clamp.

III. PURGE GAS LINES

If not previously done, purge lines after all connections have been made and check for leaks.

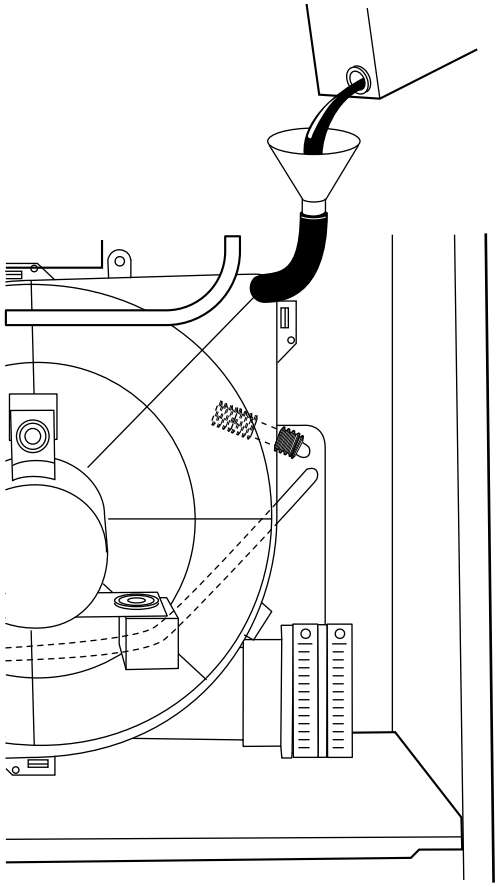
> ⚠ **WARNING:** Never purge a gas line into a combustion chamber. Never use matches, candles, flame, or other sources of ignition for purpose of checking leakage. Use a soap-and-water solution to check for leakage. Failure to follow this warning could result in fire, explosion, personal injury, or death.

IV. ADJUSTMENTS

A. 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 input on furnace rating plate.

1. Determine natural gas orifice size and manifold pressure for correct input.
   a. Obtain average yearly heat value (at installed altitude) from local gas supplier.
   b. Obtain average yearly specific gravity from local gas supplier.
   c. Verify furnace model. Table 7 can only be used for model 345MAV furnaces.



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→ **Fig. 39—Filling Condensate Trap**

   d. Find installation altitude in Table 7.

NOTE: For Canada altitudes of 2000 to 4500 ft, use U.S.A. altitudes of 5001 to 6000 ft in Table 7.

   e. Find closest natural gas heat value and specific gravity on Table 7.
   f. Follow heat value and specific gravity lines to point of intersection to find orifice size and manifold pressure settings for proper operation.

EXAMPLE: (0—2000 altitude)
Heating value = 1050 Btu/cu ft
Specific gravity = 0.62
Therefore: Orifice No. 45
Manifold pressure 3.6-in. wc
* Furnace is shipped with No. 45 orifices. In this example all main burner orifices are the correct size and do not need to be changed to obtain the proper input rate.

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

2. Adjust manifold pressure to obtain input rate.

NOTE: Manifold pressure must always be measured with burner enclosure front REMOVED. Gas meter must always be clocked with burner enclosure front INSTALLED.

   a. Remove burner enclosure front.

TABLE 7—MODEL 345MAV ORIFICE SIZE AND MANIFOLD PRESSURE FOR CORRECT INPUT (TABULATED DATA BASED ON 20,000 BTUH PER BURNER, DERATED 2% 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. and Canada		**850**	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4
		875	43	3.5	43	3.6	43	3.7	43	3.8	42	3.2
		900	44	3.7	43	3.4	43	3.5	43	3.6	43	3.7
	0	**925**	44	3.5	44	3.7	44	3.8	43	3.4	43	3.5
		950	44	3.4	44	3.5	44	3.6	44	3.7	44	3.8
	to	**975**	44	3.2	44	3.3	44	3.4	44	3.5	44	3.6
		1000	**45**	**3.7**	**45**	**3.8**	44	3.2	44	3.4	44	3.5
	2000	**1025**	**45**	**3.5**	**45**	**3.6**	**45**	**3.7**	44	3.2	44	3.3
		1050	**45**	**3.3**	**45**	**3.4**	**45**	**3.6**	**45**	**3.7**	**45**	**3.8**
		1075	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**
		1100	47	3.6	47	3.7	**45**	**3.2**	**45**	**3.4**	**45**	**3.5**

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. and Canada	**U.S.A.**	**775**	43	3.8	42	3.2	42	3.3	42	3.4	42	3.5
	Altitudes	**800**	43	3.5	43	3.7	43	3.8	42	3.2	42	3.3
	2001	**825**	44	3.8	43	3.4	43	3.6	43	3.7	43	3.8
	to	**850**	44	3.6	44	3.7	44	3.8	43	3.5	43	3.6
	3000	**875**	44	3.4	44	3.5	44	3.6	44	3.7	43	3.4
	or	**900**	44	3.2	44	3.3	44	3.4	44	3.5	44	3.6
	Canada	**925**	**45**	**3.7**	**45**	**3.8**	44	3.2	44	3.3	44	3.4
	Altitudes	**950**	**45**	**3.5**	**45**	**3.6**	**45**	**3.7**	**45**	**3.8**	44	3.3
	2000	**975**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**	**45**	**3.8**
	to	**1000**	**45**	**3.1**	**45**	**3.2**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**
	4500	**1025**	**45**	**3.0**	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**

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		**750**	43	3.7	43	3.8	42	3.3	42	3.4	42	3.5
		775	43	3.5	43	3.6	43	3.7	43	3.8	42	3.2
		800	44	3.7	43	3.4	43	3.5	43	3.6	43	3.7
	3001	**825**	44	3.5	44	3.6	44	3.8	43	3.4	43	3.5
		850	44	3.3	44	3.4	44	3.5	44	3.7	44	3.8
	to	**875**	**45**	**3.8**	44	3.2	44	3.3	44	3.5	44	3.6
		900	**45**	**3.6**	**45**	**3.7**	**45**	**3.8**	44	3.3	44	3.4
	4000	**925**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**	**45**	**3.7**	44	3.2
		950	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**	**45**	**3.7**
		975	**45**	**3.0**	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**
		1000	**45**	**2.9**	**45**	**3.0**	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**

* Orifice numbers shown in **BOLD** are factory installed.

TABLE 7—MODEL 345MAV ORIFICE SIZE AND MANIFOLD PRESSURE FOR CORRECT INPUT Continued
(TABULATED DATA BASED ON 20,000 BTUH PER BURNER, DERATED 2% 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		**725**	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4
		750	43	3.4	43	3.5	43	3.7	43	3.8	42	3.2
		775	44	3.7	44	3.8	43	3.4	43	3.5	43	3.7
	4001	**800**	44	3.5	44	3.6	44	3.7	44	3.8	43	3.4
		825	44	3.2	44	3.4	44	3.5	44	3.6	44	3.7
	to	**850**	**45**	**3.7**	**45**	**3.8**	44	3.3	44	3.4	44	3.5
		875	**45**	**3.5**	**45**	**3.6**	**45**	**3.7**	44	3.2	44	3.3
	5000	**900**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**	**45**	**3.8**
		925	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**	**45**	**3.6**
		950	**45**	**3.0**	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**

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		**700**	43	3.6	43	3.7	42	3.2	42	3.3	42	3.4
		725	43	3.4	43	3.5	43	3.6	43	3.7	43	3.8
		750	44	3.6	44	3.7	43	3.4	43	3.5	43	3.6
		775	44	3.4	44	3.5	44	3.6	44	3.7	43	3.4
	5001	**800**	44	3.2	44	3.3	44	3.4	44	3.5	44	3.6
		825	**45**	**3.6**	**45**	**3.7**	44	3.2	44	3.3	44	3.4
	to	**850**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**	**45**	**3.8**	44	3.2
		875	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**	**45**	**3.6**	**45**	**3.7**
	6000	**900**	**45**	**3.0**	**45**	**3.1**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**
		925	**45**	**2.9**	**45**	**3.0**	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**
		950	**45**	**2.7**	**45**	**2.8**	**45**	**2.9**	**45**	**3.0**	**45**	**3.1**
		975	**45**	**2.6**	**45**	**2.7**	**45**	**2.8**	**45**	**2.9**	**45**	**2.9**
		1000	**45**	**2.5**	**45**	**2.5**	**45**	**2.6**	**45**	**2.7**	**45**	**2.8**

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		**650**	42	3.2	42	3.3	42	3.4	42	3.5	42	3.6
		675	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3
		700	44	3.8	43	3.4	43	3.6	43	3.7	43	3.8
	6001	**725**	44	3.6	44	3.7	44	3.8	43	3.4	43	3.5
		750	44	3.3	44	3.4	44	3.6	44	3.7	44	3.8
	to	**775**	**45**	**3.8**	44	3.2	44	3.3	44	3.4	44	3.5
		800	**45**	**3.5**	**45**	**3.7**	**45**	**3.8**	44	3.2	44	3.3
	7000	**825**	**45**	**3.3**	**45**	**3.4**	**45**	**3.6**	**45**	**3.7**	**45**	**3.8**
		850	**45**	**3.1**	**45**	**3.2**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**
		875	**45**	**3.0**	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**

* Orifice numbers shown in **BOLD** are factory installed.

→ **TABLE 7—MODEL 345MAV ORIFICE SIZE AND MANIFOLD PRESSURE FOR CORRECT INPUT Continued**
(TABULATED DATA BASED ON 20,000 BTUH PER BURNER, DERATED 2% 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		**625**	43	3.8	42	3.3	42	3.4	42	3.5	42	3.6
		650	43	3.5	43	3.7	43	3.8	42	3.2	42	3.3
		675	44	3.8	43	3.4	43	3.5	43	3.6	43	3.7
	7001	**700**	44	3.5	44	3.6	44	3.8	43	3.4	43	3.5
		725	44	3.3	44	3.4	44	3.5	44	3.6	44	3.7
	to	**750**	**45**	**3.7**	**45**	**3.8**	44	3.3	44	3.4	44	3.5
		775	**45**	**3.5**	**45**	**3.6**	**45**	**3.7**	**45**	**3.8**	44	3.3
	8000	**800**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**	**45**	**3.7**
		825	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**
		850	**45**	**2.9**	**45**	**3.0**	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**

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		**600**	43	3.8	42	3.3	42	3.4	42	3.5	42	3.6
		625	43	3.5	43	3.6	43	3.8	42	3.2	42	3.3
	8001	**650**	44	3.7	43	3.4	43	3.5	43	3.6	43	3.7
		675	44	3.5	44	3.6	44	3.7	44	3.8	43	3.4
	to	**700**	44	3.2	44	3.3	44	3.4	44	3.6	44	3.7
		725	**45**	**3.6**	**45**	**3.8**	44	3.2	44	3.3	44	3.4
	9000	**750**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**	**45**	**3.8**	44	3.2
		775	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**	**45**	**3.6**
		800	**45**	**3.0**	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**

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		**575**	43	3.8	42	3.2	42	3.3	42	3.5	42	3.6
		600	43	3.5	43	3.6	43	3.7	42	3.2	42	3.3
	9001	**625**	44	3.7	44	3.8	43	3.5	43	3.6	43	3.7
		650	44	3.4	44	3.5	44	3.7	44	3.8	43	3.4
	to	**675**	**45**	**3.8**	44	3.3	44	3.4	44	3.5	44	3.6
		700	**45**	**3.6**	**45**	**3.7**	**45**	**3.8**	44	3.3	44	3.4
	10,000	**725**	**45**	**3.3**	**45**	**3.4**	**45**	**3.6**	**45**	**3.7**	**45**	**3.8**
		750	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**	**45**	**3.4**	**45**	**3.5**
		775	**45**	**2.9**	**45**	**3.0**	**45**	**3.1**	**45**	**3.2**	**45**	**3.3**

* Orifice numbers shown in **BOLD** are factory installed.

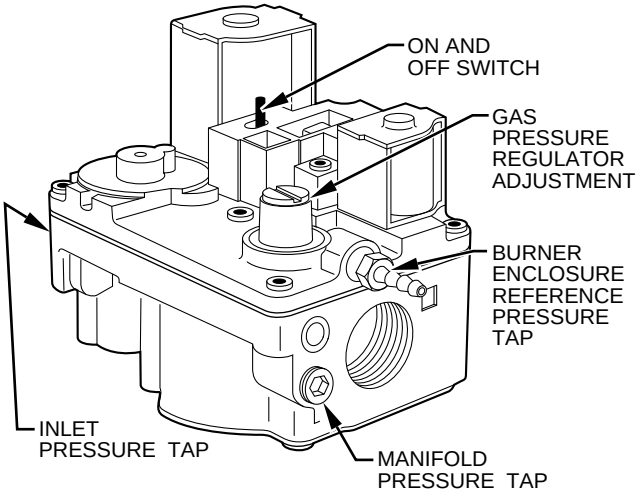

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Fig. 40—Redundant Automatic Gas Valve

b. Remove cap that conceals adjustment screw for gas valve regulator. (See Fig. 40.)

c. Turn adjusting screw, counterclockwise (out) to decrease manifold pressure or clockwise (in) to increase manifold pressure.

NOTE: This furnace has been approved for a manifold pressure of 3.2 in. wc to 3.8 in. wc when installed at altitudes up to 2000 ft. For altitudes above 2000 ft, the manifold pressure can be adjusted from 2.0 in. wc to 3.8 in. wc.

⚠ **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.

d. Replace gas valve regulator adjustment screw cap.

e. Replace burner enclosure front and verify adjusted gas input rate using method outlined in item 3.

f. Look through sight glass in burner enclosure and check burner flame. Burner flame should be clear blue, almost transparent. (See Fig. 41.)

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

NOTE: Be sure all pressure tubing, combustion-air and vent pipes, and burner enclosure front are in place when checking input by clocking gas meter.

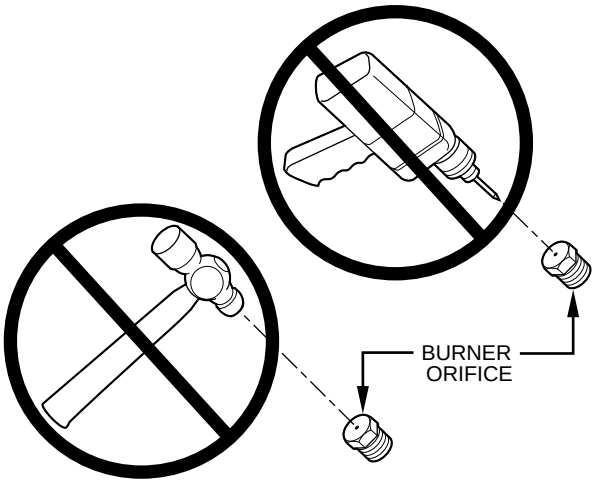
NOTE: High-Altitude Adjustment

UNITED STATES

At altitudes above 2000 ft, this furnace has been approved for a 2% derate for each 1000 ft above sea level. See Table 8 for derate multiplier factor.

EXAMPLE:
100,000 Btuh input furnace installed at 4300 ft.

Furnace Input Rate at Sea Level	X	Derate Multiplier Factor	=	Furnace Input Rate at Installation Altitude
100,000	X	0.91	=	91,000



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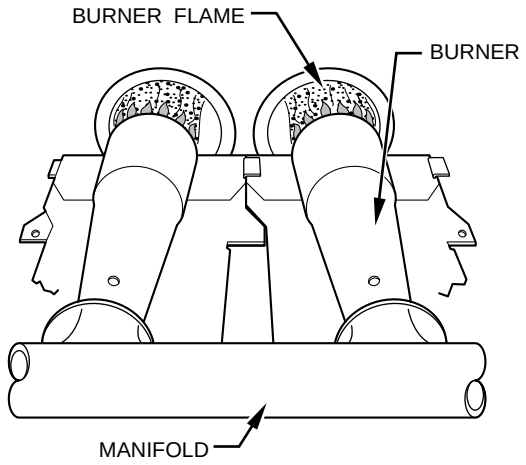
⚠ **CAUTION:** DO NOT redrill orifices. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flames. This can result in flame impingement of burners and heat exchangers causing failures.



A89020

Fig. 41—Burner Flame

TABLE 8—ALTITUDE DERATE MULTIPLIER FOR U.S.A.

ALTITUDE (FT)	% OF DERATE	DERATE MULTIPLIER FACTOR FOR U.S.A*
0—2000	0	1.00
2001—3000	4—6	0.95
3001—4000	6—8	0.93
4001—5000	8—10	0.91
5001—6000	10—12	0.89
6001—7000	12—14	0.87
7001—8000	14—16	0.85
8001—9000	16—18	0.83
9001—10,000	18—20	0.81

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

CANADA

→ At installation altitudes from 2000 to 4500 ft, this furnace must be derated 5% by an authorized Gas Conversion Station. To determine correct input rate for altitude, see example above and use 0.95 as derate multiplier factor.

a. Turn off all other gas appliances and pilots.

b. Start furnace and let operate for 3 minutes.

c. Measure time (in sec) for gas meter test dial to complete 1 revolution.

d. Refer to Table 9 for cu ft of gas per hr.

e. Multiply gas rate (cu ft/hr) X heating value (Btu/cu ft) using natural gas heating value from local gas utility/supplier.

TABLE 9—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				

EXAMPLE:
Btu heating input = Btu/cu ft X cu ft/hr
Heating value of gas = 975 Btu/cu ft
Time for 1 revolution of 2-cu ft dial = 70 sec
Gas rate = 103 cu ft/hr (from Table 9)
Btu heating input = 103 X 975 = 100,425 Btuh
In this example, the orifice size and manifold pressure adjustment is within ±2 percent of the furnace input rate.

B. Set Temperature Rise

⚠ **CAUTION:** Temperature rise must be within limits specified on unit rating plate. Recommended operation is at midpoint of rise or above. Failure to follow this caution may result in condensing or overheating the heat exchangers.

Determine and adjust air temperature rise as follows:

1. Place thermometers in return and supply ducts as close to furnace as possible. Be sure thermometers do not see heat exchanger so that radiant heat does not affect readings. This practice is particularly important with straight-run ducts.
2. When thermometer readings stabilize, subtract return-air temperature from supply-air temperature to determine air temperature rise.
3. Adjust temperature rise by adjusting blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise.

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

4. To change blower motor speed selections for heating mode, remove blower motor lead from control center HEAT terminal. (See Fig. 27.) Select desired blower motor speed lead from 1 of the other terminals and relocate it to HEAT terminal. See Table 10 for lead color identification. Reconnect original lead on SPARE terminal.

   Follow this same procedure for proper COOL speed selection.

TABLE 10–SPEED SELECTOR

COLOR	SPEED	FACTORY-SHIPPED CONNECTION
Black	High	Cool
Yellow (When Present)	Medium High	Spare
Blue	Medium Low	Heat
Red	Low	Spare
White	Common	Com

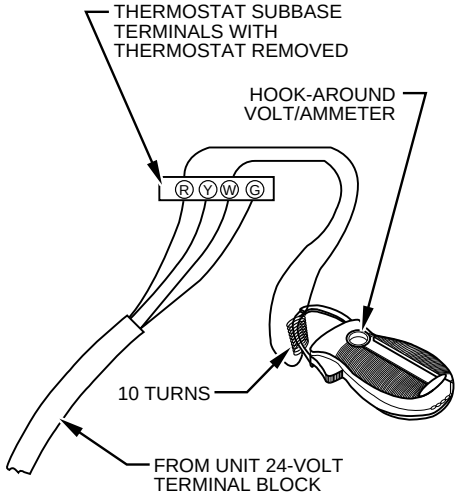
C. Blower Off Delay (Heat Mode)

The main blower off time delay period is factory-set at 135 sec and is not field-adjustable.

D. Set Thermostat Heat Anticipator

Thermostat heat anticipator must be set to match amp draw of components in R-W circuit. Accurate amp draw measurements can be obtained at thermostat subbase terminals R and W.

Fig. 42 illustrates an easy method of obtaining these measurements. Amp reading should be taken after blower motor has started. See thermostat manufacturer's instructions for adjusting heat anticipator and for varying heating cycle length.



EXAMPLE: $\frac{\text{5.0 AMPS ON AMMETER}}{\text{10 TURNS AROUND JAWS}}$ = 0.5 AMPS FOR THERMOSTAT SETTING

A80201

Fig. 42—Amp Draw Check with Ammeter

CHECK SAFETY CONTROLS

I. CHECK PRIMARY LIMIT CONTROL

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 operates 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.

II. CHECK PRESSURE SWITCH

This control proves operation of draft inducer. Check switch operation as follows:

1. Turn off 115-v power to furnace.
2. Remove main furnace door and disconnect inducer motor lead wires from wire harness.
3. Turn on 115-v power to furnace.
4. Set thermostat to "call for heat" and wait 1 minute. When pressure switch is functioning properly, hot surface ignitor should NOT glow, and control center diagnostic light flashes a 31 fault. If hot surface ignitor glows when inducer motor is disconnected, shut furnace down immediately. Determine reason pressure switch did not function properly and correct condition.
5. Turn off 115-v power to furnace.
6. Reconnect inducer motor leads, reinstall main furnace door, and turn on 115-v power supply.

CHECKLIST

1. Put away tools and instruments. Clean up debris.
2. Verify manual reset switch has continuity.
3. Verify that blower and control 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

VENT PIPING

Termination Location

_____ Roof or Sidewall

_____ Vent Pipe Length

_____ Vent Pipe Elbow Quantity

_____ Pipe Diameter Determined from Sizing Table

_____ Pipe Sloped To Furnace

Pipe Insulation

_____ Over Ceilings

_____ Low-Ambient Exposed Pipes

Condensate Drain

_____ Unit Level or Pitched Forward

_____ Internal Tubing Connections Free of Kinks and Traps

_____ External Drain Connection Leak Tight and Sloped

_____ Condensate Trap Primed before Start-Up

_____ Heat Tape Installed if Required

CHECKLIST—START-UP

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

_____ Temperature Rise Adjusted

Thermostat Anticipator

_____ Anticipator Setting Adjusted or

_____ Cycle Rate (3 Cycles per Hr) Selected

Safety Controls Check Operation

_____ Primary Limit

_____ Pressure Switch

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