



# installation, start-up, and operating instructions

## DOWNFLOW MANUFACTURED (MOBILE) AND MODULAR HOME DIRECT-VENT CONDENSING GAS FURNACE

# 351DAS

## Series A

Cancels: II 351D-80-1

II 351D-80-2  
8-99



A93040

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

This symbol → indicates a change since the last issue.

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



REGISTERED QUALITY SYSTEM

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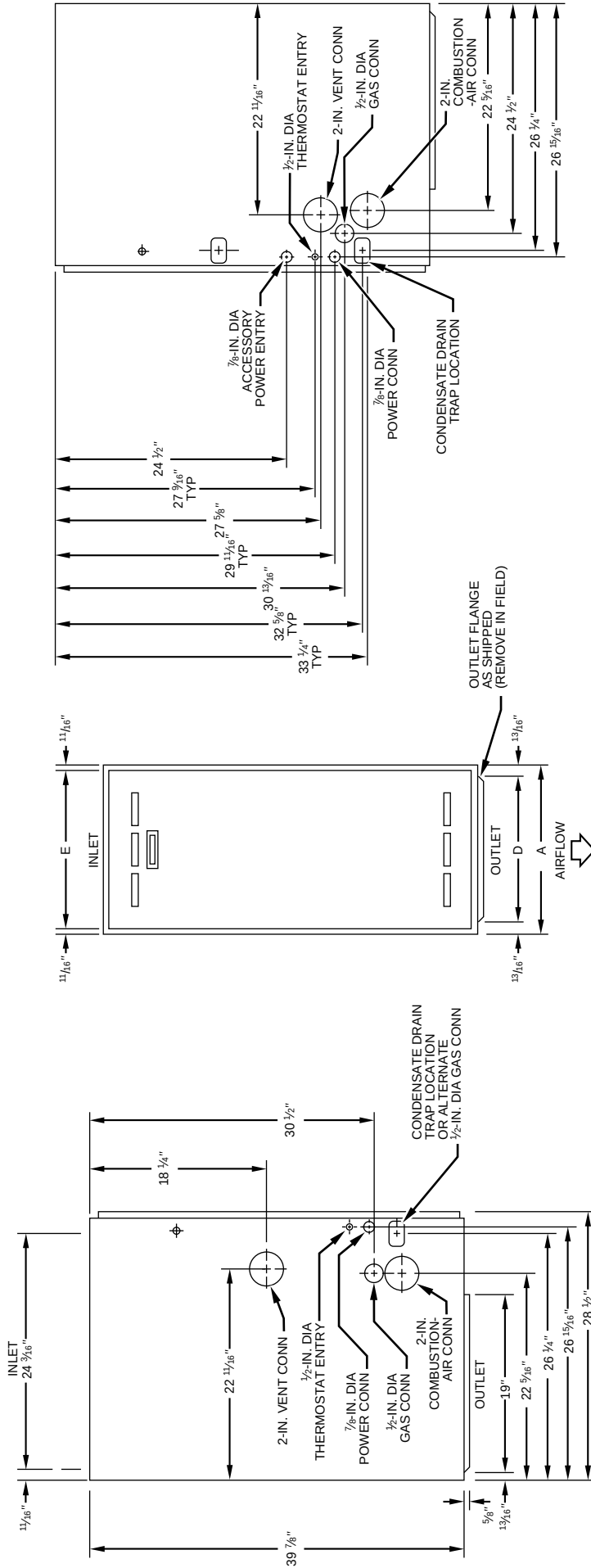
### SAFETY CONSIDERATIONS

Installing and servicing heating equipment can be hazardous due to gas and electrical components. Only trained and qualified personnel should install, repair, or service heating equipment. Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. 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. In the United States, follow all safety codes including the National Fuel Gas Code (NFPA 54-1999/ANSI Z223.1-1999 and the Installation Standards, Warm Air Heating and Air Conditioning Systems (NFPA 90B) ANSI/NFPA 90B. In Canada, refer to 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 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 unit or in instructions and manuals, be alert to potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies most serious hazards which **will** result in



**NOTES:** Minimum return-air opening at furnace, based on metal duct. If flex duct is used, see flex duct manufacturer's recommendation for equivalent diameters.

1. For 800 CFM—16-in. round or 14-1/2 X 12-in. rectangle.
2. For 1200 CFM—20-in. round or 14-1/2 X 19-1/2 in. rectangle.
3. For 1600 CFM—22-in. round or 14-1/2 X 23-1/4 in. rectangle.

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# **DIMENSIONS (IN.)**

| UNIT SIZE | A      | D      | E      |
|-----------|--------|--------|--------|
| 036080    | 17-1/2 | 15-7/8 | 16     |
| 048080    | 17-1/2 | 15-7/8 | 16     |
| 060080    | 21     | 19-3/8 | 19-1/2 |

**Fig. 1—Dimensional Drawing**

## INSTALLATION

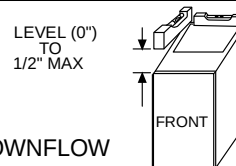
This forced air furnace is equipped for use with natural or propane gas at altitudes 0 - 10,000 ft (0 - 3,050m).

This furnace is for indoor installation in a manufactured (mobile) or modular home.

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, CPVC, 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.



DOWNFLOW

### MINIMUM INCHES CLEARANCE TO COMBUSTIBLE CONSTRUCTION

#### DOWNFLOW POSITION:

★ Minimum front clearance for service 30 inches (762 mm)

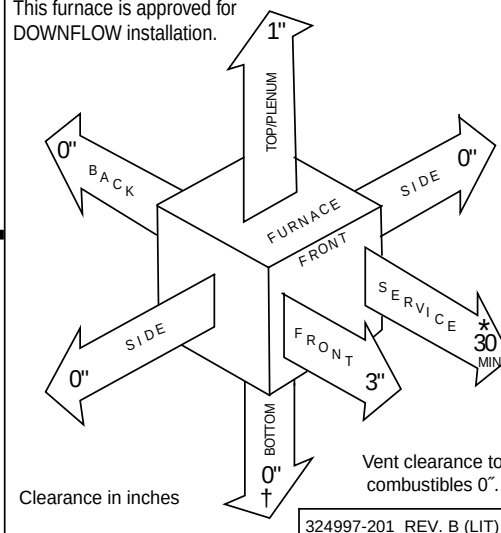
† For installation on combustible floors only when installed on special base No. KGASB0201ALL, Coil Assembly, Part No. CD5 or CK5, or Coil Casing, Part No. KCAKC.

### MANUFACTURED MOBILE HOME STANDARDS

This furnace must be installed in accordance with the manufacturer's instructions and Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 or, when such standard is not applicable, the ANSI A225.1, Standard for Manufactured Home Installation (Manufactured Home Sites, Communities and Set-Ups), or the Mobile Homes Standard CAN/CSA-Z240 MH Series-M86.

This furnace must be installed with a direct vent (combustion air and flue) system, and use a factory accessory termination kit.

This furnace is approved for DOWNFLOW installation.



→ Fig. 2—Clearances to Combustibles

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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 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 model 351DAS, Series A Furnaces are available in 3 heating and cooling airflow sizes.

The 351DAS Condensing Gas-Fired Furnace is A.G.A./C.G.A. design certified for installation in a manufactured (mobile) and modular home in the downflow position and is for natural and propane gases when installed in alcove, closets, and utility rooms. The furnace is factory-shipped for use with natural gas and can be converted to propane with factory-provided parts and instructions. The design of this furnace line is **NOT** A.G.A./C.G.A. certified for installation in recreation vehicles or outdoors.

These furnaces **SHALL NOT** be installed directly on carpeting, tile, or any other combustible material other than wood flooring. A factory accessory floor base **MUST** be used when installed on combustible materials and wood flooring. Accessory floor base is not required when this furnace is installed on manufacturer's Coil Assembly Part No. CD5 or CK5, or when Coil Box Part No. KCAKC is used.

These furnaces are for downflow applications only.

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

| Loose Parts Bag includes:                                                               | Quantity |
|-----------------------------------------------------------------------------------------|----------|
| Installer Packet includes:                                                              | 1        |
| Installation, Start-Up, and Operating Instructions Service and Maintenance Instructions |          |
| User's Information Manual                                                               |          |
| Warranty Certificate                                                                    |          |
| Condensate trap                                                                         | 1        |
| Gas valve adjustment tool                                                               | 1        |
| Main burner orifices (drill size No. 55)                                                | 7        |
| Main burner orifices (drill size 1.30mm)                                                | 7        |
| Bag for natural gas orifices                                                            | 1        |
| Vent and combustion-air pipe support                                                    | 2        |
| Combustion-air pipe perforated disk assembly                                            | 1        |

This furnace must be installed in accordance with the manufacturer's instructions and Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 or, when such standard is not applicable, the ANSI A225.1, Standard for Manufactured Home Installation (Manufactured Home Sites, Communities and Set-Ups), or the Mobile Homes Standard CAN/CSA-Z240 MH Series-M86.

Ce générateur d'air chaud doit être installé conformément avec les instructions du fabricant et la norme intitulée Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 ou, lorsque cette norme ne s'applique pas, la norme ANSI A225.1, intitulée Standard for Manufactured Home Installation (Manufactured Home Sites, Communities and Set-Ups), ou la norme CAN/CSA-Z240 MH Série M86 de l'ACNOR, intitulée Maisons mobiles.

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

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

Installations must comply with applicable regulations of serving gas supplier and local building, heating, plumbing, or other codes in effect in area in which installation is made. In absence of local codes, installation must conform with 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.

**WARNING:** The conversion from natural gas to propane gas or propane gas to natural gas shall be installed by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. If the information in these instructions is not followed exactly, a fire, explosion, or production of carbon monoxide may result causing property damage, personal injury, or loss of life. The qualified service agency is responsible for the proper installation of this furnace with these instructions. The installation is not proper and complete until the operation of the converted appliance is checked as specified in these manufacturer's instructions.

**AVERTISSEMENT:** La conversion du gaz naturel au gaz propane ou du gaz propane au gaz naturel doit être effectuée par une agence de service qualifiée conformément aux instructions du fabricant et à tous les codes et à toutes les exigences applicables de l'autorité compétente. Si ces instructions ne sont pas observées exactement, il peut en résulter un incendie, une explosion ou une production d'oxyde de carbone pouvant résulter en dommages matériels, lésions corporelles ou mort. L'agence de service qualifiée est responsable d'installer correctement cette fournaise conformément à ces instructions. L'installation n'est ni correcte ni complète tant que le fonctionnement de l'appareil converti n'a pas été vérifié de la manière précisée dans ces instructions du fabricant.

For accessory installation details, refer to applicable installation literature.

## APPLICATIONS

### I. GENERAL

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

Some assembly and modifications are required for furnaces installed in either applications shown in Fig. 4 or 5. All drain and pressure tubes must be connected as shown in Fig. 4 or 5.

Attach adhesive pouch containing literature packet and gas conversion parts to side of furnace for use at a later date. (See Fig. 3.)

|   |                                                                                                                                                                                   |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ⚠ | <b>CAUTION:</b> When installing the air conditioning coil casing or when servicing air conditioning, caution must be taken to ensure furnace will not fall forward. (See Fig. 7.) |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ⚠ | <b>CAUTION:</b> To prevent damage during transportation of the home, coil casing must be secured to the floor, furnace and coil casing must be fastened together, and furnace must be secured to wall of the structure. When a coil casing is not used, an accessory floor base is required. (See furnace rating plate or clearance label for special accessory floor base part number.) Secure floor base to structure and attach furnace to floor base. |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## RECOMMENDED METHODS OF SECURING FOR TYPICAL INSTALLATION. (SEE FIG. 3.) ALL MOUNTING HARDWARE IS FIELD SUPPLIED.

1. Secure coil casing to floor.
  - a. Secure coil casing to floor of structure using 5/16-in. lag screws (one each side) through lower inside flanges of coil casing.
  - b. *Alternate method:* Attach right angle mounting brackets or pipe strap (bent 90 degrees) to coil casing using No. 10 self tapping screws. Attach other end of brackets/strap to floor of structure using 5/16-in. lag screws. If coil is present in casing, be careful not to damage condensate pan with tip of screw or remove coil from casing.
2. Fasten furnace to coil casing.
  - a. Secure furnace to coil casing using 2 No. 10 self tapping screws (one on each side of burner enclosure) through cell panel flange, lower furnace casing plate, and coil casing top flange.
  - b. *Alternate method:* Attach pipe strap to both furnace casing and coil casing (one each side). If coil is present in coil casing, be careful not to damage it with tip of screw.
1. Secure furnace to structure.
  - a. Attach pipe strap to top of furnace casing using No. 10 self tapping screws. Angle strap down and away from back of furnace, remove all slack, and fasten to wall stud of structure using 5/16-in. lag screws. Typical both sides of furnace.
  - b. *Alternate method:* Secure furnace to wall stud using 1/8-in. thick right-angle brackets. Attach brackets to furnace using No. 10 self tapping screws, and to wall stud using 5/16-in. lag screws.

## WHEN COIL CASING IS NOT INSTALLED (NOT SHOWN)

1. Accessory floor base **MUST** be used. Review floor base Installation Instructions before installation.
2. Secure accessory floor base to structure using 5/16-in. lag screws.
3. Fasten furnace to accessory floor base using No. 10 self tapping screws through tabs on both sides of base (two each side).

Some assembly and modifications are required for furnaces installed in either applications shown in Fig. 4 or 5. All drain and pressure tubes must be connected as shown in Fig. 4 or 5.

Attach adhesive pouch containing literature packet and gas conversion parts to side of furnace for use at a later date. (See Fig. 3.)

|   |                                                                                                                                                                                   |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ⚠ | <b>CAUTION:</b> When installing the air conditioning coil casing or when servicing air conditioning, caution must be taken to ensure furnace will not fall forward. (See Fig. 7.) |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## II. CONDENSATE TRAP INSTALLATION

1. Select condensate trap location from 1 shown in either Fig. 4 or 5.
2. If casing hole filler cap is installed in casing hole selected for trap location, remove cap and install it in unused trap location hole.
3. Install condensate trap (located in factory-supplied loose parts bag) into selected location casing hole by inserting tabs at top of trap onto upper edge of hole and rotating trap until lower tabs fit into hole. Then allow trap to slide down slightly and lock into position. (See Fig. 6.)
4. Connect collector box drain tube to condensate trap.

**NOTE:** See Fig. 4, 5, or tube routing label on main furnace door to check for proper tube connections.

- a. Condensate trap located on left-hand side of casing. (See Fig. 4.)
  - (1.) Remove smooth collector box extension tube and coupling from corrugated collector box tube and discard.
  - (2.) Connect corrugated collector box tube to condensate trap.
  - (3.) Clamp tube to prevent any condensate leakage.
- b. Condensate trap located on right-hand side of casing. (See Fig. 5.)
  - (1.) Cut smooth collector box extension tube as shown in Table 1 for model furnace used.
  - (2.) Connect collector box drain tube and extension tube to condensate trap.
  - (3.) Clamp tube to prevent any condensate leakage.
5. Connect inducer housing drain tube to condensate trap. (See Fig. 4 or 5.)
  - a. Cut smooth inducer housing drain tube as shown in Table 1 for model furnace used.
  - b. Connect inducer housing drain tube to condensate trap.
  - c. Clamp tube to prevent any condensate leakage.
6. Connect collector box upper pressure tube to condensate trap. (See Fig. 4 or 5.)
  - a. Cut collector box upper pressure tube as shown in Table 1 for model furnace used.
  - b. Connect collector box upper pressure tube to condensate trap.
  - c. Clamp tube to prevent any condensate leakage.
7. Refer to Condensate Drain section for recommendations and procedures for installing field drain tubing.
8. Refer to Condensate Drain Protection section for recommendations and procedures when condensate trap maybe exposed to freezing temperatures.

## LOCATION

### I. GENERAL

Return-air plenum is not required when this direct vent furnace is installed in a dedicated confined space or installed in a space with other direct vent appliances. (Manufactured Home Construction and Safety Standards, Title 24 CFR, Part 3280.709.e.1).

**TABLE 1—CONDENSATE TRAP TUBING LENGTH (IN.)**

TUBING MUST NOT KINK OR SAG

Trim and route tubing to prevent kinking or sagging. Clamp drain tubes to prevent leakage.

| TUBE                               | FACTORY-SUPPLIED LENGTH | 036080 AND 048080                       |                  | 060080                                  |                  |
|------------------------------------|-------------------------|-----------------------------------------|------------------|-----------------------------------------|------------------|
|                                    |                         | Left-Side Trap*                         | Right-Side Trap* | Left-Side Trap*                         | Right-Side Trap* |
| Collector Box Extension Drain Tube | 17                      | 0 (Remove extension tube and coupling.) | 11 (6)           | 0 (Remove extension tube and coupling.) | 12 (5)           |
| Inducer Tube                       | 20                      | 9 (11)                                  | 18 (2)           | 9 (11)                                  | 20 (0)           |
| Upper Collector Box Pressure Tube  | 26                      | 26 (0)                                  | 19 (7)           | 26 (0)                                  | 19 (7)           |

\*Trim tube to this length. (Length to trim off.)

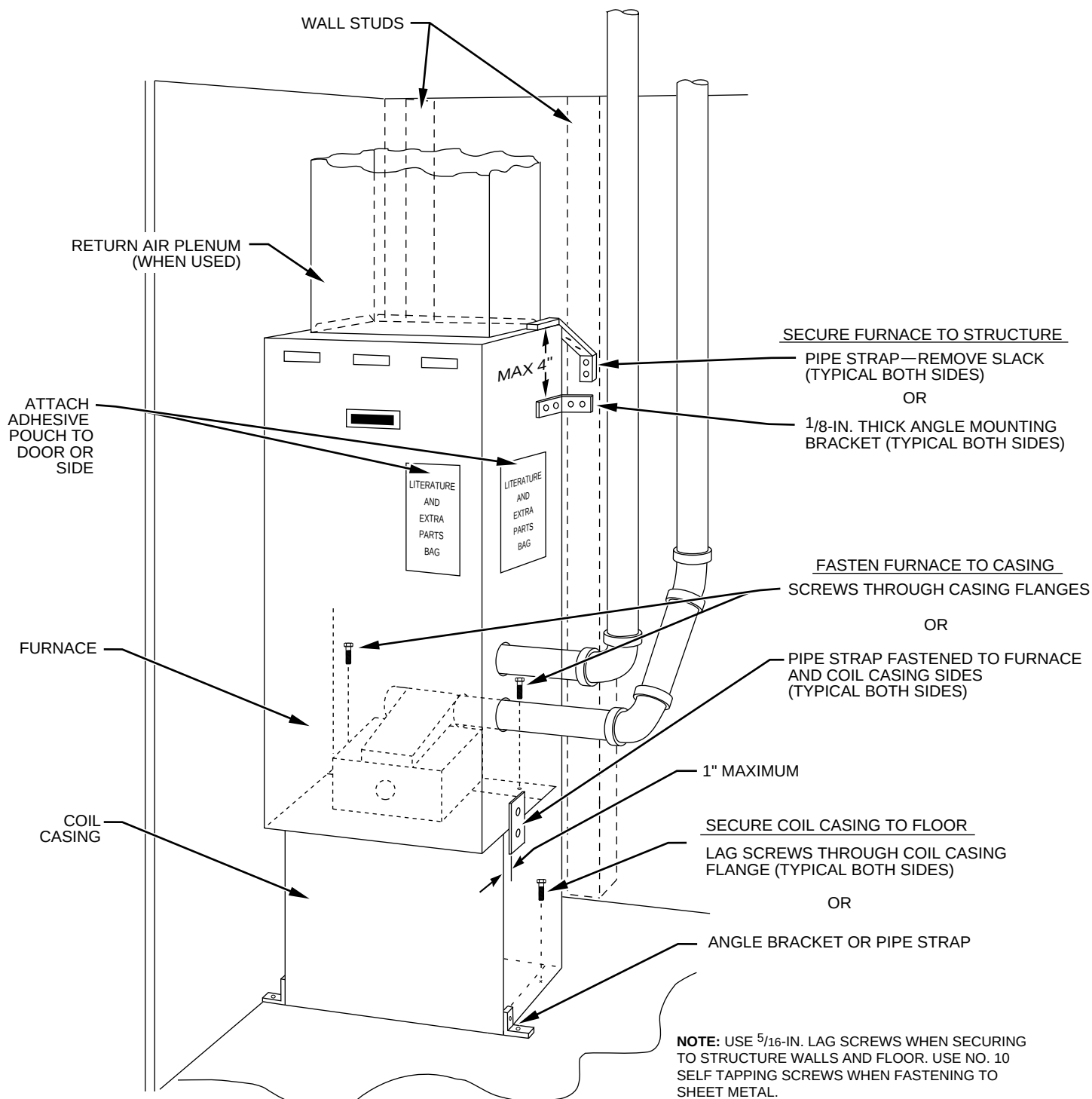


**Fig. 3—Securing Furnace to Structure**

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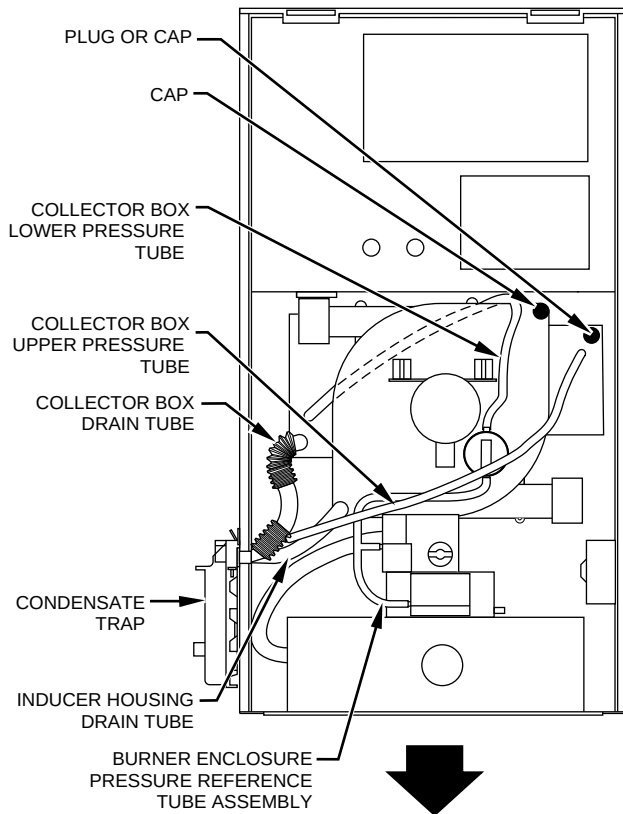


**Fig. 4—Downflow Tube Configuration  
(Left-Hand Trap Installation)**

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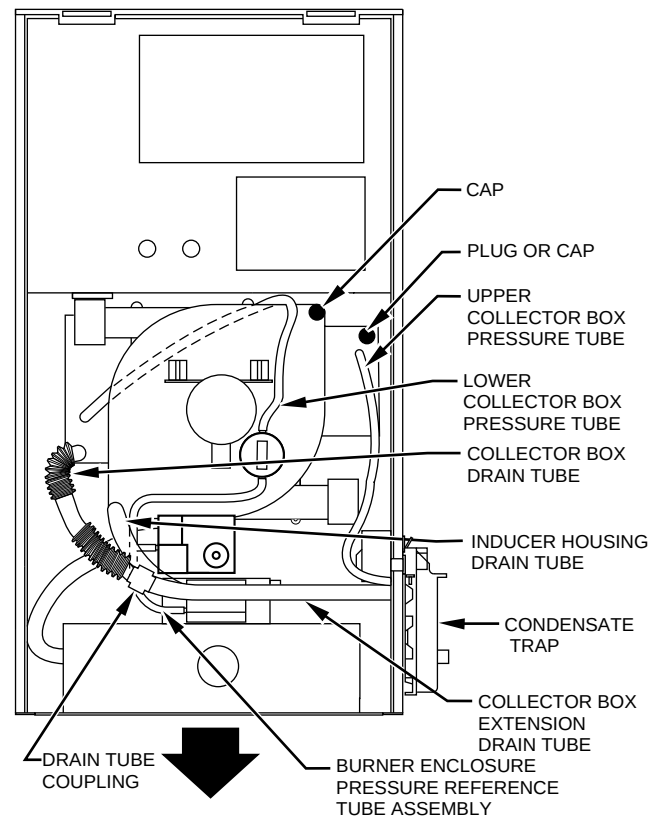


**Fig. 5—Downflow Tube Configuration  
(Right-Hand Trap Installation)**

A99043

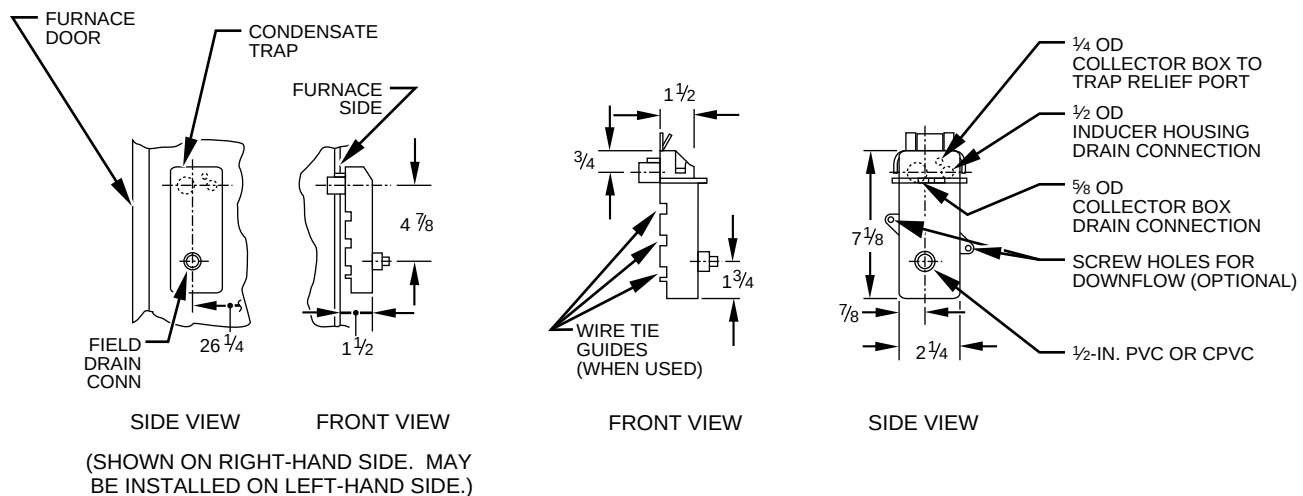


**Fig. 6—Condensate Trap**

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When the furnace is installed in a space containing other non-direct vent appliances, the return air must be handled by ducts and 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. Furnace may be located in a confined space without special provisions for dilution or ventilation air. This furnace must be installed so electrical components are protected from water.

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

Locate furnace so combustion-air and vent pipe maximum lengths are not exceeded. Refer to Table 7.

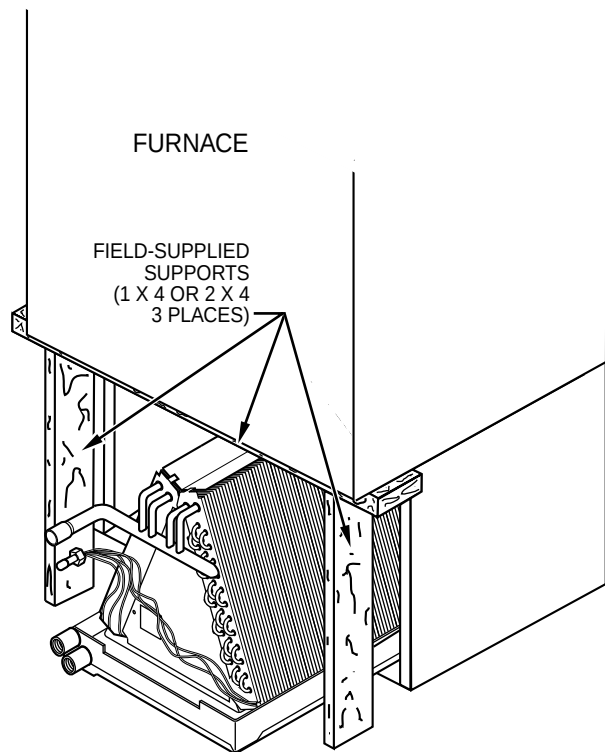
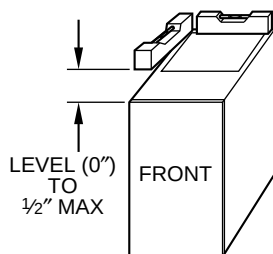


**Fig. 7—Furnace Support for Servicing Air Conditioning Coil**

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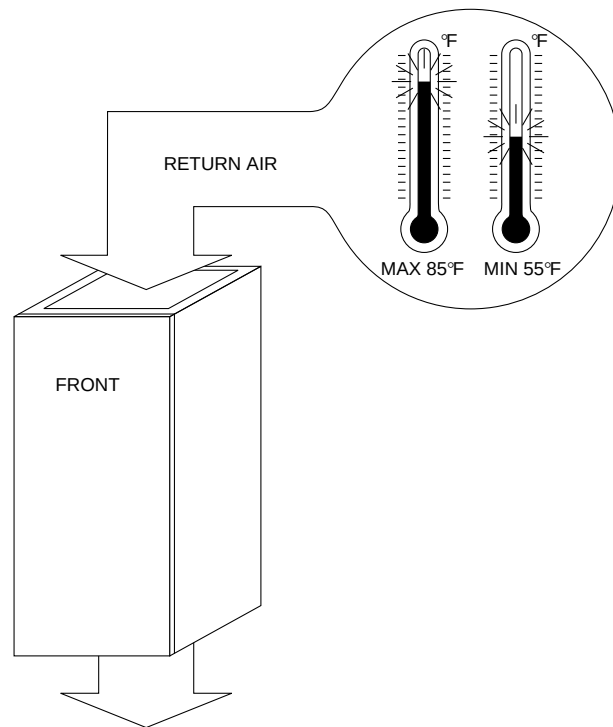


**NOTE:** For proper furnace operation, install furnace so that it is level or pitched forward within 1/2 in. to ensure proper condensate drainage from secondary heat exchangers.

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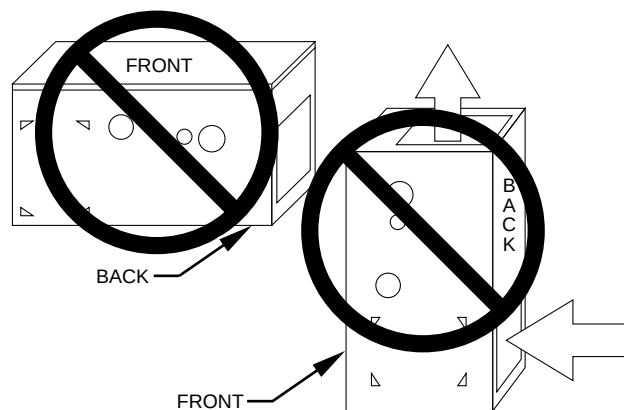
**CAUTION:** If these furnaces are used during construction when adhesives, sealers, and/or new carpets are being installed, make sure all combustion and circulating air requirements are followed. If operation of furnace is required during construction, use clean outside air for combustion and ventilation. Compounds of chlorine and fluorine, when burned with combustion air, form acids which will cause corrosion of heat exchangers. Some of these compounds are found in paneling, dry wall adhesives, paints, thinners, masonry cleaning materials, and many other solvents commonly used in construction process. Excessive exposure to contaminated combustion air will result in safety and performance related problems.

Provide ample space for servicing and cleaning. Always comply with minimum fire protection clearances shown on unit's clearance to combustibles label. (See Fig. 2.) Locate furnace where available electric power and gas supplies meet specifications on furnace rating plate.



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**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.

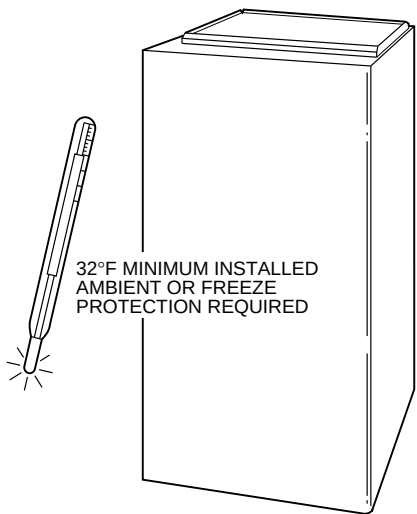


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**WARNING:** Do not install furnace on its back. Safety control operation will be adversely affected. Never connect return-air ducts to back of furnace. Failure to follow this warning could result in fire, personal injury, or death.

## II. FURNACE LOCATION RELATIVE TO COOLING EQUIPMENT

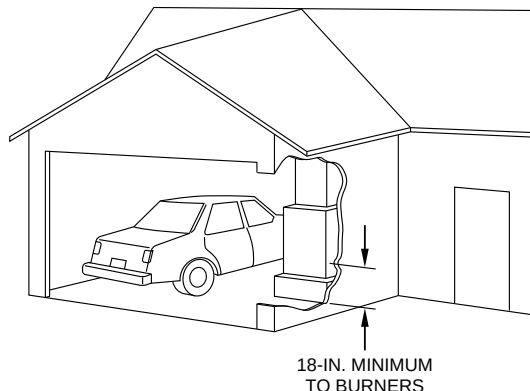
The cooling coil must be installed parallel with or on downstream side of furnace to avoid condensation in heat exchanger. When installed parallel with a furnace, dampers or other means used to control flow of air must prevent chilled air from entering furnace. If dampers are manually operated, they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



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.

### III. HAZARDOUS LOCATIONS



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**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.

## INSTALLATION

### I. INSTALLATION IN DOWNFLOW APPLICATION

**NOTE:** For downflow application, this furnace is approved for use on combustible flooring when accessory floor base (available from manufacturer) Part No. KGASB0201ALL is used. Accessory floor base is not required when this furnace is installed on manufacturer's Coil Assembly Part No. CD5 or CK5, or Coil Box Part No. KCAKC is used.

1. Determine application of condensate trap being installed from Table 1.
2. Construct hole in floor per dimensions specified in Table 2 and Fig. 8.
3. Construct plenum to dimensions specified in Table 2 and Fig. 8.

4. If downflow accessory floor base (KGASB) is used, install as shown in Fig. 9.

If Coil Assembly Part No. CD5 or CK5 or Coil Box Part No. KCAKC is used, install as shown in Fig. 10.

**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. 11.)

### II. FILTER ARRANGEMENT

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

Factory-supplied washable framed filter is shipped in blower compartment. Determine location for filter and relocate filter retaining wire if necessary. See Table 3 to determine correct filter size for desired filter location. Table 3 indicates filter size, location, and quantity shipped with this furnace. See Fig. 1 for location and size of top return-air opening.

### III. GAS PIPING

Gas piping must be installed in accordance with national and local codes. Refer to current edition of NFPA. 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 4 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.

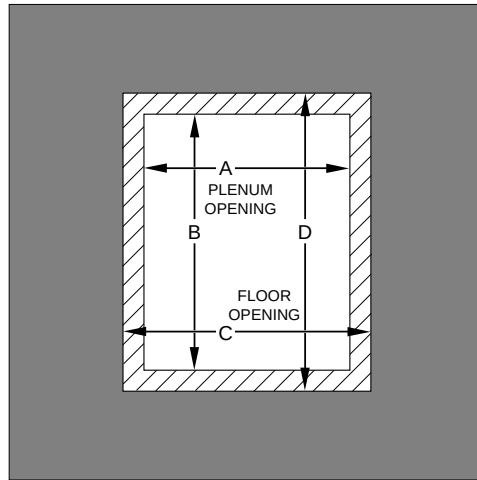
**CAUTION:** Connect gas pipe to furnace using a backup wrench to avoid damaging gas controls.

**WARNING:** Gas valve shutoff switch **MUST** be facing forward or tilted upward. 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.

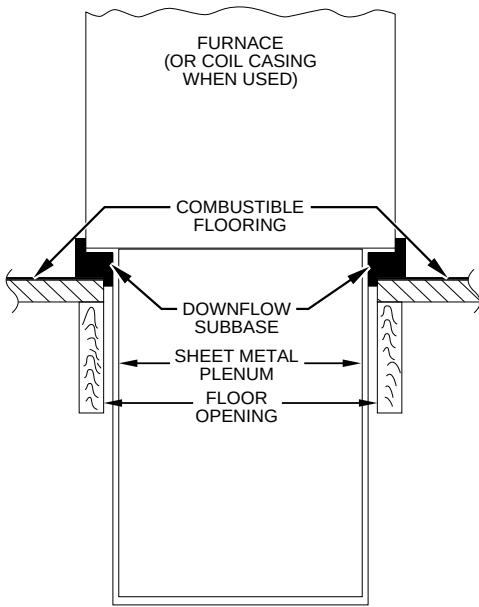
**WARNING:** Use proper length of pipe to avoid stress on gas control manifold. Failure to follow this warning could result in a gas leak resulting in fire, explosion, personal injury, or death.

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 horizontal. 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. 13.)



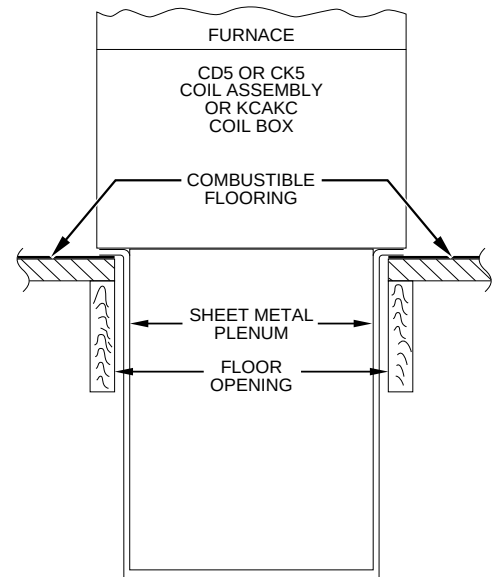
A96283

**Fig. 8—Floor and Plenum Opening Dimensions**



A96285

**Fig. 9—Furnace, Plenum, and Subbase Installed on a Combustible Floor**

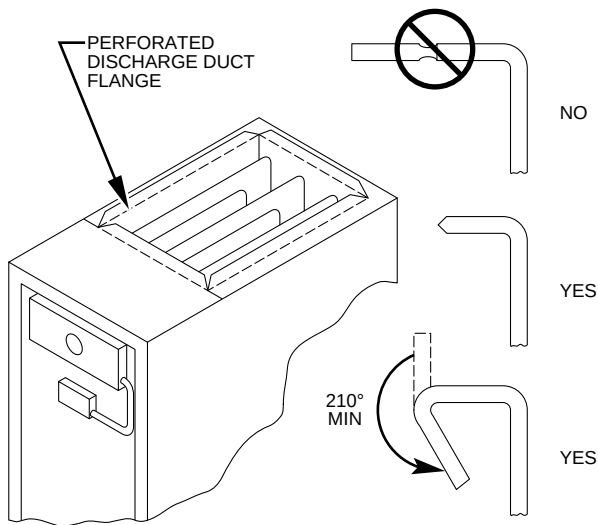


A96284

**Fig. 10—Furnace, Plenum, and Coil Assembly or Coil Box Installed on a Combustible Floor**

**TABLE 2—OPENING DIMENSIONS (IN.)**

| FURNACE CASING WIDTH | APPLICATION                                                                                                                          | PLENUM OPENING |    | FLOOR OPENING |        |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------|----|---------------|--------|
|                      |                                                                                                                                      | A              | B  | C             | D      |
| 17-1/2               | Downflow Applications on Non-Combustible Flooring                                                                                    | 15-7/8         | 19 | 16-1/2        | 19-5/8 |
|                      | Downflow Applications on Combustible Flooring Using KGASB Subbase Furnace with or without CD5 or CK5 Coil Assembly or KCAKC Coil Box | 15-1/8         | 19 | 16-3/4        | 20-3/8 |
|                      | Downflow Applications on Combustible Flooring NOT Using KGASB Subbase Furnace with CD5 or CK5 Coil Assembly or KCAKC Coil Box        | 15-1/2         | 19 | 16-1/2        | 20     |
| 21                   | Downflow Applications on Non-Combustible Flooring                                                                                    | 19-3/8         | 19 | 20            | 19-5/8 |
|                      | Downflow Applications on Combustible Flooring Using KGASB Subbase Furnace with or without CD5 or CK5 Coil Assembly or KCAKC Coil Box | 18-5/8         | 19 | 20-1/4        | 20-3/8 |
|                      | Downflow Applications on Combustible Flooring NOT Using KGASB Subbase Furnace with CD5 or CK5 Coil Assembly or KCAKC Coil Box        | 19             | 19 | 20            | 20     |



A93029

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

**Fig. 11—Duct Flanges**  
(Bend or remove before inverting furnace)

**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. 31.) 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. 14 for field wiring diagram showing typical field 115-v and 24-v wiring. Check all factory and field electrical connections for tightness.

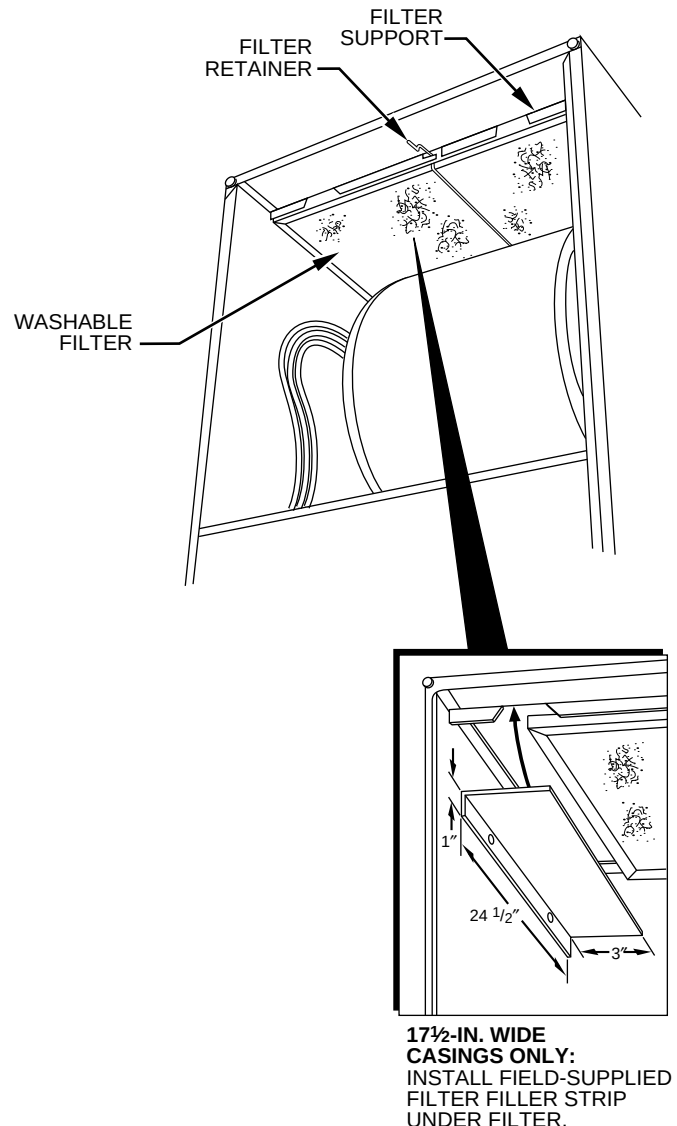
**WARNING:** Blower access panel door switch opens 115-v power to control center. No component operation can occur. Do not bypass or close switch with panel removed. Failure to follow this warning could result in personal injury or death.

**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 5 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.



A99021

**Fig. 12—Filter Arrangement**

**TABLE 3—FILTER INFORMATION**

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

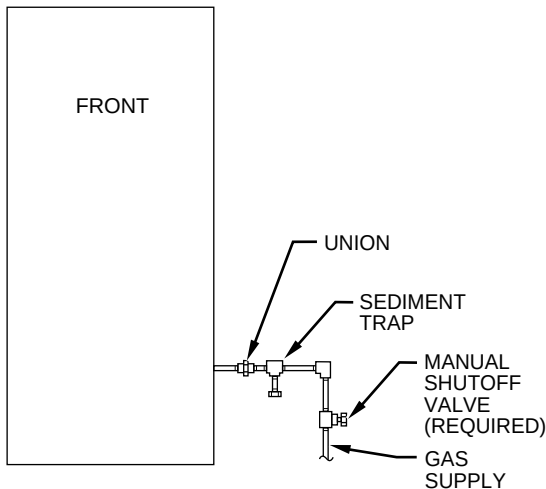
\* Factory-provided with furnace.

TABLE 4—MAXIMUM CAPACITY OF PIPE\*

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

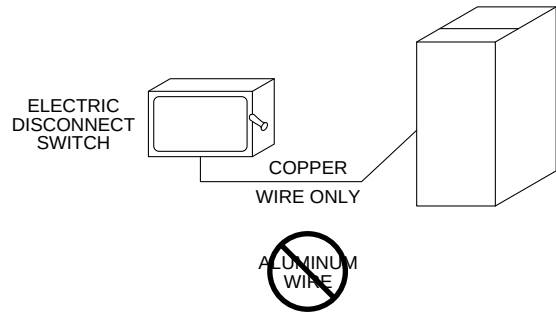
\* Cubic ft of gas per hr for gas pressures of 0.5 psig (14-in. wc) or less, and a pressure drop of 0.5-in. wc (based on a 0.60 specific gravity gas).  
Ref: Table 10-2 NFPA 54-1999.

Use a separate, fused branch electrical circuit containing a properly sized fuse or circuit breaker for this furnace. See Table 5 for wire size and fuse specifications. An electric disconnect switch must be located within sight from and readily accessible to furnace.



A99022

Fig. 13—Typical Gas Pipe Arrangement



A93033

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

**NOTE:** Proper polarity must be maintained for 115-v wiring. If polarity is incorrect, control center LED status 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.

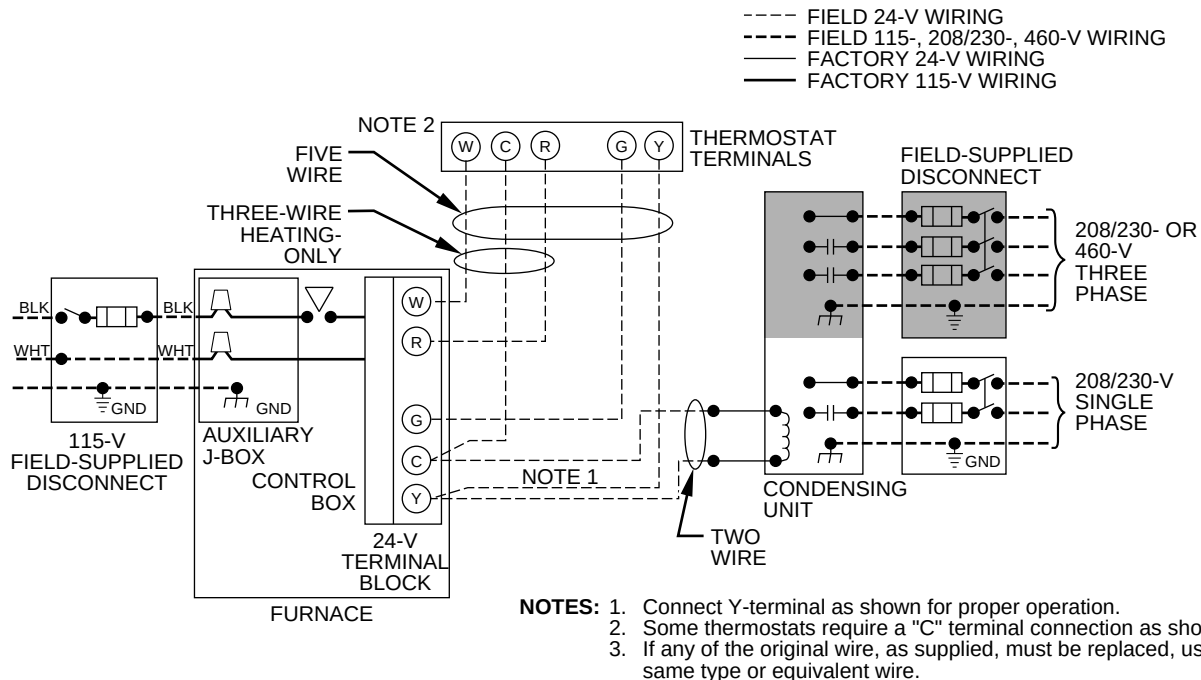
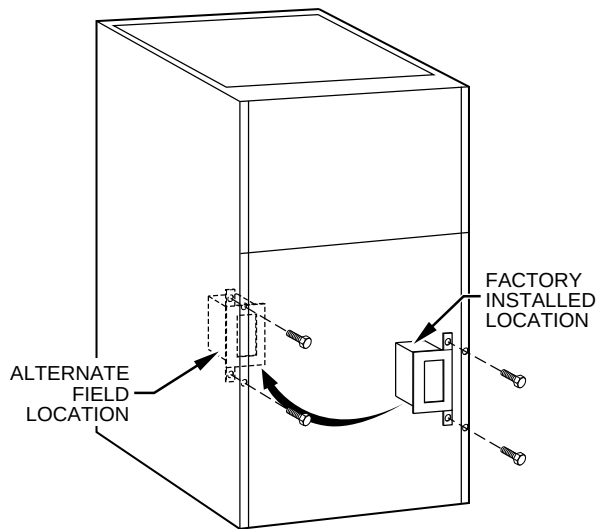
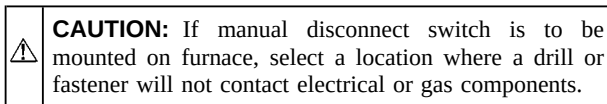


Fig. 14—Heating and Cooling Application Wiring Diagram

A98209

## J-BOX RELOCATION

1. Remove 2 screws holding auxiliary J-box. (See Fig. 15.)
2. Rotate J-box 180° and attach box to left side, using holes provided.



A99023

**Fig. 15—Relocating J-Box**

## 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. 14. The 24-v terminal board is marked for easy connection of field wiring. (See Fig. 16.) The 24-v circuit contains a 3-amp, automotive-type fuse located on control center. (See Fig. 17.) 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. 17.) 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. 16.) 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.

## DIRECT VENTING

The 351DAS Furnace requires a dedicated direct-vent system. In a direct-vent system, all air for combustion is taken directly from outside atmosphere, 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.
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 as determined using appropriate table found in the NFGC or NSC-NGPIC.

## II. COMBUSTION-AIR AND VENT PIPING

### A. General

→ 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). See Table 7 for maximum pipe lengths and Fig. 22, 23, 24, 25, and 26 for exterior piping arrangements. 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.

**NOTE:** Furnace combustion-air and vent pipe connections are sized for 2-in. pipe. Any pipe size change should be made outside furnace casing in vertical pipe. (See Fig. 18.) This allows proper drainage of vent condensate.

Combustion-air and vent pipes must terminate together in same atmosphere pressure zone, either through roof or sidewall (roof termination preferred), using accessory termination kit. See Table 6 for required clearances.

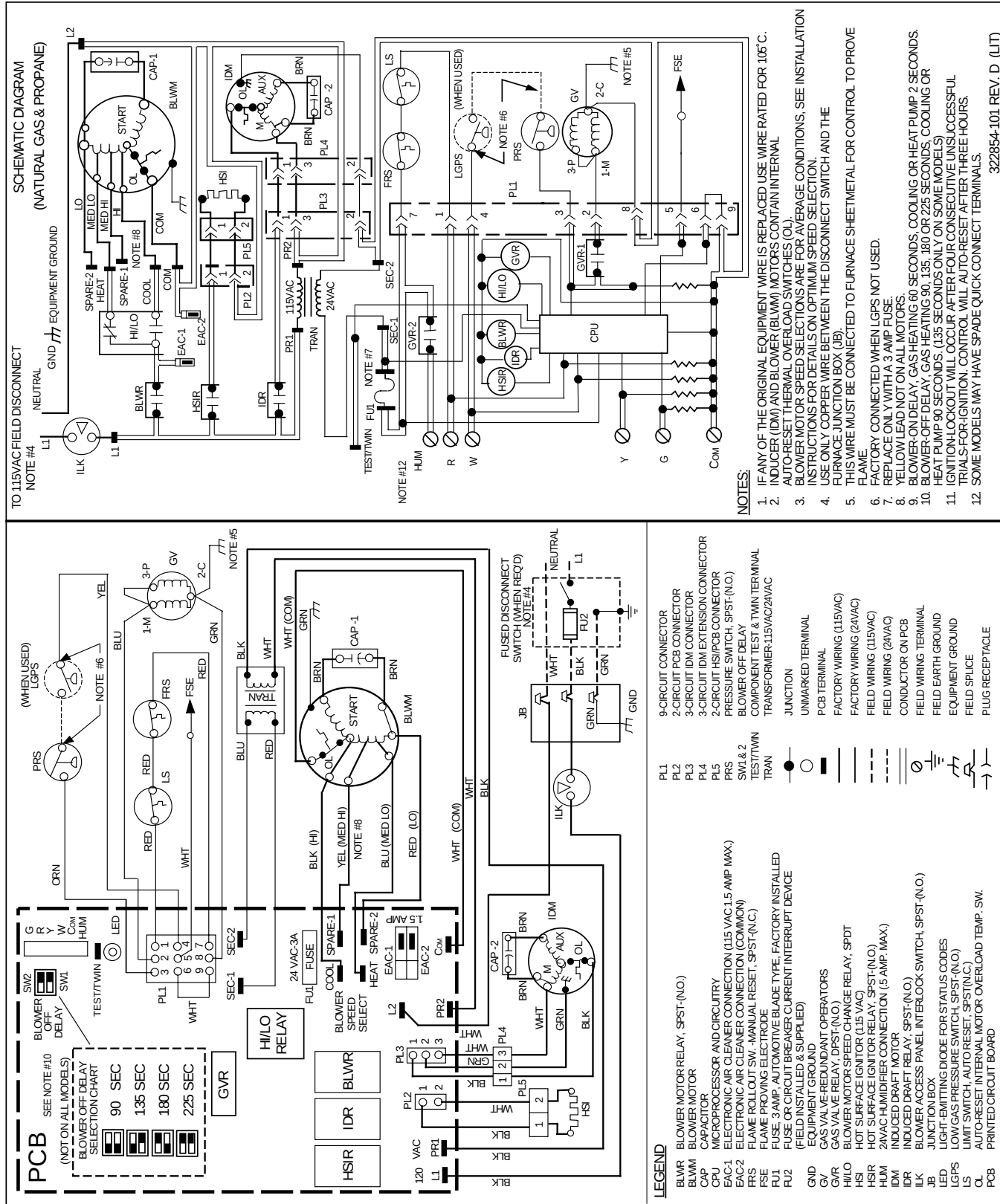


Fig. 16—Wiring Diagram

TABLE 5—ELECTRICAL DATA

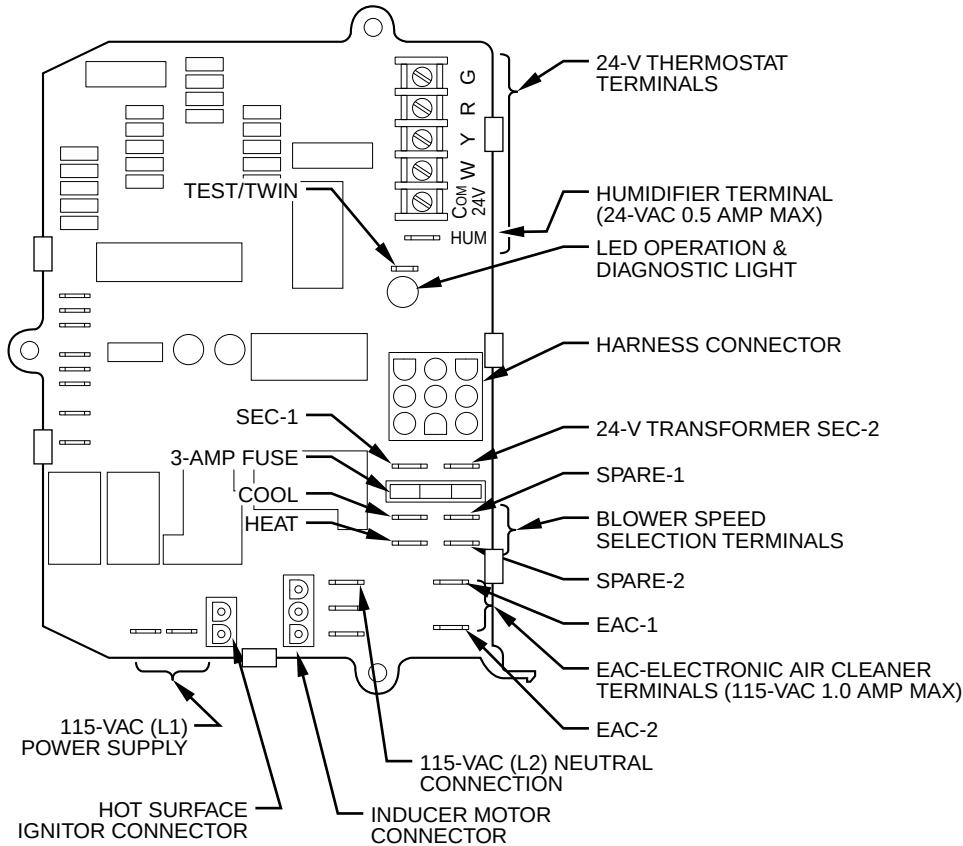
| UNIT SIZE | VOLTS—HERTZ—PHASE | OPERATING VOLTAGE RANGE |      | MAX UNIT AMPS | UNIT AMPACITY† | MIN WIRE SIZE | MAX WIRE LENGTH (FT)‡ | MAX FUSE OR CKT BKR AMPS** |
|-----------|-------------------|-------------------------|------|---------------|----------------|---------------|-----------------------|----------------------------|
|           |                   | Max*                    | Min* |               |                |               |                       |                            |
| 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                         |

\* 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.

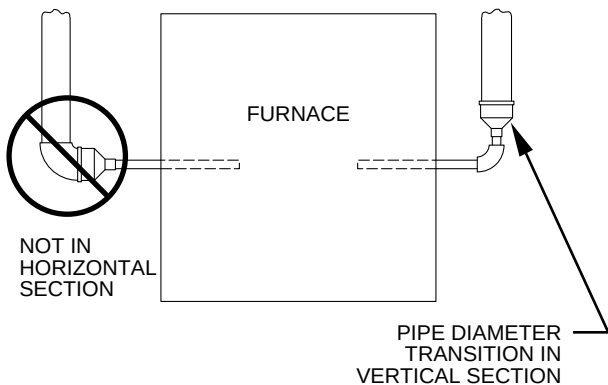


→ Fig. 17—Control Center

A99255

Furnace combustion-air and vent pipe connections must be attached as shown in Fig. 19. Combustion-air intake plug fitting and inducer housing alternate vent cap may need to be relocated in some applications.

**NOTE:** Slope combustion-air and vent pipes a minimum of 1/4 in. per linear ft with no sags between hangers.



A93034

Fig. 18—Combustion-Air and Vent Pipe Diameter Transition Location and Elbow Configuration

**CAUTION:** When combustion-air pipe is installed above a suspended ceiling, pipe must be insulated with 3/8-in. thick Armaflex-type insulation. Combustion-air pipe should also be insulated when it passes through warm, humid space.

**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 shown in Table 8 with Armaflex-type insulation.

**TABLE 6—COMBUSTION-AIR AND 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      |
| From service regulator vent, electric and gas meters, and relief equipment                                                                                      | 4*             | 6‡     |
| Above grade when adjacent to public walkway                                                                                                                     | Note 1         | Note 2 |

\* Horizontal distance.

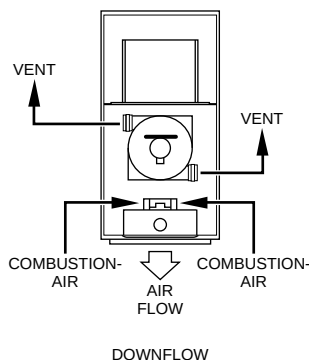
† 18 in. above roof surface in Canada.

‡ 36 in. to electric meter in Canada only.

**NOTES:**

1. When locating combustion-air and 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.
2. 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.

**NOTE:** Select 1 vent pipe connection and 1 combustion-air pipe connection.



A99024

**Fig. 19—Combustion-Air and Vent Pipe Connections**



**CAUTION:** Combustion air must not be taken from inside structure because inside air 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.



**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.



**WARNING:** All combustion-air and vent pipes must be airtight and watertight. Pipes must also terminate exactly as shown in Fig. 22, 23, 24, 25, or 26. Failure to follow this warning could result in property damage, personal injury, or death.

**NOTE:** The minimum combustion-air and vent pipe length (each) 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, as shown in Fig. 20, to reduce excessive droplets from exiting vent pipe outlet.

## B. Combustion-Air and Vent Pipe Diameter

Determine combustion-air and vent pipe diameter.

1. Using Table 7, individually determine the combustion-air and vent pipe diameters. Pick the larger of these 2 pipe diameters and use this diameter for both combustion-air and vent pipes.
2. When installing vent systems of short pipe length, use the smallest allowable pipe diameter. Do not use pipe size greater than required or incomplete combustion, flame disturbance, or flame sense lockout may occur.

**NOTE:** Do not count elbows or pipe sections in terminations or within furnace. See shaded areas in Fig. 22, 23, 24, 25, and 26.

### 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, along with 5 elbows and 34 ft of combustion-air pipe. Table 7 indicates this application would allow a 2-in. diameter vent pipe, but require a 2-1/2 in. diameter combustion air pipe (2-in. pipe is good for 35 ft with 3 elbows, but only 30 ft with 5 elbows). Therefore, 2-1/2 in. diameter pipe must be used for both vent and combustion-air pipes since larger required diameter must always be used for both pipes. If same installation were in Albuquerque, elevation 5250 ft above sea level, installation would require 2-1/2 in. vent pipe and combustion-air pipe. At 5001- to 6000-ft elevation, 2-in. pipe is only good for 17 ft with 5 elbows, and 2-1/2 in. pipe is good for 70 ft with 5 elbows.

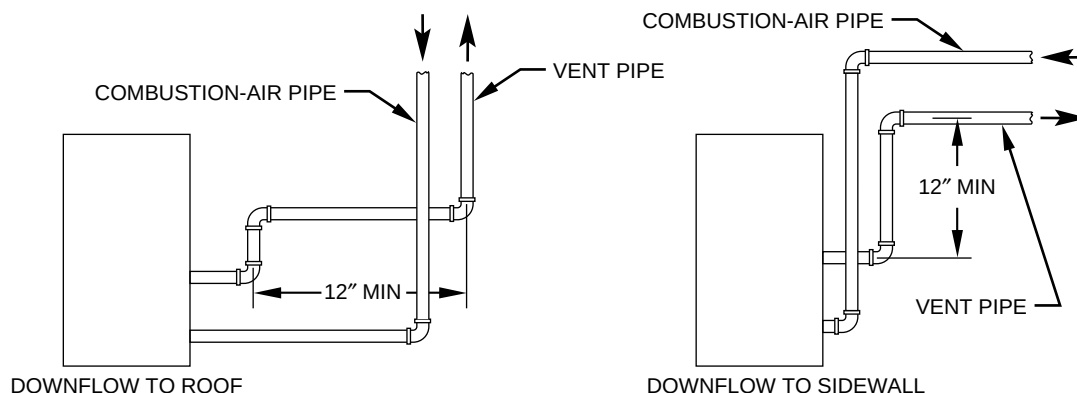
## C. Combustion-Air and Vent Pipe Attachment

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

1. Attach combustion-air pipe as follows:
  - a. Determine location of combustion-air intake pipe connection to combustion-air intake housing as shown in Fig. 19 for application.
  - b. Reposition combustion-air intake housing plug fitting in appropriate unused intake housing connection.
    - (1.) 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.

- (2.) A plugged drain connection has been provided on this fitting for use when moisture is found in combustion-air intake pipe and combustion box.



**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.

**Fig. 20—Short Vent (5 to 8 Ft) System**

A99025

**TABLE 7—MAXIMUM ALLOWABLE PIPE LENGTH (FT)**

| ALTITUDE        | UNIT SIZE            | TERMINATION TYPE           | PIPE DIA (IN.)* | NUMBER OF 90° ELBOWS |    |    |    |    |    |
|-----------------|----------------------|----------------------------|-----------------|----------------------|----|----|----|----|----|
|                 |                      |                            |                 | 1                    | 2  | 3  | 4  | 5  | 6  |
| 0 to 2000       | 036080 048080 060080 | 2 Pipe or 2-In. Concentric | 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 |
| 2001 to 3000    | 036080 048080 060080 | 2 Pipe or 2-In. Concentric | 2               | 49                   | 44 | 30 | 25 | 25 | 15 |
|                 |                      |                            | 2-1/2           | 70                   | 70 | 70 | 70 | 70 | 70 |
| 3001 to 4000    | 036080 048080 060080 | 2 Pipe or 2-In. Concentric | 2               | 46                   | 41 | 28 | 23 | 22 | 13 |
|                 |                      |                            | 2-1/2           | 70                   | 70 | 70 | 70 | 70 | 70 |
| 4001 to 5000†   | 036080 048080 060080 | 2 Pipe or 2-In. Concentric | 2               | 44                   | 39 | 26 | 21 | 20 | 11 |
|                 |                      |                            | 2-1/2           | 70                   | 70 | 70 | 70 | 70 | 70 |
| 5001 to 6000†   | 036080 048080 060080 | 2 Pipe or 2-In. Concentric | 2               | 41                   | 36 | 23 | 18 | 17 | 8  |
|                 |                      |                            | 2-1/2           | 70                   | 70 | 70 | 70 | 70 | 70 |
| 6001 to 7000†   | 036080 048080 060080 | 2 Pipe or 2-In. Concentric | 2               | 38                   | 33 | 21 | 16 | 15 | 6  |
|                 |                      |                            | 2-1/2           | 70                   | 70 | 68 | 67 | 66 | 64 |
| 7001 to 8000†   | 036080 048080 060080 | 2 Pipe or 2-In. Concentric | 2               | 36                   | 31 | 19 | 14 | 12 | NA |
|                 |                      |                            | 2-1/2           | 66                   | 65 | 63 | 62 | 60 | 59 |
| 8001 to 9000†   | 036080 048080 060080 | 2 Pipe or 2-In. Concentric | 2               | 33                   | 28 | 17 | 12 | 10 | NA |
|                 |                      |                            | 2-1/2           | 62                   | 60 | 58 | 56 | 55 | 53 |
| 9001 to 10,000† | 036080 048080 060080 | 2 Pipe or 2-In. Concentric | 2               | 30                   | 25 | 14 | 9  | 7  | NA |
|                 |                      |                            | 2-1/2           | 57                   | 55 | 53 | 51 | 49 | 47 |

\* Disk usage—Perforated disk assembly (factory-supplied in loose parts bag) **MUST BE USED**. See Combustion-Air and Vent Pipe Attachment section.

† 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. Size both the combustion-air and vent pipe independently, then use the larger diameter for both pipes.
3. Assume two 45° elbows equal one 90° elbow. Long radius elbows are desirable and may be required in some cases.
4. Elbows and pipe sections within the furnace casing and at the vent termination should not be included in vent length or elbow count.
5. The minimum pipe length is 5 ft for all applications.

**NOTE:** Moisture in combustion-air intake may be result of improper termination. Ensure combustion-air intake pipe is similar to that shown in Fig. 22, 23, 24, 25, or 26 so it will not be susceptible to areas where light snow or other sources of moisture could be pulled in.

- (3.) 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. 21.)

- c. Insert perforated disk assembly (factory-supplied in loose parts bag) in intake housing where combustion-air intake pipe will be connected.

- d. 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.

- e. Insert 2-in. diameter pipe into intake housing.

**NOTE:** A 2-in. diameter pipe must be used within the furnace casing. Make all pipe diameter transitions outside furnace casing. (See Fig. 18.)

- f. Drill a 1/8-in. hole in 2-in. combustion-air 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.

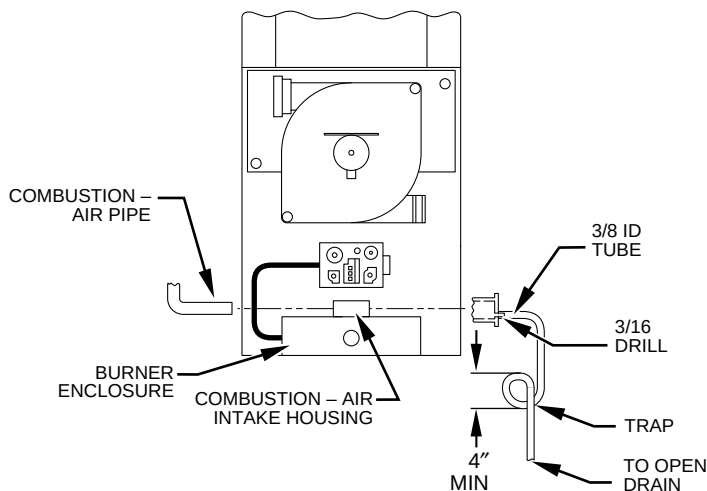


**Fig. 21—Intake Housing Plug Fitting Drain**

A99026

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

**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.

2. Attach vent pipe as follows:
  - a. Determine location of vent pipe connection to inducer housing as shown in Fig. 19 for application.
  - b. Reposition elastomeric (rubber) inducer housing outlet cap and clamp to appropriate unused inducer housing connection. Tighten clamp.

**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.

- c. 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.
- d. Be certain that mating surfaces of inducer housing connection, elastomeric (rubber) coupling and 2-in. diameter vent pipe are clean and dry. Assemble the elastomeric vent coupling onto inducer housing connection. Insert 2-in. diameter vent pipe through elastomeric coupling and fully onto inducer housing connection until it bottoms on the internal stop and tighten both clamp(s) to secure vent pipe to inducer housing. Tighten clamp screw(s) 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.

3. Working from furnace to outside, cut pipe to required length(s).
4. Deburr inside and outside of pipe.
5. Chamfer outside edge of pipe for better distribution of primer and cement.

6. Clean and dry all surfaces to be joined.

7. 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.

8. 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.
9. While cement is still wet, twist pipe into socket with 1/4 turn. Be sure pipe is fully inserted into fitting socket.
10. Wipe excess cement from joint. A continuous bead of cement will be visible around perimeter of a properly made joint.
11. Handle pipe joints carefully until cement sets.
12. Support combustion-air and vent piping a minimum of every 5 ft (3 ft for SDR-21 or -26 PVC) using perforated metal hanging strap.
13. Slope combustion-air and vent pipes toward furnace a minimum of 1/4 in. per linear ft with no sags between hangers.
14. Use appropriate methods to seal openings where vent and combustion-air pipes pass through roof or side wall.

### III. CONCENTRIC VENT AND COMBUSTION-AIR TERMINATION KIT INSTALLATION

**NOTE:** If these instructions differ from those packaged with termination kit, follow kit instructions.

Combustion-air and vent pipes must terminate outside structure. A factory accessory termination kit must be installed in 1 of the installations shown in Fig. 22, 23, 24, 25, or 26. Four termination kits are available.

1. The 2-in. termination bracket kit is for 1-1/2 in., and 2-in. diameter 2-pipe termination systems.
2. The 3-in. termination bracket kit is for 2-1/2 in. diameter 2-pipe termination systems.
3. The 2-in. concentric vent/air termination kit is for 1-1/2 in., 2-in., and 2-1/2 in. diameter pipe systems when single penetration of wall or roof is desired.
4. The 3-in. concentric vent/air termination kit is for 2-1/2 in., diameter pipe systems when single penetration of wall or roof is desired.

**NOTE:** Shaded parts in Fig. 22, 23, 24, 25, and 26 are considered to be termination. These components should NOT be counted when determining pipe diameter. Roof termination is preferred since it is less susceptible to damage, has reduced chances to take in contaminants, and has less visible vent vapors. (See Fig. 22 or 23.) Sidewall termination may require sealing or shielding of building surfaces with a corrosive resistance material due to corrosive combustion products of vent system.

#### A. Extended Exposed Sidewall Pipes

Sidewall combustion-air and vent pipe terminations may be extended beyond area shown in Fig. 25 or 26 in outside ambient by insulating pipes as indicated in Table 8.

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

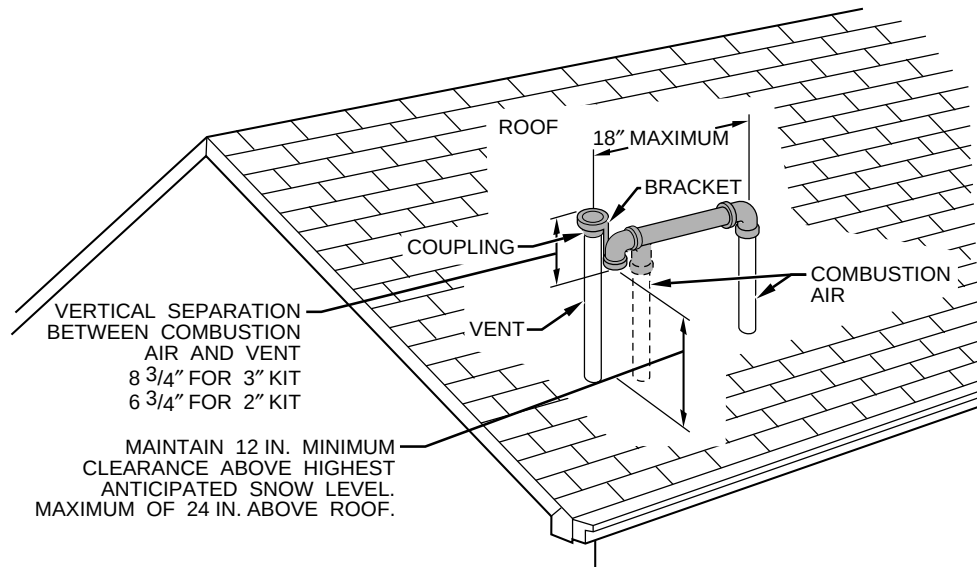
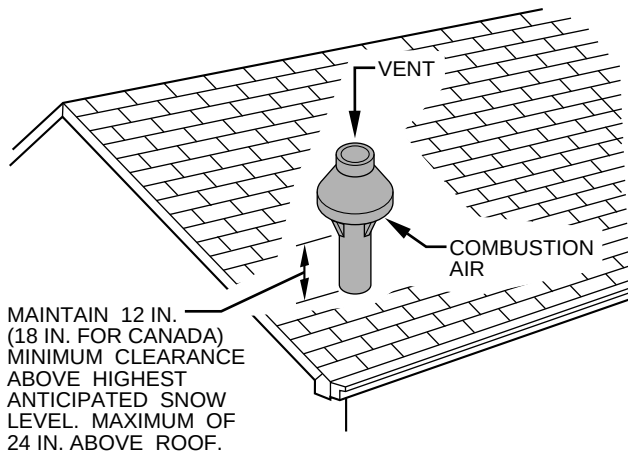


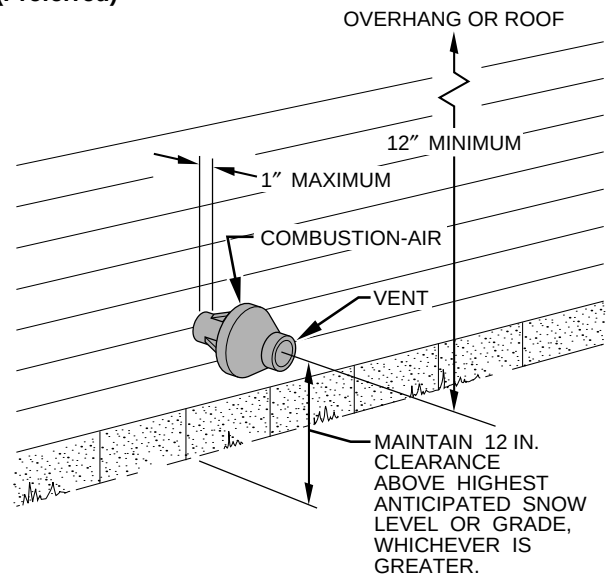
**Fig. 22—Roof Termination (Preferred)**

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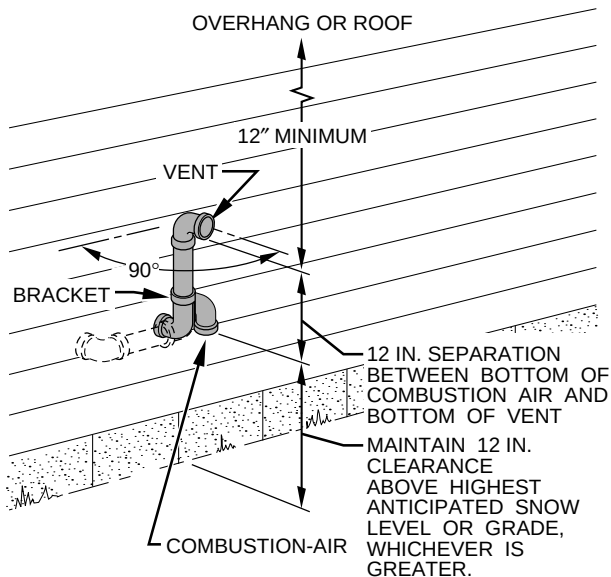
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**Fig. 23—Concentric Vent and Combustion-Air Roof Termination (Preferred)**



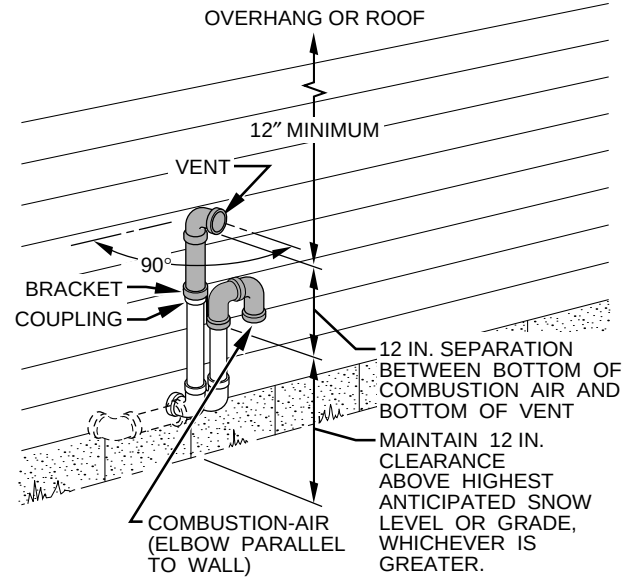
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**Fig. 24—Concentric Vent and Combustion-Air Side Termination**



A87225

**Fig. 25—Sidewall Termination of 12 in. or More**



A87226

**Fig. 26—Sidewall Termination of Less than 12 in.**

→ **TABLE 8—MAXIMUM ALLOWABLE EXPOSED VENT PIPE LENGTH (FT) WITH AND WITHOUT INSULATION  
IN WINTER DESIGN TEMPERATURE AMBIENT\***

| UNIT<br>SIZE | WINTER DESIGN<br>TEMPERATURE<br>(°F) | MAX PIPE<br>DIAMETER<br>(IN.) | WITHOUT<br>INSULATION | WITH 3/8-IN. OR<br>THICKER INSULATION† |
|--------------|--------------------------------------|-------------------------------|-----------------------|----------------------------------------|
| 080          | 20                                   | 2                             | 55                    | 55                                     |
|              | 0                                    | 2                             | 48                    | 55                                     |
|              | -20                                  | 2                             | 30                    | 55                                     |
|              | 20                                   | 2-1/2                         | 70                    | 70                                     |
|              | 0                                    | 2-1/2                         | 47                    | 70                                     |
|              | -20                                  | 2-1/2                         | 28                    | 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 7.

† Insulation thickness based on R value of 3.5 (ft<sup>2</sup> • °F • hr) (Btu • in.).

**NOTE:** Pipe length (ft) specified for maximum pipe lengths located in unconditioned spaces cannot exceed total allowable pipe length as specified in Table 7.

## B. Two-Pipe Termination Kit

1. Determine location for termination.

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

- a. Comply with all clearance requirements as stated in Table 6.
  - b. Termination kit should be positioned where vent vapors will not damage plants/shrubs or air conditioning equipment.
  - c. Termination kit should be positioned so that it will not be affected by wind eddy (such as inside building corners) or allow recirculation of flue gases, airborne leaves, or light snow.
  - d. Termination kit should be positioned where it will not be damaged by or subjected to foreign objects, such as stones, balls, etc.
  - e. Termination kit should be positioned where vent vapors are not objectionable.
2. Cut 2 holes, 1 for each pipe, of appropriate size for pipe size being used.
  3. Loosely install elbow in bracket and place assembly on combustion-air pipe.

**Roof terminations**—Loosely install pipe coupling on properly cut vent pipe. Coupling must be positioned so bracket will mount as shown in Fig. 22.

For applications using combustion-air pipe option, indicated by dashed lines in Fig. 22, install 90° street elbow into 90° elbow, making U-fitting. A 180° U-fitting may be used.

**Sidewall terminations**—Install bracket as shown in Fig. 25 or 26.

For applications using vent pipe option indicated by dashed lines in Fig. 25, rotate vent elbow 90° from position shown in Fig. 25.

4. Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.
5. Check required dimensions as shown in Fig. 22, 25, or 26.

## C. Concentric Vent/Air Termination Kit

1. Determine location for termination.

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

- a. Comply with all clearance requirements as stated in Table 6.
- b. Termination kit should be positioned where vent vapors will not damage plants/shrubs or air conditioning equipment.

- c. Termination kit should be positioned so it will not be affected by wind eddy (such as inside building corners) or that may allow recirculation of flue gases, airborne leaves, or light snow.
- d. Termination kit should be positioned where it will not be damaged by or subjected to foreign objects, such as stones, balls, etc.
- e. Termination kit should be positioned where vent vapors are not objectionable.

2. Cut one 4-in. diameter hole for 2-in. kit.

3. Loosely assemble concentric vent/air termination components together using instructions in kit.

4. Slide assembled kit with rain shield REMOVED through hole.

**NOTE:** Do not allow insulation or other materials to accumulate inside of pipe assembly when installing it through hole.

**Roof terminations**—Locate assembly through roof to appropriate height as shown in Fig. 23.

**Sidewall terminations**—Locate assembly through sidewall with rain shield positioned no more than 1-in. from wall as shown in Fig. 24.

5. Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.
6. Check required dimensions as shown in Fig. 23 or 24.  
Condensate Drain

## CONDENSATE DRAIN

### I. GENERAL

Condensate trap is shipped with the factory-supplied loose parts bag. Condensate trap must be LOCATED as shown in Fig. 4 or 5. 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 this condensate, a condensate pH neutralizing filter may be desired. Check with local authorities to determine if a pH neutralizer is required.

**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.

**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.

## 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. 27 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.

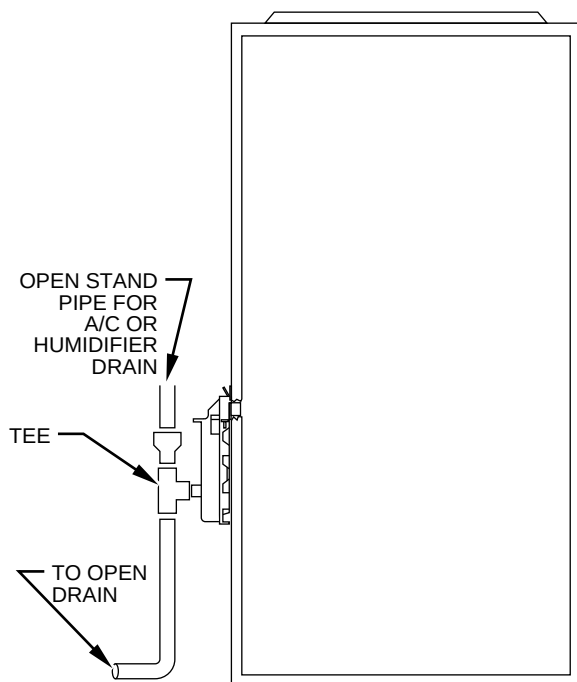


Fig. 27—Example of Field Drain Attachment

## 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. 28.)

3. Use wire ties to secure heat tape in place. Wire ties can be positioned in notches of condensate trap sides. (See Fig. 28.)
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.

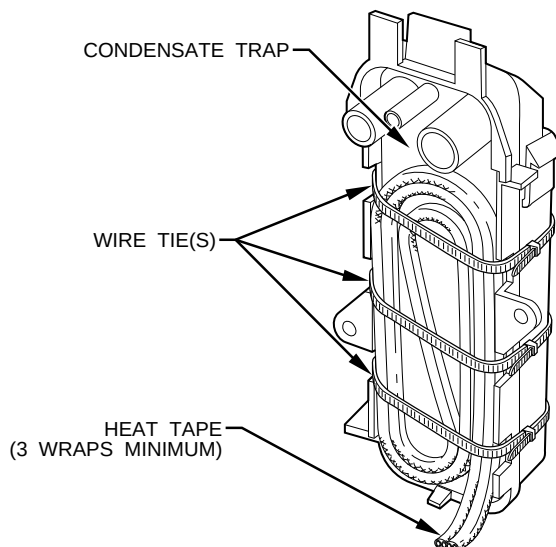


Fig. 28—Condensate Trap Heat Tape

### 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. 16.) 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.

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 remains energized for 135.
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 of 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 selected heating blower off delay period of 135 sec 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 status 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 24-v terminal on thermostat connection block. (See Fig. 25.)

**NOTE:** If TEST to Com 24-v 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 LED status 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.

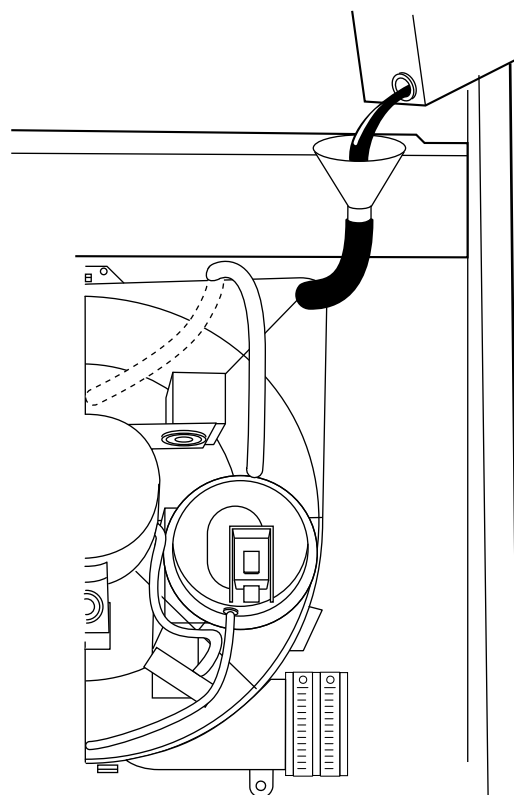
**CAUTION:** These furnaces are equipped with a manual reset limit switch in burner box. This switch will open if an overheat condition (rollout) occurs in burner enclosure. Correct inadequate combustion-air supply or improper venting condition and reset switch. DO NOT jumper this switch.

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

### II. PRIME CONDENSATE TRAP WITH WATER

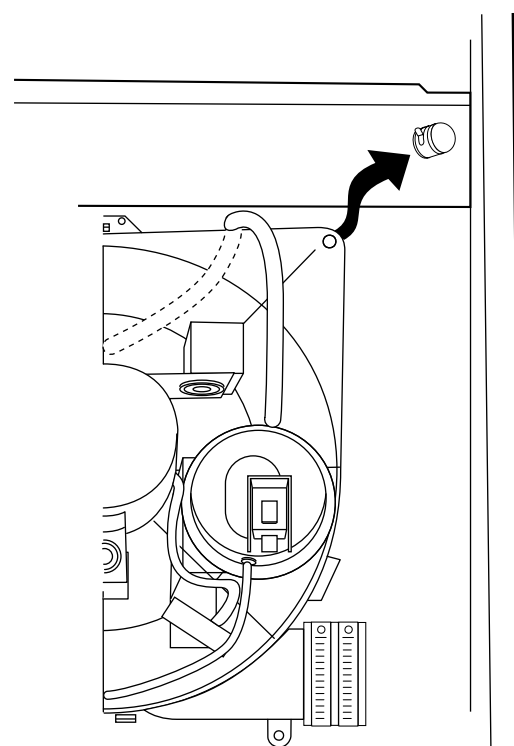
**CAUTION:** Condensate trap must be PRIMED or proper draining may not occur. The condensate trap has 2 internal chambers which can ONLY be primed by pouring water into the inducer drain side of condensate trap.

1. Remove upper inducer housing drain connection cap. (See Fig. 29.)
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, overflow condensate trap, and flow into open field drain. (See Fig. 30.)



A99303

→ Fig. 29—Inducer Housing Drain Tube



A99302

→ Fig. 30—Filling Condensate Trap

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



**WARNING:** The conversion from natural gas to propane gas or propane gas to natural gas shall be installed by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. If the information in these instructions is not followed exactly, a fire, explosion, or production of carbon monoxide may result causing property damage, personal injury, or loss of life. The qualified service agency is responsible for the proper installation of this furnace with these instructions. The installation is not proper and complete until the operation of the converted appliance is checked as specified in these manufacturer's instructions.

**AVERTISSEMENT:** La conversion du gaz naturel au gaz propane ou du gaz propane au gaz naturel doit être effectuée par une agence de service qualifiée conformément aux instructions du fabricant et à tous les codes et à toutes les exigences applicables de l'autorité compétente. Si ces instructions ne sont pas observées exactement, il peut en résulter un incendie, une explosion ou une production d'oxyde de carbone pouvant résulter en dommages matériels, lésions corporelles ou mort. L'agence de service qualifiée est responsable d'installer correctement cette fournaise conformément à ces instructions. L'installation n'est ni correcte ni complète tant que le fonctionnement de l'appareil converti n'a pas été vérifié de la manière précisée dans ces instructions du fabricant.

#### A. Set Gas Input Rate—Natural Gas (See Section IV. B for Propane Gas Adjustment.)

Furnace gas input rate on rating plate is for installations at altitudes up to 2000 ft.

In the U.S.A., the input ratings for altitudes above 2000 ft must be reduced by 2 percent for each 1000 ft above sea level.

In Canada, the input ratings must be derated by 5 percent for altitudes of 2000 ft to 4500 ft above sea level.

Furnace input rate must be within  $\pm 2$  percent of input on furnace rating plate adjusted for altitude.

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. Find installation altitude in Table 9.

**NOTE:** For Canada altitudes of 2000 to 4500 ft, use U.S.A. altitudes of 2001 to 3000 ft in Table 9 or 10.

- d. Find closest natural gas heat value and specific gravity on Table 9.
- e. 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 ft altitude using Table 9)

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.

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

**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.

3. Change orifice if required or proceed to Item 4.
  - a. Turn off gas and electrical supplies to furnace.
  - b. Remove main furnace door.
  - c. Turn furnace gas valve control knob or switch to OFF position.
  - d. Remove burner enclosure front.
  - e. Remove gas supply pipe from gas valve.
  - f. Remove wires from gas valve. Note location for reassembly.



**CAUTION:** Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

**ATTENTION:** Lors des opérations d'entretien des commandes, étiqueter tous les fils avant de les déconnecter. Toute erreur de câblage peut être une source de danger et de panne.

- g. Remove burner enclosure pressure tube from gas valve burner enclosure reference pressure tap fittings. (See Fig. 31.)
- h. Remove screws securing manifold to burner box. Remove manifold, orifices, and gas valve as 1 assembly.
- i. Obtain new natural gas orifices from authorized factory parts distributor.
- j. Remove natural gas orifices from manifold and place them in the bag supplied marked "Natural Gas Orifices." Manufactured (mobile) home installations are required to have these materials located with furnace for future conversion.
- k. Install main burner orifices. Do not use Teflon tape. Finger-tighten orifices at least 1 full turn to prevent cross-threading, then tighten with wrench. There are enough orifices in each kit for the largest furnace. Orifices of other sizes must be field supplied and are available through your local distributor.
- l. Reinstall manifold, orifices, and gas valve assembly in burner box. Ensure manifold seal is installed properly and burners fit over orifices. (See Fig. 32.)

**TABLE 9—MODEL 351DAS ORIFICE SIZE\* AND MANIFOLD PRESSURE FOR CORRECT INPUT  
FOR USE WITH 080 SIZE FURNACES USING NATURAL GAS  
(TABULATED DATA BASED ON 20,000 BTUH PER BURNER, DERATED 2 PERCENT FOR EACH 1000 FT ABOVE SEA LEVEL)**

| ALTITUDE RANGE (FT) |                                                                | AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT) | SPECIFIC GRAVITY OF NATURAL GAS |                   |             |                   |             |                   |             |                   |             |                   |
|---------------------|----------------------------------------------------------------|--------------------------------------------|---------------------------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|
|                     |                                                                |                                            | 0.58                            |                   | 0.60        |                   | 0.62        |                   | 0.64        |                   | 0.66        |                   |
|                     |                                                                |                                            | Orifice No.                     | Manifold Pressure | Orifice No. | Manifold Pressure | Orifice No. | Manifold Pressure | Orifice No. | Manifold Pressure | Orifice No. | Manifold Pressure |
| U.S.A. and Canada   | 0 to 2000                                                      | 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               |
|                     |                                                                | 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               |
|                     |                                                                | 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               |
|                     |                                                                | 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. Altitudes 2001 to 3000 or Canada Altitudes 2000 to 4500 | 775                                        | 43                              | 3.8               | 42          | 3.2               | 42          | 3.3               | 42          | 3.4               | 42          | 3.5               |
|                     |                                                                | 800                                        | 43                              | 3.5               | 43          | 3.7               | 43          | 3.8               | 42          | 3.2               | 42          | 3.3               |
|                     |                                                                | 825                                        | 44                              | 3.8               | 43          | 3.4               | 43          | 3.6               | 43          | 3.7               | 43          | 3.8               |
|                     |                                                                | 850                                        | 44                              | 3.6               | 44          | 3.7               | 44          | 3.8               | 43          | 3.5               | 43          | 3.6               |
|                     |                                                                | 875                                        | 44                              | 3.4               | 44          | 3.5               | 44          | 3.6               | 44          | 3.7               | 43          | 3.4               |
|                     |                                                                | 900                                        | 44                              | 3.2               | 44          | 3.3               | 44          | 3.4               | 44          | 3.5               | 44          | 3.6               |
|                     |                                                                | 925                                        | 45                              | 3.7               | 45          | 3.8               | 44          | 3.2               | 44          | 3.3               | 44          | 3.4               |
|                     |                                                                | 950                                        | 45                              | 3.5               | 45          | 3.6               | 45          | 3.7               | 45          | 3.8               | 44          | 3.3               |
|                     |                                                                | 975                                        | 45                              | 3.3               | 45          | 3.4               | 45          | 3.5               | 45          | 3.6               | 45          | 3.8               |
|                     |                                                                | 1000                                       | 45                              | 3.1               | 45          | 3.2               | 45          | 3.4               | 45          | 3.5               | 45          | 3.6               |
| 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         | 3001 to 4000                                                   | 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               |
|                     |                                                                | 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               |
|                     |                                                                | 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               |
|                     |                                                                | 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 9—MODEL 351DAS ORIFICE SIZE\* AND MANIFOLD PRESSURE FOR CORRECT INPUT (Continued)**  
**FOR USE WITH 080 SIZE FURNACES USING NATURAL GAS**  
**(TABULATED DATA BASED ON 20,000 BTUH PER BURNER, DERATED 2 PERCENT FOR EACH 1000 FT ABOVE SEA LEVEL)**

| ALTITUDE RANGE (FT) |              | AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT) | SPECIFIC GRAVITY OF NATURAL GAS |                   |             |                   |             |                   |             |                   |             |                   |
|---------------------|--------------|--------------------------------------------|---------------------------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|
|                     |              |                                            | 0.58                            |                   | 0.60        |                   | 0.62        |                   | 0.64        |                   | 0.66        |                   |
|                     |              |                                            | Orifice No.                     | Manifold Pressure | Orifice No. | Manifold Pressure | Orifice No. | Manifold Pressure | Orifice No. | Manifold Pressure | Orifice No. | Manifold Pressure |
| U.S.A. Only         | 4001 to 5000 | 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               |
|                     |              | 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               |
|                     |              | 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               |
|                     |              | 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         | 5001 to 6000 | 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               |
|                     |              | 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               |
|                     |              | 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               |
|                     |              | 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         | 6001 to 7000 | 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               |
|                     |              | 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               |
|                     |              | 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               |
|                     |              | 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 9—MODEL 351DAS ORIFICE SIZE\* AND MANIFOLD PRESSURE FOR CORRECT INPUT (Continued)**  
**FOR USE WITH 080 SIZE FURNACES USING NATURAL GAS**  
**(TABULATED DATA BASED ON 20,000 BTUH PER BURNER, DERATED 2 PERCENT FOR EACH 1000 FT ABOVE SEA LEVEL)**

| ALTITUDE RANGE (FT) |                | AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT) | SPECIFIC GRAVITY OF NATURAL GAS |                   |             |                   |             |                   |             |                   |             |                   |
|---------------------|----------------|--------------------------------------------|---------------------------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|
|                     |                |                                            | 0.58                            |                   | 0.60        |                   | 0.62        |                   | 0.64        |                   | 0.66        |                   |
|                     |                |                                            | Orifice No.                     | Manifold Pressure | Orifice No. | Manifold Pressure | Orifice No. | Manifold Pressure | Orifice No. | Manifold Pressure | Orifice No. | Manifold Pressure |
| U.S.A. Only         | 7001 to 8000   | 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               |
|                     |                | 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               |
|                     |                | 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               |
|                     |                | 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         | 8001 to 9000   | 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               |
|                     |                | 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               |
|                     |                | 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               |
|                     |                | 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         | 9001 to 10,000 | 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               |
|                     |                | 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               |
|                     |                | 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               |
|                     |                | 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.

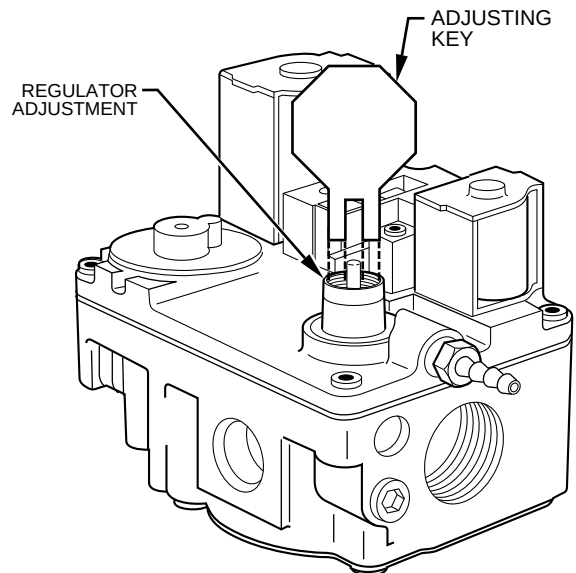
**WARNING:** Gas valve knob or switch **MUST** be facing forward or tilted upward. Failure to follow this warning could result in property damage, personal injury, or death.

**NOTE:** DO NOT reinstall burner enclosure front at this time.

4. 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**.

- Remove burner enclosure front.
- Remove LP/NAT cap that conceals adjustment screw for gas valve regulator. (See Fig. 31.)
- Adjust manifold pressure by using gas valve adjustment key, factory-provided in loose parts bag. (See Fig. 33.) Turn adjusting screw, counterclockwise (out) to decrease manifold pressure or clockwise (in) to increase manifold pressure. Adjust pressure to setting found in Table 9.

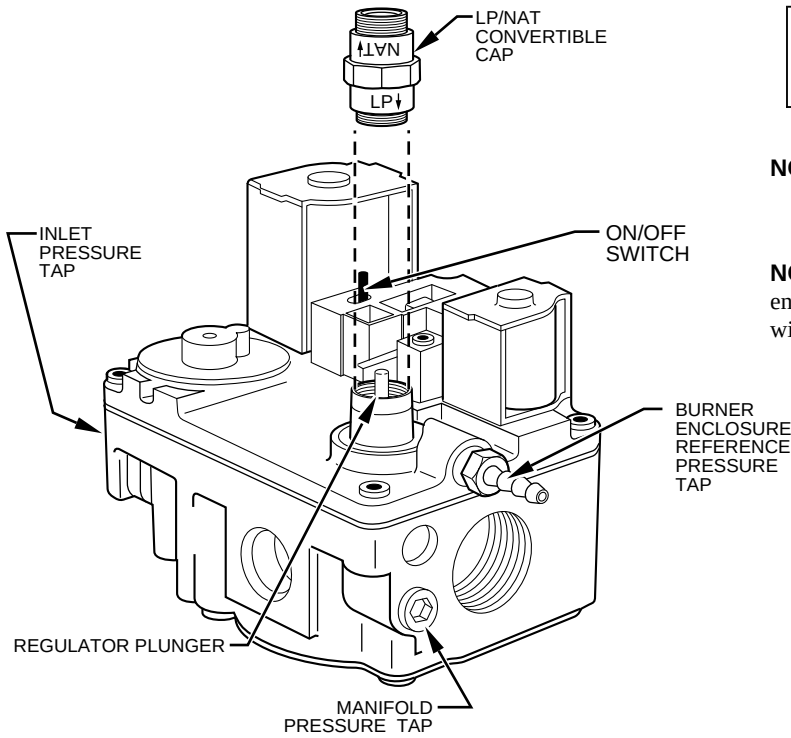


A99057

**Fig. 33—Adjusting Manifold Pressure With Adjustment Key**

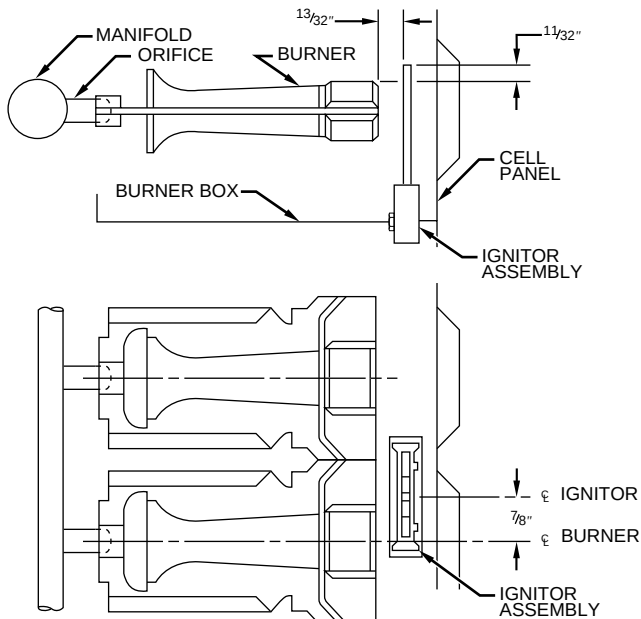
**NOTE:** This furnace has been approved for a manifold pressure of 3.2 in. wc to 3.8 in. wc when installed at altitudes up to 2000 ft. For altitudes above 2000 ft, the manifold pressure can be adjusted from 2.0 in. wc to 3.8 in. wc.

**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.



A99048

**Fig. 31—Redundant Convertible Automatic Gas Valve**



A99017

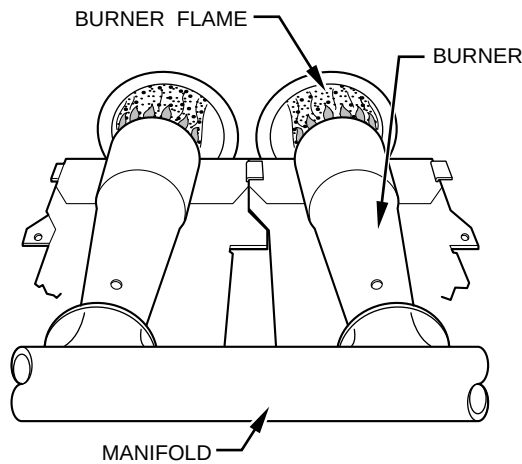
**Fig. 32—Burner Assembly**

- Reconnect wires to gas valve. Refer to furnace wiring schematic or as labeled earlier for proper wire location.
- Reinstall burner enclosure pressure tube to gas valve burner enclosure reference pressure tap. (See Fig. 31.)
- Reinstall gas supply pipe to gas valve using backup wrench to prevent rotation and improper orientation.

**NOTE:** Use propane-gas-resistant pipe dope to prevent gas leaks. DO NOT use Teflon tape.

- Replace gas valve LP/NAT cap. The NAT arrow point should be toward valve.
- Replace burner enclosure front and verify adjusted gas input rate using method outlined in item 5.
- Look through sight glass in burner enclosure and check burner flame. Burner flame should be clear blue, almost transparent. (See Fig. 34.)

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



A89020

**Fig. 34—Burner Flame**

**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.

- Calculate high-altitude adjustment (if required).

#### UNITED STATES

At altitudes above 2000 ft, this furnace has been approved for a 2 percent derate for each 1000 ft above sea level. See Table 10 for derate multiplier factor.

**TABLE 10—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.

† Derate multiplier for Canada is 0.95.

#### EXAMPLE:

80,000 Btuh input furnace installed at 4300 ft.

| Furnace Input Rate at Sea Level | X | Derate Multiplier Factor | = | Furnace Input Rate at Installation Altitude |
|---------------------------------|---|--------------------------|---|---------------------------------------------|
| 80,000                          | X | 0.91                     | = | 72,800                                      |

#### CANADA

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

- Turn off all other gas appliances and pilots.
- Start furnace and let operate for 3 minutes.
- Measure time (in sec) for gas meter test dial to complete 1 revolution.
- Refer to Table 11 for cu ft of gas per hr.
- Multiply gas rate (cu ft/hr) X heating value (Btu/cu ft) using natural gas heating value from local gas utility/supplier.

**TABLE 11—GAS RATE (CU FT/HR)**

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

#### EXAMPLE: (0—2000 ft altitude)

Furnace input from rating plate is 80,000 Btuh.

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 = 88 sec

Gas rate = 82 cu ft/hr (from Table 11)

Btu heating input = 82 X 975 = 79,950 Btuh

In this example, the orifice size and manifold pressure adjustment is within  $\pm 2$  percent of the furnace input rate.

- Fill in conversion responsibility label located on inside of main furnace door. Date, name, and address of organization making the conversion is required.

#### B. Set Gas Input Rate—Propane Gas (See Section IV. A for Natural Gas Adjustment.)

Furnace gas input rate on rating plate is for installations at altitudes up to 2000 ft. Input rate is same for propane and natural gases.

In the U.S.A., the input ratings for altitudes above 2000 ft must be reduced by 2 percent for each 1000 ft above sea level.

In Canada, the input ratings must be derated by 5 percent for altitudes of 2000 ft to 4500 ft above sea level.

Furnace input rate must be within  $\pm 2$  percent of input on furnace rating plate adjusted for altitude.

- Determine propane gas orifice size and manifold pressure for correct input using Fig. 35.
- Check and verify burner orifice size in furnace. NEVER ASSUME ORIFICE SIZE; ALWAYS CHECK AND VERIFY. (See Fig. 35.)

**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.

## MANUFACTURED (MOBILE) OR MODULAR HOME RATING PLATE

This appliance is for Manufactured (Mobile) or Modular home applications only. Refer to installation instructions for gas conversion procedures. Use parts supplied by manufacturer and installed by qualified personnel. See main rating plate for appliance model number and input rating.

NOTE: Furnace gas input rate on rating plate is for installations up to 2000 ft above sea level. In U.S.A. the input rating for altitudes above 2000 ft must be derated by 2% for each 1000 ft above sea level. In Canada the input rating must be derated by 5% for altitudes of 2000 ft to 4500 ft above sea level.

**FUEL USED: NATURAL GAS**

**INLET PRESSURE (min - max): 4.5 - 13.6 in. wc**

Furnace supplied with 45 orifices. Adjust input rate using local natural gas heat content and application altitude to determine proper orifice size. See installation instructions.

**FUEL USED: PROPANE GAS**

**INLET PRESSURE (min - max): 11.0 - 13.6 in. WC**

| Orifice No.       | ALTITUDE OF INSTALLATION (FT. ABOVE SEA LEVEL) U.S.A. * |             |           |           |           |           |           |           |            |
|-------------------|---------------------------------------------------------|-------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
|                   | 0 - 2000                                                | 2001-3000 * | 3001-4000 | 4001-5000 | 5001-6000 | 6001-7000 | 7001-8000 | 8001-9000 | 9001-10000 |
|                   | 55                                                      | 55          | 55        | 55        | 1.30mm    | 1.30mm    | 1.30mm    | 1.30mm    | 1.30mm     |
| Manifold Pressure | 10.0                                                    | 10.0        | 10.0      | 10.0      | 10.0      | 10.0      | 10.0      | 10.0      | 10.0       |

\* For Canadian Installations from 2000 to 4500 ft use U.S.A. Column 2001 to 3000 ft.

324998-101 REV. A (LIT)

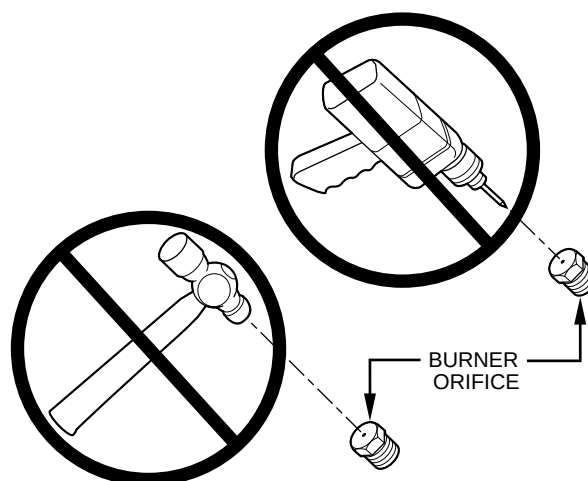
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**Fig. 35—Conversion Kit Rating Plate**

3. Change orifice if required or proceed to Item 4.
  - a. Turn off gas and electrical supplies to furnace.
  - b. Remove main furnace door.
  - c. Turn furnace gas valve control knob or switch to OFF position.
  - d. Remove burner enclosure front.
  - e. Remove gas supply pipe from gas valve.
  - f. Remove wires from gas valve. Note location for reassembly.

**CAUTION:** Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

**ATTENTION:** Lors des opérations d'entretien des commandes, étiqueter tous les fils avant de les déconnecter. Toute erreur de câblage peut être une source de danger et de panne.



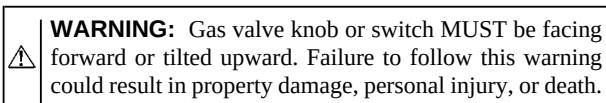
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**CAUTION:** DO NOT redrill orifices. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flames. This can result in flame impingement of burners and heat exchangers causing failures.

- g. Remove burner enclosure pressure tube from gas valve burner enclosure reference pressure tap fittings. (See Fig. 31.)
- h. Remove screws securing manifold to burner box. Remove manifold, orifices, and gas valve as 1 assembly.
- i. Find correct propane gas orifices in loose parts bag (factory-supplied with furnace) or in adhesive pouched bag attached to side of furnace.
- j. Remove natural gas orifices from manifold and place them in the bag supplied marked "Natural Gas Orifices." Manufactured (mobile) home installations are required to have these materials located with furnace for future conversion.
- k. Install main burner orifices. Do not use Teflon tape. Finger-tighten orifices at least 1 full turn to prevent cross-threading, then tighten with wrench. There are enough orifices in each kit for the largest furnace. Orifices of other sizes must be field supplied and are available through your local distributor.

- l. Reinstall manifold, orifices, and gas valve assembly in burner box. Ensure manifold seal is installed properly and burners fit over orifices. (See Fig. 32.)
- m. Reconnect wires to gas valve. Refer to furnace wiring schematic or as labeled earlier for proper wire location.
- n. Reinstall burner enclosure pressure tube to gas valve burner enclosure reference pressure tap. (See Fig. 31.)
- o. Reinstall gas supply pipe to gas valve using backup wrench to prevent rotation and improper orientation.

**NOTE:** Use propane-gas-resistant pipe dope to prevent gas leaks. DO NOT use Teflon tape.

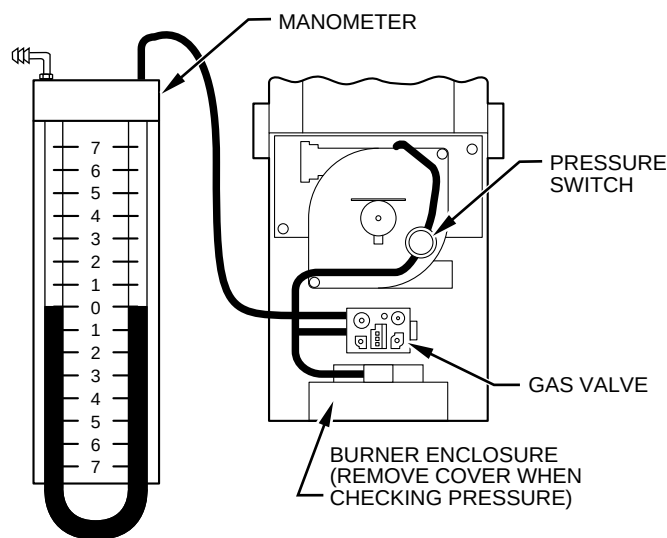


**NOTE:** DO NOT reinstall burner enclosure front at this time.

4. Check Inlet Gas Pressure

**NOTE:** For propane applications, inlet gas pressure must be regulated between 11.0-in. wc and 13.6-in. wc.

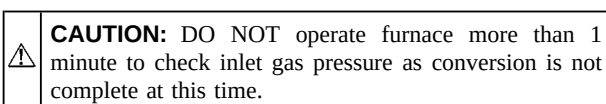
- a. Be sure main gas and electric supplies to furnace are off.
- b. Remove 1/8-in. pipe plug from inlet pressure tap on gas valve. (See Fig. 31.)
- c. Attach manometer to inlet pressure tap on gas valve. (See Fig. 36.)



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**Fig. 36—Adjusting Manifold Pressure Using Manometer**

- d. Turn on furnace power supply.
- e. Turn gas supply manual shutoff valve to ON position.
- f. Turn furnace gas valve control knob or switch to ON position.



- g. Jumper R and W thermostat connections to call for heat.
- h. When main burners have ignited, confirm proper inlet gas pressure is between 11.0-in. wc and 13.6-in. wc for propane applications.
- i. Remove jumper across R and W thermostat connections to terminate call for heat.
- j. Turn furnace gas valve control knob or switch to OFF position.
- k. Turn gas supply manual shutoff valve to OFF position.
- l. Turn off furnace power supply.

5. Adjust manifold pressure to obtain input rate.

**NOTE:** Manifold pressure must always be measured with burner enclosure front REMOVED.

6. Check Input Manifold Pressure

See furnace rating plate for input rate.

Furnace gas input rate on rating plate is for installations at altitudes up to 2000 ft.

In the U.S.A., the input rating for altitudes above 2000 ft must be reduced by 2 percent for each 1000 ft above sea level.

In Canada, the input rating must be derated by 5 percent for altitudes of 2000 ft to 4500 ft above sea level.

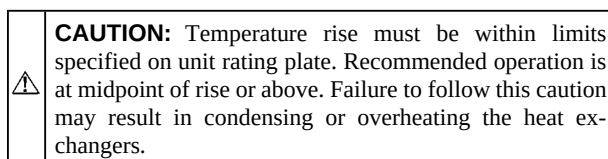
Furnace input rate must be within  $\pm 2$  percent of input on furnace rating plate.

- a. Orient LP/NAT cap for propane gas. The LP arrow should point toward gas valve. (See Fig. 31.)
- b. Adjust manifold pressure by using gas valve adjustment key, factory-provided in loose parts bag. (See Fig. 33.) Adjust manifold pressure to setting found in Fig. 35.

**NOTE:** Gas valve NAT/LP regulator cap must be installed to ACTIVATE LP regulator.

- c. Main burner flame should be clear blue, almost transparent. (See Fig. 34.)
- d. Remove jumper across R and W thermostat connections to terminate call for heat.
- e. Turn furnace gas valve control knob or switch to OFF position.
- f. Turn off furnace power supply.
- g. Remove manometer and replace manifold pressure tap plug. (See Fig. 35 and 31.)
- h. Reinstall burner enclosure front.
- i. Turn furnace gas valve control knob or switch to ON position.
- j. Turn on furnace power supply.
- k. Set room thermostat to call for heat.
- l. Check pressure tap plug for gas leaks when main burners ignite.
- m. Observe unit operation through 2 complete heating cycles. See sequence of operation in furnace Installation, Start-Up, and Operating Instructions.
- n. Set room thermostat to desired temperature.
- o. Fill in Conversion Responsibility Label located on inside of main furnace door by installer. Date, name, and address of organization making this conversion is required.
- p. Place ALL unused parts, adjusting key, and these Installation Instructions in adhesive pouch attached to outside of main furnace door.
- q. Reinstall main furnace door.
- r. Fill in conversion responsibility label located on inside of main furnace door. Date, name, and address of organization making the conversion is required.

### C. Set Temperature Rise



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.

- 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.

- To change blower motor speed selections for heating mode, remove blower motor lead from control center HEAT terminal. (See Fig. 17.) Select desired blower motor speed lead from 1 of the other terminals and relocate it to HEAT terminal. See Table 12 for lead color identification. Reconnect original lead on SPARE terminal.

Follow this same procedure for proper selection of COOL speed selection.

**TABLE 12—SPEED SELECTION**

| COLOR                 | SPEED       | AS SHIPPED |
|-----------------------|-------------|------------|
| Black                 | High        | COOL       |
| Yellow (When Present) | Medium High | SPARE      |
| Blue                  | Medium Low  | HEAT       |
| Red                   | Low         | SPARE      |
| White                 | Common      | COM        |

#### D. Blower Off Delay (Heat Mode)

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

#### E. 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. 37 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.

### CHECK SAFETY CONTROLS

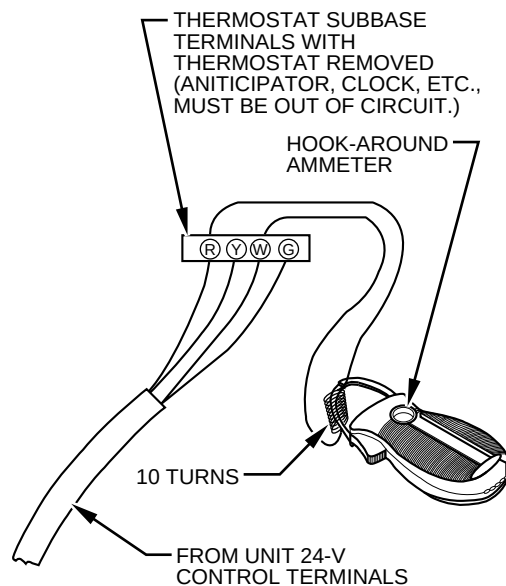
#### I. CHECK PRIMARY LIMIT CONTROL

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:

- Turn off 115-v power to furnace.



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

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**Fig. 37—Amp Draw Check with Ammeter**

- Remove main furnace door and disconnect inducer motor lead wires from wire harness.
- Turn on 115-v power to furnace.
- 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 Status Code 31. 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.
- Turn off 115-v power to furnace.
- Reconnect inducer motor leads, reinstall main furnace door, and turn on 115-v power supply.

### CHECKLIST

- Put away tools and instruments. Clean up debris.
- Verify manual reset switch has continuity.
- Verify that blower and control access doors are properly installed.
- Cycle test furnace with room thermostat.
- Check operation of accessories per manufacturer's instructions.
- Review User's Guide with owner.
- Place ALL unused parts, adjusting key, and these Installation Instructions in adhesive pouch attached to outside of furnace.

## CHECKLIST—INSTALLATION

### LOAD CALCULATION

\_\_\_\_\_ Heating Load (Btuh)  
\_\_\_\_\_ Cooling Load (Btuh)  
\_\_\_\_\_ Furnace Model Selection

### COMBUSTION AND VENT PIPING

#### Termination Location

\_\_\_\_\_ Roof or Sidewall  
\_\_\_\_\_ Termination Kit — 2 Pipe or Concentric  
\_\_\_\_\_ Combustion-Air Pipe Length  
\_\_\_\_\_ Combustion-Air Pipe Elbow Quantity  
\_\_\_\_\_ 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





# SERVICE TRAINING

**Packaged Service Training** programs are an excellent way to increase your knowledge of the equipment discussed in this manual, including:

- Unit Familiarization
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