

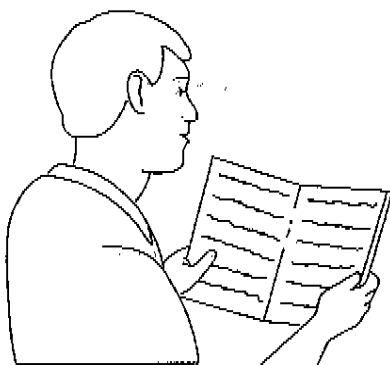


# installation, start-up and operating instructions

## MULTIPOISE CONDENSING GAS-FIRED FURNACE

### 490AAV Series A

Cancels: New

II 490A-40-1  
6-15-93

A93040

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

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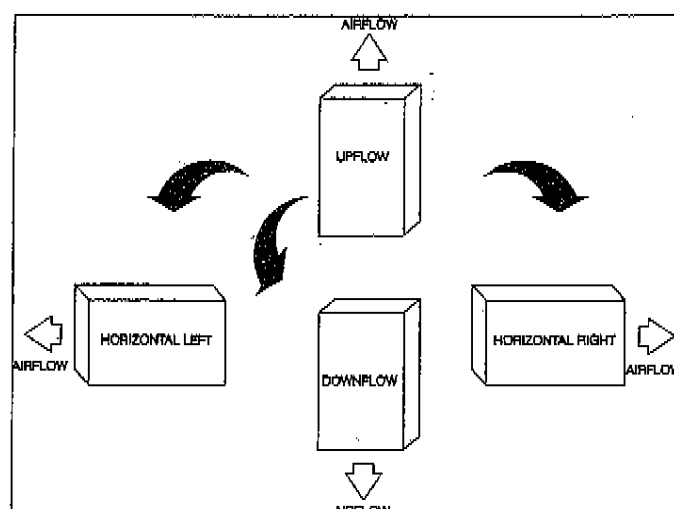


Fig. 1—Multipoise Orientations

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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, tags, and 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 National Fuel Gas Code NFPA No. 54-1992/ANSI Z223.1-1992. In Canada, refer to current edition of National Standard of Canada CAN/CGA-B149 Installation Codes. Wear safety glasses and work gloves. Have fire extinguisher available during start-up, 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 word DANGER, WARNING, or CAUTION. These words are used with safety-alert symbol. DANGER identifies most serious hazards which will result in severe personal injury or death. WARNING signifies hazards that 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 that will result in enhanced installation, reliability, or operation.

## INTRODUCTION

The 490AAV Multipoise Condensing Gas-Fired Furnace is A.G.A./C.G.A. certified for natural and propane gases and for installation in alcoves, attics, basements, closets, utility rooms, crawlspaces and garages. These furnaces SHALL NOT be installed directly on carpeting, tile, or any other combustible material other than wood flooring. In downflow installations, accessory floor base must be used when installed on combustible materials and wood flooring. The design of this furnace line is not A.G.A./C.G.A. certified for installation in mobile homes, recreation vehicles, or outdoors. These furnaces are suitable for installation in a residence built on site or a manufactured residence completed at final site.

These furnaces are shipped in the UPFLOW orientation and can be used in UPFLOW, DOWNFLOW, HORIZONTAL RIGHT, or HORIZONTAL LEFT (supply airflow direction) applications with minor modifications as shown in Fig. 1. See details under Section 1—Applications.

Before installing this furnace, refer to current edition of National Fuel Gas Code NFPA 54-1992/ANSI Z223.1-1992 which is available from National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269, American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209, or from Literature Distribution, catalog number 858-232. In Canada, contact Standards Department of Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ontario, Canada M3B 2R3. Installations must comply with 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 National Fuel Gas Code, NFPA No. 54-1992/ANSI Z223.1-1992. Canadian installations must be made in accordance with CAN/CGA-B149 Installation Codes and all authorities having jurisdiction. 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. BDP requires 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, your distributor or branch for information or assistance. The qualified installer or agency must use only factory-authorized and listed kits or accessories when modifying this product. Failure to follow this warning could result in electrical shock, fire, personal injury, or death.

For accessory installation details, refer to applicable installation literature.

## 1. APPLICATIONS

### A. General

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

### B. Upflow Applications

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

### CONDENSATE TRAP LOCATION

The condensate trap is factory shipped in the combustion and controls section. To install condensate trap, select 1 of 2 available locations as shown in Fig. 2 or Fig. 6.

Insert trap in appropriate hole. Note furnace casing will be positioned between top tabs. Rotate trap downwards until lower tab latches in furnace casing. If desired, trap can be attached to furnace casing after it is installed. Using holes in trap as a guide, drill and install field-supplied screws. Note that screw attachment is only an option and not required.

### CONDENSATE TRAP TUBING

#### 1. Collector Box Drain Tubing

The collector box drain tube (blue) is factory assembled to both collector box drain connections. This tube can be identified by corrugated ends, (approximately 5 in. long each end) with a section of straight tube in center.

- Cut straight section of tube to desired length but not less than 1 in. from UPPER corrugated connection.
- After condensate trap is installed, determine proper length of tube to connect LOWER collector box drain connection to LARGER (5/8-in. OD) tube connection on condensate trap. (See Fig. 5.)
- Cut straight section of tube to appropriate length and discard excess.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

- Connect tube to condensate trap and clamp (clamp located on straight section of tube) to prevent leakage.
- Remove collector box tube plug from inducer housing. (See Fig. 4 for factory shipped location.) Insert plug in open end of tube and gently push center of plug into tube until tube is flush with shoulder on plug.
- Clamp plug to prevent leakage. (Extra clamp located on straight section of tube.)

This unit complies with CAN/CGA 2.3 M86, CAN/CSA C22.2 No. 0-M91, CSA C22.2 No. 3-1988 standards.

This appliance is equipped only for altitudes 0 - 2,000 ft (0-610 m) for use with natural gas and propane. A conversion kit, supplied by the manufacturer, shall be used to convert to the alternate fuel.

This direct-vent, forced-air furnace is for indoor installation in a building constructed on site. For installation in alcove or closet at minimum clearances from combustible material as shown below, minimum front clearance for service is 30 inches. (762 mm).

**Upflow furnace only:** For installation on combustible flooring.

**Downflow furnace only:** For installation on non-combustible floors only. For installation on combustible floors only when installed on special base No. KGASB0201ALL.

**Horizontal position:** Line contact is permissible only between lines formed by intersections of top and two sides of furnace jacket, and building joists, studs, or framing. This furnace is for use with schedule-40 PVC, PVC-DWV, or ABS-DWV pipe, and must not be vented in common with other gas-fired appliances. Construction through which vent/air intake pipes may be installed is maximum 24 inches (600 mm), minimum 3/4 inches (19 mm) thickness.

Special venting system required. In Canada use certified venting system provided by furnace manufacturer. See Installation Instructions provided with furnace. Flue gas temperature 131°F (55°C), vent pressure positive.

#### MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL

INCHES

| TOP | SIDES | BACK | FRONT | VENT |
|-----|-------|------|-------|------|
| 0   | 0     | 0    | 3     | 0    |
| 0   | 0     | 0    | 3     | 0    |
| 1   | 1*    | 0    | 3     | 0    |

UPFLOW

DOWNFLOW

HORIZONTAL

\* Clearance shown is for air inlet and air outlet end.

Fig. 3—Clearances to Combustibles

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g. Position plugged tube behind inducer housing assembly.

**NOTE:** When condensate trap is installed on right-hand side, the blue collector box drain tube **MUST** be routed through clamp provided. (See Fig. 6.)

**WARNING:** Failure to route tube through clamp may interfere with blower access panel door switch operation. Failure to follow this warning could result in electrical shock, personal injury, or death.

#### 2. Inducer Housing Drain Tubing

The inducer housing drain tube (violet) is factory assembled to both inducer housing drains. This tube has 1 corrugated section and a straight section.

- Disconnect UPPER inducer housing drain connection.
- After condensate trap is installed, determine proper length of tube to connect LOWER inducer housing drain connection to SMALLER 3/8-in. OD tube connection on condensate trap. (See Fig. 5.)
- Cut tube to appropriate length and discard excess.
- Connect tube to condensate trap and clamp to prevent leakage.

**NOTE:** Do not allow kinks, traps or sags in tubes or furnace operation may be affected and lockout will occur.

- Remove cap and clamp from inducer housing. See Fig. 4 for factory shipped location. Install on UPPER inducer housing drain connection to prevent leakage.

#### 3. Collector Box to Trap Relief Port Tubing

The collector box to condensate trap relief port tube (green) is shipped from the factory attached to the inducer housing post as shown in Fig. 4. This tube **MUST** be relocated to the condensate trap.

**WARNING:** Failure to connect and clamp relief port tube properly to the condensate trap could result in intermittent operation and flue product leakage. Failure to follow this warning could result in personal injury or death.

- Disconnect the green 3/8-in. OD tube from the inducer housing post.

- Reroute tube from between the inducer housing and blower shelf to left-hand side of inducer housing, between collector box drain and pressure tubes.
- Determine proper length of tube to connect to condensate trap, after trap is installed.

**NOTE:** If additional tube length is required, use factory-supplied tube in installer packet.

- Cut tube to appropriate length.
- Connect tube to condensate trap and clamp to prevent leakage.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

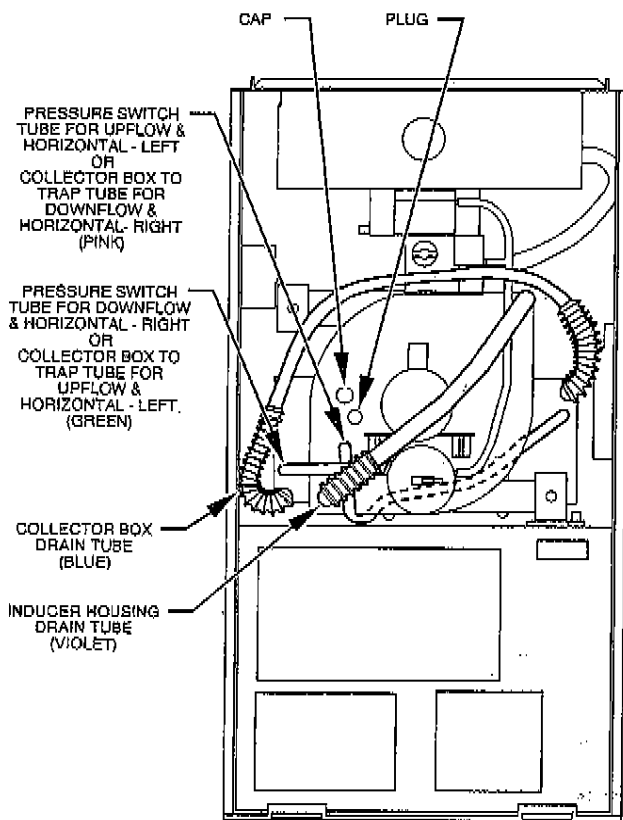


**Fig. 4—Factory Shipped Tube Arrangement**

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**WARNING:** When condensate trap is installed on right-hand side, route inducer drain and relief port tube behind clamped collector box tube (blue). (See Fig. 6.) Failure to route tube through clamp may interfere with blower access panel door switch operation. Failure to follow this warning could result in electrical shock, personal injury, or death.

#### PRESSURE SWITCH TUBING

The pressure switch tubing is factory assembled for upflow applications and should not require any modifications. See Fig. 6 to check routing of pressure switch tubing connections.

#### CONDENSATE TRAP FREEZE PROTECTION

Refer to Section 6—Condensate Trap Freeze Protection section for recommendations and procedures.

#### CONDENSATE TRAP DRAIN

Refer to Section 6—Condensate Drain section for recommendations and procedures.

#### C. Downflow Applications

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

#### CONDENSATE TRAP LOCATION

The condensate trap is factory shipped in combustion and controls section. To install condensate trap, select 1 of 2 available locations as shown in Fig. 2 or 7. Insert trap in appropriate hole. Note furnace casing will be positioned between top tabs. Rotate trap downwards until lower tab latches in furnace casing. If desired, trap can be attached to furnace casing after it is installed. Using holes in trap as a guide, drill and install field-supplied screws. Note, screw attachment is only an option and not required.

#### CONDENSATE TRAP TUBING

##### 1. Collector Box Drain Tubing

The collector box drain tube (blue) is factory assembled to both collector box drain connections. This tube can be identified by corrugated ends, approximately 5 in. long, with a section of straight tube in center.

- Cut straight section of tube approximately 1 in. from corrugated connection.
- After trap is installed determine proper length of tube to connect LOWER collector box drain connection to LARGER 5/8-in. OD tube connection on condensate trap. (See Fig. 5.)
- Cut straight section of tube to appropriate length and discard excess.
- Connect tube to condensate trap and clamp (clamp located on straight section of tube) to prevent leakage.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

- Remove collector box tube plug from inducer housing. (See Fig. 4 for factory shipped location.) Insert plug in open end of tube and gently push center of plug into tube until tube is flush with shoulder on plug.
- Clamp plug to prevent leakage. (Extra clamp located on straight section of tube.)
- Position plugged tube behind inducer housing assembly.

**NOTE:** When condensate trap is installed on right-hand side, the collector box drain tube **MUST** be routed behind the inducer housing and gas valve as shown in Fig. 7.

##### 2. Inducer Housing Drain Tubing

The inducer housing drain tube (violet) is factory assembled to both inducer housing drains. This tube has 1 corrugated section and a straight section.

- After trap is installed disconnect both ends of inducer housing drain tube.
- Connect corrugated end to LOWER inducer housing drain connection.
- Determine proper length of tubing to connect LOWER inducer housing drain connection to SMALLER 3/8-in. OD tube connection on condensate trap. (See Fig. 5.)
- Cut tube to appropriate length and discard excess.
- Connect tube to condensate trap and clamp to prevent leakage.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

- Remove cap and clamp from inducer housing (See Fig. 4 for factory shipped location) and install on UPPER inducer housing drain connection to prevent leakage.

**NOTE:** When condensate trap is located on right-hand side, route collector box and inducer housing drain tubes behind gas valve. (See Fig. 7.)

##### 3. Collector Box to Trap Relief Port Tubing

The collector box to condensate trap relief port tube (pink) is shipped from the factory attached to the pressure switch as shown in Fig. 4. This tube **MUST** be relocated to the condensate trap.

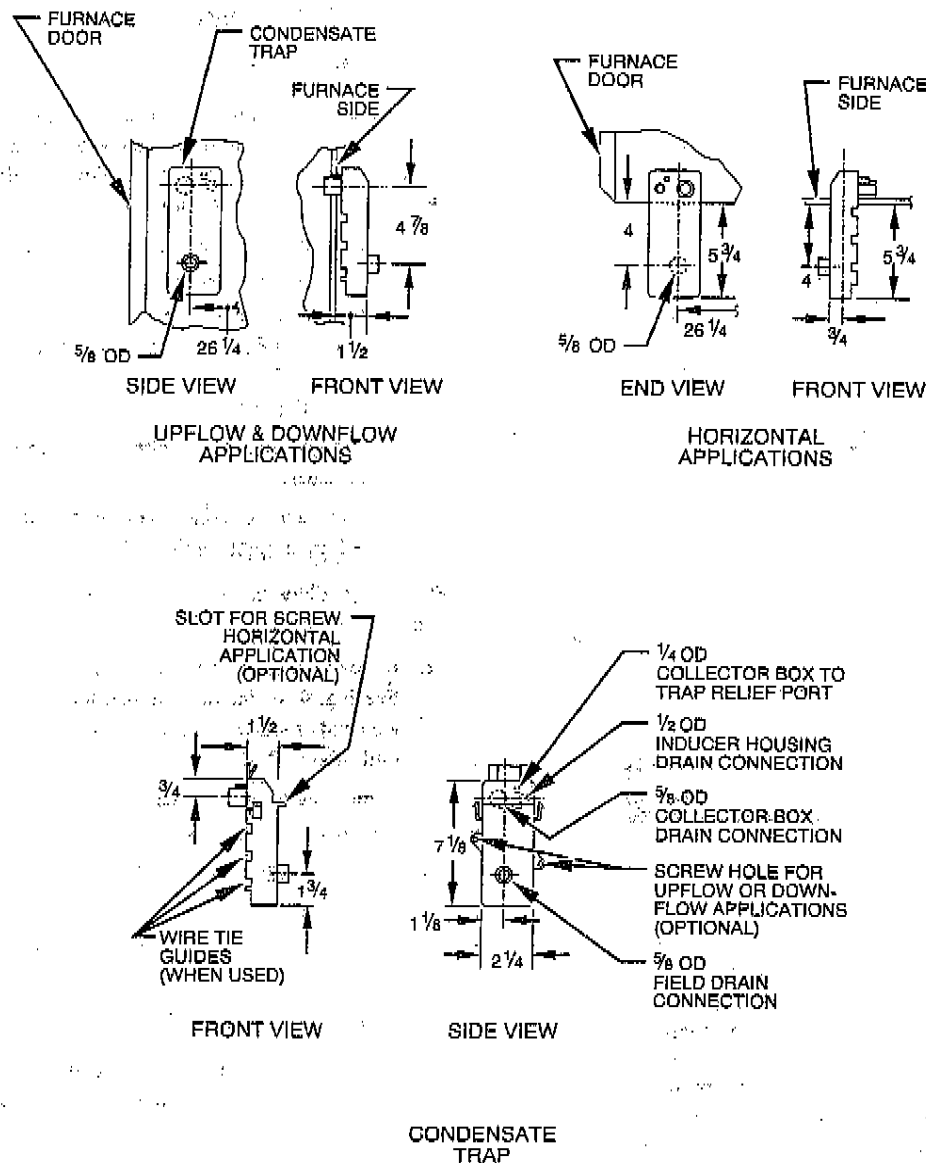


Fig. 5—Condensate Trap

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**WARNING:** Failure to connect and clamp relief port tube properly to the condensate trap could result in intermittent operation and flue product leakage. Failure to follow this warning could result in personal injury or death.

- Disconnect the pink 3/8-in. OD tube from the pressure switch.

**NOTE:** This is NOT tube connecting burner box and gas valve to the pressure switch.

- Determine proper length of tube to connect to condensate trap after trap has been installed.
- Cut tube to appropriate length.
- If needed, extend length of pink 3/8-in. OD tube by using factory-supplied extra tubing in installer packet. Determine proper length of tube to connect to condensate trap after trap is installed.
- Relocate clamp to condensate trap connection.
- Connect tube to condensate trap and clamp to prevent leakage.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

### PRESSURE SWITCH TUBING

The pressure switch tubing (green) is shipped from the factory assembled as shown in Fig. 4 and **REQUIRES** modifications. See Fig. 7 for proper location of pressure switch tubing connections.

- Remove green collector box pressure tube from inducer housing POST.

**NOTE:** This is NOT tube connecting burner box and gas valve to pressure switch, or tube removed earlier from the pressure switch and connected to the condensate trap relief port.

- Connect tube to pressure switch and clamp to prevent leakage. (See Fig. 7.)

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

### CONDENSATE TRAP FREEZE PROTECTION

Refer to Section 6—Condensate Trap Freeze Protection section for recommendations and procedures.

### CONDENSATE TRAP DRAIN

Refer to Section 6—Condensate Drain section for recommendations and procedures.

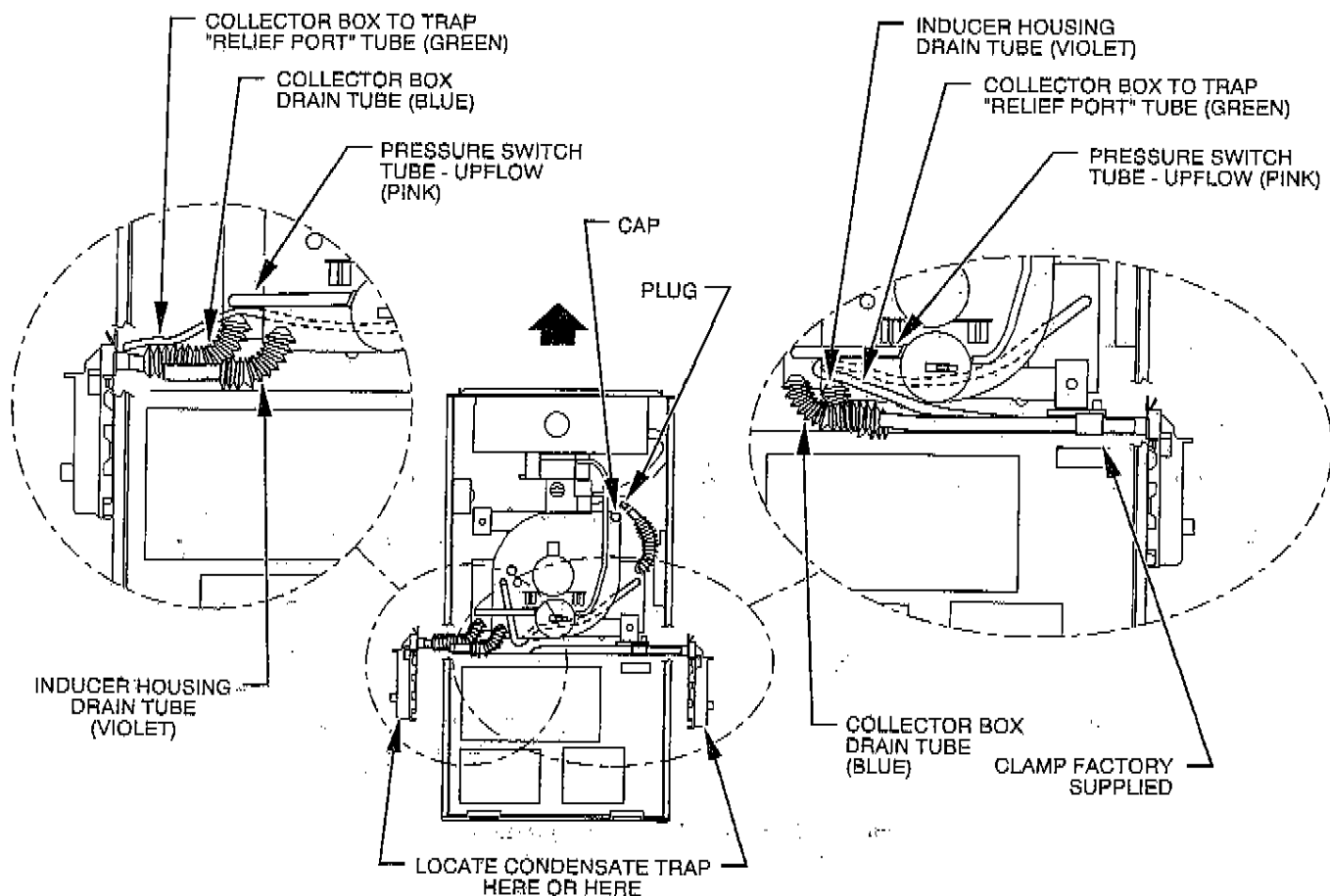


Fig. 6—Upflow Tube Configuration

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#### D. Horizontal Left (Supply-Air Discharge) Applications

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

**CAUTION:** Local codes may require a drain pan under entire furnace and condensate trap when a condensing furnace is used in attic applications.

**NOTE:** In Canada, installation shall be in accordance with current CAN/CGA-B149 Installation Codes and/or local codes.

#### CONDENSATE TRAP LOCATION

The condensate trap is factory shipped in combustion and controls section of unit. Install condensate trap in location shown in Fig. 2 or 8.

**NOTE:** The auxiliary junction box (J-Box) MUST be relocated to opposite side of furnace casing. (See Fig. 8.) See Electrical Connection section for J-Box relocation. Insert trap in appropriate hole by positioning drain tube stubs in hole and rotating downward until latches engage in furnace casing. If desired, trap can be attached to furnace casing after it is installed. Using slotted tab in trap as a guide, drill and install field-supplied screw. Note that screw attachment is only an option and not required.

#### CONDENSATE TRAP TUBING

##### 1. Collector Box Drain Tubing

The collector box drain tube (blue) is factory assembled to both collector box drain connections. This tube can be identified by corrugated ends, approximately 5 in. long, with a section of straight tube in center.

- Cut straight section of tube approximately 1 in. from corrugated connection.
- After trap is installed, determine proper length of tube to connect LOWER collector box drain connection to LARGER 5/8-in. OD tube connection on condensate trap. (See Fig. 5.)
- Cut straight section of tube to appropriate and discard excess.
- Connect tube to condensate trap and clamp (clamp located on straight section of tube) to prevent leakage.
- Remove collector box tube plug from inducer housing. See Fig. 4 for factory shipped location. Insert plug in open end of tube and gently push center of plug into tube until tube is flush with shoulder on plug.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

- Clamp plug to prevent leakage. (Extra clamp located on straight section of tube.)
- Position plugged tube behind inducer housing assembly.

##### 2. Inducer Housing Drain Tubing

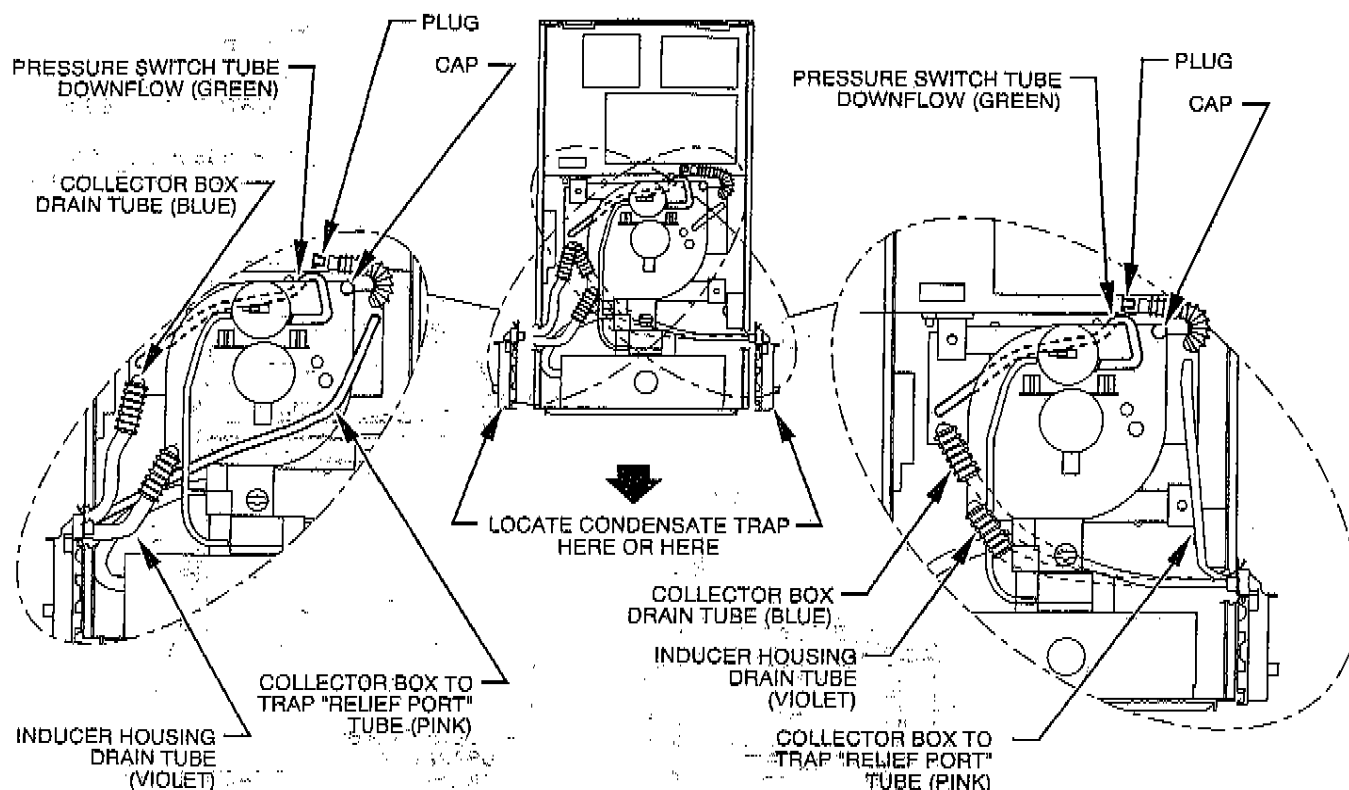


**Fig. 7—Downflow Tube Configuration**

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The inducer housing drain tube (violet) is factory assembled to both inducer housing drains. This tube has 1 corrugated section end and a straight section.

- Locate condensate trap. Disconnect UPPER inducer housing drain connection.
  - After trap is installed, determine proper length of tube to connect LOWER inducer housing drain connection to SMALLER 3/8-in. OD tube connection on condensate trap. (See Fig. 5.)
  - Cut tube to appropriate length and discard excess.
  - Connect tube to condensate trap and clamp to prevent leakage.
3. Collector Box to Trap Relief Port Tubing

The collector box to condensate trap relief port tube (green) is shipped from the factory attached to the inducer housing post as shown in Fig. 4. This tube **MUST** be relocated to the condensate trap.

**WARNING:** Failure to connect and clamp this tube properly to the condensate trap could result in intermittent operation and flue product leakage. Failure to follow this warning could result in personal injury or death.

- Disconnect the green, 3/8-in. OD tube from the inducer housing post.
- Reroute tube from between the inducer housing and blower shelf to bottom side of the inducer housing between the collector box drain and the pressure switch tube.
- Cut tube to appropriate length.
- If needed, extend length of pink 3/8-in. OD tube by using factory-supplied extra tubing in installer packet.
- Determine proper length of tube to connect to condensate trap after trap is installed.

f. Cut tube to appropriate length.

g. Connect tube to condensate trap and clamp to prevent leakage.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

#### PRESSURE SWITCH TUBING

The pressure switch tubes connections are shipped from the factory assembled for the horizontal left application and should not require any modifications. See Fig. 8 to check routing and connection location of pressure switch tubes.

#### CONDENSATE TRAP FREEZE PROTECTION

Refer to Section 6—Condensate Trap Freeze Protection section for recommendations and procedures.

#### CONDENSATE TRAP DRAIN

Refer to Section 6—Condensate Drain section for recommendations and procedures.

#### CONSTRUCT A WORKING PLATFORM

Construct working platform where all required furnace clearances are met. (See Fig. 3 and 9.)

**CAUTION:** The condensate trap **MUST** be installed below furnace. See Fig. 5 for dimensions. The drain connection to condensate trap must also be properly sloped to an open drain.

**NOTE:** Combustion-air and vent pipes are restricted to a minimum length of 5 ft. (See Table 7)

**NOTE:** A 12-in. minimum horizontal pipe section is recommended with short (5 to 8 ft) vertical vent systems. This recommendation is to reduce excessive condensate droplets from exiting the vent pipe. (See Fig. 9.)

### E. Horizontal Right (Supply-Air Discharge) Applications

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

**CAUTION:** Local codes may require a drain pan under entire furnace and condensate trap when a condensing furnace is used in attic applications.

**NOTE:** In Canada, installation shall be in accordance with current CAN/CGA-B149 Installation Codes and/or local codes.

#### CONDENSATE TRAP LOCATION

The condensate trap is factory shipped in combustion and controls section of unit. Install condensate trap in location shown in Fig. 2 or 10. Insert trap in appropriate hole by positioning drain tube stubs in hole and rotating downward until latches engage in furnace casing. If desired, trap can be attached to furnace casing after it is installed. Using slotted tab in trap as a guide, drill and install field-supplied screw. Note that screw attachment is only an option and not required.

#### CONDENSATE TRAP TUBING

##### 1. Collector Box Drain Tubing

The collector box drain tube (blue) is factory assembled to both collector box drain connections. This tube can be identified by corrugated ends, approximately 5 in. long, with a section of straight tube in center.

- Cut straight section of tube approximately 1 in. from corrugated connection.
- After trap is installed, determine proper length of tube to connect LOWER collector box drain connection to LARGER 5/8-in. OD tube connection on condensate trap. (See Fig. 5.)
- Cut straight section of tube to appropriate length and discard excess.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

- Connect tube to condensate trap and clamp (clamp located on straight section of tube) to prevent leakage.
- Remove collector box tube plug from inducer housing. See Fig. 4 for factory shipped location. Insert plug in open end of tube and gently push center of plug into tube until tube is flush with shoulder on plug.
- Clamp plug to prevent leakage. (Extra clamp located on straight section of tube.)
- Position plugged tube behind inducer housing assembly.

##### 2. Inducer Housing Drain Tubing

The inducer housing drain tube (violet) is factory assembled to both inducer housing drains. This tube has 1 corrugated section and a straight section.

- After trap is installed disconnect both ends of inducer housing drain tube.
- Connect corrugated end to LOWER inducer housing drain connection.

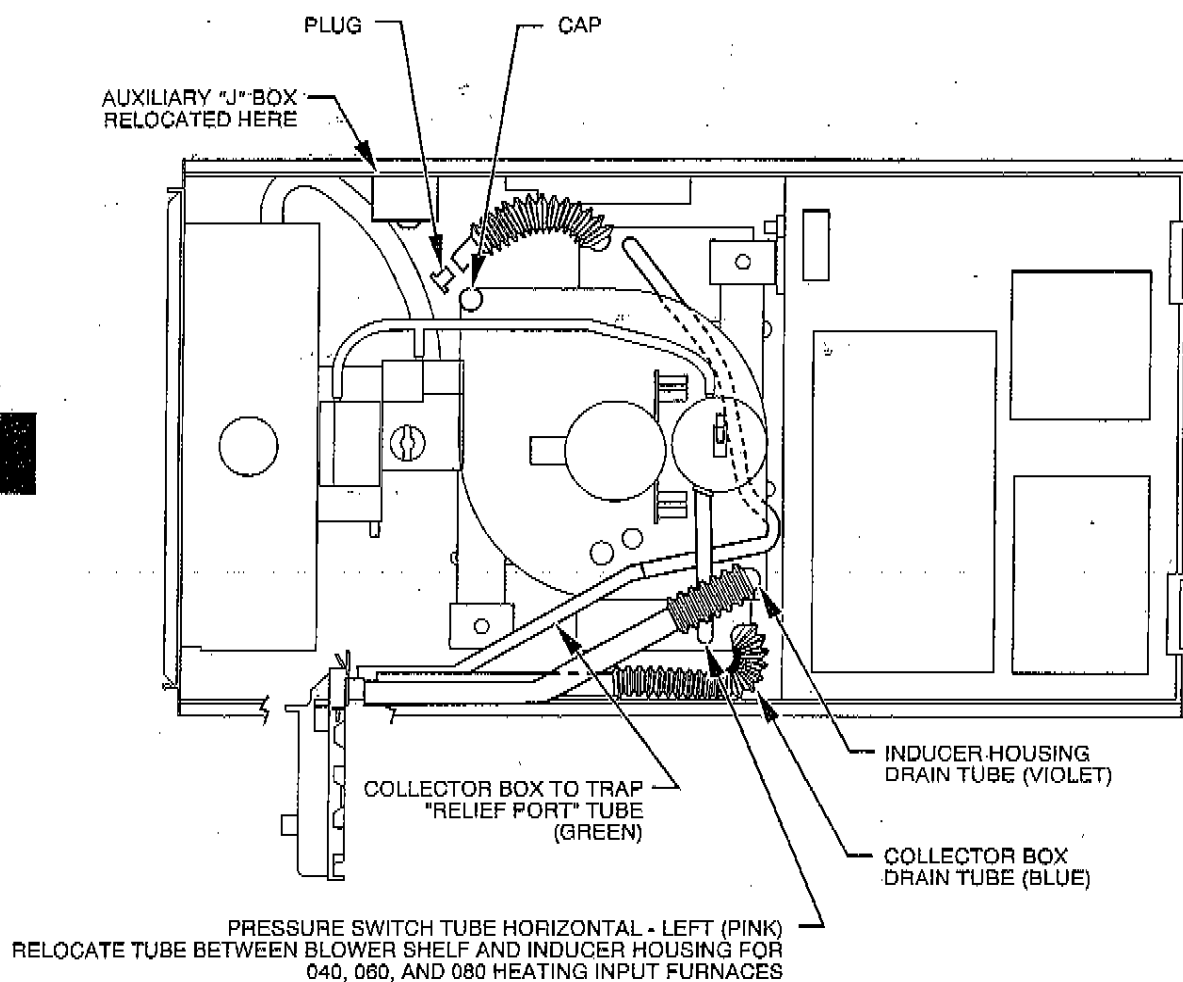


Fig. 8—Horizontal Left Tube Configuration

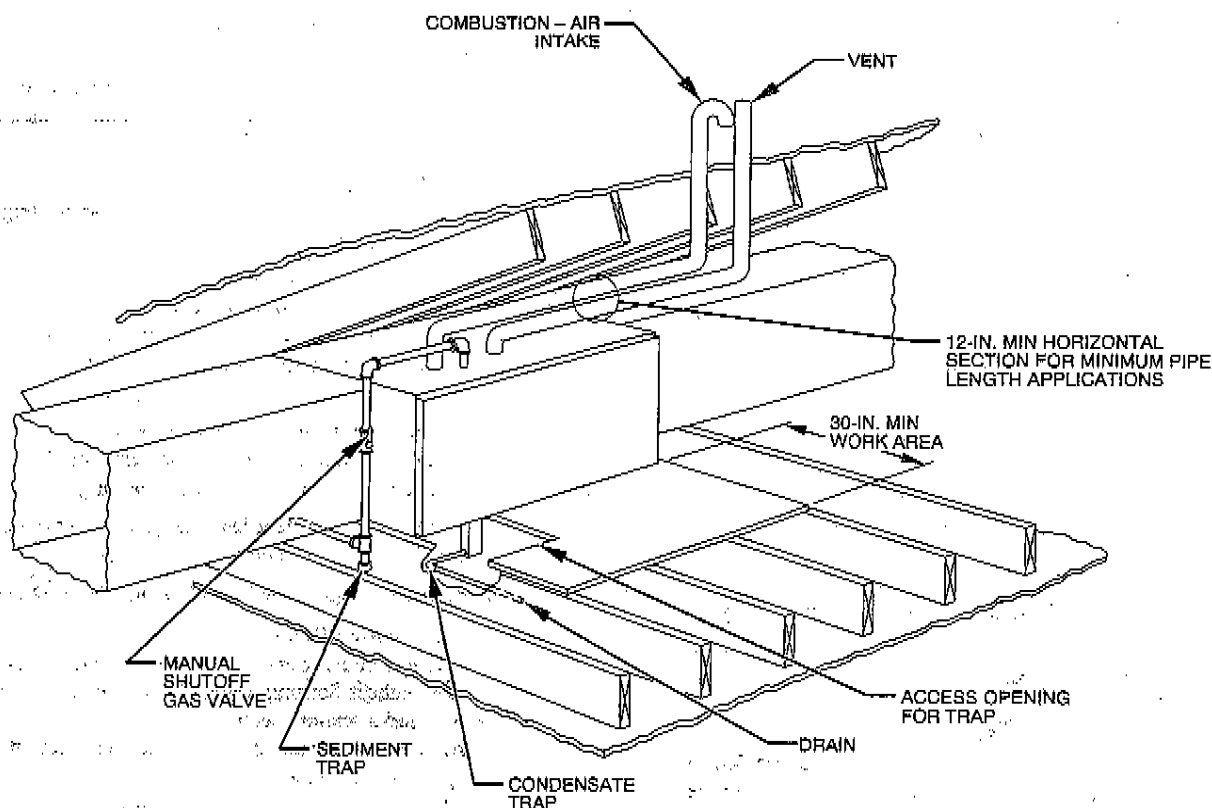


Fig. 9—Attic Location and Working Platform

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c. Determine proper length of tube to connect LOWER inducer housing drain connection to SMALLER 3/8-in. OD tube connection on condensate trap. (See Fig. 5.)

d. Cut tube to appropriate length and discard excess.

e. Connect tube to condensate trap and clamp to prevent leakage.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

f. Remove cap and clamp from inducer housing. See Fig. 4 for factory location. Install on UPPER inducer housing drain connection to prevent leakage.

### 3. Collector Box to Trap Relief Port Tubing

The collector-box to condensate trap relief port tube (pink) is shipped from the factory attached to the pressure switch as shown in Fig. 4. This tube **MUST** be relocated to the condensate trap.

**WARNING:** Failure to connect and clamp the relief port tube properly to the condensate trap could result in intermittent operation and flue product leakage may occur. Failure to follow this warning could result in personal injury or death.

a. Disconnect the pink 3/8-in. OD tube from the pressure switch.

**NOTE:** This is NOT tube connecting burner box and gas valve to pressure switch.

b. Determine proper length of tube to connect to condensate trap after trap is installed.

c. Cut tube to appropriate length.

d. If needed, extend length of pink 3/8-in. OD tube by using factory-supplied extra tubing in installer packet.

e. Relocate clamp to condensate trap connection.

f. Connect tube to condensate trap and clamp to prevent leakage.

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

### PRESSURE SWITCH TUBING

The pressure switch tubing is shipped from the factory assembled as shown in Fig. 4, and **REQUIRES** modifications. See Fig. 10 for proper location of pressure switch tubing connections.

1. Remove green collector box pressure tube from inducer housing POST.

**NOTE:** This is NOT tube connecting burner box and gas valve to the pressure switch or tube removed earlier from the pressure switch and connected to the condensate trap relief port.

2. Connect tube to pressure switch and clamp to prevent leakage. (See Fig. 10.)

**NOTE:** Do not allow kinks, traps or sags in tube or furnace operation may be affected and lockout will occur.

### CONDENSATE TRAP FREEZE PROTECTION

Refer to Section 6—Condensate Trap Freeze Protection section for recommendations and procedures.

### CONDENSATE TRAP DRAIN

Refer to Section 6—Condensate Drain section for recommendations and procedures.

### CONSTRUCT A WORKING PLATFORM

Construct working platform where all required furnace clearances are met. (See Fig. 3 and 9.)

**CAUTION:** The condensate trap **MUST** be installed below furnace. See Fig. 5 for dimensions. The drain connection to condensate trap must also be properly sloped to an open drain.

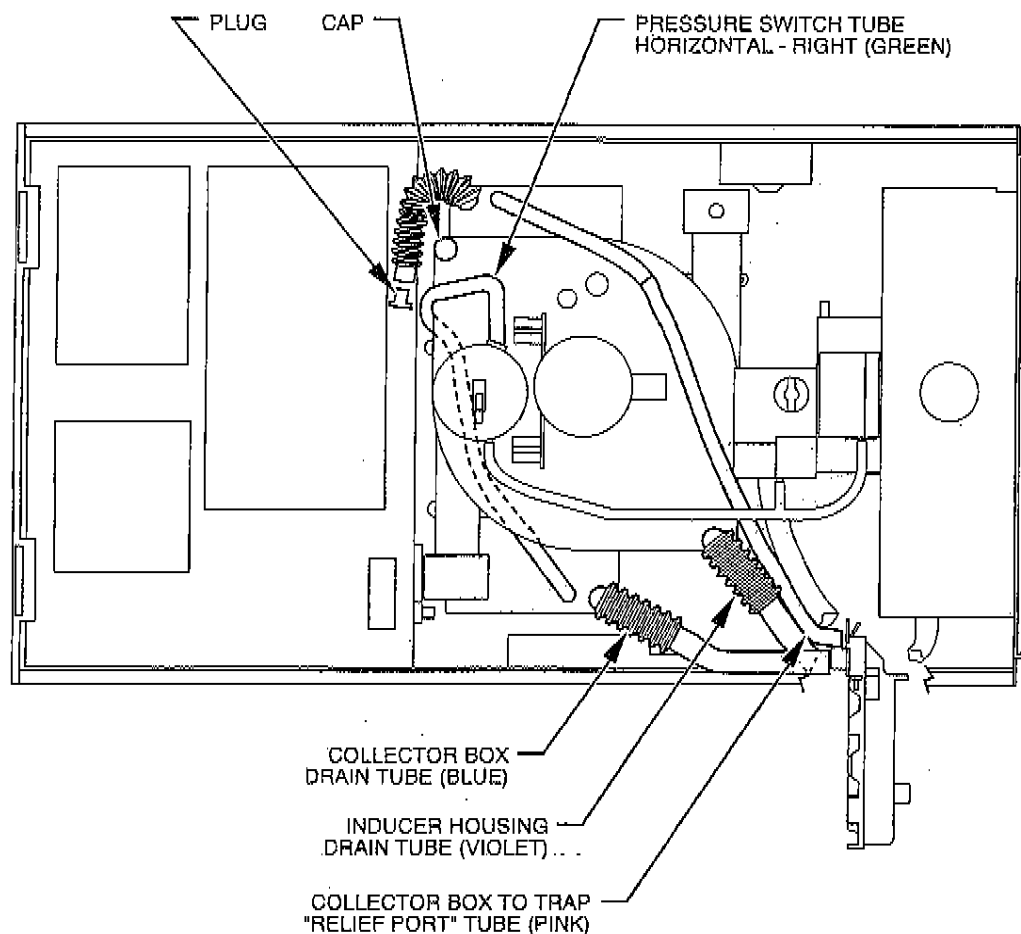


Fig. 10—Horizontal Right Tube Configuration

A93303

**NOTE:** Combustion-air and vent pipes are restricted to a minimum length of 5 ft. (See Table 7.)

**NOTE:** A 12-in. minimum horizontal pipe section is recommended with short (5 to 8 ft) vertical vent systems. This recommendation is to reduce excessive condensate droplets from exiting the vent pipe. (See Fig. 9.)

## II. LOCATION

### A. General

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

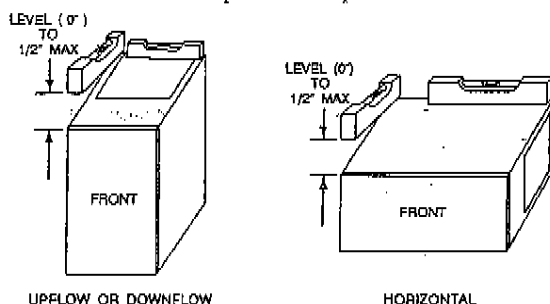


Fig. 11—Return-Air Temperature

A93042

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

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

Locate furnace so combustion-air pipe lengths are not exceeded. Refer to Table 7—Maximum Allowable Pipe Length.

**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.

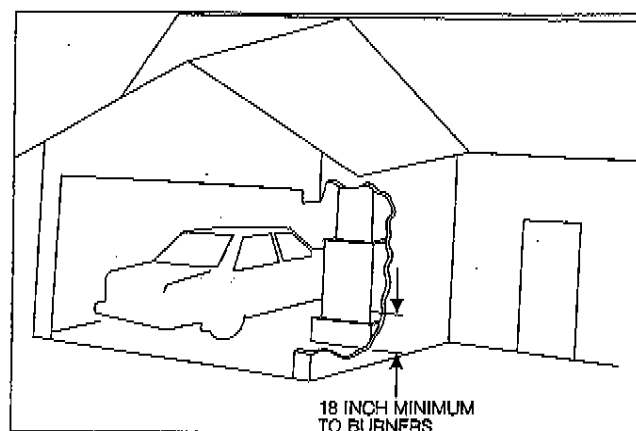
A93025

**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.

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

#### B. Furnace Location Relative to Cooling Equipment

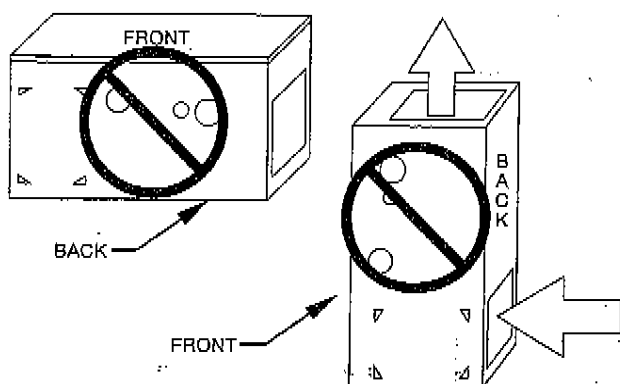
The cooling coil must be installed parallel with or on downstream side of furnace to avoid condensation in heat exchanger. When installed parallel with a furnace, dampers or other means used to control flow of air must prevent chilled air from entering furnace. If dampers are manually operated, they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



A93044

#### HAZARDOUS LOCATIONS

**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.



A93043

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

**CAUTION:** 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. INSTALLATION

#### CONDENSATE TRAP FREEZE PROTECTION

Refer to Section 6—Condensate Trap Freeze Protection section for recommendations and procedures.

#### CONDENSATE TRAP DRAIN

Refer to Section 6—Condensate Drain section for recommendations and procedures.

#### LEVELING LEGS (IF DESIRED)

When furnace is used in upflow position with side inlet(s), leveling legs may be desired. (See Fig. 12.) Install field-supplied corrosion-resistant 5/16-in. machine bolts and nuts.

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

1. Position furnace on its back, locate and drill a 5/16-in. diameter hole in each bottom corner of furnace. (See Fig. 12.) Holes in bottom closure panel may be used as guide locations.
2. For each hole, install nut on bolt and then install bolt and nut in hole. (Install flat washer if desired.)
3. Install another nut on other side of furnace base. (Install flat washer if desired.)
4. Adjust outside nut to provide desired height, and tighten inside nut to secure arrangement.

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

#### INSTALLATION ON A CONCRETE SLAB

1. Construct hole in floor per dimensions in Fig. 13 and Table 2.
2. Place plenum and furnace as shown in Fig. 14.

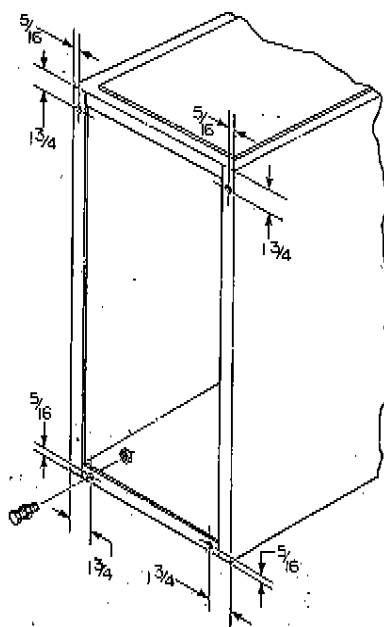


Fig. 12—Leveling Legs

A89014

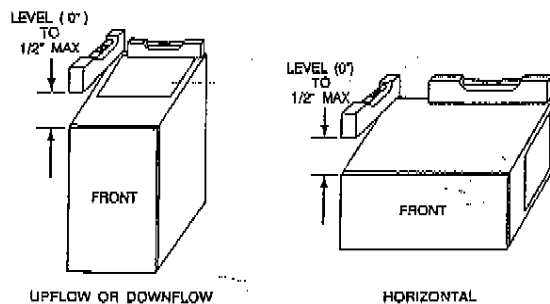


TABLE 2—OPENING DIMENSIONS (IN.)

A93025

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

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

#### INSTALLATION ON COMBUSTIBLE FLOOR

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

**NOTE:** Remove furnace perforated, discharge duct flanges when they interfere with mating flanges on coil on downflow subbase. To remove furnace perforated, discharge duct flange, use wide duct pliers or duct flange tool to bend flange back-and-forth until it breaks off. Be careful of sharp edges. (See Fig. 15.)

**WARNING:** Do not bend duct flanges inward as shown in Fig. 15. This will affect air flow across heat exchangers and may cause limited cycling or premature heat exchanger failures. Remove duct flange completely or bend it inward a minimum of 210° as shown in Fig. 15.

2. When complete, downflow subbase, plenum, and furnace (or coil casing when used) should be installed as shown in Fig. 16.

**NOTE:** These furnaces can be installed horizontally in either horizontal left or right discharge position. In a crawl space, furnace can either be hung from floor joist or installed on suitable blocks

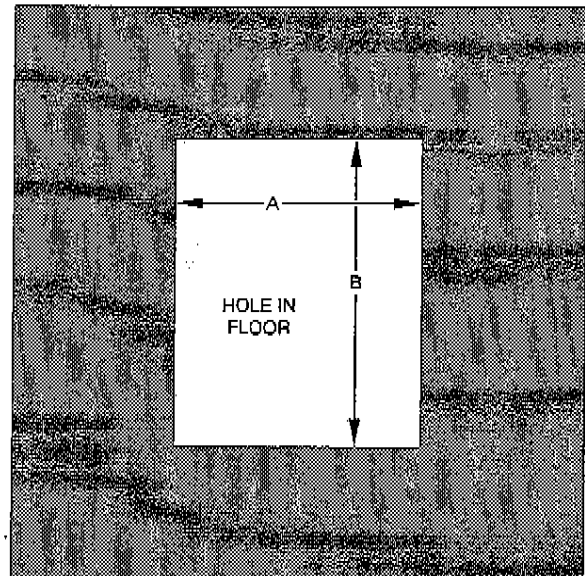


Fig. 13—Floor Opening in Concrete Slab

A73382

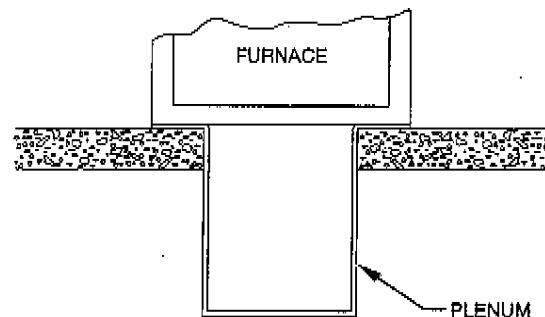


Fig. 14—Furnace on a Concrete Slab (Non-Garage Installation)

A73383

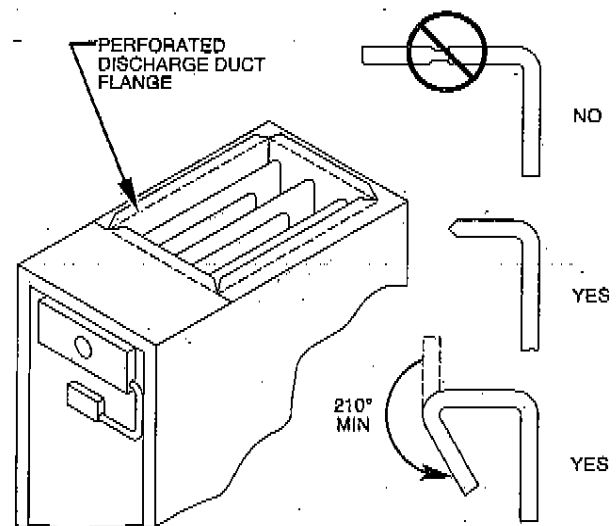
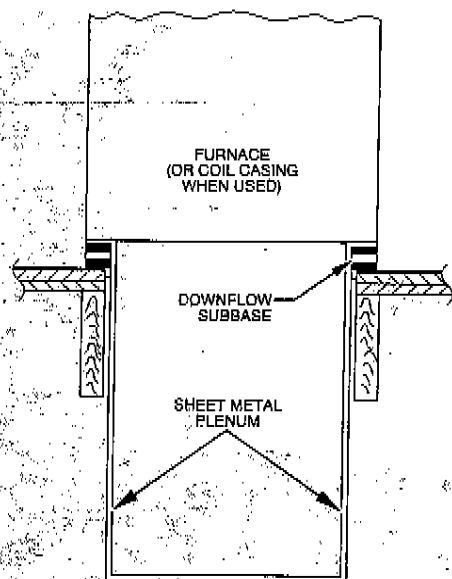


Fig. 15—Duct Flanges

A93029

or pad. Furnace can be suspended from each corner by hanger bolts (4 each 3/8-in. all-thread rod) cut to desired length, 1 by 3/8 flat washer, 3/8 lockwasher, and 3/8 nut. Dimples are provided for hole locations. (See Fig. 2.)



A78651

Fig. 16--Furnace, Plenum, and Subbase Installed on a Combustible Floor

### A. Filter



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

### FILTER ARRANGEMENT

Factory-supplied washable framed filters are 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. 2 for location and size of bottom and side return-air openings.

TABLE 3--FILTER INFORMATION

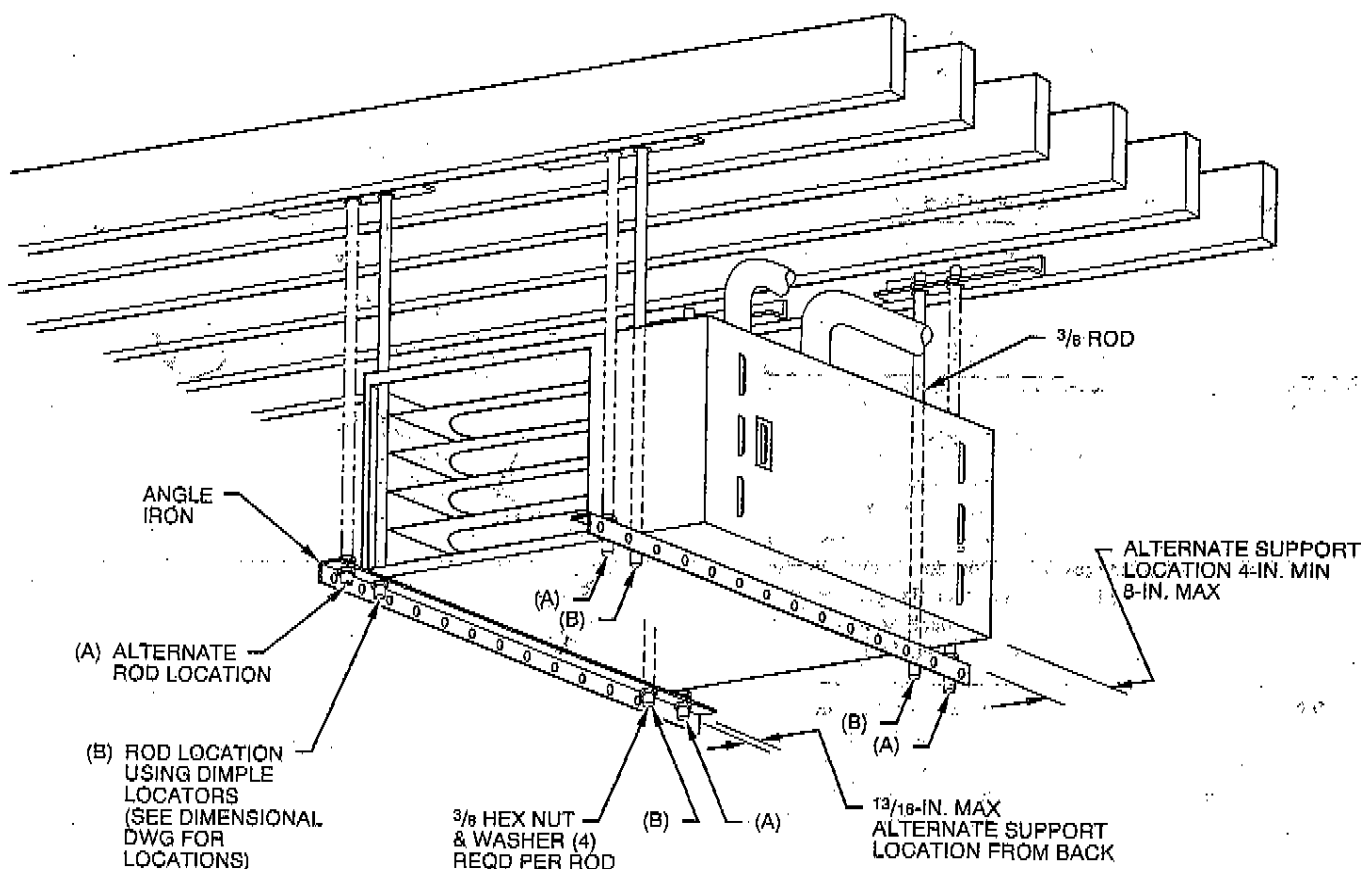
| FURNACE CASING WIDTH (IN.) | FILTER SIZE (IN.)* |                  | FILTER TYPE FRAMED |
|----------------------------|--------------------|------------------|--------------------|
|                            | Side Return        | Bottom Return    |                    |
| 17-1/2                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

\* Filters can be field modified by cutting frame as marked and folding to desired size. Alternate sizes can be ordered from your distributor or dealer.

† Factory provided with furnace.



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



NOTE: 1-in. clearance minimum between top of furnace and combustible material

Fig. 17--Crawlspace Horizontal Application

A93323

**NOTE:** Side return-air openings can **ONLY** be used in UPFLOW installed configurations. Install filter(s) as shown in Fig. 18.

For bottom return-air applications, filter may need to be cut to fit some furnace widths. Install filter as shown in Fig. 19.

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

### B. Bottom Closure Panel

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

**Removal of Bottom Closure Panel** – To remove bottom closure panel, perform following:

1. Tilt or raise furnace and remove 2 screws holding front filler panel. (See Fig. 20.)
2. Rotate front filler panel downward to release holding tabs.
3. Remove bottom closure panel.
4. Reinstall front filter panel and screws.

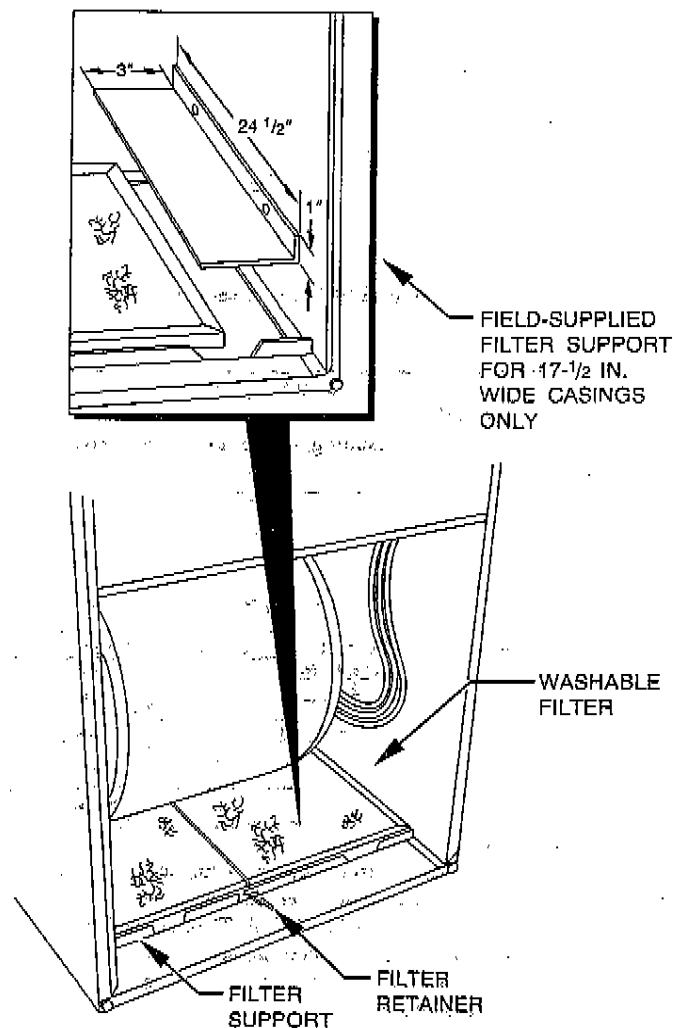
### C. Gas Piping

Gas piping must be installed in accordance with national and local codes. Refer to current edition of National Fuel Gas Code. Canadian installations must be made in accordance with CAN/CGA-B149 Installation Codes, 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:** Use a backup wrench when connecting gas pipe to furnace to avoid damaging gas controls.

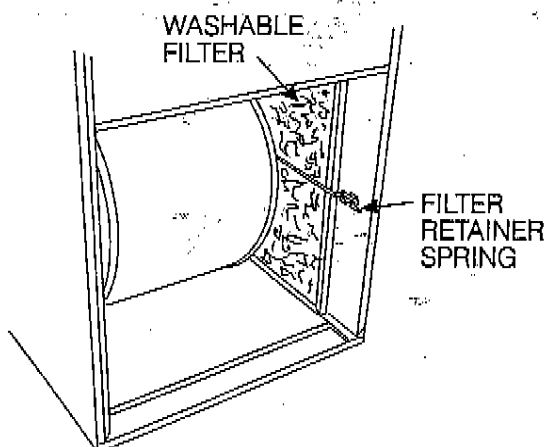
**WARNING:** Gas valve knob **MUST** be facing forward or tilted upward. Failure to follow this warning could result in property damage or death.

**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.



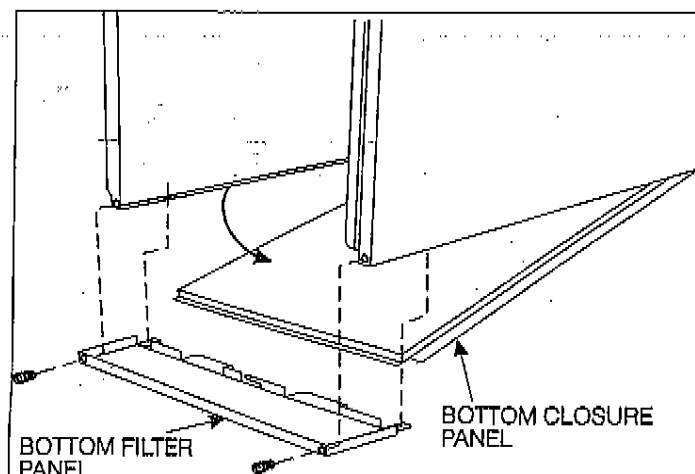
A93321

Fig. 19-Bottom Filter Arrangement



A93045

Fig. 18-Filter Installed for Side Inlet



A93047

Fig. 20-Removing Bottom Closure Panel

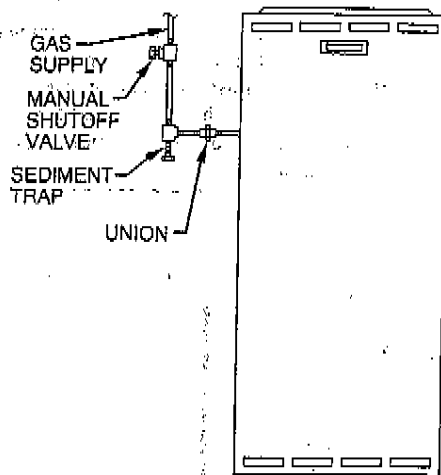


Fig. 21—Typical Gas Pipe Arrangement

A93324

**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.

TABLE 4—MAXIMUM CAPACITY OF PIPE\*

| NOMINAL IRON PIPE SIZE (IN.) | INTERNAL DIAMETER (IN.) | LENGTH OF PIPE (FT) |      |      |     |     |
|------------------------------|-------------------------|---------------------|------|------|-----|-----|
|                              |                         | 10                  | 20   | 30   | 40  | 50  |
| 1/2                          | 0.622                   | 175                 | 120  | 97   | 82  | 73  |
| 3/4                          | 0.824                   | 380                 | 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 C-4 NFPA 54-1992.

Install a sediment trap in riser leading to furnace. Trap can be installed by connecting a tee to riser leading to furnace, so that straight-through section of tee is vertical. Then connect a capped nipple into lower end of tee. Capped nipple should extend below level of gas controls. Place a ground joint union between gas control manifold and manual gas shutoff valve. (See Fig. 21.)

**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 (See Fig. 45.) 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. Piping should be pressure tested in accordance with local and national plumbing and gas codes before furnace has been attached. In Canada, refer to current edition of National Standard of Canada CAN/CGA-B149 Installation Codes. 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), close manual shutoff valve 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.

#### IV. ELECTRICAL CONNECTIONS

See Fig. 22 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 24-v power to control center. No component operation can occur. The 115-v power is still present at control center and transformer. 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 lockout. Control is grounded through green wire routed to gas valve and burner box screw.

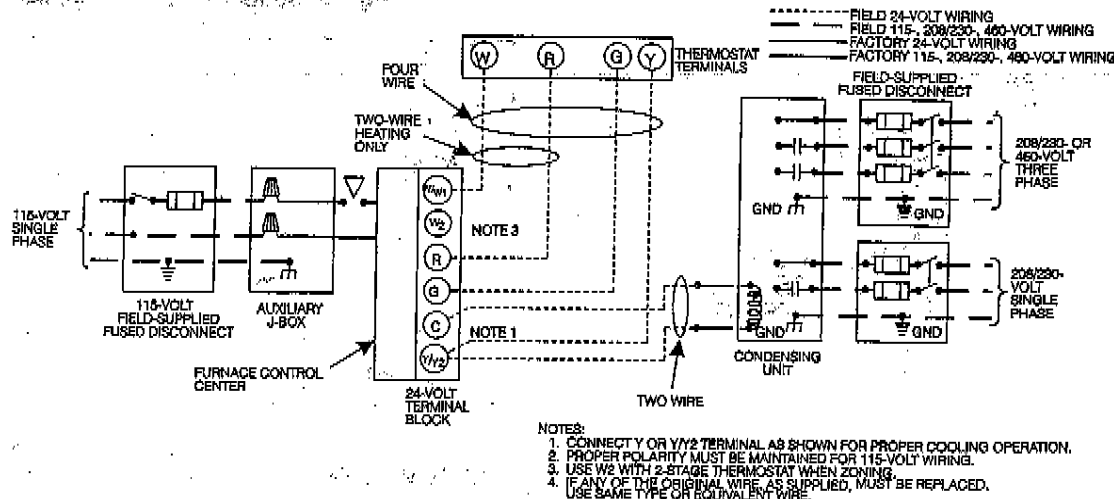


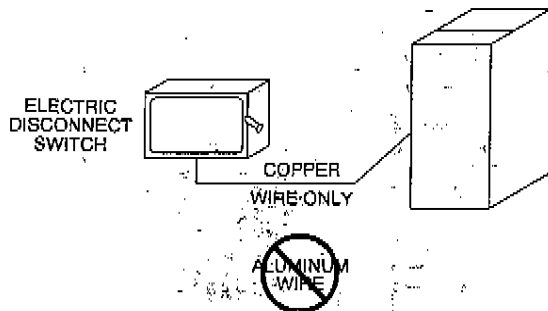
Fig. 22—Heating and Cooling Application Wiring Diagram

A93049

### A. 115-v Wiring

Before proceeding with electrical connections, make certain that voltage, frequency, and phase correspond to that specified on unit rating plate. Also, check to be sure that service provided by utility is sufficient to handle load imposed by this equipment. Refer to rating plate or to Table 5 for equipment electrical specifications.

Make all electrical connections in accordance with National Electrical Code ANSI/NFPA 70-1993 and any local codes or ordinances that might apply. For Canadian installations, all electrical connections must be made in accordance with CSA C22.1 Canadian Electrical Code, or subauthorities having jurisdiction.



A93033

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

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

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

**WARNING:** Cabinet MUST have an uninterrupted or unbroken ground according to National Electrical Code, ANSI/NFPA 70-1993 and Canadian Electrical Code, CSA C22.1 or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground. Failure to follow this warning could result in electrical shock, fire, or death.

### J-BOX RELOCATION

1. Remove 2 screws holding auxiliary J-box. (See Fig. 24.)
2. Rotate J-box 180° and attach box to right side, using holes provided.

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

### B. 24-v Wiring

Make field 24-v thermostat connections at 24-v terminal block on control center. Y wire from thermostat must be connected to Y terminal on control center, as shown in Fig. 22, for proper cooling operation. The 24-v terminal board is marked for easy connection of field wiring. (See Fig. 23.) The 24-v circuit contains a 3-amp, automotive-type fuse located on control center. (See Fig. 25.) 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.

### C. Accessories

#### 1. Electronic Air Cleaner (EAC)

Two spring clamp terminals (for 12 gage maximum, solid or stranded wire), marked EAC-1 and EAC-2, are provided for EAC connection. (See Fig. 25.) These terminals are energized with 115v (1.5-amp maximum) during blower motor operation. To connect EAC power leads to furnace control center, strip approximately 1/8 in. of insulation from wire. Open terminal by depressing switch arm with a screwdriver or finger, and insert wire as shown in Fig. 26.

TABLE 5—ELECTRICAL DATA

| FURNACE SIZE | VOLTS-HERTZ-PHASE | OPERATING VOLTAGE RANGE |      | MAX UNIT AMPS | MIN WIRE SIZE | MAX WIRE LENGTH (FT)† | MAX FUSE OR CKT BKR AMPS‡ |
|--------------|-------------------|-------------------------|------|---------------|---------------|-----------------------|---------------------------|
|              |                   | Max*                    | Min* |               |               |                       |                           |
| 024040       | 115-60-1          | 127                     | 104  | 7.1           | 14            | 52                    | 15                        |
| 036040       | 115-60-1          | 127                     | 104  | 9.7           | 14            | 38                    | 15                        |
| 036060       | 115-60-1          | 127                     | 104  | 9.7           | 14            | 38                    | 15                        |
| 048060       | 115-60-1          | 127                     | 104  | 12.7          | 14            | 29                    | 15                        |
| 036080       | 115-60-1          | 127                     | 104  | 9.5           | 14            | 39                    | 15                        |
| 048080       | 115-60-1          | 127                     | 104  | 13.1          | 14            | 28                    | 15                        |
| 060080       | 115-60-1          | 127                     | 104  | 16.1          | 12            | 35                    | 20                        |
| 048100       | 115-60-1          | 127                     | 104  | 13.3          | 14            | 27                    | 15                        |
| 060100       | 115-60-1          | 127                     | 104  | 16.1          | 12            | 35                    | 20                        |
| 060120       | 115-60-1          | 127                     | 104  | 17.6          | 12            | 32                    | 20                        |

\* Permissible limits of voltage range at which unit will operate satisfactorily.

† Length shown is as measured 1 way along wire path between unit and service panel for maximum 2 percent voltage drop.

‡ Time-delay fuse is recommended.



## 2. Humidifier (HUM)

Screw terminals (HUM and C) are provided for 24-v humidifier connection. (See Fig. 23.) HUM terminal is energized with 24-v (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.

## 3. Dehumidification (DH)

A 1/4-in. male quick connect terminal is provided on the control center to attach a normally open (N/O) humidistat contact when dehumidification is desired. Connect the humidistat to the thermostat R terminal and DH terminal on the control center. A 15 percent reduction of the cooling airflow or constant fan airflow will occur when the DH terminal is energized and a "call for cooling", single or 2-speed, is received.

## V. DIRECT VENTING

The 490AAV furnace requires a dedicated (one 490AAV furnace only) 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.

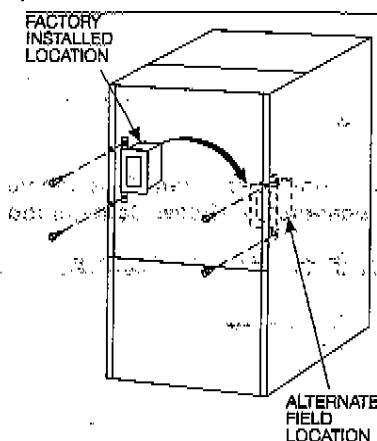


Fig. 24—Relocating J-Box

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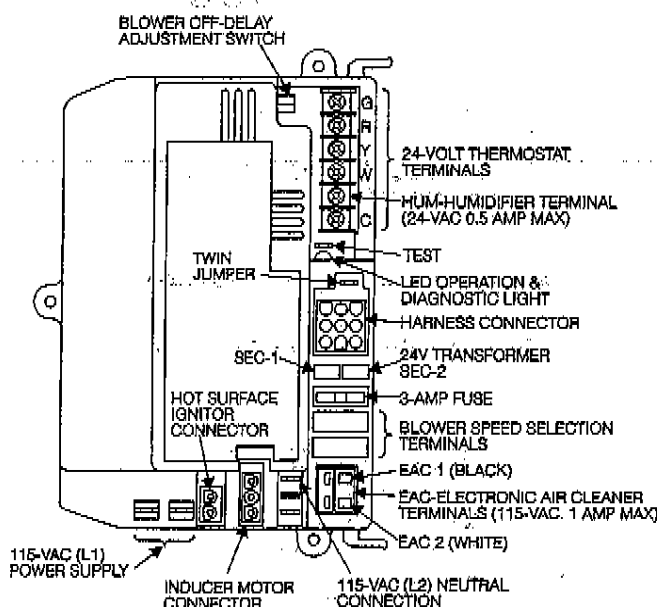
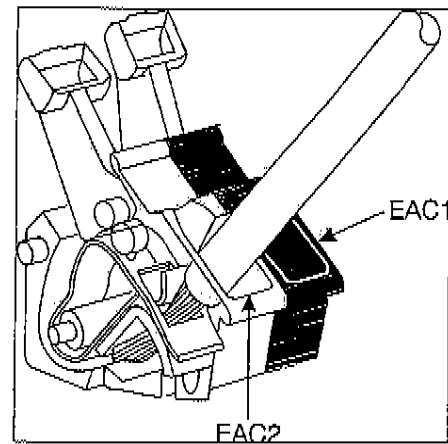


Fig. 25—Control Center

A93052



A93053

Fig. 26—EAC Terminals on Control Center

### A. Removal of Existing Furnaces from Common Vent Systems

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

1. Seal any unused openings in common vent system.
2. Visually inspect vent system for proper size and horizontal pitch, and determine there is no blockage or restriction, leakage, corrosion, and other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between space in which appliances remaining connected to common vent system are located and other spaces of building. Turn on clothes dryers and any appliance not connected to common vent system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Follow lighting instructions and place appliance in operation. Adjust thermostat so appliance will operate continuously.
5. Test for flue gas spillage at drafthood relief opening after 5 minutes of main burner operation. Use flame of a match or candle, etc.
6. After it has been determined that each appliance remaining connected to common vent system properly vents when tested as above, return doors, windows, exhaust fans, fireplace dampers, any other gas burning appliances to their previous condition of use.
7. If improper venting is observed during any of above tests, common vent 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 Part 11 of National Fuel Gas Code NFPA 54 or ANSI Z223.1-1992, or Section 5 of CAN/CGA-B149 for Canadian standards.

### B. COMBUSTION-AIR AND VENT PIPING

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), or F628 (schedule-40 ABS). Pipe cement and primer must conform to ASTM standards D2564 (PVC) or D2235 (ABS). See Table 7 for maximum pipe lengths and Fig. 30, 31, 32, 33, and 34 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. 27.) This will allow proper drainage of vent condensate.

**NOTE:** Vertical vent installations may require two 45° elbows instead on one 90° elbow to minimize gurgling sound from excessive condensate draining in vent pipe. (See Fig. 27.)

**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      |
| Gas appliance vent terminal                                                                                                | 3              | 3      |
| From any mechanical fresh air intake                                                                                       | 1              | 6      |
| For furnaces with an input capacity less than 100,000 Btuh—from any non-mechanical air supply or combustion-air opening    | 1              | 1      |
| For furnaces with an input capacity greater than 100,000 Btuh—from any non-mechanical air supply or combustion-air opening | 1              | 3      |
| From service regulator, vent, electric and gas meters, and relief equipment                                                | 4*             | 6†     |
| Above grade when adjacent to public walkway                                                                                | 7              | 7      |

If installing 2 adjacent 490AAV furnaces, refer to Multi-Venting and Vent Terminations of 490AAV furnaces for proper vent configurations.

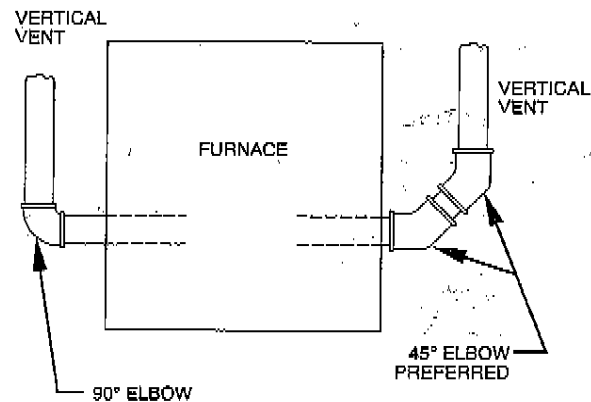
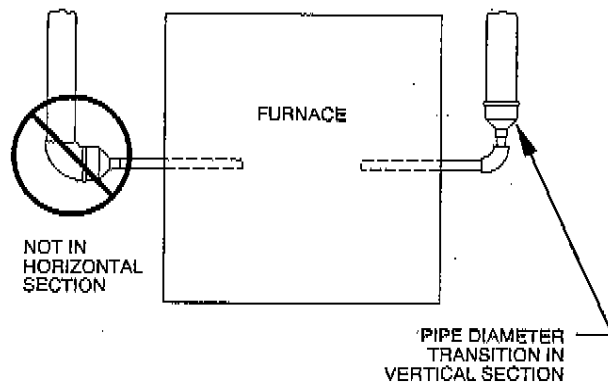
\* Horizontal distance.

†36 in. to electric meter in Canada only.  
†18 in. above roof surface in Canada.

Combustion-air and vent pipes must terminate together in same atmosphere pressure zone, either through roof or sidewall (roof termination preferred), using 1 of 4 accessory termination kits. See Table 6 for required clearances.

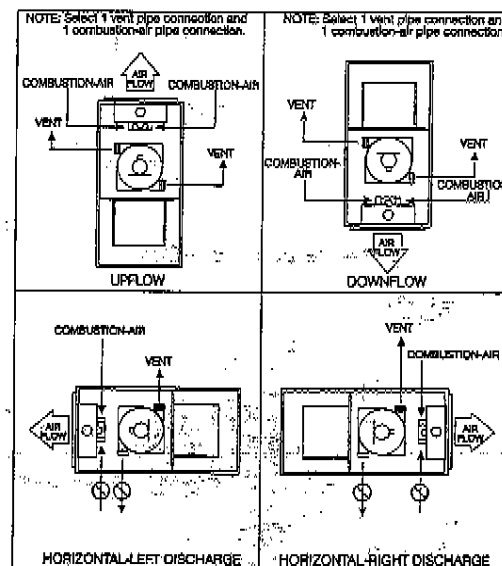
Furnace combustion-air and vent pipe connections must be attached as shown in Fig 28. Combustion-air intake plug fitting and inducer housing tuning valve may need to be relocated in some applications.

**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.



A93034

**Fig. 27—Combustion-Air and Vent Pipe Diameter Transition Location and Elbow Configuration**



A93083

**Fig. 28—Combustion-Air and Vent Pipe Connections**

**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.

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

**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. 30, 31, 32, 33, and 34. Failure to follow this warning could result in property damage, personal injury, or death.

### COMBUSTION-AIR INTAKE HOUSING PLUG FITTING

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

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

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

**NOTE:** Moisture in combustion-air intake may be result of improper termination. Ensure combustion-air intake pipe is similar to that shown in Fig. 30, 31, 32, 33, or 34 so it will not be susceptible to areas where light snow or other sources of moisture could be pulled in.

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. 29.)

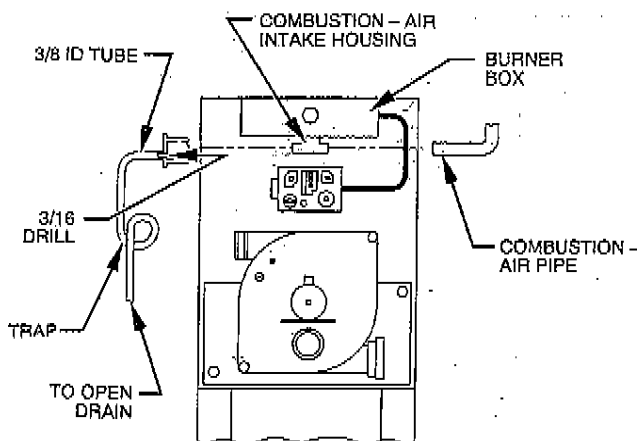


Fig. 29—Intake Housing Plug Fitting Drain

A93035

Combustion-air intake pipe must be connected as shown in Fig. 28 for application. Insert 2-in. pipe into appropriate opening of combustion-air intake housing. Drill a 1/8-in. hole in pipe using hole in combustion-air intake housing as a guide. Install a field-supplied No. 6 or No. 8 sheet metal screw.

**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.

Vent pipe must be connected as shown in Fig. 28 for application. Locate tuning valve to unused pipe opening. See details below. Locate neoprene coupling and clamp on appropriate vent pipe inducer housing connection. Insert 2-in. vent pipe through coupling and bottom it in inducer housing. Tighten clamp securely to pipe and inducer housing.

### TUNING VALVE

Tuning valve is factory located in left inducer housing vent connection. If tuning valve needs to be relocated, turn it COUNTER-CLOCKWISE until tabs on inducer housing hit tuning valve stops. Pull tuning valve out of inducer housing and insert it in unused inducer housing opening. Install it by aligning tabs on inducer housing with slots in tuning valve. Slide tuning valve into inducer housing opening and turn CLOCKWISE until tabs engage on notches. See Section-6 Start-Up procedures for adjustment of tuning valve.

### COMBUSTION-AIR AND VENT PIPE DIAMETER

Determine combustion-air and vent pipe diameter.

1. Using Table 7, determine preliminary combustion-air pipe diameter.
2. Using Table 7, determine preliminary vent pipe diameter.
3. Use largest diameter pipe determined in (1) and (2) above for both pipes.

**NOTE:** Do not count elbows or pipe sections in terminations or within furnace. See shaded areas in Fig. 30, 31, 32, 33, and 34.

**EXAMPLE:** An 036080 size furnace located in Indianapolis, elevation 650 ft above sea level, could be installed in an application requiring 3 elbows and 42 ft of vent pipe, along with 5 elbows and 44 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 55 ft with 3 elbows, but 40 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 25 ft with 5 elbows, and 2-1/2 in. pipe is good for 70 ft with 5 elbows.

### COMBUSTION-AIR AND VENT PIPE ATTACHMENT

1. Attach combustion-air pipe to intake housing and secure with screw as stated above.

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

2. Working from furnace to outside, cut pipe to required length(s).
3. Deburr inside and outside of pipe.
4. Chamfer outside edge of pipe for better distribution of primer and cement.
5. Clean and dry all surfaces to be joined.
6. 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.

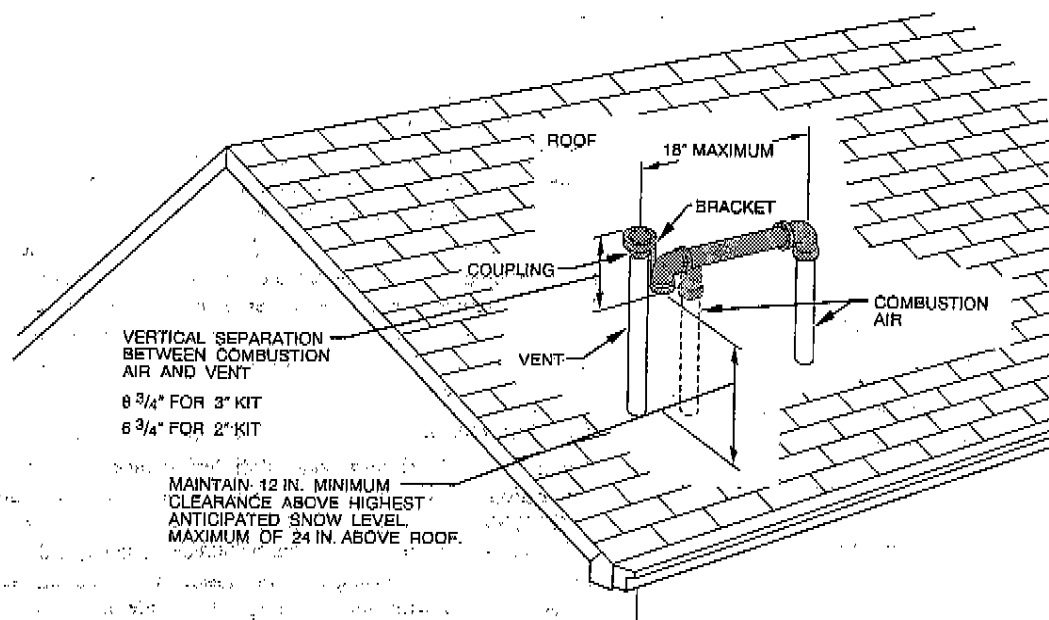


Fig. 30-Roof Termination (Preferred)

A87224

7. 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.
8. While cement is still wet, insert pipe into socket with a 1/4-turn twist. Be sure pipe is fully inserted into fitting socket.
9. Wipe excess cement from joint. A continuous bead of cement will be visible around perimeter of a properly made joint.
10. Handle pipe joints carefully until cement sets.
11. 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.
12. Slope combustion-air and vent pipes toward furnace a minimum of 1/4 in. per linear ft with no sags between hangers.
13. Use appropriate methods to seal openings where vent and combustion-air pipes pass through roof or side wall.

#### C. 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. 30, 31, 32, 33, and 34. Four termination kits are available.

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

**NOTE:** Shaded parts in Fig. 30, 31, 32, 33, and 34 are considered to be termination. These components should NOT be counted when determining pipe diameter.

**NOTE:** Roof termination is preferred since it is less susceptible to damage, has reduced changes to intake contaminants, and has less visible vent vapors. See Fig. 30 or 31.

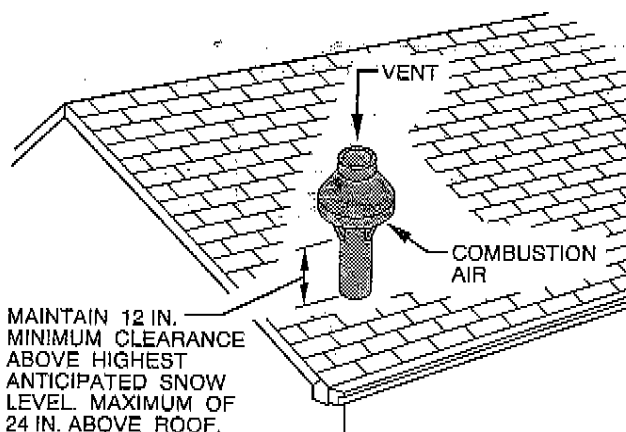
**NOTE:** Sidewall termination may require sealing or shielding of building surfaces with a corrosive resistance material due to corrosive combustion products of vent system.

#### D. Extended Exposed Sidewall Pipes

Sidewall combustion-air and vent pipe terminations may be extended beyond area shown in Fig. 32 or 33 in outside ambients 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.

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



A93054

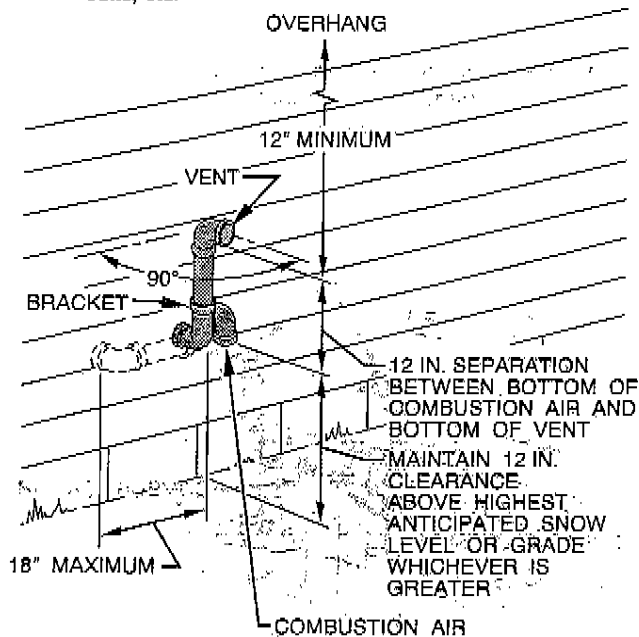
Fig. 31-Concentric Vent and Combustion-Air Termination, Roof Termination (Preferred)

### E. Two-Pipe Termination Kit

#### 1. Determine location for termination.

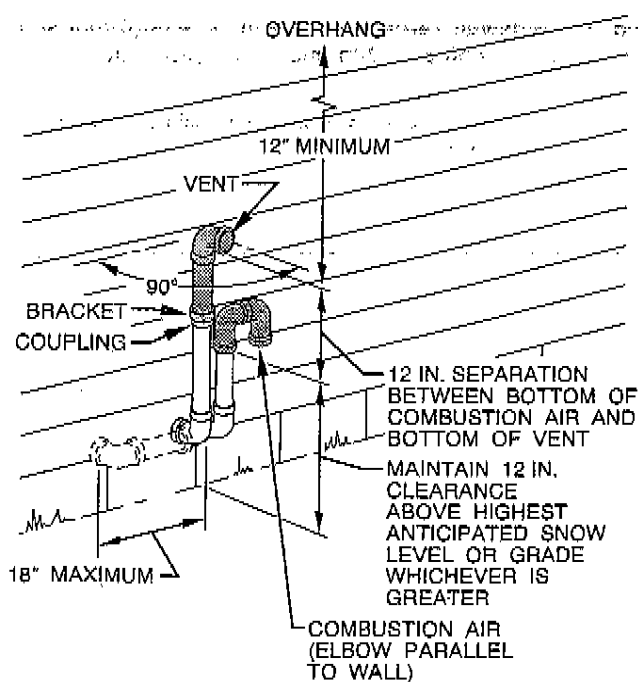
Considerations for following should be used when determining an appropriate location for termination kit.

- Comply with all clearance requirements as stated in Table 6.
- Termination kit should be positioned where vent vapors will not damage plants/shrubs or air conditioning equipment.
- Termination kit should be positioned so that it will not be affected by wind eddy, or allow recirculation of flue gases, airborne leaves, or light snow.
- Termination kit should be positioned where it will not be damaged or subjected to foreign objects, such as stones, balls, etc.



A87225

Fig. 32—Sidewall Termination (12 in. or more)



A87226

Fig. 33—Sidewall Termination (less than 12 in.)

- Termination kit should be positioned where vent vapors are not objectionable.

- Cut 2 holes, 1 for each pipe, of appropriate size for pipe size being used.

- 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. 30.

For applications using combustion-air pipe option, indicated by dashed lines in Fig. 30, 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. 32 or 33.

For applications using vent pipe option indicated by dashed lines in Fig. 32, rotate vent elbow 90° from position shown in Fig. 32.

- Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.

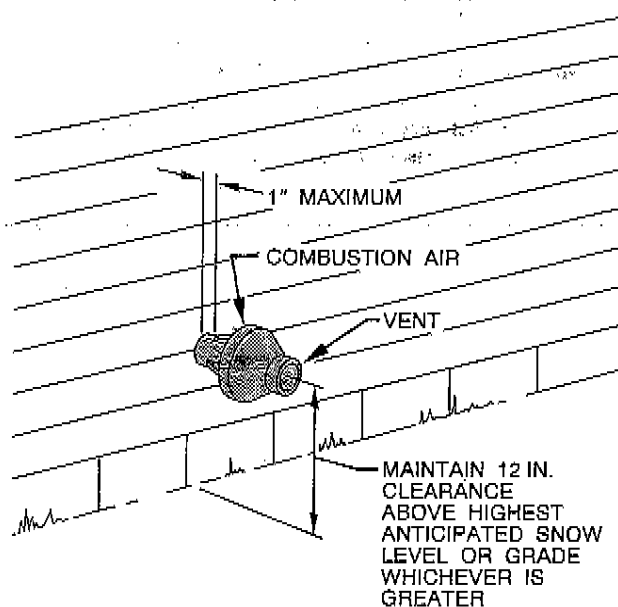
- Check required dimensions as shown in Fig. 30, 32, or 33.

### F. Concentric Vent/Air Termination Kit

#### 1. Determine location for termination.

Considerations for following should be used when determining an appropriate location for termination kit.

- Comply with all clearance requirements as stated in Table 6.
- Termination kit should be positioned where vent vapors will not damage plants/shrubs or air conditioning equipment.
- Termination kit should be positioned so it will not be affected by wind eddy, or that may allow recirculation of flue gases, airborne leaves, or light snow.
- Termination kit should be positioned where it will not be damaged or subjected to foreign objects, such as stones, balls, etc.
- Termination kit should be positioned where vent vapors are not objectionable.



A93055

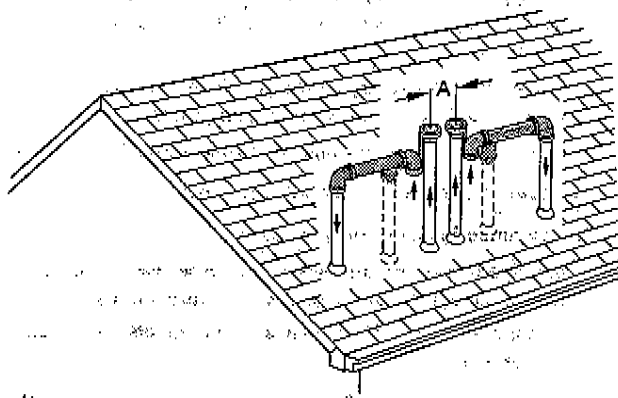
Fig. 34—Concentric Vent and Combustion-Air Side Termination

2. Cut 1 hole. A 4-in. diameter hole for 2-in. kit, or a 5-in. diameter hole for 3-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. 31.

**Sidewall terminations** – Locate assembly through side-wall, with rain shield positioned no more than 1-in. from wall as shown in Fig. 34.



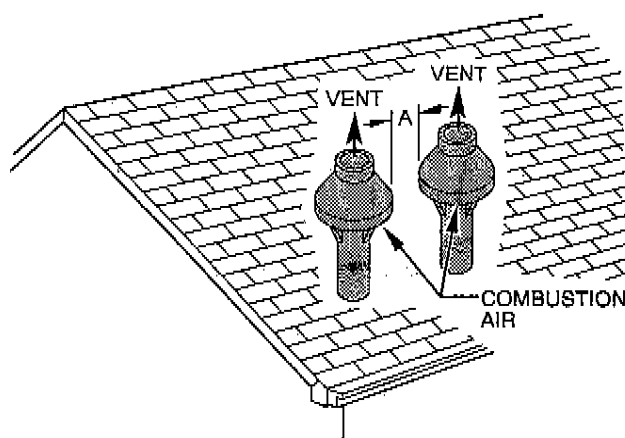
A85182

**Fig. 35—Rooftop Termination (Dimension A as touching or 2-in. maximum separation)**

5. Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.
6. Check required dimensions as shown in Fig. 31 or 34.

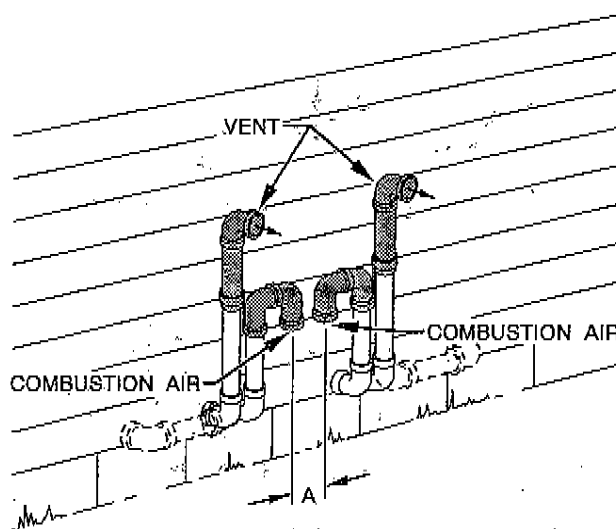
#### G. Multiventing and Vent Terminations of 490AAV Furnace

When 2 or more 490AAV furnaces are vented near each other, each furnace must be individually vented. NEVER common vent or breach vent 490AAV furnaces. When 2 or more 490AAV furnaces are vented near each other, 2 vent terminations may be installed as shown in Fig. 35, 36, 37, 38, or 39, but next vent termination must be at least 36 in. away from first 2 terminations. It is important that vent terminations be made as shown to avoid recirculation of flue gases. Dimension A in Fig. 35, 36, 37, 38, and



A83056

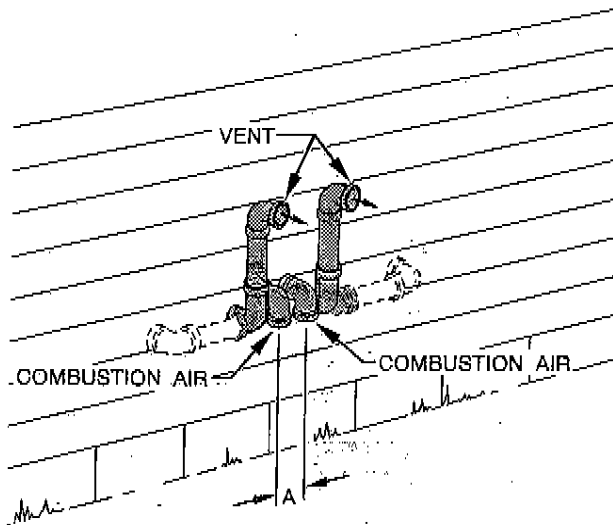
**Fig. 36—Concentric Vent and Combustion-Air Roof Termination (Dimension A as touching or 2-in. maximum separation)**



A85184

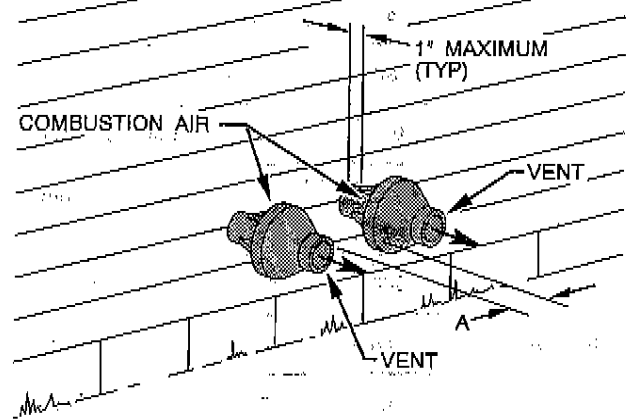
**Fig. 37—Sidewall Termination (12 in. or less) (Dimension A as touching or 2-in. maximum separation)**

39 represents distance between pipes or rain shields, as touching or 2 in. maximum separation.



A85183

Fig. 38—Sidewall Termination (more than 12 in.) (Dimension A as touching or 2-in. maximum separation)



A93057

Fig. 39—Concentric Vent and Combustion Air Termination (Dimension A as touching or 2-in. maximum separation)

TABLE 7—MAXIMUM ALLOWABLE PIPE LENGTH (FT)

| ALTITUDE     | UNIT SIZE    | TERMINATION TYPE           | PIPE DIAMETER (IN.) | NUMBER OF 90° ELBOWS |    |    |    |    |    |
|--------------|--------------|----------------------------|---------------------|----------------------|----|----|----|----|----|
|              |              |                            |                     | 1                    | 2  | 3  | 4  | 5  | 6  |
| 0 TO 2000    | 040          | 2 Pipe or 2-In. Concentric | 1                   | 5                    | 5  | 0  | 0  | 0  | 0  |
|              |              |                            | 1-1/2               | 70                   | 70 | 70 | 70 | 70 | 70 |
|              | 060          | 2 Pipe or 2-In. Concentric | 1-1/2               | 35                   | 30 | 20 | 15 | 15 | 10 |
|              |              |                            | 2                   | 70                   | 70 | 70 | 70 | 70 | 70 |
|              | 080          | 2 Pipe or 2-In. Concentric | 1-1/2               | 10                   | 5  | 0  | 0  | 0  | 0  |
|              |              |                            | 2                   | 65                   | 60 | 55 | 45 | 40 | 35 |
|              |              |                            | 2-1/2               | 70                   | 70 | 70 | 70 | 70 | 70 |
|              | 100          | 2 Pipe or 2-In. Concentric | 2                   | 10                   | 5  | 0  | 0  | 0  | 0  |
|              |              | 2 Pipe or 3-In. Concentric | 2-1/2               | 65                   | 60 | 50 | 45 | 35 | 25 |
|              | 120          | 2 Pipe or 3-In. Concentric | 3                   | 70                   | 70 | 70 | 70 | 70 | 70 |
|              |              |                            | 2-1/2               | 10                   | 5  | 5  | 0  | 0  | 0  |
|              |              |                            | 3                   | 40                   | 35 | 30 | 15 | 5  | 0  |
| 2001 to 3000 | 040          | 2 Pipe or 2-In. Concentric | 3*                  | 70                   | 70 | 70 | 70 | 70 | 70 |
|              |              |                            | 1-1/2               | 70                   | 70 | 70 | 70 | 66 | 61 |
|              | 060          | 2 Pipe or 2-In. Concentric | 1-1/2               | 31                   | 26 | 16 | 11 | 11 | 6  |
|              |              |                            | 2                   | 70                   | 67 | 66 | 61 | 61 | 61 |
|              | 080          | 2 Pipe or 2-In. Concentric | 2                   | 58                   | 53 | 48 | 39 | 34 | 29 |
|              |              |                            | 2-1/2               | 70                   | 70 | 70 | 70 | 70 | 70 |
|              | 100          | 2 Pipe or 3-In. Concentric | 2-1/2               | 58                   | 53 | 44 | 39 | 29 | 20 |
|              |              |                            | 3                   | 70                   | 70 | 70 | 70 | 70 | 70 |
|              | 120          | 2 Pipe or 3-In. Concentric | 3                   | 35                   | 30 | 25 | 11 | 2  | 0  |
|              |              |                            | 3*                  | 63                   | 62 | 62 | 61 | 61 | 61 |
|              |              |                            | 1-1/2               | 70                   | 70 | 67 | 66 | 61 | 56 |
|              | 3001 to 4000 | 040                        | 1-1/2               | 29                   | 24 | 15 | 10 | 9  | 0  |
|              |              |                            | 2                   | 68                   | 63 | 62 | 57 | 57 | 56 |
|              |              | 060                        | 2                   | 55                   | 50 | 45 | 36 | 31 | 26 |
|              |              |                            | 2-1/2               | 70                   | 70 | 70 | 70 | 70 | 70 |
|              |              | 080                        | 2-1/2               | 55                   | 50 | 41 | 36 | 26 | 17 |
|              |              |                            | 3                   | 70                   | 70 | 70 | 70 | 70 | 70 |
|              |              | 120                        | 3                   | 33                   | 28 | 23 | 10 | 0  | 0  |
|              |              |                            | 3*                  | 59                   | 59 | 58 | 57 | 57 | 56 |

| ALTITUDE        | UNIT SIZE       | TERMINATION TYPE           | PIPE DIAMETER (IN.)        | NUMBER OF 90° ELBOWS |    |    |    |    |    |    |
|-----------------|-----------------|----------------------------|----------------------------|----------------------|----|----|----|----|----|----|
|                 |                 |                            |                            | 1                    | 2  | 3  | 4  | 5  | 6  |    |
| 4001 to 5000†   | 040             | 2 Pipe or 2-In. Concentric | 1-1/2                      | 70                   | 67 | 62 | 62 | 57 | 52 |    |
|                 | 060             | 2 Pipe or 2-In. Concentric | 1-1/2                      | 27                   | 22 | 13 | 8  | 7  | 0  |    |
|                 |                 |                            | 2                          | 64                   | 59 | 58 | 53 | 52 | 52 |    |
|                 | 080             | 2 Pipe or 2-In. Concentric | 2                          | 52                   | 47 | 42 | 33 | 28 | 23 |    |
|                 |                 |                            | 2-1/2                      | 70                   | 70 | 70 | 70 | 70 | 70 |    |
|                 | 100             | 2 Pipe or 3-In. Concentric | 2-1/2                      | 52                   | 47 | 38 | 33 | 24 | 15 |    |
| 5001 to 6000†   | 120             | 2 Pipe or 3-In. Concentric | 3                          | 70                   | 70 | 70 | 70 | 70 | 70 |    |
|                 |                 |                            | 3                          | 31                   | 26 | 21 | 8  | 0  | 0  |    |
|                 | 040             | 2 Pipe 2-In. Concentric    | 1-1/2                      | 56                   | 55 | 54 | 53 | 52 | 52 |    |
|                 | 060             | 2 Pipe or 2-In. Concentric | 1-1/2                      | 68                   | 63 | 58 | 57 | 52 | 47 |    |
|                 |                 |                            | 2                          | 26                   | 21 | 12 | 7  | 6  | 0  |    |
|                 | 080             | 2 Pipe or 2-In. Concentric | 2                          | 60                   | 55 | 54 | 49 | 48 | 47 |    |
| 2-1/2           |                 |                            | 49                         | 44                   | 39 | 30 | 25 | 20 |    |    |
| 6001 to 7000†   | 100             | 2 Pipe or 3-In. Concentric | 2-1/2                      | 70                   | 70 | 70 | 70 | 70 | 70 |    |
|                 |                 |                            | 3                          | 49                   | 44 | 35 | 30 | 21 | 12 |    |
|                 | 120             | 2 Pipe or 3-In. Concentric | 3                          | 70                   | 70 | 70 | 70 | 70 | 70 |    |
|                 |                 |                            | 3                          | 29                   | 24 | 19 | 7  | 0  | 0  |    |
|                 | 040             | 2 Pipe or 2-In. Concentric | 3†                         | 53                   | 52 | 50 | 49 | 48 | 47 |    |
|                 | 7001 to 8000†   | 060                        | 2 Pipe or 2-In. Concentric | 1-1/2                | 53 | 52 | 50 | 49 | 48 | 47 |
| 2               |                 |                            |                            | 64                   | 59 | 54 | 53 | 48 | 43 |    |
| 080             |                 | 2 Pipe or 2-In. Concentric | 1-1/2                      | 24                   | 19 | 10 | 5  | 0  | 0  |    |
|                 |                 |                            | 2                          | 57                   | 52 | 50 | 45 | 44 | 43 |    |
| 100             |                 | 2 Pipe or 3-In. Concentric | 2                          | 46                   | 41 | 36 | 27 | 22 | 17 |    |
|                 |                 |                            | 2-1/2                      | 70                   | 70 | 68 | 67 | 66 | 64 |    |
| 8001 to 9000†   | 120             | 2 Pipe or 3-In. Concentric | 2-1/2                      | 46                   | 41 | 32 | 27 | 18 | 10 |    |
|                 |                 |                            | 3                          | 70                   | 70 | 68 | 67 | 66 | 64 |    |
|                 | 040             | 2 Pipe or 2-In. Concentric | 3                          | 27                   | 22 | 17 | 5  | 0  | 0  |    |
|                 |                 |                            | 3*                         | 49                   | 48 | 47 | 45 | 44 | 43 |    |
|                 | 060             | 2 Pipe or 2-In. Concentric | 1-1/2                      | 60                   | 55 | 50 | 48 | 43 | 38 |    |
|                 |                 |                            | 2                          | 22                   | 17 | 8  | 0  | 0  | 0  |    |
| 9001 to 10000†  | 080             | 2 Pipe or 2-In. Concentric | 2                          | 53                   | 48 | 46 | 41 | 40 | 38 |    |
|                 |                 |                            | 2-1/2                      | 42                   | 37 | 32 | 24 | 19 | 14 |    |
|                 | 100             | 2 Pipe or 3-In. Concentric | 2-1/2                      | 66                   | 65 | 63 | 63 | 60 | 59 |    |
|                 |                 |                            | 3                          | 42                   | 37 | 29 | 24 | 16 | 7  |    |
|                 | 120             | 2 Pipe or 3-In. Concentric | 3                          | 66                   | 65 | 63 | 62 | 60 | 59 |    |
|                 |                 |                            | 3                          | 25                   | 20 | 15 | 0  | 0  | 0  |    |
| 10001 to 11000† | 040             | 2 Pipe or 2-In. Concentric | 3*                         | 46                   | 44 | 43 | 41 | 40 | 38 |    |
|                 |                 |                            | 1-1/2                      | 55                   | 50 | 45 | 44 | 39 | 34 |    |
|                 | 060             | 2 Pipe or 2-In. Concentric | 1-1/2                      | 20                   | 15 | 7  | 0  | 0  | 0  |    |
|                 |                 |                            | 2                          | 49                   | 44 | 42 | 37 | 35 | 34 |    |
|                 | 080             | 2 Pipe or 2-In. Concentric | 2                          | 39                   | 34 | 29 | 21 | 16 | 11 |    |
|                 |                 |                            | 2-1/2                      | 62                   | 60 | 58 | 56 | 55 | 53 |    |
| 11001 to 12000† | 100             | 2 Pipe or 3-In. Concentric | 2-1/2                      | 39                   | 34 | 26 | 21 | 13 | 5  |    |
|                 |                 |                            | 3                          | 62                   | 60 | 58 | 56 | 55 | 53 |    |
|                 | 120             | 2 Pipe or 3-In. Concentric | 3                          | 23                   | 18 | 13 | 0  | 0  | 0  |    |
|                 |                 |                            | 3*                         | 43                   | 41 | 39 | 37 | 35 | 34 |    |
|                 | 12001 to 13000† | 040                        | 2 Pipe or 2-In. Concentric | 1-1/2                | 51 | 46 | 41 | 39 | 34 | 29 |
|                 |                 |                            |                            | 2                    | 18 | 13 | 5  | 0  | 0  | 0  |
| 060             |                 | 2 Pipe or 2-In. Concentric | 2                          | 48                   | 40 | 38 | 33 | 31 | 29 |    |
|                 |                 |                            | 2-1/2                      | 36                   | 31 | 26 | 18 | 13 | 8  |    |
| 080             |                 | 2 Pipe or 2-In. Concentric | 2-1/2                      | 57                   | 55 | 53 | 51 | 49 | 47 |    |
|                 |                 |                            | 3                          | 36                   | 31 | 23 | 18 | 10 | 2  |    |
| 13001 to 14000† | 100             | 2 Pipe or 3-In. Concentric | 3                          | 57                   | 55 | 53 | 51 | 49 | 47 |    |
|                 |                 |                            | 3                          | 21                   | 16 | 11 | 0  | 0  | 0  |    |
|                 | 120             | 2 Pipe or 3-In. Concentric | 3*                         | 39                   | 37 | 35 | 33 | 31 | 29 |    |

## 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.

\* 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.

**TABLE 8—MAXIMUM ALLOWABLE EXPOSED PIPE LENGTH (FT) WITH INSULATION IN WINTER DESIGN TEMPERATURE AMBIENT\***

| UNIT SIZE | WINTER DESIGN TEMPERATURE (°F) | MAX PIPE DIAMETER | INSULATION THICKNESS (IN.)† |     |     |     |    |
|-----------|--------------------------------|-------------------|-----------------------------|-----|-----|-----|----|
|           |                                |                   | 0                           | 3/8 | 1/2 | 3/4 | 1  |
| 040       | 20                             | 2                 | 31                          | 56  | 63  | 70  | 70 |
|           | 0                              | 2                 | 16                          | 34  | 39  | 47  | 54 |
|           | -20                            | 2                 | 9                           | 23  | 27  | 34  | 39 |
| 060       | 20                             | 2                 | 45                          | 70  | 70  | 70  | 70 |
|           | 0                              | 2                 | 25                          | 61  | 58  | 70  | 70 |
|           | -20                            | 2                 | 16                          | 36  | 42  | 51  | 60 |
| 080       | 20                             | 2-1/2             | 55                          | 70  | 70  | 70  | 70 |
|           | 0                              | 2-1/2             | 31                          | 61  | 69  | 70  | 70 |
|           | -20                            | 2-1/2             | 20                          | 43  | 49  | 61  | 70 |
| 100       | 20                             | 3                 | 61                          | 70  | 70  | 70  | 70 |
|           | 0                              | 3                 | 33                          | 65  | 70  | 70  | 70 |
|           | -20                            | 3                 | 20                          | 45  | 52  | 66  | 70 |
| 120       | 20                             | 3                 | 70                          | 70  | 70  | 70  | 70 |
|           | 0                              | 3                 | 40                          | 70  | 70  | 70  | 70 |
|           | -20                            | 3                 | 26                          | 55  | 64  | 70  | 70 |

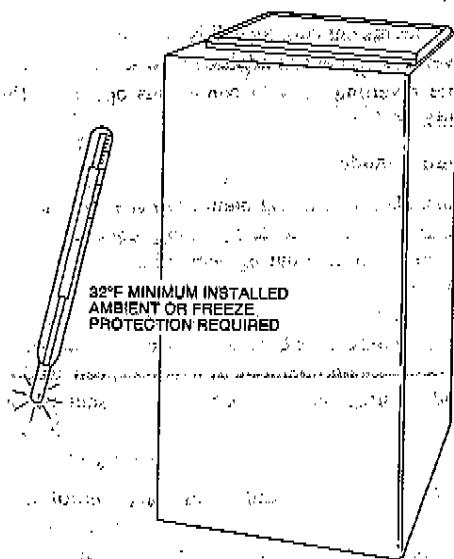
\*Pipe length (ft) specified for maximum pipe lengths located in unconditioned spaces. Pipes located in unconditioned space cannot exceed total allowable pipe length as specified in Table 7.

† Insulation thickness based on R value of 3.5 per in.

## VI. CONDENSATE DRAIN

### A. Condensate Drain Piping

The 1/2-in. diameter schedule 40 PVC or CPVC condensate drain piping and pipe fittings must conform to ANSI standards and ASTM D1785 or D2846. Schedule 40 PVC or CPVC cement and primer must conform to ASTM D2564 or F493. In Canada, use CSA or ULC certified schedule 40 PVC or CPVC drain pipe and cement.



A93058

**CAUTION:** Unit must not be installed, operated, and then turned off and left turned off 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.

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

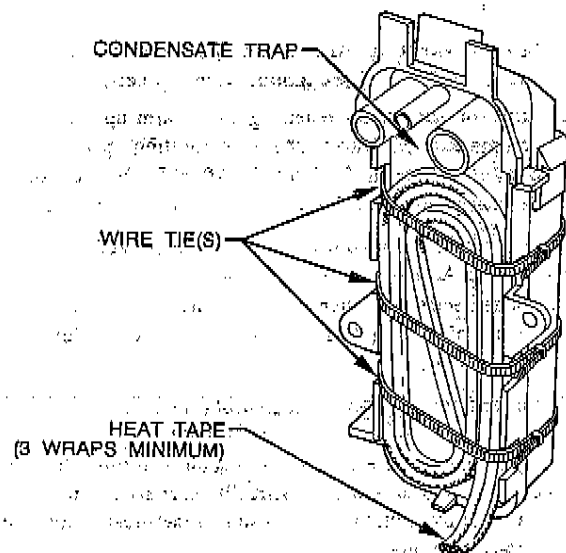
**NOTE:** Condensate trap is shipped with this furnace and must be used. An external trap must not be installed.

Cut and preassemble field-supplied drain piping to an open drain from condensate trap located in Section 1—Applications section.

### B. Condensate Trap Freeze 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 its self 3 times.
2. Locate heat tape between sides of condensate trap back. (See Fig. 40.)
3. Use wire ties to secure heat tape in place. Wire ties can be positioned in notches of condensate sides. (See Fig. 40.)
4. Wrap field drain line with remaining heat tape, approximately 1 wrap per ft.



A93036

**Fig. 40—Condensate Trap Heat Tape**

## VII. START-UP

### A. General

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

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

2. Thermostat wire connections at terminals R, W, G, and Y must be made at 24-v terminal block on control center.

3. Natural gas service pressure must not exceed 0.5 psig (14-in. wc), but must be no less than 0.16 psig (4.5-in. wc).
4. Blower access door 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.

#### B: Sequence of Operation

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

Using schematic diagram (Fig. 23), follow sequence of operation through different modes. This furnace has a new control system. Read and follow wiring diagram carefully.

**NOTE:** If 115-v power supply to furnace or 24-v blower access panel switch is interrupted during a call for heat, blower will operate for 90 sec when power is restored before heating cycle is resumed.

##### 1. 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.

- a. **Prepurge period**—As inducer motor comes up to speed, pressure switch contacts close to begin a 15-sec prepurge period.
- b. **Ignitor warm up**—At end of prepurge period, ignitor is energized for a 17-sec ignitor warm-up period.
- c. **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.

- d. **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 will de-energize gas valve and ignition sequence is repeated.

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

- e. **Blower on delay**—60 sec after burner flame is proven, blower motor is energized on heating speed. Simultaneously, electronic air cleaner terminal (EAC-1) is energized.

- f. **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 will remain energized 90, 135, 180, or 225 sec (depending on blower off time selection). Furnace is factory shipped set for a 135-sec blower off delay.

- g. **Post purge**—Inducer motor will remain energized 15 sec after burners are extinguished.

##### 2. 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 will continue operating on cooling speed for an additional 90 sec.

##### 3. Continuous blower mode

- a. When R-G circuit is made, blower motor will operate on heating speed.

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

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

Blower will revert to continuous operation after heating cycle is completed.

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

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

##### 4. 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 together at furnace control center, control will start blower in heating speed. Then a gas heat mode will begin. Blower will remain operating at heating speed for 15 sec or until end of purge period, then blower will shut off until end of ignition warm up and trial for ignition periods (a total of 24 sec). Blower will then restart at heating speed.

When R-W thermostat call disappears, control will complete inducer post-purge period (15 sec) and then blower will change to cooling speed after a 1-sec delay.

If R-W, R-Y, and R-G thermostat signals should disappear simultaneously, blower will remain on for selected heating blower off delay period (90, 135, 180, or 225 sec), and inducer will go through its 15 sec post-purge period. If R-W and R-Y thermostat signals should disappear, leaving R-G thermostat signal, blower will remain on in heating speed and inducer will remain on for 15 sec to complete post-purge period.

Control will initiate 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 will lock 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.

### C. Start-Up Procedures

#### 1. Adjusting Tuning Valve

Before firing furnace, pressure drop through heat exchanger must be adjusted for maximum efficiency. Pressure drop adjustment is accomplished with tuning valve as follows:

**CAUTION:** Ensure that gas supply to furnace is turned OFF.

**NOTE:** Burner box cover must be in place to ensure proper pressure switch operation:

- Remove tubes from both sides of pressure switch.
- Install field-supplied plastic tee and short piece of tube to each tube removed as shown in Fig. 41.
- Attach short piece of field-supplied tube to pressure switch as shown. Note label on pressure switch for proper tube connections.
- Connect slope gage or digital manometer to tees as shown in Fig. 42.
- Jumper R to W on control center to start inducer motor. Motor will start immediately.

**NOTE:** If pressure switch normally open (N/O) contacts are closed within 30 sec, or are opened longer than 30 sec after being closed, STATUS LED will flash. Proceed with adjustment regardless of this flashing code.

- Adjust tuning valve (located on inducer housing vent connection) to obtain  $1.83 \pm 0.01$ -in. negative water column. Use a 2-in. minimum slope gage or digital manometer. Adjust tuning valve as follows:

(1.) Rotate tuning valve counter-clockwise until pin hits stop.

(1.) Rotate tuning valve clockwise 1 notch at a time with inducer motor operating and manometer attached until pressure switch opens or manometer is  $1.83 \pm 0.01$ -in. wc.

(1.) Rotate tuning valve counter-clockwise 2 notches.

g. Disconnect R to W jumper and wait for inducer to stop. Motor will be turned off without any post-purge delays.

h. Repeat steps e. through g. to ensure tuning valve is adjusted properly.

**NOTE:** If tuning valve is adjusted properly, hot surface ignitor will be energized approximately 15 sec after pressure switch closes its N/O contacts.

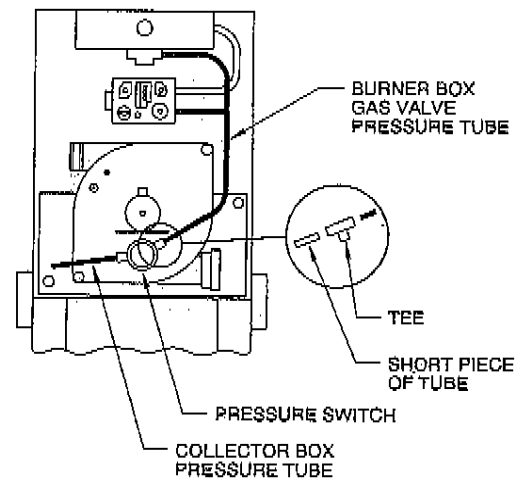
- Remove R to W jumper.
- Disconnect slope gage, field-supplied plastic tees, and short pieces of tube.
- Connect furnace pressure tubes to pressure switch. See pressure tubing routing label on blower access panel or Fig. 6, 7, 8, or 10 for proper locations.

#### 2. Fill condensate trap with water.

- Disconnect condensate drain tube from inducer housing (small tube on condensate drain trap). (See Fig. 43.)
- Insert funnel into tube and pour 1 quart of water into tube. This should overflow trap and flow into an open drain. (See Fig. 44.)
- Reconnect drain tube to inducer housing.

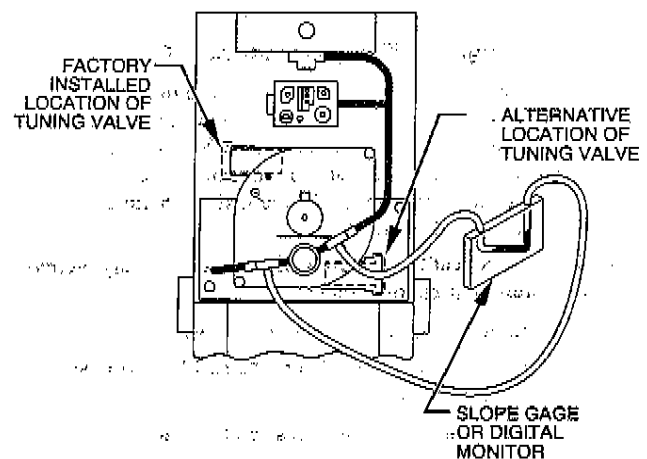
#### 3. Purge gas lines.

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



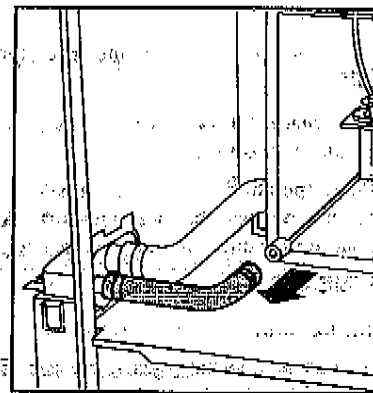
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Fig. 41—Adjusting Tuning Valve – Pressure Tube Connections



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Fig. 42—Adjusting Tuning Valve – Slope Gage Attachment



A93015

Fig. 43—Inducer Housing Drain Tube

**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.

#### 4. Component test.

The furnace control center allows all components, except gas valve, to be run for a short period of time.

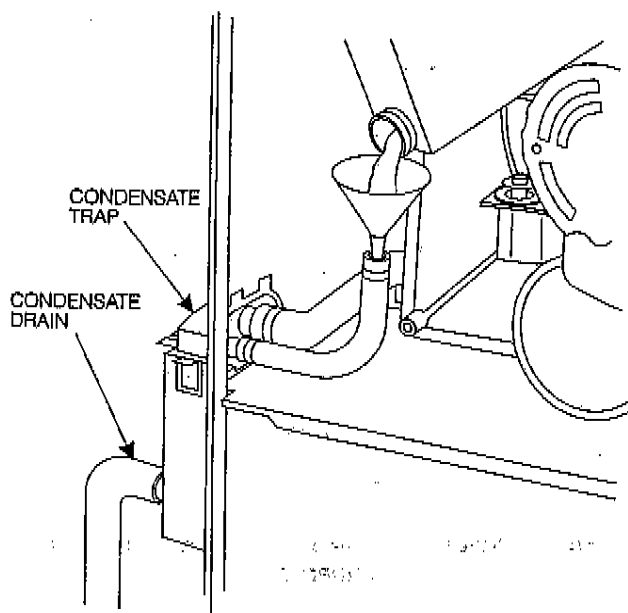


Fig. 44—Filling Condensate Trap

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This feature helps diagnose a system problem in case of a component failure. To initiate component test procedure, short (jumper) for approximately 2 sec the (TEST) 1/4-in. quick connect terminal on control center (adjacent to diagnostic light) and the C terminal on thermostat connection block. (See Fig. 25.)

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

Component test sequence is as follows:

- a. Jumper TEST and C terminals. LED will be off for approximately 2 sec.
  - b. LED will display previous fault 3 times.
  - c. Inducer motor operates for 10 sec, then turns off.
  - d. Hot surface ignitor is then energized for 15 sec, then turns off.
  - e. Blower motor operates on cooling speed for 10 sec, then turns off.
  - f. Blower motor operates on heating speed for 10 sec, then turns off.
5. To operate furnace, follow procedures on operating instruction label attached to furnace.
  6. With furnace operating, set thermostat below room temperature and observe that furnace goes off. Set thermostat above room temperature and observe that furnace restarts.

## VIII: ADJUSTMENTS

### A. Set gas input rate.

There are 2 methods of adjusting gas input rate. The preferred method is by using Table 9 and item 1. The second method is by clocking gas meter as outlined in item 2. Item 2 must be used for altitudes above 2000 ft.

1. Determine natural gas orifice size and manifold pressure for correct input by using Table 9. Adjust manifold pressure per item 3.
  - a. Obtain average yearly heat value for local gas supply.

- b. Obtain average yearly specific gravity for local gas supply.
- c. Verify furnace model. Table 9 can only be used for model 490AAV furnaces.
- d. Find natural gas heat value and specific gravity in Table 9.
- e. Follow heat value line and specific gravity line to point of intersection to find orifice size and manifold pressure settings for proper operation and given natural gas condition.

#### EXAMPLE :

Heat value 1025 Btu/cu ft

Specific gravity 0.60

Therefore; Orifice No. 45\* with manifold pressure 3.7-in. wc

\* Furnace is shipped with No. 44 orifices. In this example all main burner orifices must be changed and manifold pressure adjusted.

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

Proceed to item 3 to adjust manifold pressure.

2. Determine natural gas input rate by clocking gas meter and adjusting manifold pressure per item 3.

**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.

- a. Obtain average yearly heat value for local gas supply.

**NOTE:** Be sure heating value of gas used for calculations is correct for your altitude. Consult local gas utility for altitude adjustments of gas heating value. Turn off all other gas appliances and pilots.

- b. Start furnace and let run for 3 minutes.
- c. Measure time (in sec) for gas meter test dial to complete 1 revolution.
- d. Refer to Table 10 for cubic ft of gas per hr.
- e. Multiply gas rate (cu ft/hr) X heating value (Btu/cu ft). Obtain heating value from local gas utility.

**EXAMPLE :** Btu heating input = Btu/cu ft X cu ft/hr

Heating value of gas = 1070 Btu/cu ft

Time for 1 revolution of 2-cu-ft dial = 72 sec

Gas rate = 100 cu ft/hr (from Table 10)

Btu heating input = 100 X 1070 = 107,000 Btu/hr

Measured gas input must be within gas input on unit rating plate. (0-2000 ft altitude.)

**NOTE:** High altitude—Gas input on rating plate is for altitudes up to 2000 ft. Ratings for altitudes over 2000 ft must be 4 percent less for each 1000 ft above sea level. To obtain altitude adjusted rating, adjust manifold pressure, item 3, and replace main burner orifices as needed. Refer to National Fuel Gas Code Appendix F, Table F-4 for proper orifice sizing at high altitudes.

**NOTE:** In Canada installation applications from 2000 to 4500 ft above sea level are derated 10 percent from Conversion Station.

**TABLE 9—MODEL 490AAV ORIFICE SIZE AND MANIFOLD PRESSURE FOR CORRECT INPUT RATE  
(TABULATED DATA BASED ON ALTITUDE UP TO 2000 FT AND 20,000 BTUH PER BURNER)**

| GAS HEAT<br>VALUE<br>(BTU/CU FT) | 0.56     |                | 0.58     |                | 0.60     |                | 0.62     |                | 0.64     |                | 0.66     |                | 0.68     |                | 0.70     |                | 0.72     |                |
|----------------------------------|----------|----------------|----------|----------------|----------|----------------|----------|----------------|----------|----------------|----------|----------------|----------|----------------|----------|----------------|----------|----------------|
|                                  | Orf. No. | Manifd. Press. | Orf. No. | Manifd. Press. | Orf. No. | Manifd. Press. | Orf. No. | Manifd. Press. | Orf. No. | Manifd. Press. | Orf. No. | Manifd. Press. | Orf. No. | Manifd. Press. | Orf. No. | Manifd. Press. | Orf. No. | Manifd. Press. |
| 880                              | 43       | 3.6            | 43       | 3.7            | 43       | 3.8            | 42       | 3.2            | 42       | 3.3            | 42       | 3.4            | —        | —              | —        | 3.3            | 41       | 3.4            |
|                                  | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | 41       | 3.2            | 41       | 3.7            | 42       | 3.8            |
| 875                              | 43       | 3.6            | 43       | 3.7            | 43       | 3.8            | 42       | 3.2            | 42       | 3.3            | 42       | 3.4            | —        | —              | —        | 3.2            | 41       | 3.3            |
|                                  | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | 41       | 3.2            | 41       | 3.5            | 42       | 3.6            |
| 890                              | 43       | 3.3            | 43       | 3.5            | 43       | 3.6            | 43       | 3.7            | 43       | 3.8            | 42       | 3.2            | 42       | 3.3            | 42       | 3.4            | 41       | 3.2            |
|                                  | 44       | 3.8            | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | 42       | 3.5            |
| 905                              | 43       | 3.2            | 43       | 3.3            | 43       | 3.5            | 43       | 3.6            | 43       | 3.7            | 43       | 3.8            | —        | —              | —        | —              | —        | —              |
|                                  | 44       | 3.7            | 44       | 3.8            | —        | —              | —        | —              | —        | —              | —        | —              | 42       | 3.2            | 42       | 3.3            | 42       | 3.4            |
| 920                              | —        | —              | 43       | 3.2            | 43       | 3.3            | 43       | 3.5            | 43       | 3.6            | 43       | 3.7            | 43       | 3.8            | —        | —              | —        | —              |
|                                  | 44       | 3.6            | 44       | 3.7            | 44       | 3.8            | —        | —              | —        | —              | —        | —              | —        | —              | 42       | 3.2            | 42       | 3.3            |
| 935                              | —        | —              | —        | —              | 43       | 3.2            | 43       | 3.3            | 43       | 3.5            | 43       | 3.6            | 43       | 3.7            | 43       | 3.8            | —        | —              |
|                                  | 44       | 3.4            | 44       | 3.6            | 44       | 3.7            | 44       | 3.8            | —        | —              | —        | —              | —        | —              | —        | —              | 42       | 3.2            |
| 950                              | —        | —              | —        | —              | —        | —              | 43       | 3.2            | 43       | 3.3            | 43       | 3.4            | 43       | 3.6            | 43       | 3.7            | 43       | 3.8            |
|                                  | 44       | 3.3            | 44       | 3.5            | 44       | 3.6            | 44       | 3.7            | 44       | 3.8            | —        | —              | —        | —              | —        | —              | —        | —              |
| 985                              | 44       | 3.2            | 44       | 3.4            | 44       | 3.5            | 44       | 3.6            | 44       | 3.7            | 44       | 3.8            | —        | —              | —        | —              | —        | —              |
|                                  | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              |
| 980                              | —        | —              | 44       | 3.3            | 44       | 3.4            | 44       | 3.5            | 44       | 3.6            | 44       | 3.7            | 44       | 3.8            | —        | —              | —        | —              |
|                                  | 45       | 3.8            | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              |
| 995                              | —        | —              | 44       | 3.2            | 44       | 3.3            | 44       | 3.4            | 44       | 3.5            | 44       | 3.6            | 44       | 3.7            | 44       | 3.8            | —        | —              |
|                                  | 45       | 3.7            | 45       | 3.8            | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              |
| 1010                             | —        | —              | —        | —              | 44       | 3.2            | 44       | 3.3            | 44       | 3.4            | 44       | 3.5            | 44       | 3.6            | 44       | 3.7            | 44       | 3.8            |
|                                  | 45       | 3.6            | 45       | 3.7            | 45       | 3.8            | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              |
| 1025                             | —        | —              | —        | —              | —        | —              | 44       | 3.2            | 44       | 3.4            | 44       | 3.5            | 44       | 3.6            | 44       | 3.7            | 44       | 3.8            |
|                                  | 45       | 3.5            | 45       | 3.6            | 45       | 3.7            | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              |
| 1040                             | —        | —              | —        | —              | —        | —              | —        | —              | 44       | 3.2            | 44       | 3.3            | 44       | 3.4            | 44       | 3.5            | 44       | 3.6            |
|                                  | 45       | 3.4            | 45       | 3.5            | 45       | 3.6            | 45       | 3.7            | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              |
| 1055                             | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | 44       | 3.2            | 44       | 3.3            | 44       | 3.4            | 44       | 3.5            |
|                                  | 45       | 3.3            | 45       | 3.4            | 45       | 3.5            | 45       | 3.6            | 45       | 3.8            | —        | —              | —        | —              | —        | —              | —        | —              |
| 1070                             | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | —        | —              | 44       | 3.2            | 44       | 3.3            | 44       | 3.4            |
|                                  | 45       | 3.2            | 45       | 3.3            | 45       | 3.4            | 45       | 3.5            | 45       | 3.7            | 45       | 3.8            | —        | —              | —        | —              | —        | —              |
| 1085                             | —        | —              | 45       | 3.2            | 45       | 3.3            | 45       | 3.4            | 45       | 3.6            | 45       | 3.7            | 45       | 3.8            | —        | —              | —        | —              |
|                                  | 46       | 3.3            | 46       | 3.4            | 46       | 3.5            | 46       | 3.6            | 46       | 3.7            | —        | —              | —        | —              | —        | —              | —        | —              |
| 1100                             | —        | —              | —        | —              | 45       | 3.2            | 45       | 3.4            | 45       | 3.5            | 45       | 3.6            | 45       | 3.7            | 45       | 3.8            | —        | —              |
|                                  | 46       | 3.2            | 46       | 3.3            | 46       | 3.4            | 46       | 3.5            | 46       | 3.6            | 46       | 3.8            | —        | —              | —        | —              | —        | —              |

f. Proceed to item 3 to adjust manifold pressure.

### 3. Adjust gas input.

**NOTE:** Manifold pressure must always be measured with burner enclosure front REMOVED. Gas meter must always be clocked with burner enclosure front INSTALLED. Gas valve has been nominally set at 3.5-in. wc for natural gas.

- Remove burner enclosure front and cap that conceals adjustment screw for gas valve regulator. (See Fig. 45.)
- Turn adjusting screw either counterclockwise (out) to decrease input rate or clockwise (in) to increase rate. When adjusting input rate, DO NOT set manifold pressure less than 3.2-in. wc or more than 3.8-in. wc for natural gas. Make any major adjustments by changing main burner orifices.

**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.

- Replace burner enclosure front and measure adjusted gas input rate using method outlined in item 2.
- Replace cap that conceals gas valve regulator adjustment screw.
- Look through sight glass in burner enclosure and check burner flame. Burner flame should be clear blue, almost transparent. (See Fig. 46.)

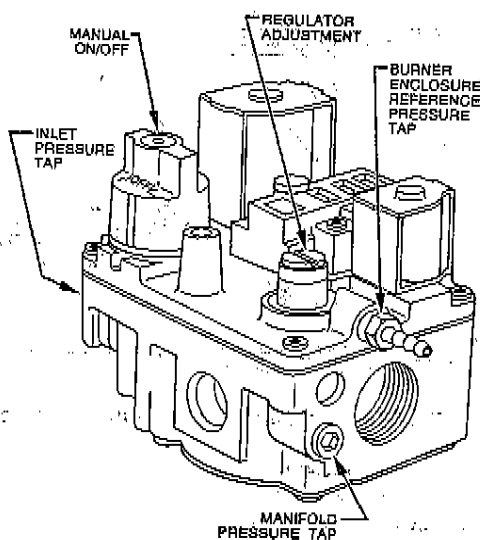


Fig. 45-Redundant Automatic Gas Valve

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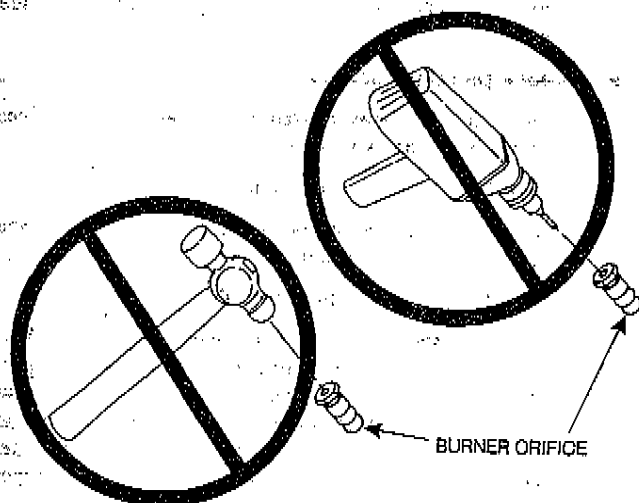


Fig. 46-Burner Flame

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## 4. Set temperature rise.

Furnace must operate within range of temperature rise specified on unit rating plate. Determine air temperature rise as follows:

- Place thermometers in return and supply ducts as near 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.
- 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.

**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.

**CAUTION:** Be sure burner enclosure front is in place after adjustments have been made.

- To change blower motor speed selections for heating mode remove blower motor lead from control center HEAT terminal. (See Fig. 25.) Select desired blower motor speed lead from 1 of the other terminals and relocate it to HEAT terminal. See Table 11 for lead color identification. Reconnect original lead on SPARE terminal.

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

TABLE 10—GAS RATE CU FT/HR

| SECONDS<br>FOR<br>1<br>REVOLUTION | SIZE OF TEST DIAL |            |            | SECONDS<br>FOR<br>1<br>REVOLUTION | SIZE OF TEST DIAL |            |            |
|-----------------------------------|-------------------|------------|------------|-----------------------------------|-------------------|------------|------------|
|                                   | 1<br>cu ft        | 2<br>cu ft | 5<br>cu ft |                                   | 1<br>cu ft        | 2<br>cu ft | 5<br>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                | 135        | 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        | 266        |
| 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        | 114                               | 31                | 62         | 155        |
| 48                                | 75                | 150        | 375        | 116                               | 31                | 62         | 150        |
| 49                                | 73                | 147        | 367        | 120                               | 30                | 60         | 150        |

TABLE 11—SPEED SELECTOR

| COLOR                 | SPEED       | FACTORY ATTACHED TO |
|-----------------------|-------------|---------------------|
| Black                 | High        | Cool                |
| Yellow (when present) | Medium High | Spare               |
| Blue                  | Medium Low  | Heat                |
| Red                   | Low         | Spare               |
| White                 | Common      | COM                 |



**CAUTION:** Recheck temperature rise. It must be within limits specified on unit rating plate. Recommended operation is at mid-point of rise or above.

#### 5. Set thermostat heat anticipator.

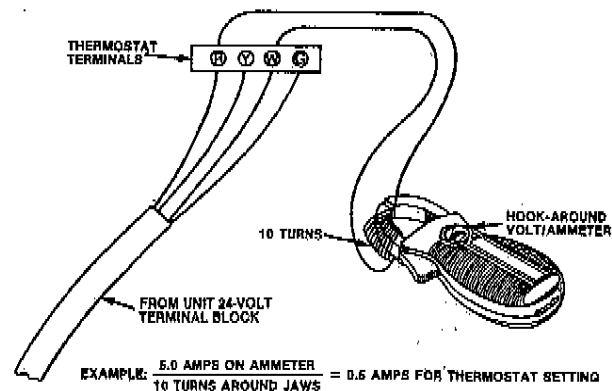
Thermostat heat anticipator must be set to match amp draw of components in R-W circuit. Accurate amp draw measurements can be obtained at thermostat subbase terminals R and W.

Fig. 47 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.

### IX. CHECK SAFETY CONTROLS

#### A. 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



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Fig. 47—Amp Draw Check with Ammeter

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

#### B. Check pressure switch.

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

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

#### X. CHECKLIST

1. Put away tools and instruments. Clean up debris.
2. Verify manual reset switch has continuity.
3. Verify that blower and control access doors are properly installed.
4. Cycle test furnace with room thermostat.
5. Check operation of accessories per manufacturer's instructions.
6. Review User's Guide with owner.
7. Leave literature packet near furnace.

**CHECKLIST - INSTALLATION****LOAD CALCULATION**

\_\_\_\_\_ Heating Load (Btuh)

\_\_\_\_\_ Cooling Load (Btuh)

\_\_\_\_\_ Furnace Model Selection

**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 Length 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

\_\_\_\_\_ Heat Tape Installed If Required

**CHECKLIST—START-UP**

\_\_\_\_\_ Tuning Valve Adjusted

\_\_\_\_\_ 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